

Contents, Abstracts and Keywords for the *Journal of Cetacean Research and Management* (excluding supplements but including *Special Issues*)

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VOLUME 1 ISSUE 1

Dufault, S., Whitehead, H. and Dillon, M. 1999. An examination of the current knowledge on the stock structure of sperm whales (*Physeter macrocephalus*) worldwide. *J. Cetacean Res. Manage.* 1(1):1-10

There is no clear picture of the worldwide stock structure of sperm whales in spite of a great deal of effort, especially in areas where there has been substantial modern whaling. Techniques to examine stock structure have included: the interpretation of catch and sighting distributions and catch per unit of effort; morphological examinations; biochemical and genetic analyses; comparisons of life history parameters; mark-recapture using artificial and natural marks; the occurrence of parasitic infestations; and the comparison of vocal repertoires. Methods which depended on the whaling industry were often limited by unequal distribution of effort and lack of standardised collection methods. Also, most analyses failed to consider the effect of social groupings. Recent research, independent of the whaling industry, has addressed some of these problems. However, the results are equally inconsistent. Variation between the results of different studies can be explained, at least partially, by the temporal scales of the measures used. In general, groups of female and immature sperm whales appear to be restricted to ranges of about 1,000km over periods of 10 years or so. Occasionally, they move much further. Male ranges are generally larger, especially latitudinally. Occasional movements across, and sometimes between, ocean basins seem to have resulted in remarkable global genetic uniformity. To effectively conserve and manage sperm whales in the face of substantial anthropogenic disturbance, we need new and good information on modal and exceptional movement patterns over a range of timescales. KEYWORDS: DISTRIBUTION; GENETICS; MANAGEMENT; MARKING/TAGGING; MIGRATION; MORPHOMETRICS; MOVEMENT; PHOTO-ID; SPERM WHALE; STOCK IDENTITY

Butterworth, D.S., Punt, A.E., Geromont, H.F., Kato, H. and Fujise, Y. 1999. Inferences on the dynamics of Southern Hemisphere minke whales from ADAPT analyses of catch-at-age information. *J. Cetacean Res. Manage.* 1(1):11-32

The dispute over the last two decades in the IWC Scientific Committee as to whether inferences of utility for management purposes can be drawn from catch-at-age information for Southern Hemisphere minke whales is reviewed, particularly in the context of whether or not such data are able to reveal if this population was increasing prior to the start of major commercial harvests in the early 1970s. Butterworth et al. (1996) developed an ADAPT VPA estimation procedure to address this last question. This paper extends that procedure to take account of assumed separability of the fishing mortality matrix for the periods of the commercial and of the Japanese scientific take (although only for ages above 15 for the former). A base-case estimator is motivated from the many possible variants of the procedure, and applied to catch-at-age and survey abundance estimates for Areas IV and V, both separately and in combination. The survey estimates used include results from both international and Japanese research programmes. Bootstrap methods are used to estimate precision, and a number of sensitivity tests for the Area IV assessment are performed. Estimates are provided of the extent to which this precision is expected to improve given the further data to be collected before the end of the Japanese scientific programme (JARPA) as currently conceived; this is achieved by using the current Area IV assessment as a basis to develop an operating model of the population for evaluation (by simulation) of the information content of future data. The Area IV base-case assessment shows satisfactory behaviour under retrospective analysis, and is consistent with the separability assumptions made. It provides an estimate of 5.5%yr⁻¹ (90% confidence interval [1.4%; 9.1%]) for the historic (increasing) trend in minke whale recruitment over the period 1947-1968 prior to the exploitation of this resource. The positivity of this estimate and the associated interval is robust to a number of sensitivity tests. The point estimate of this trend for Area V is larger, but less precisely estimated. Important implications (both qualitative and quantitative) for management of the resource that follow from these results are discussed. The point estimate of age-independent natural mortality M for Area IV is 0.057yr⁻¹. The root mean square error of this estimate by the end of the JARPA programme is estimated to be about 0.022yr⁻¹ (much of this reflecting negative bias related to assumptions concerning the slope of the commercial selectivity-at-age vector for large ages). The point estimates of M for Area V, and for the two Areas combined, are lower. A notable result of the Area IV assessment is a marked drop in recruitment from 1970 to the mid-1980s, for which some possible reasons are advanced. Patterns of inter-annual change in recruitment (as distinct from overall trends) are well estimated from the data, indicating that the availability of catch-at-age data leads to the provision of a much finer probe to detect possible links between minke whale dynamics and environmental factors than would survey estimates of total abundance alone. KEYWORDS: DIRECT CAPTURE; INDEX OF ABUNDANCE; MINKE WHALE; MODELLING; RECRUITMENT RATE; SCIENTIFIC PERMIT; SOUTHERN HEMISPHERE; SURVEY-VESSEL; TRENDS

Butterworth, D.S. and Punt, A.E. 1999. An initial examination of possible inferences concerning MSYR for Southern Hemisphere minke whales from recruitment trends estimated in catch-at-age analyses. *J. Cetacean Res. Manage.* 1(1):33-9

A slightly modified version of the BALEEN II population dynamics model, which makes allowance for time trends in carrying capacity K , is fitted to the recruitment time series provided by the base-case ADAPT VPA assessment of the catch-at-age and survey abundance data for minke whales in Area IV reported in Butterworth *et al.* (1999). The initial increasing trend of these recruitment estimates from 1944-1968 is well fitted by the model, yielding an estimate of $MSYR_{mat}$ of some 13% (or $MSYR_{1+}$ of about 6%) which is reasonably robust to changes in a number of assumptions such as variation in the period over which K is assumed to increase. The post-1970 drop in recruitment indicated by the base-case ADAPT VPA assessment cannot be explained by the effects of catches and super-compensation alone, and requires the additional assumption of a recent decline in K . However, the need for this last assumption diminishes if allowance is made for likely negative bias in the absolute abundance estimates from the IWC surveys input to the ADAPT VPA assessments. KEYWORDS: INDEX OF ABUNDANCE; MINKE WHALE; MODELLING; MSY RATE; RECRUITMENT RATE; TRENDS

Palacios, D.M. 1999. Blue whale (*Balaenoptera musculus*) occurrence off the Galapagos Islands, 1978-1995. *J. Cetacean Res. Manage.* 1(1):41-51

Twenty-three blue whale (*Balaenoptera musculus*) sightings made in the vicinity of the Galápagos Islands (~00°S, 90°W) between 1978-1995 are analysed. Blue whales occurred seasonally in the austral winter/spring months. A significant proportion of the sightings (13 or 56.5%) had a tendency to occur on the same day or on consecutive days in a given year. Five (21.7%) of the sightings were of groups of three or more individuals. Distribution was to the west and southwest of the Galápagos archipelago, where a plume of cool, upwelling-enriched surface water with high planktonic biomass develops during this season. Blue whales were observed feeding on surface swarms of the euphausiid *Nyctiphanes simplex* in 1993. Defecation was commonly seen. The external appearance of these whales suggests they were true blue whales (*B.m. intermedia*). Much of the evidence from this study suggests a Southern Hemisphere stock feeding west of the Galápagos during the austral winter/spring months. Alternatively, they may belong to a presumed eastern tropical Pacific stock of blue whales which exploits the productive habitats of the Costa Rica Dome and the Peruvian/Ecuadorian coast. KEYWORDS: BLUE WHALE; EUPHAUSIIDS/COPEPODS; FEEDING; FEEDING GROUNDS; HABITAT; INCIDENTAL SIGHTINGS; MOVEMENT; OCEANOGRAPHY; PACIFIC OCEAN; PHOTO-ID; SANCTUARIES; SOUTH AMERICA; SURVEY-VESSEL

Punt, A.E. and Butterworth, D.S. 1999. On assessment of the Bering-Chukchi-Beaufort Seas stock of bowhead whales (*Balaena mysticetus*) using a Bayesian approach. *J. Cetacean Res. Manage.* 1(1):53-71

This paper explores a number of issues surrounding the current assessment of the Bering-Chukchi-Beaufort (B-C-B) Seas stock of bowhead whales and provides a 'preferred' set of specifications for this assessment. A Bayesian approach appears to be preferable. However, the Bayesian Synthesis method is subject to the Borel paradox. Reverting to a 'standard' Bayesian approach which places all 'indirect' information in priors (rather than representing this information as likelihoods) would overcome this problem. The basis for the prior distributions used should be documented clearly, and the sources of information for the B-C-B bowhead stock divided into 'indirect' and 'direct'. Simulation results and 'in principle' arguments support the choice of a current population size rather than the pre-exploitation equilibrium size for the parameter to scale the population size (i.e. a 'backwards' rather than a 'forwards' approach). Arguments are presented that the most appropriate choice for a productivity-related parameter, for which a prior has to be specified, is the maximum steady rate of increase. A method for treating the N_4/P_4 estimates as relative indices of abundance, allowing for prior information about the relationship between absolute abundance and those estimates, and accounting for the correlation among the indices of relative abundance derived from the N_4 and P_4 data is developed. Two 'preferred approaches' for assessing the resource both lead to estimates for the lower 5th percentile of the replacement yield that are greater than the current annual strike limit of 67 for the B-C-B stock. KEYWORDS: ARCTIC; BIOLOGICAL PARAMETERS; BOWHEAD WHALE; MODELLING; POPULATION ASSESSMENT; TRENDS; WHALING - ABORIGINAL

Forney, K.A. 1999. Trends in harbour porpoise abundance off central California, 1986-95: evidence for interannual changes in distribution. *J. Cetacean Res. Manage.* 1(1):73-80

This paper presents an updated analysis of trends in the abundance of harbour porpoise, *Phocoena phocoena*, in central and northern California, for the period 1986-95. The most recent survey effort (1995) was comparable to previous years, and regional patterns of density were similar to those found on past surveys, with densities lowest south of Monterey Bay, intermediate from Monterey Bay to the Russian River and highest off northern California. An analysis of covariance model was constructed to test for a trend in abundance while accounting for the effects of sea state, cloud cover and area. The results are qualitatively similar to those obtained for the 1986-93 time series, but encounter rates were higher in 1995, and the estimated rate of decline over the entire time period changed from 9.4% to 5.9% per year. The decreasing trend is no longer significant at $\alpha = 0.10$ ($p = 0.149$). A power analysis based on Monte Carlo simulations revealed that power remains low to detect trends of less than 10% per year. Possible effects of oceanographic conditions, as measured by the September average sea surface temperature anomaly (SSTa), on porpoise abundance are investigated using two different techniques. Correlation tests indicate an inverse relationship between SSTa and relative porpoise abundance for the eight survey years. The correlation is greatest when considering the change between survey years (decreases in relative abundance and increases in SSTa), rather than the individual values of relative abundance and SSTa. An alternate, Poisson-based generalised additive model (GAM) of porpoise sighting rates in relation to area, sea state, cloud cover, year and SSTa indicates a significant, non-linear effect of sea surface temperature on porpoise sighting rates, with no significant year effect once SSTa is included. These results suggest that harbour porpoise may exhibit interannual movement in and out of the study area in relation to changing oceanographic conditions. KEYWORDS: DISTRIBUTION; HARBOUR PORPOISE; INDEX OF ABUNDANCE; MOVEMENT; NORTH PACIFIC; OCEANOGRAPHY; SURVEY - AERIAL; TRENDS

Kasuya, T. 1999. Review of biology and exploitation of striped dolphins off Japan. *J. Cetacean Res. Manage.* 1(1):81-100

The biology, distribution, abundance and exploitation of striped dolphins off Japan are reviewed in an attempt to collate the available information required for a better understanding of the status of populations exploited by Japanese fisheries. Striped dolphins are found in summer in three geographical aggregations in the Pacific waters off Japan, between 20° and 42°N. Occurrence is seasonal in the northern part of the range. They are uncommon in the Sea of Japan, East China Sea and Ryukyuan waters. School structure is believed to be fluid.

Weaned juveniles usually leave their natal schools to aggregate with individuals of similar age. Adults move between schools depending on sex and reproductive status. They have been harvested along the Japanese coast since at least the 19th century. An annual catch of over 21,000 continued from the end of World War II to the end of 1950s. This has been followed by a gradual decline in catches despite demand for dolphin meat. Changes in life history parameters such as female age at sexual maturity and perhaps in female reproductive cycles have occurred over time. Japanese multispecies dolphin fisheries now receive an annual quota of 725 striped dolphins. Fragmented information on morphology, life history, pollutant levels and genetics suggests that the striped dolphins taken by Japanese fisheries are from more than one population, with varying proportions among fisheries and perhaps over time. Further study is needed to clarify population structure, immigration among populations, site fidelity and the function of dolphin 'schools'. KEYWORDS: DIRECT CAPTURE; FISHERIES; GROWTH/LENGTH DISTRIBUTIONS; MOVEMENT; PACIFIC; POLLUTANTS; POPULATION PARAMETERS; REGULATION; REPRODUCTION; SOCIAL; STOCK IDENTITY; STRIPED DOLPHIN; TRENDS

Fiscus, C.H. and Jones, L.L. 1999. A note on cephalopods from the stomachs of Dall's porpoises *Phocoenoides dalli* from the Northwestern Pacific and Bering Sea, 1978-1982. *J. Cetacean Res. Manage.* 1(1):101-7

Cephalopod prey were identified from the stomachs of 100 Dall's porpoise (*Phocoenoides dalli*) incidentally taken by commercial salmon gillnets and research vessels from 1978 to 1982 in the western North Pacific Ocean and Bering Sea. Eighty-four porpoise were collected in June and July during the salmon fishing season; the remainder were collected in August-September. Seven cephalopod families (Enoploteuthidae, Onychoteuthidae, Gonatidae, Histioteuthidae, Chiroteuthidae, Cranchiidae and Bolitaenidae) were identified in the stomachs. Gonatids were the most abundant, comprising 98% of the beaks. *Gonatopsis borealis* was the most abundant species, occurring in 85 stomachs. The gonatids occur in meso- and epi-pelagic waters and many approach the surface at night when the porpoise are feeding. KEYWORDS: DALL'S PORPOISE; FEEDING; FOOD/PREY; NORTHERN HEMISPHERE; PACIFIC OCEAN; SQUID

Kasuya, T. 1999. Examination of the reliability of catch statistics in the Japanese coastal sperm whale fishery. *J. Cetacean Res. Manage.* 1(1):109-22

Catch statistics are important for the assessment of whale stocks. This paper reviews earlier questions over the reliability of statistics from the Japanese land based sperm whale fishery, and presents some new information for the periods 1959-65 and 1983-84. The available data suggest that aspects of post-World War II statistics are unreliable to an unknown extent in terms of total numbers, length and sex ratio. The level of unreliability appears to vary by month, year and whaling company. Suggestions for future work to try to determine the likely levels of unreliability are presented. This is important to enable an accurate assessment of the status of North Pacific sperm whales. KEYWORDS: PACIFIC OCEAN; REGULATION; SEX RATIO; SPERM WHALE; STATISTICS; WHALING - MODERN

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Vinther, M. 1999. Bycatches of harbour porpoises (*Phocoena phocoena*, L.) in Danish set-net fisheries. *J. Cetacean Res. Manage.* 1(2):123-35

Data on bycatch of harbour porpoise (*Phocoena phocoena* L.) in the commercial Danish set-net fisheries were sampled from 5,591km nets in the period 1992 to 1998 using independent observers. A total bycatch of 325 harbour porpoises was reported. Cluster analysis was used to stratify the sampled fishing trips and official catch statistics into a number of different métiers defined by the target species for the trips. Extrapolation of the observed bycatch rate to total fish landings of the Danish set-net fleet gave an average annual bycatch for other areas. Bycatch was observed in Kattegat but not in the Baltic Sea. Generalised Linear Models were used to identify significant factors for bycatch in the North Sea. The bycatch rate, given as number per length of nets x soak time, was significantly lower in fisheries for flatfish compared to roundfish fisheries. The highest bycatch rate was in the cod fishery over wrecks and no bycatch was observed in the sole fishery. Significant seasonal variation of bycatch was identified with the highest bycatch rate in the first and third quarter of the year. Bycatch rates had not changed in the observed period and there was no significant difference in bycatch rates between sub-areas. KEYWORDS: EUROPE; FISHERIES; GILLNETS; HARBOUR PORPOISE; INCIDENTAL CATCHES; STATISTICS

Schweder, T. and Hagen, G. 1999. A note on the cost of instability in whale management. *J. Cetacean Res. Manage.* 1(2):137-40

The history of whaling has been characterised by considerable variation in management 'philosophy'. For example, an early period of overexploitation led eventually to the present period of protectionism and might be followed by a period of excessive catches. Is such instability in long-term management costly? The risk of depletion increases with increasing instability. A simulation experiment is carried out to quantify the loss in whale catches due to 'stop-go' instability in whale management. To examine possible costs in terms of fisheries for cod and herring, a multi-species simulation model is used, with minke whales managed by a stochastic stop-go procedure and with cod, herring and capelin managed by VPA-type procedures. In the simulations, whale catches are reduced by increased stability in whale management while long-term catches of cod and herring are unaffected, provided mean whale abundance is kept fixed. KEYWORDS: FISHERIES; MANAGEMENT; MODELLING; WHALING - MODERN

Clapham, P.J., Wetmore, S.E., Smith, T.D. and Mead, J.G. 1999. Length at birth and at independence in humpback whales. *J. Cetacean Res. Manage.* 1(2):141-6

This paper reviews published and unpublished data on length at birth and at independence in the humpback whale (*Megaptera novaeangliae*). The available data indicate that humpback whale calves are 3.96-4.57m (13 to 15ft) in length at birth, and approximately 8 to 10m (26.25 to 30.48ft) at independence. Timing is important in such assessments: because of the strong seasonal breeding cycle of this species, for young calves (i.e. those observed or taken in winter on the breeding grounds), length data alone are sufficient to determine whether an animal is a calf. In cases where actual length data are unavailable or unreliable, apparent length relative to that of an accompanying adult (i.e. the possible mother) may be used to define a calf, but only for young animals (less than 3 months of age) during winter. Simulations based upon available length frequencies are used to calculate probabilities associated with such a ratio; the results indicate that any animal whose length appears to be less than 63% of that of an accompanying whale is probably a calf. KEYWORDS: HUMPHACK WHALE; MORPHOMETRICS; PARTURITION; REPRODUCTION; SEXUAL MATURITY; WHALING - ABORIGINAL; WHALING - MODERN

Stevick, P.T., Øien, N. and Mattila, D.K. 1999. Migratory destinations of humpback whales from Norwegian and adjacent waters: evidence for stock identity. *J. Cetacean Res. Manage.* 1(2):147-52

Migratory destinations of humpback whales (*Megaptera novaeangliae*) in the eastern North Atlantic were investigated using natural markings. A total of 96 individuals was identified from Norwegian and adjacent waters during 1992 and 1993; of these 63 were observed in the Norwegian and Barents Seas and 33 in the Greenland Sea near Jan Mayen. These were compared with other individuals identified throughout the North Atlantic to identify resightings. Ten individuals were identified in both Norway and in the West Indies. There were no significant differences in this rate of exchange to the West Indies between the sample from Norway or either Norwegian sub-area and other feeding areas in the North Atlantic. The mean West Indies sighting date for humpback whales from Norway was 2 March, significantly later than the overall mean for sightings from the West Indies. The individuals identified represent a variety of reproductive classes and both sexes. Observations of mothers with newborn calves, and males in competitive groups, provide the strongest evidence to date that the West Indies is utilised as a breeding and calving ground by humpback whales which feed in Norwegian waters. These results suggest that the West Indies is an important, and likely the primary, breeding destination for individual humpback whale feeding off Norway. KEYWORDS: ATLANTIC OCEAN; BREEDING GROUNDS; HUMPBACK WHALE; MIGRATION; MOVEMENT; PHOTO-ID

Holst, M. and Stirling, I. 1999. A note on sightings of bowhead whales in the North Water Polynya, Northern Baffin Bay, May-June, 1998. *J. Cetacean Res. Manage.* 1(2):153-6

As part of a multidisciplinary research cruise by icebreaker in the North Water Polynya in northern Baffin Bay, we conducted shipboard surveys of marine mammal distribution and abundance throughout the area from April to July 1998. Fourteen sightings of at least ten individual bowhead whales (*Balaena mysticetus*) were made during May and June. Five additional large baleen whales, whose identities were not confirmed, were also seen. As well as being important feeding ground, the polynya may also serve as an overwintering site for bowhead whales of the Davis Strait/Baffin Bay stock. KEYWORDS: ARCTIC; BOWHEAD WHALE; INCIDENTAL SIGHTINGS; SURVEY-VESSEL

Peddemors, V.M. 1999. Delphinids of southern Africa: a review of their distribution, status and life history. *J. Cetacean Res. Manage.* 1(2):157-65

Eighteen species of delphinids have been recorded from Africa, south of 17°S. This review includes analyses of the distribution and status, life history and feeding habits for each species, primarily using published data from strandings, incidentally caught animals and sightings. Although there is little known for most of the species distributed over the continental shelf, it appears that there is presently little human-induced threat to these. However, more research emphasis should in future be placed on possible detrimental interactions due to overfishing of delphinid prey stocks. Increased commercial fishing pressure will inevitably also increase interactions between the fishery and the affected delphinids. Only three inshore species are presently considered to be vulnerable: Heaviside's dolphin (*Cephalorhynchus heavisidii*), bottlenose dolphins (*Tursiops truncatus*) in KwaZulu-Natal and Namibia, and Indo-Pacific hump-backed dolphins (*Sousa chinensis*) in KwaZulu-Natal. Heaviside's dolphins are endemic and, although presently probably able to sustain mortalities following interactions with commercial fishing gear, may become negatively impacted should fishing activities increase. The bottlenose dolphin population in Namibia appears localised in its distribution and may therefore also be vulnerable to any future coastal development or commercial fishery expansions, while in KwaZulu-Natal they are subjected to ongoing incidental catches in shark nets, heavy pollution levels, habitat destruction and increased competition with fishermen for limited food resources. In KwaZulu-Natal, Indo-Pacific hump-backed dolphins are subjected to the same pressures as experienced by bottlenose dolphins, albeit more severely, while in Mozambique it is occasionally caught incidentally in gillnets or in a targeted fishery. Although generally considered an offshore species, southern right whale dolphins (*Lissodelphis peronii*) also appear to be extremely localised in distribution within southern Africa, and any future planned expansion of commercial driftnet fisheries off Namibia should be carefully monitored for incidental catches which may impact this population. KEYWORDS: AFRICA; CONSERVATION; FOOD/PREY; INCIDENTAL CATCHES; POLLUTANTS; REPRODUCTION; REVIEW; SMALL CETACEANS - GENERAL; TAXONOMY

Van Waerebeek, K., Gallagher, M., Baldwin, R., Papastavrou, V. and Al-Lawati, S.M. 1999. Morphology and distribution of the spinner dolphin, *Stenella longirostris*, rough-toothed dolphin, *Stenella bredanensis* and melon-headed whale, *Peponocephala electra*, from waters off the Sultanate of Oman. *J. Cetacean Res. Manage.* 1(2):167-77

The morphology of three tropical delphinids from the Sultanate of Oman and their occurrence in the Arabian Sea are presented. Body lengths of four physically mature spinner dolphins (three males) ranged from 154-178.3cm (median 164.5cm), i.e. smaller than any known stock of spinner dolphins, except the dwarf forms from Thailand and Australia. Skulls of Oman spinner dolphins (n=10) were practically indistinguishable from those of eastern spinner dolphins (*Stenella longirostris orientalis*) from the eastern tropical Pacific, but were considerably smaller than skulls of populations of pantropical (*Stenella longirostris longirostris*) and Central American spinner dolphins (*Stenella longirostris centroamericana*). Two colour morphs (CM) were observed. The most common (CM1) has the typical tripartite pattern of the pantropical spinner dolphin. A small morph (CM2), so far seen mostly off Muscat, is characterised by a dark dorsal overlay obscuring most of the tripartite pattern and by a pinkish or white ventral field and supragenital patch. Two skulls were linked to a CM1 colour morph, the others were undetermined. It is concluded that Oman spinner dolphins should be treated as a discrete population, morphologically distinct from all known spinner dolphin subspecies. Confirmed coastal range states off the Arabian Peninsula include the United Arab Emirates, the Sultanate of Oman, Yemen, Somalia, Djibouti, Saudi Arabia, Sudan and Egypt. The taxonomic position of the two damaged dolphin calvariae from Oman has been the issue of much debate. This paper discusses the cranial characteristics that allow positive identification as rough-toothed dolphin (*Steno bredanensis*) and melon-headed whale (*Peponocephala electra*) respectively. The calvariae represent the first confirmed specimen records of these dolphin species for the Arabian Sea sensu lato. KEYWORDS: COLOURATION; DISTRIBUTION; INDIAN OCEAN; MELON-HEADED WHALE; MORPHOMETRICS; ROUGH-TOOTHED DOLPHIN; SPINNER DOLPHIN; STOCK IDENTITY; TAXONOMY

Pinedo, M.C. and Polacheck, T. 1999. Trends in franciscana (*Pontoporia blainvillei*) strandings rates in Rio Grande do Sul, Southern Brazil (1979-1998). *J. Cetacean Res. Manage.* 1(2):179-89

For over twenty years incidental takes of the franciscana, *Pontoporia blainvillei*, in coastal artisanal gillnet fisheries have been documented from strandings in Rio Grande do Sul, Southern Brazil (29°20'S to 33°45'S). No direct measures of fishing effort exist for these artisanal gillnet fisheries. However, the fisheries are known to have increased substantially since the early 1980s. Indicative fishing effort in the artisanal bottom gillnet fishery was calculated from the available time series of CPUE from industrial trawl fisheries combined with estimates of the annual catch from the artisanal fisheries. The resulting time series indicates that effort was generally increasing throughout the period. Trends in stranding rates of franciscana were analysed for the 1979-1998 period from systematically collected data as part of a long-term beach monitoring programme for marine mammals. Strandings of franciscana generally occur during spring, from September to December. This is the main period when the artisanal bottom-tending gillnet fisheries are active. However, strandings have occurred in all months, indicating that at least some franciscanas remain in the area year-round. Strandings rates for the spring months were generally high during 1979-81, declined to relatively low levels during 1982-85, increased again until 1987 and subsequently declined, with perhaps some increase again in the most recent years. While clearly recognising the limitations of attempting to infer changes in abundance from strandings data, one of the most likely explanations for declining stranding rates in the face of substantially increasing fishing effort would be a decline in franciscana abundance. As such, the strandings rate trends in conjunction with the effort trends, are a matter of concern and the available information, while limited, suggests that an impact on the southern Brazil population may have occurred. KEYWORDS: ATLANTIC; FISHERIES; FRANCISCANA; INCIDENTAL CATCHES; SOUTH AMERICA; STRANDINGS; TRENDS

Mignucci-Giannoni, A.A., Pinto-Rodríguez, B., Velasco-Escudero, M., Montoya-Ospina, R.A., Jiménez-Marrero, N.M., Rodríguez-López, M.A., Williams, E.H. and Odell, D.K. 1999. Cetacean strandings in Puerto Rico and the Virgin Islands. *J. Cetacean Res. Manage.* 1(2):191-8

An assessment of cetacean strandings was conducted in waters off Puerto Rico and the United States and British Virgin Islands to identify, document and analyse factors associated with reported mortality events. Nineteen species of cetaceans were reported stranded. The total number of events recorded between 1867 and 1995 was 129, comprising over 159 individuals. The bottlenose dolphin (*Tursiops truncatus*) was the species most commonly found stranded, followed by Cuvier's beaked whale (*Ziphius cavirostris*), sperm whale (*Physeter macrocephalus*), Atlantic spotted dolphin (*Stenella frontalis*) and short-finned pilot whale (*Globicephala macrocephalus*). An increase in the number of strandings is evident over the past 20 years, averaging 63.1% per year. Between 1990 and 1995, the average number of cases per year increased from 2.1 to 8.2. The seasonal pattern of strandings was not found to be uniform, with a high number of strandings occurring in the winter and spring. The monthly temporal distribution showed an overall bimodal pattern, with the highest number of cases reported for February, May and September. The spatial distribution was not even, and differed between countries, within countries, and between taxonomic groups and species. Aside from undetermined causes of mortality, the ratio of natural causes in relation to human-related causes was 1.2:1. Between 1990 and 1995, a reduction of the percentage of undetermined cause of deaths resulted from the establishment of a cooperative effort in studying mortality in an organised and systematic manner. The most common natural cause of death category was dependent calf. The most common human-related cause categories observed were entanglement and accidental captures, followed by animals being shot or speared. Evaluation and recommendations to improve the research conducted are formulated, including guidelines for the development of a strategic plan to obtain baseline data on the biology and life history of cetaceans to be applied to their conservation and management. KEYWORDS: BEAKED WHALE-CUVIER'S; BOTTLENOSE DOLPHIN; DISEASE; EPIZOOTIC; INCIDENTAL CATCHES; PILOT WHALE - SHORT-FINNED; SMALL CETACEANS - GENERAL; SPERM WHALE; SPOTTED DOLPHIN; STRANDINGS

Berrow, S.D. and Holmes, B. 1999. Tour boats and dolphins: A note on quantifying the activities of whalewatching boats in the Shannon estuary, Ireland. *J. Cetacean Res. Manage.* 1(2):199-204

Commercial whalewatching of bottlenose dolphins, *Tursiops truncatus*, in the Shannon estuary, Ireland first began in 1993. This note attempts to quantify the development of this industry and operational procedures of commercial tour boats. Up to four vessels are involved, which carry out annually about 200 trips in total, involving ca 2,500 passengers, mainly (78%) in July and August. Thirty-six trips were accompanied, mainly in July 1997 and 1998, to record the search pattern and location at which tour boats observed dolphins and to identify the individual dolphins watched. The time to locate dolphins, total number observed and group size on each trip varied between years and between ports. There is some evidence that dolphins were less abundant and further upriver in 1998 compared to 1997. Operators from each port tended to search for dolphins in different areas and, over the short summer sampling period, largely watched different groups of dolphins to each other. The implications for management and the development of a sustainable whalewatching industry in the Shannon estuary are discussed. KEYWORDS: ATLANTIC; BOTTLENOSE DOLPHIN; NORTHERN HEMISPHERE; PHOTO-ID; SUSTAINABILITY; WHALEWATCHING

Mesnick, S.L., Clapham, P. and Dizon, A.E. 1999. A note on the collection of associated behavioural data with biopsy samples during cetacean assessment cruises. *J. Cetacean Res. Manage.* 1(2):205-11

Understanding the influence of social organisation on the distribution, abundance and genetic structure of cetacean populations is critical in developing better predictive models for management. Field data on cetacean social organisation are far more valuable when collected and analysed together with genetic data from biopsy samples and environmental information (e.g. oceanographic patterns, prey availability). Traditionally, however, studies of cetacean social behaviour and studies of cetacean population dynamics have been conducted independently (Tillman and Donovan, 1986). To integrate these fields, this paper recommends that multi-disciplinary cetacean assessment surveys collect biopsy and associated behavioural data for each sample taken (the minimum data being group size, number of animals biopsied and age class). Examples of sampling forms, outlining the desired information, are provided. Understanding of cetacean stock structure and the processes affecting stock differentiation will best come from a combined genetic, social, ecological and oceanographic approach. KEYWORDS: BEHAVIOUR; BIOPSY SAMPLING; COLOURATION; GENETICS; SOCIAL; SURVEY - COMBINED; VOCALISATION

Bordino, P., Thompson, G. and Iníguez, M. 1999. Ecology and behaviour of the franciscana (*Pontoporia blainvillei*) in Bahía Anegada, Argentina. *J. Cetacean Res. Manage.* 1(2):213-22

From January 1993 to July 1997, franciscana sightings were recorded from shore-based stations and vessels at Bahía Anegada, Argentina. In total, 321 hours were spent in direct observation of dolphins following the *Ad libitum* and *Focal* sampling methods. The present study provides information on the ecology and behaviour of the franciscana in the study area. A total of 251 sightings were made and the number

of sightings per unit effort (SPUE) was significantly greater during spring ($p=0.001$). Dolphins were recorded at a mean distance from shore of 3.2km (0.4km-10.7km), although they were found at a significantly greater mean distance from shore during winter ($p=0.005$). More sightings were recorded during flood tide than during ebb tide ($p=0.016$). A higher SPUE was also recorded from a sailboat than from a motor boat ($p=0.005$). Group size was small, ranging from 1 to 6 individuals. Calves were recorded during spring and summer and only one calf was observed per group. The behaviour showed a seasonal pattern with co-operative feeding and travelling activities increasing during winter. Tide and depth also influence behaviour. Co-operative feeding increased during flood tide, while travelling decreased. The behavioural ecology of the franciscana appears similar to that of other coastal and river dolphins. This study represents the first attempts to understand the behaviour of the franciscana in its natural habitat. KEYWORDS: ATLANTIC; BEHAVIOUR; CONSERVATION; ECOLOGY; FRANCISCANA; SURVEY - COMBINED

VOLUME 1 ISSUE 3

Van Waerebeek, K., André, M., Sequeira, M., Martín, D., Robineau, D., Collet, A., Papastavrou, V. and Ndiaye, E. 1999. Spatial and temporal distribution of the minke whale, *Balaenoptera acutorostrata* (Lacépède, 1804), in the southern northeast Atlantic Ocean and the Mediterranean Sea, with reference to stock identity. *J. Cetacean Res. Manage.* 1(3):223-37

New strandings, bycatch and sightings data for minke whales in the northeast Atlantic Ocean south of Cape Finisterre (Galicia) and the Mediterranean Sea were combined with earlier authenticated records, in order to re-assess spatial and temporal distribution, and provide clues to breeding areas and stock identity. The southern range of IWC-defined Northeastern Atlantic and Central North Atlantic stocks with no explicit, but a de facto, boundary of the Equator, was explored in particular. Senegal (6 records), Mauritania (1) and Western Sahara/Southern Morocco (3) are new West African Range States for the North Atlantic minke whale. Morocco and The Gambia are likely Range States. Specimens stranded or captured in Senegal and Mauritania were either calves ($n=6$) or neonate ($n=1$), a strong indication for a near-by calving ground. Juveniles and calves (median SL:418cm, $n=6$) commonly occur off the Canary Islands, without apparent seasonality. Two strandings, one of which was a neonate (in February), were documented in the Azores. Evidence of minke whales is lacking for Madeira and the Cape Verde Islands. The temporal distribution of 33 records from the western coasts of the Iberian Peninsula in the period 1905-1998 included all seasons, but 76% were registered in spring and summer (March-August). The majority of animals were juveniles (mean SL:537.5cm, $n=26$); none were neonates. Minke whales were encountered in low numbers in the western and central Mediterranean Sea mostly from March to November, although documented strandings in December and February argue for a year-round presence. The Ligurian and Tyrrhenian Seas and the Gulf of Lion are concentration areas, presumably (cf. fin whales) linked to the abundance of euphausiids. Small calves (SL:300-360cm) suggest that at least some females give birth in the Mediterranean. An unusual stranding in the eastern Black Sea (Georgia) may be related to migration of schooling fish. The southernmost specimen known from the North Atlantic is a calf captured near Hann (14°41'N, 17°27'W), Senegal, in May. Southernmost sightings include: (a) inshore: a foraging individual at Garnet's Bay (24°51'N, 15°05'W) in November; (b) offshore: three minke whales at 10°40'N, 22°00'W in December. While small, the sample from West Africa does not seem to support a restricted, seasonal presence. Most likely, these individuals constitute the offspring and juveniles from the Northeastern Atlantic and/or Central North Atlantic populations, but an unrecognised local population cannot be discounted. Preliminary cladistic analysis of the mtDNA control region of one Senegal minke whale yielded equivocal results depending on the fragment sequenced. Field research in the region should be continued to provide the necessary samples to resolve the question of stock identity. KEYWORDS: AFRICA; ATLANTIC OCEAN; BREEDING GROUNDS; DISTRIBUTION; GENETICS; INCIDENTAL CATCHES; MIGRATION; MINKE WHALE; STRANDINGS

Krahn, M.M., Burrows, D.G., Stein, J.E., Becker, P.R., Schantz, M.M., Muir, D.C.G., O'Hara, T.M. and Rowles, T. 1999. White whales (*Delphinapterus leucas*) from three Alaskan stocks: concentrations and patterns of persistent organochlorine contaminants in blubber. *J. Cetacean Res. Manage.* 1(3):239-49

White whale (*Delphinapterus leucas*) blubber samples from three of the five different Alaskan stocks, Cook Inlet ($n=20$), Eastern Chukchi Sea ($n=19$) and Eastern Beaufort Sea ($n=2$), were analysed for levels and patterns of chemical contaminants. Blubber from these whales contained OPCBs , ODDTs , Ochlordanes , HCB, dieldrin, mirex, Otoxaphene and OHCH , generally in concentration ranges similar to those found in white whales from the Canadian Arctic but lower than those in white whales from the highly contaminated St Lawrence River. Males from the Cook Inlet and Eastern Chukchi Sea stocks had higher mean concentrations of all contaminant groups than females of the same stock, a result attributable to the transfer of these organochlorine contaminants (OCs) from the mother to the calf during pregnancy and lactation. Principal component analysis of patterns of contaminants present in blubber showed that the Cook Inlet stock appeared to have identifiable contaminant patterns that allowed the stock to be distinguished from the others. Our results also showed that blubber from the three Alaskan stocks was a source of contaminant exposure for human subsistence consumers, but the health risks from consumption are currently unknown. KEYWORDS: ARCTIC; MONITORING; ORGANOCHLORINES; POLLUTANT BURDEN; POLLUTANTS; WHITE WHALE

Stevick, P.T., Carlson, C.A. and Balcomb, K.C. 1999. A note on migratory destinations of humpback whales from the eastern Caribbean. *J. Cetacean Res. Manage.* 1(3):251-54

Identification photographs of humpback whales taken in the eastern Caribbean were compared with photographs from the North Atlantic to identify re-sightings. Nine individuals were identified in the eastern Caribbean region, seven of these in the Grenadine Islands. There were three re-sightings. Two individuals were re-sighted in northern feeding grounds: one between Newfoundland and Saba Bank; the other between Greenland and Grenada. This demonstrates movement between this breeding and calving area and two of the primary humpback whale feeding grounds in the North Atlantic. The re-sighting rate (0.222) is comparable to the rate of re-sightings between feeding grounds and other breeding areas in the North Atlantic. Another individual was re-sighted in Puerto Rico and Dominica, demonstrating an exchange between the eastern Caribbean and another breeding and calving area in the West Indies. KEYWORDS: ATLANTIC OCEAN; BREEDING GROUNDS; HUMPBAC WHALE; MARK-RECAPTURE; MIGRATION; PHOTO-ID

Hedley, S., Buckland, S.T. and Borchers, D.L. 1999. Spatial modelling from line transect data. *J. Cetacean Res. Manage.* 1(3):255-64

In this paper, two new methods are presented that enable spatial models to be fitted from line transect data. Building on preliminary work by Cumberworth *et al.* (1996) and Hedley *et al.* (1997), the first method is based on a count model and involves cutting up the survey effort into small segments then modelling the number of schools in each segment. In contrast, the second method uses a model based on the intervals between detections. Its formulation is derived in detail to obtain the likelihood function for the distances between detections, conditional on an estimated detection function. Both models can be fitted using standard statistical software, although variances must be estimated using computer intensive methods. We apply the methods to data from the 1992/93 IWC/IDCR Antarctic survey of Area III, fitting generalised additive models to obtain estimates of minke whale abundance, using the parametric bootstrap to estimate variance. The results from fitting these models are compared with the results of a previous analysis by Borchers and Cameron (1995), which used conventional stratified methods. KEYWORDS: ABUNDANCE ESTIMATE; ANTARCTIC; DISTRIBUTION; MINKE WHALE; MODELLING; SOUTHERN HEMISPHERE; SURVEY-VESSEL

Tolley, K.A., Rosel, P.E., Walton, M., Bjørge, A. and Øien, N. 1999. Genetic population structure of harbour porpoises (*Phocoena phocoena*) in the North Sea and Norwegian waters. *J. Cetacean Res. Manage.* 1(3):265-74

The harbour porpoise (*Phocoena phocoena*) is subject to a high rate of incidental mortality in fisheries worldwide and, in some areas, these rates are sufficiently high to warrant concern over population sustainability. Thus, the definition of sub-populations is paramount to the conservation of this species. To investigate the population structure in northeastern Atlantic waters, genetic sequence variation in mitochondrial DNA was examined in porpoises incidentally bycaught or stranded. The first 200 base-pairs of the control region were sequenced in 36 females and 47 males from Norwegian waters of the Barents and North Seas. In addition, 35 females and 31 males from United Kingdom waters, sequenced in a previous study (Walton, 1997) were included as a third study group. One haplotype was found to be common in all geographic groups, accounting for over 49% of all individuals sequenced. An analysis of molecular variance showed no significant difference among males from these regions. However, females showed a greater degree of genetic differentiation for both haplotype frequencies (FT) and molecular diversity (FT) than males. There was a significant difference ($\alpha=0.05$) in the haplotype frequencies between the Barents Sea and North Sea UK female porpoises when adjusted for multiple comparisons. Haplotype frequencies showed a significant difference between the North Sea UK and North Sea Norway females only after porpoises from the Shetland Islands were excluded from the North Sea UK sample. A phylogenetic tree revealed two main haplotypic clades, although there was little geographic structuring among these clades. These results are consistent with findings from other areas and suggest females are more philopatric than males. In spite of the lack of significant phylogenetic structuring, differing haplotype frequencies suggest that the North Sea UK and the Barents Sea sub-populations should be considered separate management units. In addition, haplotype frequency differences among the North Sea Norway and North Sea UK females (excluding Shetlands) also suggest the presence of separate management units within the North Sea. KEYWORDS: CONSERVATION; GENETICS; HARBOUR PORPOISE; INCIDENTAL CATCHES; MANAGEMENT; STOCK IDENTITY

Kasamatsu, F., Kawabe, K., Inatomi, N. and Murayama, T. 1999. A note on radionuclide ^{137}Cs and ^{40}K concentrations in Dall's porpoises *Phocoenoides dalli* in coastal waters of Japan. *J. Cetacean Res. Manage.* 1(3):275-78

Concentrations of artificial radionuclide ^{137}Cs and natural radionuclide ^{40}K in Dall's porpoise, *Phocoenoides dalli*, from the Pacific coast of northern Japan in 1996 are presented. Concentrations of ^{137}Cs in muscle tissue from two male Dall's porpoises were 0.153 ± 0.011 and 0.234 ± 0.016 Bq kg^{-1} wet weight, and those of ^{40}K were 104.0 ± 0.3 and 107.8 ± 0.9 Bq kg^{-1} wet weight, respectively. Concentration factors (CF, concentration in animal/concentration in sea water) for the two porpoises are 59 and 90 for ^{137}Cs , respectively. These concentrations and CF values are within published ranges for marine fish in coastal waters. The CFs obtained in this study suggest that the trophic position of Dall's porpoises is similar to that of the large piscivorous fish in the marine community in coastal waters of Japan. KEYWORDS: DALL'S PORPOISE; NORTH PACIFIC; RADIOACTIVITY

Young, R.F. and Peace, S. 1999. Using simultaneous counts by independent observers to correct for observer variability and missed sightings in a shore-based survey of bottlenose dolphins, *Tursiops truncatus*. *J. Cetacean Res. Manage.* 1(3):279-87

Simultaneous counts by independent shore-based observers have been used to generate revised population estimates for gray and bowhead whales, but no similar technique has been applied to shore-based dolphin surveys. Shore-based whale surveys generally rely on a single observation site from which migrating whales are counted as they pass in one direction over a period of weeks to months. Shore-based dolphin surveys, however, typically use multiple observation sites over a much shorter time period (hours) in order to avoid double counting individuals as they change direction. This paper reports on a new technique to correct for observer variability and missed sightings for coastal bottlenose dolphin surveys conducted at Myrtle Beach, South Carolina, USA. Comparisons were made between concurrent counts by 39 pairs of independent shore-based observer teams. A model was developed to revise observer estimates in which the number of observed dolphin groups was multiplied by a correction factor to estimate the true number of groups, and this number in turn was multiplied by the mean group size to determine the total number of dolphins. The true number of dolphin groups was estimated using a modified Petersen mark-recapture estimate, stratified by group-size category. The mean proportion of groups missed by observers was negatively correlated with reported group size: 32.7% for groups of 1-2 dolphins; 16.5% for groups of 3-4 dolphins; and 9.9% for groups of >4 dolphins. A variability factor was also calculated to determine a confidence interval for the average number of dolphins per group, based on the mean percent difference between paired observer teams, stratified by group size. The model was used to calculate revised estimates for shore-based bottlenose dolphin surveys conducted in South Carolina in 1994 and 1995. The original uncorrected abundance estimates were increased by a factor of 1.14 and 1.19 respectively, comparable to similar calculations from shore-based surveys of gray whales. However, the estimated confidence interval of $\pm 38\%$ of the revised estimates is approximately four times the magnitude found in the gray whale studies. This difference is primarily due to the large observer variability for estimated dolphin group size and can be reduced using various revisions of survey design and methodology. Ideal conditions for this technique include elevated observer posts and accurate estimates of the proportion of the population within visual range of the coastline. This study demonstrates that shore-based dolphin surveys are a potentially efficient census technique and an attractive low cost alternative to aerial and boat surveys. KEYWORDS: ABUNDANCE ESTIMATE; BOTTLENOSE DOLPHIN; MARK-RECAPTURE; SURVEY - SHORE-BASED; TECHNIQUES

Givens, G.H., Punt, A.E. and Bernstein, T.A.O. 1999. Equivalence tuning of SLAs. *J. Cetacean Res. Manage.* 1(3):289-95

Equivalence tuning involves adjusting a candidate aboriginal whaling management Strike Limit Algorithm (SLA) to enable fair comparison with respect to its ability to satisfy the objectives for aboriginal subsistence whaling. Two methods for equivalence tuning ('depletion tuning' and 'H-tuning') are reviewed and compared. Conceptually, H-tuning is appealing because it accounts for aboriginal subsistence need and well as risk explicitly, whereas depletion tuning is based only on risk. However, H-tuning is only approximate, whereas depletion tuning is exact. Whale dynamics are slow so the choice among alternative SLAs is likely to be one related to a simple catch/risk trade-off. Hence, it is reasonable to favour the simpler depletion tuning approach if it can be implemented in a manner that facilitates fair and reasonable comparison. However, in one example shown, H-tuning was more successful at finding a comparison level that reflected an appropriate catch/risk balance. KEYWORDS: MANAGEMENT PROCEDURE; WHALING - ABORIGINAL

Lockyer, 1999. Application of a new method to investigate population structure in the harbour porpoise, *Phocoena phocoena*, with special reference to the North and Baltic Seas. *J. Cetacean Res. Manage.* 1(3):297-304

Tooth ultrastructure in harbour porpoise is examined as a possible tool for differentiating between animals from different geographical regions in the North Atlantic. Nine different characteristics in both dentine and cementum are identified and recorded in the decalcified, sectioned and stained teeth. Significant differences in several characters are found between porpoise tooth samples from the Canadian east coast and West Greenland, between Iceland, the North Sea, and Celtic Shelf, as well as sub-divisions within the North Sea, and between the North Sea, Skagerrak, Kattegat, Inner Danish waters and the Baltic Sea. The method appears promising if used on groups of known geographic origin. However, it is not certain that any one tooth could be assigned to a particular geographic group, when selected randomly. KEYWORDS: ATLANTIC OCEAN; HARBOUR PORPOISE; STOCK IDENTITY

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Gearin, P.J., Goshko, M.E., Laake, J., Cooke, L., Delong, R.L. and Hughes, K.M. 2000. Experimental testing of acoustic alarms (pingers) to reduce bycatch of harbour porpoise, *Phocoena phocoena*, in the state of Washington. *J. Cetacean Res. Manage.* 2(1):1-10

Field tests were conducted on the effectiveness of acoustic alarms (pingers) in reducing the incidental catch of harbour porpoise (*Phocoena phocoena*) in a salmon gillnet fishery in northern Washington in July and August of 1995-1997. The alarms produced a broadband signal with peaks at 3 and 20kHz, with mean source levels between 121.7-124.7dB re 1µ@1m. For 1995 and 1996 combined, 47 harbour porpoise were taken in control nets and only two were taken in alarmed nets. The alarms significantly reduced the bycatch of harbour porpoise for both seasons (1995: $c_2 = 5.28$, $df=1$, $p=0.02$; 1996: $c_2 = 11.2$, $df=1$, $p=0.001$). In 1997, all nets were alarmed and 12 porpoise were taken; however, the expected catch without alarms would have been 79. There were no significant differences in catch rates of chinook salmon (*Oncorhynchus tshawytscha*) ($c_2 = 0.31$, $df=1$, $p=0.58$), or sturgeon (*Acipenser* sp.) ($c_2 = 1.44$, $df=1$, $p=0.23$) in control or alarmed nets. There were also no significant differences in the bycatch of harbour seals (*Phoca vitulina*) ($c_2 = 0.09$, $df=1$, $p=0.76$) or depredation of salmon by seals in nets with and without alarms ($c_2 = 0.07$, $df=1$, $p=0.79$). The results of these studies indicate that acoustic alarms significantly reduce the probability of harbour porpoise entanglement in bottom-set gillnets in the fishery without reducing the catch of target fish species. KEYWORDS: ACOUSTICS; BY-CATCH; EXPERIMENTAL; GRENADA; HARBOUR PORPOISE; PACIFIC

Crespo, E.A., Alonso, M.K., Dans, S.L., García, N.A., Pedraza, S.N., Coscarella, M. and González, R. 2000. Incidental catches of dolphins in mid-water trawls for Argentine anchovy (*Engraulis anchoita*) off the Argentine shelf. *J. Cetacean Res. Manage.* 2(1):11-6

Information on the incidental mortality of dusky and common dolphins in mid-water trawl fisheries along the Argentine shelf was obtained for the 1990s. The Argentine anchovy is believed to be an under-exploited resource and is usually taken in purse seine fisheries. However, on the few occasions when it was the target species of large mid-water trawlers, anchovy-eating dolphins were incidentally caught. A few incidents accounted for relatively high numbers of dolphins but in most of the cases the information obtained was insufficient for detailed analysis. For three cases, however, sufficient information was obtained to estimate mortality rates. Nevertheless, interpretation of these rates is difficult for a number of reasons. FV Mar Salvaje caught around 60 common dolphins (*Delphinus delphis*) in only a few days and in one tow 20 dolphins were caught. Biological information on 18 common dolphins (12 males and 6 females) was obtained and ages ranged from 5-10 for females and 2-18 for males. KEYWORDS: ATLANTIC; COMMON DOLPHIN; DOLPHINS-GENERAL; DUSKY DOLPHIN; FISHERIES; GRENADA; INCIDENTAL CAPTURE; SOUTH AMERICA; TRAWLS

Aguilar, A. 2000. Population biology, conservation threats and status of Mediterranean striped dolphins (*Stenella coeruleoalba*). *J. Cetacean Res. Manage.* 2(1):17-26

The paper reviews the information available on those aspects of the biology, ecology and effects of human impact that are relevant to the management and conservation of striped dolphins in the Mediterranean Sea. The striped dolphin is common throughout the western Mediterranean, although it shows a preference for open waters beyond the continental shelf. In 1991, the western Mediterranean population was estimated as 117,880 (95% CI=68,379-214,800), but no comparable estimates are available for the eastern basin. Geographical variation in body length, skull morphometrics and genetic analyses, as well as the geographic range and evolution of the 1990-1992 epizootic, suggest some degree of isolation between dolphins in different regions within the Mediterranean and independence from those in the Atlantic. Growth and reproductive parameters in the Mediterranean are, overall, similar to those of other populations, with the exception of age at sexual maturity, which in both sexes is extremely high (11-12 years). Tissue levels of organochlorine compounds, some heavy metals and selenium are high and exceed threshold levels above which detrimental effects commonly appear in mammals. However, apart from the indication that these levels may have acted as triggering factors in the 1990-1992 epizootic by depressing the immune system of diseased individuals and potential lesions in the ovaries, no information on pollutant-related effects is available. The 1990-1992 epizootic devastated the whole Mediterranean population; over one thousand corpses were examined in the western Mediterranean alone, but the toll was probably much higher. The causative agent of the die-off was a morbillivirus, but the effect of some pollutants and decreased food availability were suggested as triggering factors. Depletion of fish and cephalopod resources is widespread in the Mediterranean and, given that the diet of striped dolphins includes commercial species, this undoubtedly has a potential for limiting population numbers. A number of fishing activities produce an associated striped dolphin bycatch. In particular, the pelagic driftnet fishery

for tuna and swordfish, carried out by boats from Italy, Spain and Morocco, produces a significant kill in various locations. Variation in sighting and stranding frequency suggests that striped dolphins may have increased their numbers in recent decades. However, this progressive increase may have run parallel to a reduction in carrying capacity of its habitat. This suggestion is supported by the late age at attainment of sexual maturity observed in the Mediterranean population as compared to other conspecific or even congeneric populations. KEYWORDS: ABUNDANCE ESTIMATE; AFRICA; AGE AT SEXUAL MATURITY; ATLANTIC; CONSERVATION; DISEASE; DISTRIBUTION; ECOSYSTEM; EPIZOOTIC; EUROPE; FEEDING; FISHERIES; FOOD; GENETICS; GILLNETS; GROWTH/LENGTH DISTRIBUTIONS; HABITAT; HEAVY METALS; INCIDENTAL CATCHES; LONG-TERM CHANGE; MEDITERRANEAN; ORGANOCHLORINES; POLLUTANTS; PREY; PURSE SEINE; REPRODUCTION; STRIPED DOLPHIN; SURVEY-VESSEL; TRENDS

Gordon, J.C.D., Matthews, J.N., Panigada, S., Gannier, A., Borsani, J.F. and Notarbartolo di Sciara, G. 2000. Distribution and relative abundance of striped dolphins, and distribution of sperm whales in the Ligurian Sea cetacean sanctuary: results from a collaboration using acoustic monitoring techniques. *J. Cetacean Res. Manage.* 2(1):27-36

The distribution and relative abundance of groups of striped dolphins (*Stenella coeruleoalba*) in the Ligurian Sea cetacean sanctuary, based on acoustic surveys carried out in the summers of 1994-1996, is presented. Abundance indices based on acoustic detections were adjusted for covariates likely to influence the detectability of dolphin vocalisations, such as wind speed, background noise and sea state. Dolphin vocalisation rates were shown to vary diurnally, being higher at night, and this effect was also modelled and removed. Results showed that dolphin groups were fairly evenly distributed throughout the sanctuary, but they were more abundant in offshore waters, peaking at water depths between 2,000-2,500m. Preliminary sightings results also indicated larger-sized groups in offshore regions. Relative abundance does not appear to vary significantly over the summer months. Sperm whales (*Physeter macrocephalus*) were detected at 4% of monitoring stations, representing at least 61 different group encounters. Although not common, they appeared to be widely distributed in deep water throughout the study area. KEYWORDS: ACOUSTICS; AREA - MEDITERRANEAN SEA; INDEX OF ABUNDANCE; MONITORING; OCEANOGRAPHY; SANCTUARIES; SURVEY-ACOUSTIC

Amano, M., Ito, H. and Miyazaki, N. 2000. Geographic and temporal comparison of skulls of striped dolphins off the Pacific coast of Japan. *J. Cetacean Res. Manage.* 2(1):37-44

Skulls of striped dolphins taken by the drive fishery off the Pacific coast of Japan in 1958-79 and 1992, and those taken by research vessels in offshore waters of the northwestern North Pacific in 1992 were examined to study the geographic and temporal differences that are expected to suggest the identity of stocks exploited by the fishery. Coastal specimens collected in 1958-79 showed distinct sexual dimorphism in rostral width, while no dimorphism was found in recent (1992) coastal specimens. Females showed more obvious variation among samples, and recent coastal specimens were distinct from others. The present results provide some support for the view that the drive fishery has exploited dolphins from plural coastal stocks, and that coastal dolphins currently taken by the Taiji fishery and offshore dolphins ranging east of 145°E do not belong to the same stock. The need to obtain larger sample sizes is stressed. KEYWORDS: INCOMPLETE; BOURNEMOUTH; DIRECT CAPTURE; MORPHOMETRICS; PACIFIC; STOCK IDENTITY; STRIPED DOLPHIN

da Silva, C.Q., Zeh, J., Madigan, D., Laake, J., Rugh, D., Baraff, L., Koski, W. and Miller, G. 2000. Capture-recapture estimation of bowhead whale population size using photo-identification data. *J. Cetacean Res. Manage.* 2(1):45-61

Statistical models and maximum likelihood methods are developed for estimating bowhead whale population size from photo-identification data. These are tested on both simulated data and actual data from 1985 and 1986 photographic studies. Initially a multinomial model that accounts for unmarked whales is used. Variance is estimated using the parametric bootstrap. In the cases considered, the variance estimators perform similarly to previously used delta method based estimators in terms of confidence interval coverage, as long as log-normal rather than symmetric confidence intervals are used for the latter. Further models are developed to account for heterogeneity in capture probabilities (highly marked whales are more likely to be captured than moderately marked) and non-random sampling caused by age segregation. These models, particularly the latter, perform better than the multinomial model on simulated data that incorporate these violations of standard capture-recapture assumptions. All three models are applied to actual bowhead whale data. The resulting estimates of the 1+ population size (animals 1 year old or older) in 1985-86 range from 4,719 (using the non-random sampling model on the small dataset in which lengths are available for all whales so that age class can be determined) to 7,331 (using the heterogeneity model on the full dataset). Standard errors are comparable to those obtained from the ice-based census in years with sub-optimal environmental conditions. All confidence intervals include the ice-based census estimates for 1985 and 1986, as well as the corresponding values of 1+ population size in the most likely trajectory from a Bayesian synthesis analysis. These most likely values - 6,649 and 6,820 - incorporate the ice-based census estimates and additional data on bowhead whale population dynamics. KEYWORDS: ABUNDANCE ESTIMATE; ARCTIC; BOWHEAD WHALE; MARK-RECAPTURE; PHOTO-ID

Walsh, P.D., Fay, J.M., Gulick, S. and Sounguet, G.P. 2000. Humpback whale activity near Cap Lopez, Gabon. *J. Cetacean Res. Manage.* 2(1):63-8

Two days of aerial transects were flown in mid-August 1998, just below the equator near Cap Lopez, Gabon. Two groups of humpback whales (*Meagaptera novaeangliae*) were sighted to the north of Cap Lopez and eighteen groups were sighted to the south. A large proportion of whales in the southern sector engaged in display behaviour. Similar observations were made during brief boat surveys on 14 August 1998 and 6-12 September 1999. Three surface-active groups were also observed, suggesting that humpback whales mate in the waters surrounding Cap Lopez. Three calves were observed during surveys. Historical whaling records and recent reports of whale sightings imply that humpback whale breeding grounds lie further north and west, in the Gulf of Guinea. Observations also suggest that humpback whales may feed at Cap Lopez and possibly at other points along the Gabonese coast. Common dolphins (*Delphinus delphis*) were abundant in the area and one other, unconfirmed, dolphin species was observed. Further research is needed to better establish the status of humpback whales and other cetaceans in the Gulf of Guinea. KEYWORDS: AFRICA; ATLANTIC OCEAN; BEHAVIOUR - DISPLAY; BREEDING GROUNDS; COMMON DOLPHIN; CONSERVATION; HUMPBACK WHALE; POLLUTANTS; SURVEY - AERIAL

Kastelein, R.A., Macdonald, G.J. and Wiepkema, P.R. 2000. A note on food consumption and growth of common dolphins (*Delphinus delphis*). *J. Cetacean Res. Manage.* 2(1):69-74

Food consumption, body weight and body length were recorded in four female common dolphins (*Delphinus delphis*) at Marineland of New Zealand between 1974 and 1996. The study is based on historical data that were recorded for short-term husbandry purposes. The composition and caloric value of the diet sometimes varied from day to day. The food intake quantities should therefore be viewed as rough weight estimates of what wild conspecifics might eat (depending on their diet). Annual food intake of two dolphins increased to 3,300kg at around 12 years of age, after which it decreased, stabilising at around 2,200kg between the ages of 16 and 25 years. Annual food intake of the other two animals increased to 2,700kg at six/seven years of age, then declined and stabilised at around 2,100kg between the ages of seven/eight and 12 years. The weights of two of the animals were first recorded at the ages of seven and eight years. During the following 19 years, their body weight gradually increased by about 15kg. The other two animals grew from around 57kg at the age of two/three years to about 100kg at around 12 years of age. The two animals grew much in length when they were between two and eight years old. The other two animals appeared to have reached asymptotic length by 18 and 19 years of age when their length was measured for the first time. As body weight increased, daily food consumption as a percentage of body weight decreased. At a body weight of around 60kg, the dolphins consumed the equivalent of around 12% of their body weight per day. When body weight had reached around 100kg, daily consumption had fallen to around 6% of body weight. KEYWORDS: CAPTIVITY; COMMON DOLPHIN; ENERGETICS; FEEDING; MORPHOMETRICS; NUTRITION

Givens, G. 2000. *Strike Limit Algorithm* optimisation: a realistic example. *J. Cetacean Res. Manage.* 2(1):75-83

This paper illustrates a process for finding an improved variant of an aboriginal whaling management procedure Strike Limit Algorithm (SLA), applying the merging and optimisation approach of Givens (1997; 1999b). A modified version of the SLA developed by Punt and Butterworth (1997) was chosen as the procedure to be optimised for management of the Bering-Chukchi-Beaufort Seas stock of bowhead whales. The optimisation considers functions of the catch limit and other outputs from the nominal SLA, along with outputs from two other SLAs and estimates of certain population dynamics parameters. The result reduced the Bayes risk by over 90%, compared to the nominal procedure, and improved simulated SLA performance by usually allowing more strikes at less depletion risk. Such results suggest that this approach may be attractive in the general development of wildlife management procedures. KEYWORDS: ARCTIC; BOWHEAD WHALE; MANAGEMENT PROCEDURE; MODELLING; WHALING - ABORIGINAL

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Le Boeuf, B.J., Pérez-Cortés M, H., Urbán R, J., Mate, B.R. and Ollervides U, F. 2000. High gray whale mortality and low recruitment in 1999: potential causes and implications. *J. Cetacean Res. Manage.* 2(2):85-99

This paper documents the high incidence of gray whale deaths in 1999 and presents the hypothesis that some of the whales were starving. Predictions from this hypothesis are tested using data on the frequency and distribution of strandings, the sex and age composition of strandings, estimates of recruitment and physiological condition, and observations of foraging during migration. The data come from multiple sources. The mortality count of 274 gray whales in 1999 was twice as high as in any previous year dating back to 1985. Dead whales were widely distributed along the migratory route, with the majority observed on the northward migration from the Mexican breeding lagoons to Alaska. Most mortalities in Mexico and California were adults and immatures, rather than the usual calves and yearlings. The majority of dead adults in Mexico, California and the Oregon/Washington region were females. Many dead whales were emaciated. Calf production was lower than in the previous six years. Aberrancies in timing and location of migration, as well as foraging on pelagic prey, were observed. These results, and an even higher stranding rate in the Mexican breeding lagoons in 2000, are consistent with the hypothesis that the whales were undernourished. It is argued that the most likely cause of this condition was a decline in the biomass of their principal prey, the benthic amphipods in the Bering and Chukchi Seas over the last decade, due in part to the combined effects of increasing sea surface temperatures and increased predation from the growing population of gray whales themselves. A significant decline in amphipod density could have long-term effects on the future growth and stability of the gray whale population because amphipods recover slowly given their low fecundity and long generation times. Annual monitoring of the status of the amphipods in the Bering and Chukchi Seas, and the effect of inter alia sea surface temperature on their biomass, is vital for understanding fluctuations in gray whale mortality and numbers, and the extent to which they are dependent on this food resource. KEYWORDS: BERING SEA; EL NINO; FEEDING GROUNDS; FOOD/PREY; GRAY WHALE; HEALTH; MORTALITY RATE; PACIFIC OCEAN; PREDATION; RECRUITMENT RATE; STRANDINGS

Garrigue, C., Forestell, P., Greaves, J., Gill, P., Naessig, P. and Baker, C.S. 2000. Migratory movement of humpback whales (*Megaptera novaeangliae*) between New Caledonia, East Australia and New Zealand. *J. Cetacean Res. Manage.* 2(2):101-10

'Discovery' marks and their recoveries from humpback whales in the southwest Pacific provide no evidence of migratory interchange between wintering grounds in New Caledonia and migratory corridors off east Australia (Moreton Island) and New Zealand, or wintering grounds in Tonga. To provide further insight into the migratory connections among these regions, images of 169 individually-identified humpback whales from New Caledonia were compared with the published catalogues of Australian (n=1,088), Tongan (n=78) and New Zealand (n=1) humpback whales. Four of the New Caledonian humpbacks were found to have migrated past east Australia and one past New Zealand in separate years. No movement was found between New Caledonia and Tonga. These data provide the first photographic information on exchanges between regions of the southwest Pacific. Reviewed in light of historical records, these data also highlight the necessity for further research in the South Pacific region to resolve the question of the proposed segregation of the Southern Hemisphere Group V stock into an eastern group (New Zealand and the Pacific Islands) and a western group (east Australia). KEYWORDS: AUSTRALASIA; HUMPBACK WHALE; MIGRATION; PHOTO-ID; SOUTHERN HEMISPHERE

Urban R, J., Jaramillo, A., Aguayo, L., Ladron de Guevara, P., Salinas, M., Alvarez, C., Medrano, L., Jacobsen, J., Balcomb, K., Claridge, D., Calambokidis, J., Steiger, G., Straley, J., von Ziegesar, O., Wate, M., Mizroch, S., Dahlheim, M., Darling, J. and Baker, S. 2000. Migratory destinations of humpback whales wintering in the Mexican Pacific. *J. Cetacean Res. Manage.* 2(2):101-10

The migratory destinations of humpback whales that winter off the Pacific coast of Mexico were examined using photo-identification. Fluke photographs taken between 1983 and 1993 from the three main whale aggregations in this area (383 from the Mainland coast; 471 from Baja California Peninsula; and 450 from Revillagigedo Archipelago) were compared with collections from all known summering grounds in the North Pacific (593 off California-Oregon-Washington; 48 off British Columbia; 429 off Southeastern Alaska; 141 off Prince William Sound; and 133 from the western Gulf of Alaska). The migratory movements of these whales were clearly non-random. The results of the photographic comparisons and the statistical tests show clear evidence for preferred migratory destinations of humpback whales from Mainland and Baja California to California-Oregon-Washington and British Columbia summering regions. Nevertheless, differences in whale abundance estimates between these summering and wintering aggregations indicate the presence of some unsampled summering region(s). The principal migratory destination was not detected for the Revillagigedo region, although matches were found with all the summering regions sampled. This supports the hypothesis that the humpback whales from Revillagigedo are separate from the 'American stock'. Based on the known abundance estimates, historical whaling records and genetic structure of the populations, it is proposed that historical feeding grounds off the Aleutian Islands and/or the Bering Sea are the main summer destinations of the whales from Revillagigedo. KEYWORDS: BREEDING GROUNDS; DISTRIBUTION; HUMPBACK WHALE; MIGRATION; NORTHERN HEMISPHERE; PACIFIC; PHOTO-ID; SITE-FIDELITY

Durban, J.W., Elston, D.A., Lambin, X. and Thompson, P.M. 2000. A role for Bayesian inference in cetacean population assessment. *J. Cetacean Res. Manage.* 2(2):117-23

Decisions concerning the management and conservation of cetacean populations depend upon knowledge of population parameters, which generally must be estimated from sample data using statistical models. However, data from the cetacean populations are often sparse, and resultant parameter estimates can be uncertain and difficult to obtain. This review uses examples from published work to highlight the utility of the Bayesian statistical paradigm as a suitable estimation framework in these situations. By evaluating the probability of obtaining the available data, given a specified estimator model, for a whole prior distribution of possible parameter values, the Bayesian approach is capable of quantifying the uncertainty associated with parameter estimates. The potential also exists for reducing uncertainty by incorporating relevant information into the prior distributions used in the Bayesian estimation procedure. The paper describes how the use of graphical model specification and graphical output of parameter estimates can make Bayesian methods attractive for data analysis and explains the recent advances in computational methods that have made Bayesian techniques more available for providing useful estimates of cetacean population parameters. KEYWORDS: CONSERVATION; MANAGEMENT; POPULATION ASSESSMENT; POPULATION PARAMETERS; STATISTICS

Punt, A.E. and Butterworth, D.S. 2000. Why do Bayesian and Maximum likelihood assessments of the Bering-Chukchi-Beaufort Seas stock of bowhead whales differ? *J. Cetacean Res. Manage.* 2(2):125-33

An approach to baleen whale stock assessment based on maximum likelihood estimation is outlined. This approach is able to consider uncertainty in all of the parameters of the BALEEN II population dynamics model used for the assessment of the Bering-Chukchi-Beaufort (B-C-B) Seas stock of bowhead whales. It replaces the prior distributions used in the Bayesian analyses to incorporate indirect information by bounds (only) on model quantities. The results from this approach are notably different from Bayesian analyses based on the same data/assumptions. These differences result from two factors: the specific shapes chosen for the priors for biological parameters needed for the Bayesian approach, and the updating of these priors, together with the covariance introduced between them, by the exclusion process which ensures consistency of parameter sets generated from these priors with the population model, before the data are taken into account in the assessment. The second of these factors is shown to be much more important in accounting for the difference between the results. However, it is unclear whether this exclusion process is defensibly accorded the probabilistic interpretation that the Bayesian approach assumes of it. Until this question is satisfactorily settled, the bounded maximum likelihood method introduced in this paper may provide a more defensible basis for assessment of the B-C-B bowhead population, even though it may be unable to take account of some information which could be incorporated in a Bayesian approach. KEYWORDS: ARCTIC; BIOLOGICAL PARAMETERS; BOWHEAD WHALE; MODELLING; POPULATION ASSESSMENT; TRENDS; WHALING - ABORIGINAL

Murray, K.T., Read, A.J. and Solow, A.R. 2000. The use of time/area closures to reduce bycatches of harbour porpoises: lessons from the Gulf of Maine sink gillnet fishery. *J. Cetacean Res. Manage.* 2(2):135-41

In 1994, the United States National Marine Fisheries Service (NMFS) implemented a series of time/area closures for the Gulf of Maine sink gillnet fishery to reduce the bycatch of harbour porpoises (*Phocoena phocoena*). The present study evaluates the effectiveness of the Mid-Coast closure area, implemented during November, 1994. Rates of porpoise bycatches are analysed prior to, during and after the closure. In addition, individual vessels are tracked and the spatial distribution of fishing effort examined to determine how fishermen responded to the closure. The highest bycatch rate occurred in September in the Mid-Coast region, well before the closure. During November, fishermen concentrated much of their effort adjacent to the closed area in unrestricted waters, where bycatch occurred. The Mid-Coast closure was not in place for a long enough period, nor was it large enough, to be effective in reducing bycatch rates of harbour porpoises. The failure of the Mid-Coast closure is attributed to temporal and spatial variation in patterns of bycatch rates, and to the displacement of fishing effort and porpoise bycatch outside the closed area. KEYWORDS: ATLANTIC OCEAN; CONSERVATION; EFFORT; GILLNETS; HARBOUR PORPOISE; INCIDENTAL CATCHES; REGULATION

Reid, K., Brierley, A.S. and Nevitt, G.A. 2000. An initial examination of relationships between the distribution of whales and Antarctic krill *Euphausia superba* at South Georgia. *J. Cetacean Res. Manage.* 2(2):143-9

The distribution of whales and krill in two survey boxes north of South Georgia was examined by comparing sightings and underway acoustic data collected as part of a multi-disciplinary research cruise carried out during January/February 1998. A total of 222 cetaceans of 10 species was recorded with southern right whale (*Eubalaena glacialis*) and humpback whale (*Megaptera novaeangliae*) the two most frequent. The largest aggregation of cetaceans (21 southern right whales, 18 fin whales (*Balaenoptera physalus*), 4 sei whales (*B. borealis*), 1 humpback whale and 8 hourglass dolphins (*Lagenorhynchus cruciger*)) occurred close to the largest single aggregation of krill. The level of association between baleen whales and krill was examined at a number of spatial scales. There was a positive relationship between whale abundance and mean krill density at the largest spatial scale examined (80x100km). At progressively smaller scales the relationship weakened, due mainly to the increased frequency of areas of high krill density where whales were not recorded. In particular, whales were absent from inshore areas (up to 300m depth) that had higher mean krill densities compared with areas where whales were recorded. To

thoroughly compare krill and whale distribution, particularly at smaller scales, will require information on krill swarm structure and density, as well as on more information on the behaviour and feeding requirements of whales. Such information may also be crucial to understanding the role of scale-dependence in potential interspecies competition among krill-feeding marine predators. KEYWORDS: ANTARCTIC; EUPHAUSIIDS/COPEPODS; FEEDING; HABITAT; SOUTH GEORGIA; WHALES-GENERAL

Punt, A.E., Butterworth, D.S. and Wada, S. 2000. On the use of allele frequency data within a Bayesian framework to evaluate the relative probabilities of alternative stock structure hypotheses for the North Pacific minke whales. *J. Cetacean Res. Manage.* 2(2):151-8

Genotype frequency information for one or more loci is used within a Bayesian modelling framework to assign relative probabilities to alternative stock-structure hypotheses using the Bayes factor approach. This framework has advantages over maximum-likelihood estimation as it provides the information needed to select amongst hypotheses. For primarily illustrative purposes, the approach is applied to the data for the Adh-1 and Gpi loci for sub-areas 6, 7, 8, 9 and 11 for North Pacific minke whales. The results confirm those of previous studies that there are (at least) two stocks to the east and west of Japan. In contrast, the results support the hypothesis of a single stock in sub-areas 7, 8 and 9 unless a priori the allele frequencies for stocks that are adjacent spatially are likely to be similar. This last result needs to be interpreted with caution as the mutation rate of allozymes is slow and so this caveat might apply in this case. KEYWORDS: GENETICS; MINKE WHALE; NORTH PACIFIC; NORTHERN HEMISPHERE; STOCK IDENTITY

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Hauser, N., Peckham, H. and Clapham, P. 2000. Humpback whales in the Southern Cook Islands, South Pacific. *J. Cetacean Res. Manage.* 2(3):159-64

The presence of humpback whales in the Southern Cook Islands (South Pacific) was investigated during a three-week exploratory survey conducted at Palmerston Atoll in September and October of 1998 and during a three-month survey conducted at Rarotonga, Aitutaki and Palmerston Atoll from July to October in 1999. During a total of 48 survey days in both years and all areas, 50 sightings of 83 humpback whales were made. All classes except mother/calf/escort trios were observed, including singers, mothers and calves, and one competitive group. To date, 31 humpbacks have been individually identified from natural markings, 29 sloughed skin samples were collected for genetic analysis and 15.6 hours of song recordings were made. Reports of whales in other areas of the Cook Islands were also noted, and included records of mother/calf pairs. The Cook Islands region appears to represent a breeding ground for humpback whales, presumably from the little-studied Area VI population. The relationship of humpbacks in this region to those in adjacent tropical areas remains largely unknown, although recent matches between the Cook Islands and both Tonga and French Polynesia indicate some movement through Oceania. KEYWORDS: AREA- COOK ISLANDS; BREEDING GROUNDS; GRENADA; HUMPBACK WHALE; PACIFIC; PHOTO-ID; STOCK IDENTITY; SURVEY-VESSEL

Scheidat, M., Castro, C., Denkinger, J., González, J. and Adelung, D. 2000. A breeding area for humpback whales (*Megaptera novaeangliae*) off Ecuador. *J. Cetacean Res. Manage.* 2(3):165-72

A photo-identification study of humpback whales (*Megaptera novaeangliae*) was conducted between 1996 and 1999 in the Machalilla National Park off mainland Ecuador. This paper compares the results obtained with those from known breeding grounds for humpback whales to determine whether the area represents a breeding area for this species. Factors considered included: seasonality in abundance; population structure (including cow-calf pairs and escort whales) in the breeding area; presence of singers; and occupancy and residence times. It is concluded that the area does represent a breeding ground but the relationship of the animals using this area with those using other areas of the eastern tropical Pacific (and the Antarctic feeding grounds) requires further work. The paper also presents a preliminary estimate of abundance (405, 95%CI 221-531) for the years 1998/1999 using the Chapman-modified Peterson method. KEYWORDS: BREEDING GROUNDS; HUMPBACK WHALE; MARK-RECAPTURE; PACIFIC; PHOTO-ID; SITE-FIDELITY; SOUTH AMERICA

Huele, R., Udo de Haes, H.A., Ciano, J.N. and Gordon, J. 2000. Finding similar trailing edges in large collections of photographs of sperm whales. *J. Cetacean Res. Manage.* 2(3):173-6

The North Atlantic and Mediterranean Sperm Whale Catalogue (NAMSC 1.0) contains images collected via the cooperative effort of several individuals studying sperm whales in the North Atlantic and Mediterranean. The collection offers an important opportunity to test matching algorithms as an aid to photo-identification of individual sperm whales. Of the 2,081 photographs in the catalogue, 1,929 were of sufficient quality for photo-identification. The trailing edge of the fluke, an identifying feature, was extracted by an interactive method. Subsequently, the trailing edge was represented in a normalised form by an affine transformation. Left and right halves were processed separately. Using different methods, 489 matching pairs of photographs were found. Based on these confirmed matches, the power of several measures of similarity was compared. The measure of similarity calculated by cross-correlating the continuous wavelet transforms of the extracted contours was found to perform best in practice. No conclusive matches between photographs from different geographic locations were found. KEYWORDS: ATLANTIC; EUROPE; PHOTO-ID; SPERM WHALE; TECHNIQUES

Malcolm, C.D. and Duffus, D.A. 2000. Comparison of subjective and statistical methods of dive classification using data from a time-depth recorder attached to a gray whale (*Eschrichtius robustus*). *J. Cetacean Res. Manage.* 2(3):177-82

This paper presents dive data obtained from the deployment of a suction-cup attached time-depth recorder (TDR) on a gray whale off the west coast of Vancouver Island, Canada. Data are presented in the form of dive profiles. This represents the first time that dive data have been collected from a gray whale. The data were used to compare subjective classification of dive types to statistical methods of classification, and to test the ability of the statistical methods to classify dives. Each dive was analysed using maximum depth, dive duration and bottom time variables for both subjective and statistical methods to make direct comparison of results. Subjective classification suggests that the tagged animal performed five distinct dive types. Two of these dive types, termed Interventilation and Feeding, were assigned a purpose. Two statistical techniques were then used to classify dives: k-means cluster analysis and discriminant

function analysis. Cluster analysis and subjective classification showed poor agreement due to the statistical technique's inability to account for dive geometry. Discriminant function analysis proved more successful, although this technique also demonstrated some weakness in testing for dive geometry. It was concluded that while statistical analysis of dive data is useful to classify dive types in a general manner, subtle differences, which may be indicative of behavioural differences, still depend on subjective analysis for identification. Detailed analyses of the third, or depth, dimension of the marine mammal environment will be important for the development of effective management strategies, especially as whalewatching grows in popularity. KEYWORDS: DIVING; GRAY WHALE; NORTH AMERICA; NORTHERN HEMISPHERE; PACIFIC; RADIO-TAGGING

Scarpaci, C., Bigger, S.W., Corkeron, P.J. and Nugegoda, D. 2000. Bottlenose dolphins (*Tursiops truncatus*) increase whistling in the presence of 'swim-with-dolphin' tour operators. *J. Cetacean Res. Manage.* 2(3):183-6

The impact of cetacean eco-tourism on subject animals is not clearly understood. Studies that monitor this impact have traditionally concentrated on observable surface behaviour despite the fact that sound is the primary communication channel for cetaceans. This study monitored whistle production in free ranging bottlenose dolphins (*Tursiops truncatus*) to evaluate if dolphins vocalise at different rates in response to commercial dolphin-swim boats. Thirty-two hours of sound were recorded in the austral spring and summer of 1995/96. Results indicate that whistle production is significantly greater in the presence of commercial dolphin swim boats, regardless of dolphins' behavioural state prior to the arrival of the vessels. The increase in whistle production suggests that group cohesion may be affected during approaches made by commercial dolphin swim tour-operators or may serve some other social function. Monitoring vocal behaviour offers another insight into short-term human impacts on cetaceans. KEYWORDS: ACOUSTICS; BEHAVIOUR; BOTTLENOSE DOLPHIN; VOCALISATION; WHALEWATCHING

Leaper, R., Gillespie, D. and Papastavrou, V. 2000. Results of passive acoustic surveys for odontocetes in the Southern Ocean. *J. Cetacean Res. Manage.* 2(3):187-96

Passive acoustic surveys for cetaceans were carried out from the British Antarctic Survey research vessel James Clark Ross in the region of South Georgia in the austral summer of 1998/99 and also during the IWC/CCAMLR collaborative survey in January/February 2000. The acoustic surveys were conducted concurrently with visual observations. A simple two element hydrophone array, sensitive to frequencies of between 300Hz and 24kHz, was towed on a 400m cable astern of the vessel. The total combined acoustic effort for the two surveys was 569 hours along 11,491km (6,205 n.miles) of trackline. On both surveys, stereo recordings were made for 30 seconds every two minutes. Acoustic detections were made of sperm, killer, pilot and southern bottlenose whales and hourglass dolphins. Reliable density estimates were only possible for sperm whales but the data on other species provide useful indications of relative distribution. A total of 42 individual sperm whales were detected and of these 33 were located by crossing bearings derived acoustically from several points along the trackline. Analysis of perpendicular distances pooled across both surveys gave an estimated strip half width of 8.0km (95% CI 6.4-9.9km) giving an overall density estimate for sperm whales of 0.13 and 0.19 whales per 1,000km² from the 1998/99 and 2000 surveys, respectively. The methods supported estimates of sperm whale density using standard line-transect analyses based on perpendicular distances. The need to filter sounds below 300Hz to reduce ship noise largely precluded monitoring for mysticete vocalisations. KEYWORDS: ACOUSTICS; SOUTHERN OCEAN SANCTUARY; SOWER 2000; SPERM WHALE; SURVEY - COMBINED

de Boer, M.N. 2000. A note on cetacean observations in the Indian Ocean Sanctuary and the South China Sea, Mauritius to the Philippines, April 1999. *J. Cetacean Res. Manage.* 2(3):197-200

Information on cetaceans in the Indian Ocean Sanctuary and the South China Sea is summarised from a cruise carried out from 29 March to 17 April 1999. Ten species were positively identified: finless porpoise, pantropical spotted dolphin, spinner dolphin, sperm whale, melon-headed whale, pygmy killer whale, false killer whale, Cuvier's beaked whale, Bryde's whale and fin whale. Spotted dolphins, melon-headed and pygmy killer whales were sighted around the Island of Borneo and sightings of fin whales and a sperm whale west of the Balabac Strait suggest a possible migration route of these species between the South China Sea and the Sulu Sea. This is the first record of fin whales in the South China Sea. KEYWORDS: ASIA; DISTRIBUTION; FIN WHALE; FINLESS PORPOISE; INCIDENTAL SIGHTINGS; INDIAN OCEAN; MELON-HEADED WHALE; MIGRATION; PANTROPICAL SPOTTED DOLPHIN; PYGMY KILLER WHALE; SURVEY-VESSEL

Gowans, S., Whitehead, H., Arch, J.K. and Hooker, S.K. 2000. Population size and residency patterns of northern bottlenose whales (*Hyperoodon ampullatus*) using the Gully, Nova Scotia. *J. Cetacean Res. Manage.* 2(3):201-10

A population of northern bottlenose whales (*Hyperoodon ampullatus*) uses the Gully, a submarine canyon off the coast of Nova Scotia, Canada. Eleven years of photo-identification records has permitted estimation of population size using mark-recapture techniques. The population estimate was small (133 individuals, 95% CI = 111-166 from left side identifications; 127 individuals, 95% CI = 106-160 from right side identifications). The population was not closed, with the combined mortality, mark change and emigration rate estimated at 13% per year for left side identifications (95% CI = 9-17) and 14% for right side identifications (95% CI = 10-18). There was no significant increase or decrease in the population size between 1988-1999 (change in population size: left side: -0.13% per year, 95% CI = -3.4 to 3.9; right side: -0.43% per year, 95% CI = -4.5 to 3.1). The sex ratio was roughly 1:1, with equal numbers of sub-adult and mature males. Over the summer field season, individuals emigrated from, and re-immigrated into the Gully, spending an average of 20 days within the Gully before leaving (left side identifications 19 days, SE = 17; right side identifications 23 days, SE = 10). Approximately 34% of the population was present in the Gully at any time. Individuals of all age and sex classes displayed similar residency patterns although there were annual differences as individuals spent less time in the Gully in 1996 than in 1990 and 1997. Sighting rates were similar in all years with extensive fieldwork, indicating little variability in the number of whales in the Gully each summer. Accurate estimates of population size and residency patterns will be useful in determining the regulations and required coverage for a marine protected area in the Gully. KEYWORDS: MARK-RECAPTURE; NORTHERN BOTTLENOSE WHALE; PHOTO-ID; POPULATION ASSESSMENT; TRENDS

Perrin, W.F., Goodall, R.N.P. and Cozzuol, M.A. 2000. Osteological variation in the spectacled porpoise (*Phocoena dioptrica*). *J. Cetacean Res. Manage.* 2(3):211-6

Cranial and post-cranial variation is described for a large series of specimens of spectacled porpoise from Argentina and compared with that for specimens from other areas of the Southern Hemisphere. Condylolbasal length in 54 adult skulls was 276-424. Tooth counts were

16-26 and 17-23 in the upper and lower jaws, respectively. Total number of vertebrae ($n = 20$) was 66-70. The rostrum may be relatively smaller in the Auckland Islands than in other regions. KEYWORDS: MORPHOMETRICS; SOUTHERN HEMISPHERE; SPECTACLED PORPOISE; STOCK IDENTITY

Bearzi, G. 2000. First report of a common dolphin (*Delphinus delphis*) death following penetration of a biopsy dart. *J. Cetacean Res. Manage.* 2(3):217-22

The remote collection of skin and blubber biopsy samples from free-ranging cetaceans is a powerful technique which has been increasingly used by scientists in recent years in a wide range of applications, particularly with respect to genetic and contaminant studies. Biopsy sampling, if carried out responsibly, is known to cause low-level reactions, and is unlikely to produce long-term deleterious effects. However, this technique is not completely devoid of risk for the sampled animals, particularly for smaller odontocetes. This paper reports the death of a common dolphin in the central Mediterranean Sea, following penetration of a biopsy dart and subsequent handling. The dolphin was hit in the dorsal muscle mass below the dorsal fin by a lightweight pneumatic dart fired from a distance of 6m by a variable-power CO₂ dart projector. The methods and equipment had been previously successfully used with minimal effect on common dolphins and other species under similar conditions; it was therefore considered to be relatively uninvasive and more likely to reduce disturbance while increasing sample retrieval. However, in the reported event, a dart stuck in the dorsal muscle mass instead of recoiling as expected. Less than 2min after the hit, the dolphin began catatonic head-up sinking, and was recovered by a team member at depth. Basic medical care was given to ensure haemostasis, but the animal died 16min later. Minimal overall bleeding and a small wound in the thick muscle mass were not among the suspected causes of death. This may have been the consequence of either indirect vertebral trauma or stress. Furthermore, the dolphin had a relatively thin (7mm) blubber layer, that may have contributed to the unwanted outcome of the biopsy attempt. The author stresses that scientists should only adopt even mildly intrusive research methods after careful review and risk assessment in the light of the precautionary principle, and that their decisions must be reviewed on a regular basis according to the best available evidence. KEYWORDS: BIOPSY SAMPLING; COMMON DOLPHIN; MEDITERRANEAN; MORTALITY; STRESS; TECHNIQUES

Romero, A. and Hayford, K. 2000. Past and present utilisation of marine mammals in Grenada, West Indies. *J. Cetacean Res. Manage.* 2(3):223-6

The exploitation of marine mammals in Grenada dates back to pre-Columbian times. Whaling ships visited Grenadian waters in the 19th century and during the 1920s there was a short-lived attempt to develop a local, modern whaling industry. Since then no exploitative interactions between Grenadians and marine mammals had taken place, until the 1990s when two whalewatching operations were established. KEYWORDS: ATLANTIC; EXPLOITATION; HUMPBACK WHALE; NORTHERN HEMISPHERE; WHALEWATCHING; WHALING - HISTORICAL

Moore, S.E., Waite, J.M., Mazzuca, L.L. and Hobbs, R.C. 2000. Mysticete whale abundance and observations on prey association on the central Bering Sea shelf. *J. Cetacean Res. Manage.* 2(3):227-34

Visual surveys for cetaceans were conducted along transect lines in the central Bering Sea in association with a groundfish stock assessment survey from 5 July to 5 August 1999. There were 125 sightings of single or groups of mysticete whales during 6,043km of survey effort. Fin whales were most common (60% of all sightings), with distribution clustered along the outer continental shelf break near the 200m isobath. In addition, there were 27 sightings of minke whales and 17 sightings of humpback whales. Minke whales were primarily found along the upper slope in water 100-200m deep, while humpbacks clustered along the eastern Aleutian Islands and near the USA/Russian Convention Line southwest of St. Lawrence Island. Abundance estimates for fin, humpback and minke whales were: 4,951 (95% CI = 2,833-8,653); 1,175 (95% CI = 197-7,009) and 936 (95% CI = 473-1,852), respectively. These three species were the only ones for which sufficient on-effort sightings were available to estimate abundance. Sei whales, a gray whale and a pair of northern right whales were also seen. Although right whales have been seen in this area before, some behavioural details are provided here because observations of these whales remain rare. KEYWORDS: ABUNDANCE; BERING SEA; DISTRIBUTION; FIN WHALE; HUMPBACK WHALE; MINKE WHALE; MYSTICETES; NORTH PACIFIC RIGHT WHALE

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Poole, D. and Givens, G.H. 2001. An explanatory assessment of the Bering-Chukchi-Beaufort Seas of bowhead whales using a stochastic population model. *J. Cetacean Res. Manage.* 3(1):1-6

The stochastic population dynamics model used by Aboriginal Whaling Management Procedure developers is revised to correct weaknesses related to uncertainty parameterisation and replacement yield estimation. Two variants of this model, along with the standard deterministic version, are used to assess the Bering-Chukchi-Beaufort Seas stock of bowhead whales. The variants differ with respect to the magnitude and complexity of the stochastic variation they introduce into natural mortality and birth/calf survival processes. An allowable catch statistic, $E(Q_0)$, is defined for appropriate use with stochastic model assessments. Using the same assessment methods, likelihood and priors as IWC (1999a), 5th percentiles of $E(Q_0)$ were found to be 117, 106 and 91 for the deterministic, simpler stochastic and extreme stochastic models, respectively. Bayes factor results show that there is no evidence suggesting that either stochastic model should be favoured over any simpler alternative, and the deterministic model yielded the best fit overall. The $E(Q_0)$ estimates confirm and strengthen past IWC Scientific Committee inference that under current bowhead subsistence hunting levels the stock should continue to increase towards stabilisation above its maximum sustainable yield level. KEYWORDS: ARCTIC; BOWHEAD WHALE; JOURNAL3/1; MODELLING; POPULATION ASSESSMENT; STATISTICS; WHALING - ABORIGINAL

Witting, L. 2001. A note on the development of Catch Control Laws for multi-species subsistence whaling. *J. Cetacean Res. Manage.* 3(1):7-11

Past work on Aboriginal Whaling Management Procedures (AWMPs) has focused on single-species approaches. This paper considers the issue of multi-species approaches by superimposing multi-species Catch Control Laws (CCLs) on top of underlying single-species models. Multi-species CCLs can fulfill larger 'need' than purely single-species approaches and can optimise the recovery rates of multiple species when need is satisfied. Four examples of multi-species CCLs are described to instigate discussion. The algorithms are based on the

principles of species ranking, even catch, even exploitation and even recovery, respectively. These allocation principles are discussed in relation to management objectives for aboriginal subsistence whaling. KEYWORDS: JOURNAL3/1; MANAGEMENT PROCEDURE; WHALING - ABORIGINAL

Ramakrishnan, U. and Taylor, B.L. 2001. Can gray whale management units be assessed using mitochondrial DNA? *J. Cetacean Res. Manage.* 3(1):13-8

Although most eastern North Pacific gray whales (*Eschrichtius robustus*) feed in Alaskan waters north of the Aleutian peninsula, some have been reported as long-term feeding residents in more southern waters ranging from northern California to southeast Alaska. The population history of this smaller putative southern feeding population is unknown. Recently, native Americans of the Makah tribe attained permits to harvest up to five whales per year in Washington State waters. Managers need to know whether southern summer residents could be potentially depleted through low-level harvesting. This paper investigates the feasibility of using genetic data to assess the plausibility of two possible population histories for the southern feeding group: panmixia with the northern feeding group and a single colonisation event less than a century ago. We find that a genetic study would most probably result in an unambiguous answer to the question of whether the southern feeding group is a separate population founded by a single colonisation event. Simulations show that a single founding event in the last century would result in genetic differentiation 97.8% of the time ($\alpha=0.05$) between the two feeding groups. Further, sensitivity analyses of uncertain parameters used in the model show that the results do not depend on the values of growth rate, mitochondrial allele frequency distribution or population size of the eastern North Pacific gray whale after commercial harvest. KEYWORDS: GENETICS; GRAY WHALE; JOURNAL3/1; MODELLING; STOCK IDENTITY

Krahn, M.M., Ylitalo, G.M., Burrows, D.G., Calambokidis, J., Moore, S.E., Gosh, M., Gearin, P., Plesha, P.D., Brownell, R.L.J., Blokhin, S.A., Tilbury, K.L., Rowles, T. and Stein, J.E. 2001. Organochlorine contaminant concentrations and lipid profiles in eastern North Pacific gray whales (*Eschrichtius robustus*). *J. Cetacean Res. Manage.* 3(1):19-29

Organochlorine (OC) contaminant concentrations in tissues and lipid profiles in blubber are summarised for 101 gray whales (*Eschrichtius robustus*) from the eastern North Pacific stock. Samples were obtained from presumably healthy gray whales during a 1994 subsistence hunt in the Russian Arctic ($n=17$) and also from biopsy sampling of live animals from the Washington coast ($n=38$). In addition, tissues were collected from two groups of animals (1988-1991, $n=22$; and 1999, $n=24$) that stranded along the west coast of the USA. These whales represent a diverse group of animals with respect to lipid stores, age, gender, health and reproductive status. Information about these biological factors is necessary before contaminant concentration data can be properly interpreted. Differences in blubber lipid levels and profiles were examined among these groups of whales. Significantly higher lipid levels were found in the blubber of subsistence animals that were sampled following summer feeding in the Bering and Chukchi Seas, compared to lipid levels in the biopsied and stranded animals. Lipid class profiles from blubber of presumably healthy gray whales (i.e. from subsistence and biopsy sampling) contained primarily triglycerides and were very different from those of stranded animals that showed lipid decomposition (increased proportions of free fatty acids, cholesterol and phospholipids). Furthermore, lipid class profiles were found to be a means of estimating the quality of a blubber sample from stranded cetaceans. An examination of how biological factors (e.g. gender, reproductive status, age) contribute to interpreting the differences found in contaminant concentrations among the gray whales was also undertaken. Although not statistically significant, higher (OC) concentrations were found in males compared to females, thus suggesting the tendency of the mother to shift her contaminant burden to her calf during gestation and lactation. Results also indicated that there was no significant increase in concentrations of contaminants in the blubber with increase in length (surrogate for age). Higher concentrations of OC contaminants were found in stranded juvenile gray whales, compared to juvenile subsistence whales, and were thought to result from retention of OCs in blubber of the stranded animals as lipid stores are mobilised for energy and total lipid levels decrease, rather than from a difference in diet or feeding areas. OC concentrations in various tissues (blubber, liver, kidney, muscle, brain) were similar on a lipid weight basis, except for brain, which had lower lipid-adjusted OCs because the blood-brain barrier limits contaminant transfer. KEYWORDS: ARCTIC; BIOPSY SAMPLING; GRAY WHALE; JOURNAL3/1; MONITORING; ORGANOCHLORINES; PACIFIC OCEAN; POLLUTANT BURDEN; POLLUTANTS; STRANDINGS

Rugh, D.J., Shelden, K.E.W. and Schulman-Janiger, A. 2001. Timing of the gray whale southbound migration. *J. Cetacean Res. Manage.* 3(1):31-9

The southbound migration of the eastern North Pacific stock of gray whales (*Eschrichtius robustus*) has been documented by the National Marine Fisheries Service most seasons since 1967 at or near Granite Canyon, in central California, and by the American Cetacean Society's Los Angeles Chapter every season since 1985 at Point Vicente, southern California. This has provided a rare opportunity to examine cetacean migratory timing data over a relatively long time series. In 1998/99, anecdotal reports indicated a major change had occurred in the timing of the migration, which prompted this study to compare the observed timing relative to expected dates. Although no observers were at Granite Canyon in 1998/99, data collected from this site indicated that prior to 1980, annual median sighting dates ranged from 4-13 January (overall median = 8 January; CI=1.3), but since then there has been a one-week (6.8 day; CI=2.0) delay, with median dates now ranging from 12-18 January (overall median = 15 January; CI=1.7). This delay in timing is better represented as a shift in dates than as a trend, and it occurred shortly after a major oceanographic regime shift in the North Pacific Ocean. The shift in whale sighting dates occurred equally in the onset of the migrations (when the first 10% of the whales passed a site), the median (50%) and end (when 90% of the whales passed). At Granite Canyon, there were no significant trends in these dates prior to 1980 or in dates following the shift. In mid-February (median = 15 February, CI=1.9, at Point Vicente), few gray whales are still going south and some are already migrating north. Most of the migration (the period between the 10% and 90% sighting dates) occurs across a period of 34 days (CI=2.0), but the entire southbound migration may take >70 days to pass a location in any given year. It takes a whale approximately 54 days to migrate from the north central Bering Sea to the lagoons in Baja California (8,000km), but some whales may travel as far as 10,000km. Based on available observations and calculations using a travel rate of 147km/day, current median (peak) sighting dates of the southbound migration should be: 1 December in the north central Bering Sea (here considered the theoretical starting point for the migration); 12 December at Unimak Pass, Alaska; 18 December for Kodiak Island, Alaska; 5 January for Washington State; 7 January for Oregon; 15 January for central California; 18 January in southern California; and 24 January at the northern lagoons in Baja California (considered here to be the terminus of the migration). Although no observations were made at Granite Canyon in 1998/99, sightings made at Yaquina Head, Oregon (median sighting date = 7 January) and at Point Vicente (median = 20 January) indicate that the timing of that migration was consistent

with previous years. KEYWORDS: ARCTIC; GRAY WHALE; JOURNAL3/1; LONG-TERM CHANGE; MIGRATION; MONITORING; NORTH PACIFIC; NORTHERN HEMISPHERE; PACIFIC OCEAN; SURVEY - SHORE-BASED; TRENDS

Gendron, D., Aguiniga, S. and Carriquiry, J.D. 2001. $\delta^{15}\text{N}$ and $\delta^{13}\text{N}$ in skin biopsy samples: a note on their applicability for examining the relative trophic level in three rorqual species. *J. Cetacean Res. Manage.* 3(1):41-4

Preliminary stable nitrogen and carbon isotope analysis was undertaken to investigate whether the resulting data support current knowledge of diet as obtained by conventional approaches. Blue (*Balaenoptera musculus*), fin (*B. physalus*) and Bryde's (*B. edeni*) whales co-occur temporally and are known to feed in the Gulf of California, Mexico. Isotope measurements were taken from: known prey (three euphausiids and four sardine samples); skin biopsies (two for each whale species); and from faeces (one blue and three fin whale samples). Although the sample size was small, the range of $\delta^{15}\text{N}$ values obtained was consistent with prior knowledge of the whales feeding habits, with values increasing in the order: blue ($x=12.9$), fin ($x=15.4$) and Bryde's whales ($x=15.8$). The low value for the blue whale confirms its known stenophagous habit. The closeness of $\delta^{15}\text{N}$ values for fin and Bryde's whales coincides with the known ichthyophagous habits of the Bryde's whale and the more generalist fin whale which feeds on both fish and zooplankton. The difference in $\delta^{13}\text{C}$ values for fin ($x=16.0$) and Bryde's whales ($x=18.1$) suggests that although they feed at the same trophic level, they might use different food sources or feeding sites. Results of $\delta^{15}\text{N}$ suggest that fin and Bryde's whales share the same relative trophic level, blue whales and juvenile sardines (*S. sagax*) share a lower position, followed by the euphausiid (*Nematocelis difficilis*) and fin whale faeces, and at the lowest level blue whale faeces. KEYWORDS: BIOPSY SAMPLING; BLUE WHALE; BRYDE'S WHALE; FIN WHALE; FOOD; ISOTOPES; JOURNAL3/1; PREY; TECHNIQUES

Reeves, R.R., Kahn, J.A., Olsen, R.R., Swartz, S.L. and Smith, T.D. 2001. History of whaling in Trinidad and Tobago. *J. Cetacean Res. Manage.* 3(1):45-54

Shore whaling for humpback whales (*Megaptera novaeangliae*) in Trinidad represents a largely overlooked aspect of North Atlantic whaling history. Literature and archival sources were searched for information on the chronology, nature and extent of this whaling. The first shore station began operations in about 1826 on one of the islands in the Dragon's Mouth, the strait connecting the southern Caribbean Sea with the Gulf of Paria. At least four stations were active in this area at one time or another and the maximum documented one-year catch was about 35 humpbacks. Whaling effort had begun to decline by the 1850s and was largely ended by the 1880s. Oil for domestic consumption as well as export was the main product. Removals by the shore whalers were in addition to those by American pelagic whalers who occasionally called at Port-of-Spain and whaled in the vicinity of Trinidad and along the Spanish Main. No evidence was found of organised shore whaling in Tobago. KEYWORDS: ATLANTIC OCEAN; BREEDING GROUNDS; DIRECT CAPTURE; EFFORT; JOURNAL3/1; SOUTH AMERICA; WHALING - HISTORICAL

Felix, F. and Haase, B. 2001. Towards an estimate of the southeastern Pacific humpback whale stock. *J. Cetacean Res. Manage.* 3(1):55-8

Between 1991 and 1997 a photo-identification study of Southeastern Pacific humpback whales was carried out on the central coast of Ecuador ($1^{\circ}26'\text{S}$, $80^{\circ}50'\text{W}$), South America. During this period, a total of 219 whales were identified and catalogued by the colouration pattern on the ventral side of their flukes. Naturally marked whales were used to estimate the population through the Petersen's mark-recapture method as modified by Bailey. With data from the final two seasons (1996-1997), the resultant estimate was 1,922 (95% CI=77-3,767) whales. Pooling data from the first six years resulted in an estimate of 2,683 (95% CI=397-4,969) whales. Sources of bias relate to violations of the assumptions of closure and equal catchability conditions. The low inter-yearly resighting rate and a high rate of new discoveries in the last season indicate that only a fraction of the population has so far been identified. Despite the broad confidence interval, these data provide an indication of the current number of whales. KEYWORDS: ABUNDANCE ESTIMATE; HUMPBACK WHALE; JOURNAL3/1; MARK-RECAPTURE; PACIFIC; PHOTO-ID; SOUTH AMERICA

Felix, F. and Haase, B. 2001. A note on humpback whales off the coast of Ecuador during the 1997 'El Niño' event. *J. Cetacean Res. Manage.* 3(1):59-64

The southeastern Pacific humpback whale stock was studied for seven years (1991-1997) on the central coast of Ecuador ($1^{\circ}25'\text{S}$, $79^{\circ}55'\text{W}$) during the breeding season (June-September). Boat trips were conducted from two different sites, Puerto López and Puerto Cayo, following well-defined routes offshore. In 1997, a strong El Niño affected the eastern Pacific area. In order to try and investigate possible climate-induced shifts, results obtained from 1996, a 'normal' year, were compared with those obtained in 1997, when water temperature was 4°C above its historical mean. Four factors were considered: whale encounter rate; distribution; group structure; and crude birth rate. The whale encounter rate decreased in 1997 for both sites: 11.2% for Puerto López and 8.7% for Puerto Cayo, although the differences were not statistically significant ($p>0.05$). Group distribution in relation to water depth was not significantly different ($p>0.05$), nor were the mean distances from sighting sites to port ($p>0.05$). Group size was equal in both years for Puerto López, but in Puerto Cayo it was larger in 1997, although not significantly ($p>0.05$). Group composition was not significantly different ($p>0.05$). No difference in birth rate was found in Puerto López. Results for Puerto Cayo are difficult to interpret. No changes in the investigated parameters were found in the study area during El Niño 1997. Since humpback whales do not feed in tropical waters, they may not be as vulnerable to El Niño events as other marine mammals. KEYWORDS: EL NINO; HUMPBACK WHALE; JOURNAL3/1; MONITORING; PACIFIC OCEAN; SOUTH AMERICA

Stafford, K.M., Niekirk, S.L. and Fox, C.G. 2001. Geographic and seasonal variation of blue whale calls in the North Pacific. *J. Cetacean Res. Manage.* 3(1):65-76

The call characteristics and distribution of blue whales in the North Pacific were examined by use of acoustic surveys. Two distinct vocalisation types have been previously attributed to blue whales from limited regions in the North Pacific (cf. Thompson and Friedl, 1982; Rivers, 1997). Hydrophone data from sixteen sites in the North Pacific were examined for these blue whale vocalisations. There were distinct geographic and seasonal differences between the occurrence of the two vocalisation types. The hydrophones that were more westerly recorded the 'northwestern' Pacific vocalisation, those in the eastern Pacific recorded the 'northeastern' Pacific vocalisation and those in the central Pacific recorded both types. Northeastern vocalisations were recorded from July-December in the northeast Pacific and February-May in the eastern tropical Pacific. Northwestern vocalisations were recorded most often from July-December, and were

essentially absent from March-May in the northwestern Pacific. These results suggest that the different vocalisation types may represent at least two distinct groups of blue whales in the North Pacific. KEYWORDS: ACOUSTICS; BLUE WHALE; DISTRIBUTION; JOURNAL3/1; NORTH PACIFIC; VOCALISATION

Gendron, D. and Mesnick, S.L. 2001. Sloughed skin: a method for the systematic collection of tissue samples from Baja California blue whales. *J. Cetacean Res. Manage.* 3(1):77-9

The frequency of occurrence of naturally sloughed skin was investigated to verify the feasibility of this method to study blue whale genetics off Baja California. Sloughed skin was recorded in 97% of 337 surfacing intervals with blue whales, *Balaenoptera musculus*, along the Baja California peninsula, Mexico. No significant difference ($P>0.05$) was found in size of pieces of skin sloughed from whales in different habitats, sea surface temperatures or whether they were alone or in pairs. Samples were recoverable independent of gender and age and could be linked to individuals. While yield of extracted DNA was low (0-0.15g/mg tissue), gender determination was successful in 55% of the samples assayed. KEYWORDS: BLUE WHALE; GENETICS; JOURNAL3/1; SAMPLING STRATEGY

Cox, T.M., Read, A.J., Solow, A. and Tregenza, N. 2001. Will harbour porpoises (*Phocoena phocoena*) habituate to pingers? *J. Cetacean Res. Manage.* 3(1):81-6

Large bycatches of harbour porpoises (*Phocoena phocoena*) occur in gillnet fisheries throughout the Northern Hemisphere. Several mitigation measures, including acoustic deterrent devices or 'pingers', have been used in efforts to reduce this bycatch. The potential exists for harbour porpoises to habituate to pingers, thus reducing their effectiveness over time. A field experiment was conducted to test the hypothesis that porpoises habituate to the sound produced by pingers. Porpoise echolocation and movements were monitored around a mooring equipped with a pinger (Dukane NetMark 1000) for three months in summer 1998 in the Bay of Fundy. Using a mean-shift model it was estimated that porpoises were initially displaced 208m from the pinger ($p=0.019$), but this displacement diminished by 50% within four days ($p=0.019$). Using a probability model it was demonstrated that the probability of porpoises within 125m of the pinger initially decreased when the pinger was turned on, but then increased to equal the control in 10-11 days. Echolocation rate ($p<0.001$) and occurrence ($p<0.001$) were significantly reduced in the vicinity of the pinger. These results indicate that porpoises habituated to the Dukane NetMark 1000 pinger and are not alerted to echolocate in the presence of nets by pingers. KEYWORDS: BEHAVIOUR; BY-CATCH; ECHOLOCATION; FISHERIES; GILLNETS; INCIDENTAL CAPTURE; JOURNAL3/1; NOISE

Scott, M.D., Hohn, A.A., Westgate, A.J., Nicolas, J.R., Whitaker, B.R. and Campbell, W.B. 2001. A note on the release and tracking of a rehabilitated pygmy sperm whale (*Kogia breviceps*). *J. Cetacean Res. Manage.* 3(1):87-94

A stranded, rehabilitated 220cm female pygmy sperm whale was radiotracked from 31 May-4 June 1994 after its release in the Gulf Stream off Cape Canaveral, Florida. The whale moved directly off the continental shelf and headed northward within a corridor bounded by the shelf break and the eastern edge of the Gulf Stream. It moved offshore up to 32 n.miles from the shelf break during the late afternoons and nights and headed back toward the shelf break during the day. The average travelling speed was 3.0kts, and ranged from 0-6kts. Speeds were greatest offshore of the shelf break (4.7kts), where the speed of the Gulf Stream was the greatest, and both travelling speeds and Gulf Stream speeds decreased with distance offshore. The whale did not appear, however, to be drifting passively with the current. Diving duration varied significantly with light levels. The whale made long dives (>8 min) at night and on overcast days when squid are known to be closer to the surface. During clear days, the whale's dives were significantly shorter, typically less than five minutes ($n=841$). Although these results come from only a single, rehabilitated animal, the four days of data provided the first information on pygmy sperm whale movements and diving behaviour at sea: how its behaviour was influenced by time of day, oceanographic features, and environmental conditions, and how the whale's surfacing behaviour could allow survey estimates to be adjusted for diving whales missed along the trackline. KEYWORDS: DIURNAL BEHAVIOUR; DIVING; JOURNAL3/1; OCEANOGRAPHY; PYGMY SPERM WHALE; RADIO-TAGGING; STRANDINGS; TELEMETRY

Secchi, E.R., Ott, P.H., Crespo, E.A., Kinan, P.G., Pedraza, S.N. and Bordino, P. 2001. A first estimate of franciscana (*Pontoporia blainvillei*) off southern Brazil. *J. Cetacean Res. Manage.* 3(1):95-100

The franciscana, *Pontoporia blainvillei*, is endemic to the western South Atlantic Ocean and is perhaps one of the most threatened small cetacean species in this region. This paper presents a first abundance estimate for the coastal waters of Rio Grande do Sul State (southern Brazil) and Uruguay. In March 1996, an aerial survey was conducted along the Rio Grande do Sul State coast. Thirty-four franciscanas (29 groups) were recorded leading to a mean density estimate of 0.657 individuals/sq km (95% CI: 0.516 to 0.836) for the study area (435 sq km) after applying a correction factor for submerged dolphins. This corresponds to an estimated abundance of 286 franciscanas (95% CI: 225 to 364). The study area represents only 0.7% of the suggested distribution of the stock. The paper discusses possible management implications of this study in the light of reported incidental mortality estimates for this region. Further surveys covering a larger area are recommended in order to obtain more reliable abundance estimates for the stock. KEYWORDS: ABUNDANCE; CONSERVATION; FRANCISCANA; INCIDENTAL CAPTURE; JOURNAL3/1; SOUTH ATLANTIC; SURVEY - AERIAL

Evans, K. and Robertson, K. 2001. A note on the preparation of sperm whale (*Physeter macrocephalus*) teeth for age determination. *J. Cetacean Res. Manage.* 3(1):101-7

We describe a modification to the most common method of preparing sperm whale teeth for age determination. The first mandibular or nearest straightest tooth was sectioned in half with a slow-rotating band saw, polished and, rather than subjecting the sectioned tooth to 10% formic acid for 30 hours, etched in 15% formic acid. The exposure time of each tooth to the acid varied depending on the size, and especially, the density of the tooth. Clear, well defined growth layer groups in sperm whale teeth suitable for age determination can be produced in substantially shorter periods of time. A method for the preparation of teeth from young sperm whales is also described. Thin sectioning and staining of teeth is used to prepare small teeth from young animals and avoids potential decalcification, which may possibly occur using acid etching methods. KEYWORDS: AGE DETERMINATION; AUSTRALASIA; JOURNAL3/1; SOUTHERN HEMISPHERE; SPERM WHALE; STRANDINGS

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Dereksdóttir, E.H. and Magnússon, K.G. 2001. Investigations of an Aboriginal Whaling Management Procedure using Adaptive Kalman Filtering (AKF). *J. Cetacean Res. Manage.* 3(2):109-16

The feasibility of using Kalman Filter methods as the basis for an Aboriginal Whaling Management Procedure is explored in this paper. Adaptive Kalman Filters are used to obtain estimates of the stock size and posterior probability distributions for MSY rate (MSYR) and the pre-exploitation stock size K. A set of catch control laws is then used on these estimates of stock size, which together with the posterior distributions of the various combinations of MSYR and K, gives a cumulative distribution function for the strike limit. The eventual strike limit is then determined as a pre-specified percentile of this distribution. The procedure is tested on some Evaluation Trials set by the Standing Working Group on Aboriginal Whaling Management Procedures of the International Whaling Commission (IWC) Scientific Committee. The estimation of a bias factor was considered and results are presented. KEYWORDS: ADELAIDE; KALMAN FILTERING; MANAGEMENT PROCEDURE; WHALING - ABORIGINAL

Reeves, R.R., Swartz, S.L., Wetmore, S.E. and Clapham, P.J. 2001. Historical occurrence and distribution of humpback whales in the eastern and southern Caribbean Sea, based on data from American whaling logbooks. *J. Cetacean Res. Manage.* 3(2):117-29

The best-known present-day wintering areas for the North Atlantic population of humpback whales (*Megaptera novaeangliae*) are in the northern West Indies, notably off the island of Hispaniola. However, it is known that in the nineteenth century American whalers hunted humpbacks in the Windward Islands (primarily from Guadeloupe southwards), along the coast of Trinidad, in the Gulf of Paria and westwards along the Venezuelan coast. To investigate the historical distribution and occurrence of humpback whales, data were extracted from nineteenth century American whaling logbooks and journals covering 48 voyages by 29 vessels to the West Indies from 1823 to 1889. Humpback whale records in these documents came from a geographical area that encompassed Haiti to the coast of Venezuela. Of 807 records in which whales were mentioned (as sightings, strikes or catches), the largest number was from the Windward Islands and Venezuela, especially St Vincent and the Grenadines (319 records covering an estimated 958 humpbacks), Guadeloupe (190 records, 592 humpbacks), Dominica/Martinique/St Lucia (74 records, 193 humpbacks) and Venezuela (64 records, 216 humpbacks). These totals should be regarded only as approximate indicators of the relative abundance of whales since the effort involved cannot be meaningfully quantified. Similarly effort-uncorrected data suggest that the peak months for humpback whales in the Windward Islands were February, March and April. Few sightings were recorded off the Dominican Republic after March, but this may reflect a lack of effort there in April and May. However, humpbacks apparently were abundant in the Windwards in April and even May, which is not the case in the major present-day wintering areas off Hispaniola. With one notable exception, there is little evidence in the logbooks and journals that humpbacks were taken on a more than casual basis in waters off Hispaniola, where the major aggregations are found today; possible explanations for the marked contrast in present versus historical distribution are discussed. The highly seasonal visitation of the West Indies by the American nineteenth-century whalers precludes a meaningful investigation of the possibility that some humpbacks from the Southern Hemisphere migrated to the Caribbean Sea in the austral winter. KEYWORDS: CARIBBEAN SEA; DISTRIBUTION; HUMPBAC WHALE; WEST INDIES; WHALING - HISTORICAL

Leaper, R. and Gordon, J. 2001. Application of photogrammetric methods for locating and tracking cetacean movements at sea. *J. Cetacean Res. Manage.* 3(2):131-41

Accurate measurements of the locations of surfacing cetaceans are important data for behavioural studies and sightings surveys. A system for tracking cetacean movements based on photogrammetric analysis of digital images has been developed and tested at sea. Radial distances from the ship to surfacing whales were calculated from video images by measuring the angle of dip between the whale and the horizon. Bearings were either measured from still images of reference points on the ship, from a magnetic bearing compass or from the bearing ring of stand-mounted binoculars. The system uses readily available equipment and can be operated by one person. Calibration tests were conducted to assess the accuracy of the system. Errors in distance measurement increased approximately linearly with distance. Under typical survey conditions, from a large vessel with an eye height of 18m, distances to whales could be measured with a root mean square error of 3.5%. A model was developed to enable corrections to be made for atmospheric refraction. This has implications for other studies using reticle binoculars. If refraction is not corrected then distance estimates will be negatively biased. Field trials of the system were conducted from several different types and sizes of vessel during studies of a number of different species. Results of these trials demonstrated that the system is a practical tool for fine-scale tracking of cetacean movements and could also be used on line transect surveys. The limitations of the system are the need for a clear horizon and difficulties, for some species, in obtaining suitable quality images of all surfacings. There is also a moderate overhead in increased analysis time. Advances in digital imaging technology are likely to solve many of the image quality problems in the future. KEYWORDS: MOVEMENT; PHOTOGRAMMETRY; SURVEY-VESSEL

Branch, T.A. and Butterworth, D.S. 2001. Southern Hemisphere minke whales: standardised abundance estimates from the 1978/79 to 1997/98 IDCR-SOWER surveys. *J. Cetacean Res. Manage.* 3(2):143-74

Minke whale abundance estimates, standardised by the use of consistent methodology throughout, are presented from the IWC/IDCR and SOWER Antarctic circumpolar sightings surveys for three circumpolar sets of cruises: 1978/79-1983/84, 1985/86-1990/91 and 1991/92-1997/98 (*still incomplete). The database estimation package DESS is used to obtain these standardised estimates. Two survey modes (closing and IO) are used in the surveys; IO mode is considered to provide less biased estimates. An updated estimate for the conversion factor from closing to "pseudo-passing" mode of $R = 0.826$ ($CV = 0.089$) is obtained. IO and "pseudo-passing" estimates are then combined using inverse-variance weighting to give estimates of 608 000 ($CV = 0.130$), 766 000 ($CV = 0.091$) and 268 000* ($CV = 0.093$) for the three circumpolar sets of cruises. These cruises have covered approximately 65%, 81% and 68% of the ice-free area south of 60oS. As estimates of abundance for Southern Hemisphere minke whales, these are negatively biased because some areas inside the pack ice cannot be surveyed, not all whales migrate into the area south of 60oS, the assumption is made that all whales on the trackline are sighted, and minke whale sightings for which species identification is uncertain ("like minkes") are omitted. The three circumpolar estimates are extrapolated simply to account for the different areas covered in the sets of surveys, and also for the increasing proportion of "like-minke" sightings over time. The results suggest that for comparable areas the abundance estimates for the third circumpolar set of cruises are 55% (closing mode only) and 45% (IO mode only) of those for the second set, but that the first and second set estimates are within 15% of each other. The decrease in abundance between the second and third sets is statistically significant at the 5% level. Possible reasons for this

estimated decline are discussed, related both to factors that might render the estimates non-comparable, and to population dynamics effects that could have led to a real decline. Further attention should be given, in particular, to the most appropriate method for estimation of mean school size for these surveys. KEYWORDS: ABUNDANCE ESTIMATE; ANTARCTIC; MINKE WHALE; SOUTHERN HEMISPHERE; SURVEY-VESSEL

Heide-Jorgensen, M.P., Nordoy, E.S., Oien, N., Folkow, L.P., Kleivane, L., Blix, A.S., Jensen, M.V. and Laidre, K.L. 2001. Satellite tracking of minke whales (*Balaenoptera acutorostrata*) off the coast of northern Norway. *J. Cetacean Res. Manage.* 3(2):175-8

Two minke whales were tagged with satellite-linked radio transmitters off the coast of northern Norway in order to obtain data on daily locations, movements and swimming speed. One whale was tagged in September 1994, south of Lofoten at the entrance to the Vestfjorden, and one whale was tagged in August 1999 just north of Vesterålen. The whale tagged in 1994 was successfully tracked for 31 days (located 1.5 times/day on average). The whale tagged in 1999 was successfully tracked for 19 days (located 3.0 times/day on average), although the first locations were not obtained until 18 days after the instrumentation. The whale tagged in 1994 travelled between two apparent feeding areas on the west coast of northern Norway: one in the mouth of Vestfjorden and the other along the continental slope north of Vesterålen. The whale tagged in 1999 moved to an area inside Vestfjorden and remained there until early September, after which it began a southward movement out of Vestfjorden offshore to the edge of the continental shelf. Both whales were presumably feeding on herring (*Clupea harengus*), which is particularly abundant in these waters at this time of year. The two minke whales travelled 78 and 79 km/day when distances between all positions were used, and 66 and 53 km/day when the daily average positions (all qualities) were used. Both calculations illustrate that minke whales can move considerable distances on a daily basis. KEYWORDS: MINKE WHALE; MOVEMENT; SATELLITE TRACKING; TELEMETRY

Olsen, E. and Holst, J.C. 2001. A note on common minke whale (*Balaenoptera acutorostrata*) diets in the Norwegian Sea and North Sea. *J. Cetacean Res. Manage.* 3(2):179-83

Visual observations and quantitative samples of forestomach contents were made of minke whales caught in the Norwegian Sea (15 visual observations in 1999, 8 in 2000 and 1 stomach sample) and North Sea (15 visual observations and 7 stomach samples, all from 1999). Prey species were identified, and from the forestomach samples, each prey's relative contribution by weight to the diet was calculated. In the Norwegian Sea, the diet was dominated by Norwegian spring-spawning herring (100%). This was consistent with the large and dominant abundance of herring in the area. Observations and forestomach samples from the North Sea indicated a more varied diet, with sandeel (*Ammodytes* spp.) contributing 86.7% to the diet by weight, followed by mackerel (9.3%), whiting (2.4%), herring (1.1%) and Norway pout (0.5%). Haddock was observed in one stomach, but was not found in any of the samples. Sandeel occurred in all observed and four of the sampled stomachs. The domination of pelagic species in the diet strongly indicates pelagic feeding behaviour in both areas. KEYWORDS: ECOSYSTEM; FEEDING GROUNDS; FISH; FOOD/PREY; MINKE WHALE

Di Beneditto, A.P.M. and Ramos, R.M.A. 2001. Biology and conservation of the franciscana (*Pontoporia blainvillei*) in the north of Rio de Janeiro State, Brazil. *J. Cetacean Res. Manage.* 3(2):185-92

This paper describes the interactions of the franciscana (*Pontoporia blainvillei*) with fisheries in the north of Rio de Janeiro State (21°18'S-22°25'S) and presents new information on its biology. A total of 181 dolphins were caught in gillnet fisheries in northern Rio de Janeiro from 1986-1999. The annual catch per unit effort (CPUE) values varied from 0.2-1.8 dolphins per gillnet fishing effort. Incidental captures were recorded throughout the year, usually less than 10 n.miles from shore, in depths less than 30m and in surface-set gillnets. There was no difference in the proportion of sexes (1 male:1.1 females). Males ranged from 66-130.0cm and 0-5 years and females from 74-147.5cm and 0-9 years. The predicted asymptotic length (using the Gompertz model) was 121.9cm for males and 145.6cm for females. Calving occurs throughout the year, with no seasonal pattern. Females attain sexual maturity at 3 years and 130.0cm in length and males at 2 years and 115.0cm. Individuals up to the age of three years represented 74% of the dolphins captured. Franciscana preferentially feed on the teleosts *Stellifer* sp., *Anchoa filifera*, *Pellona harroweri* and *Isopisthus parvipinnis*, measuring up to 10cm of length, and on the cephalopods *Loligo sanpaulensis* and *L. plei*. No internal parasites were observed. The barnacle *Xenobalanus globicipitis* was recorded on only one individual. Sightings were recorded in all seasons and 90% of them were obtained up to 5 n.miles from shore, in waters up to 15m deep. Around 70% of groups sighted consisted of up to five dolphins. Estimates of the population size and continuous gillnet fleet monitoring are required to conserve franciscana in the northern limit of its distribution range. The differences in the somatic, reproductive and genetic patterns of franciscana represent important aspects that may be used as evidence to best define their stocks. These variations may reflect the reduction of gene flow between populations, the allocation of resources between growth and reproduction and/or the influence of environmental features, such as water temperature and food availability. KEYWORDS: BIOLOGY; BRAZIL; CONSERVATION; FRANCISCANA; SOUTH ATLANTIC

Okamura, H., Matsuoka, K., Hakamada, T., Okazaki, M. and Miyashita, T. 2001. Spatial and temporal structure of the western North Pacific minke whale distribution inferred from JARPN sightings data. *J. Cetacean Res. Manage.* 3(2):193-200

The density of minke whales (*Balaenoptera acutorostrata*) in the western North Pacific was examined using a generalized additive model in order to investigate the spatial and temporal distribution patterns. The data used were a subset of JARPN sightings data collected from 1994 to 1999. The process for estimating the density was divided into two parts: the detection process for the estimation of the effective search half-width; and the encounter process for the estimation of the encounter rate. Model selection was carried out using information criteria. The selected model for the detection process included 'sightability', a synthetic index of detectability, as a covariate, and for the encounter process included the interaction between latitude and longitude and the interaction between month and latitude. The trend surface of the transformed density predicted by each month revealed no clear gaps. The monthly transition of the density distribution also suggested the northward seasonal feeding migration of the minke whales. KEYWORDS: INDEX OF ABUNDANCE; MIGRATION; MINKE WHALE; NORTH PACIFIC; STOCK IDENTITY

Barlow, J., Gerodette, T. and Forcada, J. 2001. Factors affecting perpendicular sighting distances on shipboard line-transect surveys for cetaceans. *J. Cetacean Res. Manage.* 3(2):201-12

Factors that affect cetacean perpendicular sighting distances are investigated using a Generalised Additive Modelling (GAM) framework to analyse 8,203 sightings of 34 cetacean species seen on 200,000km of shipboard line-transect surveys in the eastern Pacific in 1986-96. Perpendicular sighting distance is modelled as a non-linear function of the following predictor variables: species; an a priori species grouping; the logarithm of group size; Beaufort sea state; presence of rain or fog; sighting cue; sun glare; geographic stratum; observer; ship; year; cruise; and, in 1991-96, visibility and swell height. Based on Akaike Information Criteria (AIC), the best model for 1986/96 included all variables except rain/fog code. For the 1991/96 data, swell height anomaly was also important and replaced ship and year in the best-fit model. For independent subsets of the data, GAM coefficients were highly correlated, indicating that many of the same factors were acting in different areas and at different times. Species and sighting methods (25x binoculars vs unaided eye) had the largest effects on perpendicular sighting distances. The a priori species groups captured much, but not all of the among-species differences. Two other species-related factors (group size and sighting cue) were also important in all models. Factors related to search conditions (Beaufort sea state and swell height anomaly) and to the searchers themselves (individual observer) were also important. We anticipate that this information on the relative magnitudes of factors affecting perpendicular sighting distance can be used to improve both design and analysis of line-transect data. KEYWORDS: ABUNDANCE ESTIMATE; LINE-TRANSECT; MODELLING; PACIFIC OCEAN; SURVEY-VESSEL

Ballance, L.T., Anderson, R.C., Pitman, R.L., Stafford, K., Shaan, A., Waheed, Z. and Brownell, R.L. 2001. Cetacean sightings around the Republic of the Maldives, April 2001. *J. Cetacean Res. Manage.* 3(2):213-8

In April 1998, as part of a project to collect biopsy samples of putative pygmy blue whales (*Balaenoptera musculus brevicauda*) in the waters around the Republic of the Maldives, Indian Ocean, incidental sightings of cetaceans encountered were recorded. Using modified line-transect methods and handheld binoculars, a total of 267 sightings of 16 species of whales and dolphins were recorded during 20 at-sea days in the northeastern part of the atoll. Significant results include the following: (1) cetaceans were abundant and species diversity was high, including nearly every pantropical species of pelagic cetacean; (2) the spinner dolphin (*Stenella longirostris*) was by far the most common species encountered (62 sightings) and also had the largest average school size (= 64.1 individuals); (3) blue whales were rare; only four individuals were sighted; (4) a large concentration of Bryde's whales (28 sightings in two days) was apparently feeding in nearshore waters; (5) this paper reports the first records for the Maldives of Cuvier's beaked whale (*Ziphius cavirostris*), Blainville's beaked whale (*Mesoplodon densirostris*) and the dwarf sperm whale (*Kogia sima*): the latter was particularly common (17 sightings); (6) the spotted dolphin (*Stenella attenuata*) was rare and almost always associated with yellowfin tuna (*Thunnus albacares*), spinner dolphin, or seabirds, as has been reported in the eastern Pacific and western Indian oceans. KEYWORDS: BIOPSY SAMPLING; BLUE WHALE; BRYDE'S WHALE; FEEDING GROUNDS; INCIDENTAL SIGHTINGS; INDIAN OCEAN; PANTROPICAL SPOTTED DOLPHIN; PHOTO-ID; SANCTUARIES; SPINNER DOLPHIN; SURVEY-VESSEL; TAXONOMY

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Matthews, J.N., Steiner, L. and Gordon, J. 2001. Mark-recapture analysis of sperm whale (*Physeter macrocephalus*) photo-id data from the Azores (1987-1995). *J. Cetacean Res. Manage.* 3(3):219-26

Population estimates for female or immature male sperm whales (*Physeter macrocephalus*) in a region within the Azores archipelago are given, based on photo-identification studies with mark-recapture analysis. The study area encompassed the Central Group of islands and the island of Sao Miguel. Data indicate that the recapture rate of animals likely to be females differs from other animals, and this heterogeneity is incorporated into the models. Closed population (Petersen) estimates, using data from within summers, suggest a population of between 300-800 female or immature sperm whales in summer in the study area. Estimates of the population that visits the study area in summer were made using a model selected from the Jolly-Seber family. The open population visiting the study area appeared to vary between about 400-700 between the years 1988-1990, increasing by a factor of three to about 1,600-2,200 between the years 1991-1994. The fraction of whales which are not suitably marked for identification is estimated to be about 12%, so these estimates should be increased by a factor of 1.14. These estimates are reliable if the study area covers the range of a wider population which moves into and out of the study area randomly. The increase in abundance in 1991 is probably due to change in the composition of the population visiting the area. It is not yet possible to clearly define the wider population that the Azores samples are from, nor are migration patterns to and from the area understood. Investigations on a larger spatial scale are needed for a better understanding. KEYWORDS: ABUNDANCE ESTIMATE; GRENADA; MARK-RECAPTURE; NORTH ATLANTIC; NORTHERN HEMISPHERE; SPERM WHALE

Heckel, G., Reilly, S.B., Sumich, J.L. and Espejel, I. 2001. The influence of whalewatching on the behaviour of migrating gray whales (*Eschrichtius robustus*) in Todos Santos Bay and surrounding waters, Baja California, Mexico. *J. Cetacean Res. Manage.* 3(3):227-37

This study investigated the influence of whalewatching boats on the behaviour of gray whales on their migratory route in Todos Santos Bay, near the port of Ensenada, Baja California, Mexico. The objectives were: (1) to compare the swimming direction and velocity of whales in the presence and absence of whalewatching vessels, and when other boats were fishing, cruising or drifting; and (2) to contribute scientific data to the improvement of whalewatching regulations for Todos Santos Bay and surrounding waters. During the winters of 1998 and 1999, theodolite tracking was undertaken from a lighthouse tower located on northern Todos Santos Island. During both years, the migration corridor was about 2.5km wide at the Todos Santos Islands; this is relatively narrow compared to other shore stations along the northern coast (USA). Sightings were separated into northbound or southbound migration routes and the variability of whale swimming direction was analysed by circular statistics. During the southbound migration, whale swimming direction was not different in the presence or absence of whalewatching vessels and other boats. This variable, however, was statistically different during the northbound migration both with whalewatching vessels ($p=0.007$) and with other boats ($p=0.02$). Whale swimming velocity showed significant differences without boats and with whalewatching boats during both migrations (northbound, $p=0.04$; southbound, $p<0.001$). Analysis of velocity in the absence and presence of other boats did not yield significant differences for either of the migrations. In addition, a head-on approach by whalewatching boats changed the whales' swimming direction ($p=0.05$) and velocity ($p=0.015$) significantly when compared with an approach towards the rear or flanks. Although Mexican whalewatching law is explicit concerning manoeuvres around whale groups, an additional suggestion is made here to prevent unintentional head-on approaches. KEYWORDS: BEHAVIOUR; GRAY WHALE; MEXICO; MIGRATION; PACIFIC OCEAN; SHORT-TERM CHANGE; WHALEWATCHING

Lindstrøm, U. and Haug, T. 2001. Feeding strategy and prey selectivity in common minke whales (*Balaenoptera acutorostrata*) foraging in the southern Barents Sea during early summer. *J. Cetacean Res. Manage.* 3(3):239-49

Stomach content samples from 33 minke whales (*Balaenoptera acutorostrata*), caught during Norwegian commercial whaling between May-June 1998, were collected in four sub-areas in the southern Barents Sea. Simultaneously, a comprehensive resource survey was conducted in order to identify and estimate the abundance of potential prey items for the whales in the four sub-areas. Krill (*Thysanoessa* sp. and *Meganyctiphanes norvegica*) dominated the diet in all but one sub-area although pelagic fish such as capelin and herring also contributed significantly. The minke whales displayed monophagous feeding in all sub-areas investigated, including the medium-scale area resulting from pooling of all sub-areas. The small-scale resource surveys revealed significant variations in absolute and relative prey abundance between sub-areas, while the temporal (1-7 days) variations in relative prey biomass within sub-areas appeared to be less significant for all prey items, except herring (*Clupea harengus*) and perhaps capelin (*Mallotus villosus*). Krill was by far the most important prey item available in all areas, followed by either herring, cod (*Gadus morhua*) or saithe (*Pollachius virens*), depending on sub-area and survey. Although minke whale prey preference appeared to vary greatly in space, some new features of minke whale foraging behaviour were evident. Minke whales showed a strong preference for capelin, whereas gadoids (cod, haddock (*Melanogrammus aeglefinus*) and saithe) appeared to be avoided by the whales. Krill appeared to have been either avoided, fed upon randomly or were the preferred prey depending on sub-area and analyses level. KEYWORDS: BARENTS SEA; FEEDING STRATEGY; MINKE WHALE; PREY ABUNDANCE; PREY SELECTIVITY

Branch, T.A. and Butterworth, D.S. 2001. Estimates of abundance south of 60°S for cetacean species sighted frequently on the 1978/79 to 1997/98 IWC/IDCR-SOWER sighting surveys. *J. Cetacean Res. Manage.* 3(3):251-70

Estimates of abundance are calculated for six cetacean species in the Southern Ocean south of 60° in the austral summer, using the IWC database estimation package (DESS). The sightings data in DESS were collected during the 1978/79 to 1997/98 IWC/IDCR and SOWER circumpolar surveys. Abundance estimates are developed for the first (1978/79-1983/84), second (1985/86-1990/91) and currently incomplete third (1991/92-1997/98) circumpolar sets of surveys. The strata surveyed in these three sets cover about 65%, 81% and 68% respectively of the open ocean area south of 60°S. The surveys were designed for Antarctic minke whales and may not be optimal for all these species. Furthermore, the estimates presented here (CVs in brackets) should not necessarily be considered as estimates for the whole Southern Hemisphere. 1st=first circumpolar, 2nd=second circumpolar, 3rd=third circumpolar. Estimates: Blue whale, 1st 440 (0.41), 2nd 550 (0.48), 3rd 1,100 (0.45); Fin whale, 1st 2,100 (0.36), 2nd 2,100 (0.45), 3rd 5,500 (0.53); Sperm whale, 1st 5,400 (0.38), 2nd 10,000 (0.15), 3rd 8,300 (0.16); Humpback whale 1st 7,100 (0.36), 2nd 9,200 (0.29), 3rd 9,300 (0.22); Killer whale, 1st 91,000 (0.34), 2nd 27,000 (0.26), 3rd 25,000 (0.23); Southern bottlenose whale, 1st -, 2nd 72,000 (0.13), 3rd 54,000 (0.12). Some results are also presented for hourglass dolphins and sei whales, but estimates of abundance are not considered reliable for those two species. Effective search half-width and mean school size were estimated by pooling across strata and years. Pooling is effected separately for each circumpolar set of surveys. Additional pooling across closing and passing modes did not introduce substantial bias. The most frequently sighted species were minke, southern bottlenose, sperm, humpback and killer whales; the effective search half-widths for all five increase over time. The sensitivity of the abundance estimates to a number of factors is investigated, none of which appears to impact the results substantially, except that the incorporation of 'like species' would increase the estimate for blue whales from the third circumpolar set of surveys by 25% and for fin whales by 61%. In general, the assumption that 100% of schools on the trackline are sighted introduces variable negative bias to estimates for all species. Only two significant trends in abundance over time (for comparable areas) were detected, but both may be artefacts of changes in survey design. KEYWORDS: ABUNDANCE; ANTARCTIC; BLUE WHALE; FIN WHALE; HOURGLASS DOLPHIN; HUMPBAC WHALE; KILLER WHALE; SEI WHALE; SIGHTINGS SURVEY; SOUTHERN BOTTLENOSE WHALE; SOUTHERN HEMISPHERE; SPERM WHALE; SURVEY-VESSEL

Matthews, J.N., Brown, S., Gillespie, D., Johnson, M., McMclanaghan, R., Moscrop, A., Nowacek, D., Leaper, R., Lewis, T. and Tyack, P. 2001. Vocalisation rates of the North Atlantic right whale (*Eubalaena glacialis*). *J. Cetacean Res. Manage.* 3(3):271-81

Vocalisation rates were measured from North Atlantic right whales (*Eubalaena glacialis*) in spring 1999-2000 in the Great South Channel and off Cape Cod, USA, and in summer 1999-2000 in the Bay of Fundy, Canada. Vocalisations were classed as either 'moans', 'low-frequency (LF) calls' or 'gunshots'. Towed hydrophone recordings (36.1 hours) were made in 21 encounters where loose aggregations of right whales were within about 1,000m. Recordings were also made using acoustic tags attached by suction cups to ten different whales (29.5 hours). Tags also recorded depth data. Moan rates (sounds per aggregation per hour) were correlated with size of whale aggregation. Individual whales produced moans at ~0-10 per hour (recorded from tags and the towed hydrophone). Small aggregations (2-10) gave higher moan rates (usually <~60 per hr) and larger aggregations (>10) higher still (~70-700 per hr) (recorded from towed hydrophone). Results from the Bay of Fundy indicate high moan rates at night. Moans were usually produced in clusters. Tag data showed that moans were usually produced when whales were within about 10m of the surface. A passive acoustic system could potentially provide supplementary information on the distribution of aggregations of right whales. This could be useful for management (1) in the long term, by aiding the prediction of right whale distribution, or (2) as a real-time tool for helping to route shipping away from concentrations of right whales. The empirical evidence presented here on vocalisation rates will assist in assessing feasibility. The clustering of moans and the tendency to produce them near the surface could hamper detection and localisation efforts. Further research is underway to investigate other important practical issues such as detectability and source levels. KEYWORDS: ACOUSTICS; CONSERVATION; FEEDING GROUNDS; HABITAT; MANAGEMENT; NORTH AMERICA; NORTH ATLANTIC; RIGHT WHALE; VESSEL-STRIKE; VOCALISATION

Kemper, C.M. and Gibbs, S.E. 2001. Dolphin interactions with tuna feedlots at Port Lincoln, South Australia and recommendations for minimising entanglements. *J. Cetacean Res. Manage.* 3(3):283-92

Cetacean carcasses near Port Lincoln and entanglements in southern blue-fin tuna feedlots were monitored between 1990 and 1999. Dolphins became entangled and died in large-mesh (usually >15cm) anti-predator nets around the cages, from surface to seafloor (18m). The carcasses were retrieved and studied with respect to diet and life history. During the period of study, 29 dolphins (15 bottlenose, 9 common, 5 unidentified) were confirmed entanglement deaths and an additional eight unconfirmed reports of dead dolphins were made between 1993 and 1996. Beach-washed or floating carcasses of an additional 38 dolphins were found in the Port Lincoln region during

1990-1999, four of which were suspected entanglements. The carcasses of 23 entangled and four suspected entangled dolphins were studied for diet, and reproductive and relative age characteristics. At least 24 of the 33 entangled animals were juveniles or sexually mature animals, of which most of the females were pregnant or lactating. Three calves and no neonates were entangled. Gastrointestinal contents of 57 bottlenose and common dolphins from elsewhere along the coast of South Australia were also studied. Cephalopods were more abundant in bottlenose dolphins than common dolphins, including those entangled in tuna feedlots. Carangidae were the main identified fish prey of dolphins entangled in tuna nets. The study concluded that dolphins were being attracted to, and feeding in, the area of the cages. Recommendations for minimising entanglements include removing anti-predator nets or reducing mesh size to less than 8cm, reducing tuna food wastes and thereby the food source for other fish in the vicinity, and rigorous monitoring of both entanglements and dolphin populations in the Port Lincoln region. KEYWORDS: AUSTRALASIA; BOTTLENOSE DOLPHIN; CEPHALOPOD; COMMON DOLPHIN; FISH; FOOD/PREY; INCIDENTAL CATCHES; JOURNAL3/3; RELATIVE AGE; REPRODUCTION

Friedlaender, A.S., McLellan, W.A. and Pabst, D.A. 2001. Characterising an interaction between coastal bottlenose dolphins (*Tursiops truncatus*) and the spot gillnet fishery in southeastern North Carolina, USA. *J. Cetacean Res. Manage.* 3(3):293-303

The aim of this study was to characterise interactions between coastal bottlenose dolphins (*Tursiops truncatus* Montagu, 1821), and the autumn gillnet fishery in southeastern North Carolina, USA that targets spot (*Leiostomus xanthurus*). Beach based (conducted from April 1997 - January 1998) and aerial surveys (conducted from July 1998 - May 1999) were used to estimate the abundance of dolphins and gillnets in nearshore waters. Commercial spot landings records from Brunswick County, North Carolina were used as an index of prey abundance. Stranded bottlenose dolphins were evaluated using protocols developed to describe diagnostic evidence of human-induced fisheries mortality. During both survey periods, dolphin numbers, gillnet numbers and spot landings all peaked in October-November. Simultaneously, an increase in dolphin strandings bearing evidence of entanglement in gillnets (cuts, lacerations, or wrapping marks on their appendages) was observed. Four stranded dolphins were determined to have been killed in gillnets, and one dolphin was removed alive from a gillnet in October 1997. Six stranded dolphins were killed in gillnets in October and November 1998. Thus, 20-24% of the annual allowable human-induced mortality for all USA Atlantic coastal bottlenose dolphins could be attributed to monofilament gillnets targeting spot in October and November in southeastern North Carolina. Both recreational and commercial fishermen target spot in the autumn using gillnets and dolphin mortality may be attributable to both aspects of the fishery. Results of this study are cause for alarm because interactions between dolphins and coastal gillnets may be occurring at much larger spatial and temporal scales along the USA Atlantic coast. Understanding the relationships between the biological and anthropogenic variables leading to these interactions can facilitate conservative, pro-active, management ensuring that human-induced mortality is not negatively impacting populations of marine mammals, such as Atlantic coastal bottlenose dolphins. KEYWORDS: BOTTLENOSE DOLPHIN; BY-CATCH; CONSERVATION; FISHERIES; FOOD/PREY; GILLNETS; INCIDENTAL MORTALITY; JOURNAL3/3; STRANDINGS

Lennert-Cody, C.E., Buckland, S.T. and Marques, F.F.C. 2001. Trends in dolphin abundance estimated from fisheries data: a cautionary note. *J. Cetacean Res. Manage.* 3(3):305-19

The previously published index of relative abundance of the northeastern offshore stock of spotted dolphins, the species most affected by the purse-seine fishery for tunas in the eastern Pacific Ocean, shows a decreasing trend in the last two decades despite dramatic reductions in incidental mortality since the early 1970s. To better understand the behaviour of this index, the effects of changes in data quality and methods of searching on estimation of relative abundance using current methodologies have been studied here. Changes in data quality since the late 1980s have led to a dramatic reduction in the proportion of sightings that are reported on or near the trackline. The decreasing trend in the index in the late 1970s and through the 1980s is strongly influenced by the fit of the detection function to the high proportion of sightings near the trackline that was present in the data during that time period. If this excess of sightings near the trackline is spurious, then much of the decreasing trend in the index over this time period is likely spurious. In addition, part of the decrease in the index in the late 1980s to mid-1990s is probably due to changes in data-collection biases that result from a dramatic increase in the amount of searching that is currently being carried out using helicopters as compared to high-powered binoculars. The results suggest that trends in bias associated with changes in data quality and fishery operations may have contributed to a trend in the index on the order of 1.0-1.5% per year, or approximately 25-33% of the maximum growth rate of the northeastern stock of offshore spotted dolphin. The pervasive nature of these sources of bias, and their potential magnitude relative to the maximum growth rates of the dolphin species involved, make use of this index in population growth models ill-advised. Fishery-derived indices such as these may be most useful for comparing trends in relative abundance between species, when the sources of biases are unlikely to be species-specific. KEYWORDS: ABUNDANCE ESTIMATE; BIAS; BY-CATCH; DOLPHINS-GENERAL; FISHERIES; INCIDENTAL MORTALITY; JOURNAL3/3; TRENDS

Ramos, R.M.A., Siciliano, S., Borobia, M., Zerbini, A.N., Pizzoro, J.L.A., Fragoso, A.B.L., Lailson-Brito, J., de Freitas Azevedo, A., Simões-Lopes, P.C. and de Oliveira Santos, M.C. 2001. A note on strandings and age of sperm whales (*Physeter macrocephalus*) on the Brazilian coast. *J. Cetacean Res. Manage.* 3(3):321-6

This note compiles recorded strandings of sperm whales on the Brazilian coast. A known total of 95 sperm whales (62 single and one mass stranding of 33 individuals) stranded along the Brazilian coast from 1967-2000. A higher incidence of single strandings was observed in northeastern Brazil (~05°-17°S). No strandings occurred in lower latitudes (<14°S) from June-September. The seasonal and spatial pattern observed by the reported strandings may indicate higher stranding rates in higher latitudes (~18-25°S) between June and August (winter) and in lower latitudes (~3-7°S) between January and April (summer and spring). Strandings of smaller sperm whales (3-4.5m) were observed during the austral summer and autumn, indicating seasonality in the birth season. Growth-layer counts of three specimens provide the first data on age of sperm whales for Brazil. KEYWORDS: AGE ESTIMATION; BRAZIL; SPERM WHALE; STRANDINGS; TEETH

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LeDuc, R.G., Weller, D.W., Hyde, J., Burdin, A.M., Rosel, P.E., Brownell, R.L., Jr., Würsig, B. and Dizon, A.E. 2002. Genetic differences between western and eastern North Pacific gray whales (*Eschrichtius robustus*). *J. Cetacean Res. Manage.* 4(1):1-5

Molecular data were used to examine the differentiation between the western and eastern gray whale (*Eschrichtius robustus*) populations. Control region sequences were generated from samples collected in the western Pacific (n=45) and eastern Pacific (n=120). There were 36 unique haplotypes identified. Ten haplotypes were represented in the western samples, and 33 in the eastern samples. Seven of these haplotypes were shared between populations, leaving three haplotypes that were only seen in the western samples and 26 only in the eastern. Although there were no fixed (diagnostic) differences between the western and eastern groups, they were significantly different in their haplotype frequency distributions and should be considered as separate populations. None of the 33 haplotypes found in the eastern samples had a frequency of over 11%, yielding an estimated haplotypic diversity of 0.95. This finding indicates that the reduction in abundance due to whaling may not have had a great effect on the haplotypic diversity of the eastern population, although the loss of rare haplotypes may still have occurred and would be difficult to detect. In contrast, the western group was dominated by two haplotypes, which represented over 77% of all individuals sampled, resulting in a substantially lower haplotypic diversity of 0.70. The lack of fixed differences between the two populations and frequency of shared haplotypes renders these data inappropriate for forensic applications at the population level. KEYWORDS: CONSERVATION; GENETICS; GRAY WHALE; HELEN-GRAY; NORTH PACIFIC; POPULATIONS

Weller, D.W., Burdin, A.M., Würsig, B., Taylor, B.L. and Brownell, R.L. 2002. The western North Pacific gray whale: a review of past exploitation, current status and potential threats. *J. Cetacean Res. Manage.* 4(1):7-12

Gray whales (*Eschrichtius robustus*) occur along the eastern and western coastlines of the North Pacific and have traditionally been divided into the California-Chukchi (eastern) and Korean-Okhotsk (western) populations. Recent genetic comparisons confirm, based on differences in haplotypic frequencies, that these populations are isolated. Both populations were commercially hunted, but only the eastern gray whale has returned to near pre-exploitation numbers. In contrast, the western population remains highly depleted, shows no apparent signs of recovery, and is likely to be near extinction. Research off Sakhalin Island, Russia, between 1995-2000 has produced important information on the present day conservation status of western gray whales and provided the basis for the World Conservation Union (IUCN) to list the population as "Critically Endangered" in 2000. The information presented here -- in combination with potential impacts from anthropogenic threats throughout the range of this population -- raise strong concerns about the recovery and continued survival of the western gray whale. KEYWORDS: CONSERVATION; EXPLOITATION; GRAY WHALE; HELEN-GRAY; NORTHERN HEMISPHERE; OKHOTSK SEA; PACIFIC; POPULATIONS-STATUS

Weller, D.W., Reeve, S.H., Burdin, A.M., Würsig, B. and Brownell, R.L., Jr. 2002. A note on the spatial distribution of western gray whales (*Eschrichtius robustus*) off Sakhalin Island, Russia. *J. Cetacean Res. Manage.* 4(1):13-7

Three aerial surveys were conducted along a portion of the northeastern coast of Sakhalin Island, Russia, between August and September 1998. They were conducted to examine the spatial distribution of western gray whales on their feeding grounds, and in relation to current and planned industrial activity. A total of 32 gray whale groups, consisting of 38 whales, was sighted during the surveys. Group sizes ranged from 1-3 individuals (mean=1.2, SD=0.54), with 87.5% (n=28) composed of single whales. All groups detected were within 5km of the shore and 93.8% (n=30) were sighted inside 4km. Sighting locations ranged from 0.6-4.8km offshore, with an overall mean distance from shore of 2.5km (SD=1.11). These data suggest that western gray whales feed primarily in waters less than 20m deep and relatively close to shore. The nutrient-rich effluent from a large coastal lagoon is believed to significantly enrich the near-shore benthic environment of the northeastern Sakhalin Island coast, creating an area of particularly high food availability, and in turn contributing to the near-shore affinity of gray whales observed during this study. KEYWORDS: DISTRIBUTION; FEEDING; GRAY WHALE; HELEN-GRAY; NORTHERN HEMISPHERE; PACIFIC; SURVEY - AERIAL

Moore, S.E. and Clarke, J.T. 2002. Potential impact of offshore human activities on gray whales. *J. Cetacean Res. Manage.* 4(1):19-25

Gray whale (*Eschrichtius robustus*) reactions to offshore human activities have been relatively well studied compared to those of other mysticetes. Studies of short-term behavioural responses to underwater noise associated with aircraft, ships and seismic explorations indicate a 0.5 probability that whales will respond to continuous broadband noise when sound levels exceed ca 120dB2 and to intermittent noise when levels exceed ca 170dB, usually by changing their swimming course to avoid the source. Gray whales were 'startled' at the sudden onset of noise during playback studies, but demonstrated a flexibility in swimming and calling behaviour that may allow them to circumvent increased noise levels. Whales may be 'harassed' by noise from large commercial vessels, especially in shipping lanes or near busy ports. Gray whales sometimes change course and alter their swimming speed and respiratory patterns when followed by whalewatching boats. Conversely, some whales swim toward small skiffs deployed from whalewatching boats in breeding lagoons, seemingly attracted by the noise of idling outboard engines. Reported gray whale reactions to aircraft are varied and seem related to ongoing whale behaviour and aircraft altitude. Whale response to research involving tagging and biopsy sampling appears to be short term. Gray whales were seen swimming through surface oil from the Exxon Valdez oil spill along the Alaskan coast and showed only partial avoidance to natural oil seeps off the California coast. Laboratory tests suggest that gray whale baleen, and possibly skin, may be resistant to damage by oil, but spilled oil or oil dispersant in a primary feeding area could negatively affect gray whales by contaminating benthic prey. Gray whales are sometimes injured or killed in collisions with vessels or entanglement in fishing gear. Concern about the cumulative long-term impact of offshore human activities is particularly acute in the Southern California Bight, where many activities are often concurrent. KEYWORDS: CHANGE - LONG TERM; CHANGE - SHORT TERM; ECOSYSTEM; GRAY WHALE; HELEN-GRAY; HUMAN IMPACT; NOISE; PACIFIC; POLLUTANTS; WHALEWATCHING

Findley, L.T. and Vidal, O. 2002. The gray whale, *Eschrichtius robustus*, at calving sites in the Gulf of California, México. *J. Cetacean Res. Manage.* 4(1):27-40

Records of gray whales (*Eschrichtius robustus*) at and near their two known calving sites in the Gulf of California (Sea of Cortés), México, are reviewed up to 1995. The sites of Tojahui/Yavaros (Sonora) and Bahía Santa María (Sinaloa) represented the most distant calving grounds regularly visited by the species. Prior observations (mainly in the 1950s and 1960s) revealed relatively small but seasonally consistent numbers of whales, with maximum counts, including calves, of 30 individuals at Bahía Santa María in 1954, and 17-19 at Tojahui/Yavaros in 1955, 1963 and 1971. Observations (initiated in 1979) as well as interviews with longtime local residents and fishermen, document a decline in numbers and occupancy times of whales, especially cow/calf pairs, visiting these sites. In contrast, 19th century whaling records indicate that many more substantial numbers of gray whales were found seasonally along these coasts. The recent

decline, leading to the apparent disappearance, is likely to be due to human-induced disturbances related to accelerated regional socio-economic development, with associated increases in artisanal and industrial fishing activities and other forms of maritime traffic. Within less than four decades of their 'discovery', it appears that no gray whales have returned to calve at these sites since the mid-1980s. Barring an unlikely change in regional fishing practices, this apparent abandonment of calving sites on the northwest coast of mainland México suggests that any anticipated further increase in population size of the eastern North Pacific stock may be unwarranted. KEYWORDS: ABUNDANCE; AREA-GULF OF CALIFORNIA; DISTRIBUTION; GRAY WHALE; HELEN-GRAY; HISTORY; POPULATIONS; REPRODUCTION; TRENDS

Buckland, S.T. and Breiwick, J.M. 2002. Estimated trends in abundance of eastern Pacific gray whales from shore counts (1967/68 to 1995/96). *J. Cetacean Res. Manage.* 4(1):41-8

Estimates of abundance of eastern Pacific gray whales (*Eschrichtius robustus*) are obtained from counts made during their southbound migration past a shore-based station near Monterey, California. Assuming an exponential rate of increase, the population is estimated to have increased at 2.5% per annum (SE=0.3%) between 1967/68 and 1995/96. However, there is some indication that the population growth is slowing, so that an asymptotic growth curve may be more appropriate. The estimated asymptote from a logistic model is 26,046 (SE=6,281) and the inflection point is approximately in 1971 (SE=6.5). The onset of the migration, when 10% of the whales have passed the station, has occurred increasingly later through this sample period, by approximately one day every two years. Median dates show a similar trend of roughly one day every three years. However, there is no significant change in the date at which 90% of whales have passed the station. KEYWORDS: ABUNDANCE ESTIMATE; GRAY WHALE; HELEN-GRAY; INDEX OF ABUNDANCE; MIGRATION; PACIFIC; SURVEY - SHORE-BASED; TRENDS

Turnock, B.J. and Mizroch, S.A. 2002. The effect of census frequency on the detection of trends in the abundance of eastern North Pacific gray whales. *J. Cetacean Res. Manage.* 4(1):49-52

The ability to detect trends in gray whale abundance with various census frequencies is investigated. The number of surveys and years needed to detect a trend in abundance, and total change in abundance, are presented in graphs for various rates of change and census frequencies. The estimated annual rate of increase of the population during 1967 to 1980 using a linear model is 0.034. This rate of increase can be detected (power = 0.95) with 14 surveys over 13 years, 9 surveys over 16 years or 7 surveys over 18 years, for census frequencies of every year to every third year, respectively. Graphs are presented showing power of detecting different rates of increase with census frequencies from 1 to 3 years. KEYWORDS: ABUNDANCE; FREQUENCY; GRAY WHALE; SURVEY; TRENDS

Shelden, K.E.W. and Laake, J.L. 2002. Comparison of the offshore distribution of southbound migrating gray whales from aerial survey data collected off Granite Canyon, California, 1979-96. *J. Cetacean Res. Manage.* 4(1):53-6

Aerial surveys provide an assessment of the offshore distribution of gray whales and an estimate of the proportion of whales that migrate beyond the visual range of shore-based observers. Six surveys were conducted concurrent with shore-based surveys during 1979, 1980, 1988, 1993, 1994 and 1996. Annual differences were tested for in the distribution of whales within an area 3 n.miles north and south of Granite Canyon, and it was found that the distributions within 3 n.miles of the shore differed by year but the shifts in the distribution were minor (<0.3 n.miles). The inshore (<2.25 n.miles) and offshore (>2.25 n.miles) distribution of gray whale pods did not differ significantly between survey years. An average of 4.76% (SE=0.85%) of the whale pods were observed beyond 2.25 n.miles and only 1.28% (SE=0.07%) beyond 3 n.miles. KEYWORDS: DISTRIBUTION; GRAY WHALE; HELEN-GRAY; MIGRATION; PACIFIC; SURVEY - AERIAL

Rugh, D.J., Lerczak, J.A., Hobbs, R.C., Waite, J.M. and Laake, J.L. 2002. Evaluation of high-powered binoculars to detect inter-year changes in offshore distribution of gray whales. *J. Cetacean Res. Manage.* 4(1):57-61

Paired, independent searches for gray whales (*Eschrichtius robustus*) were conducted through fix-mounted, 25-power binoculars during January 1995 and 1996 at Granite Canyon, California. The study was a test of an efficient method for documenting inter-year changes in the offshore distribution of the migration. The research site has been used most years since 1975 by the National Marine Mammal Laboratory to make counts for abundance estimates of gray whales. Matching sightings between the paired observation efforts showed a very high agreement between observers (detection probability 0.97) for whale groups apparently of more than one animal within 1-3 n.miles of shore and a fairly high agreement (0.87) for animals travelling alone (5% of the sampled population) within 1-3 n.miles of shore. Sighting probability thus remained high up to 3 n.miles, a distance which includes most (98.7%) of the whale migration. For the critical sighting range of 1-3 n.miles, the method applied here is considered a feasible, cost-effective technique for detecting inter-year differences in the offshore tail of the distribution. KEYWORDS: DISTRIBUTION; GRAY WHALE; HELEN-GRAY; NORTH PACIFIC; SURVEY - SHORE-BASED

Butterworth, D.S., Korrûbel, J.L. and Punt, A.E. 2002. What is needed to make a simple density-dependent response population model consistent with data for the eastern North Pacific gray whales? *J. Cetacean Res. Manage.* 4(1):63-76

Census estimates indicate that the eastern North Pacific gray whale population showed an increase rate of some 3.2% per annum from 1968-1988. Further, historic records suggest that the population was 'commercially extinct' at the end of the 19th century. The standard HITTER-FITTER population model trajectories which pass through the 1987-88 census estimate of some 21,113, and utilise the customary historic commercial catch series, are inconsistent with both of these features; in particular, they generally show a decrease over the 1968-1988 period. The quantitative extent of various possible adjustment factors that would be needed to resolve these inconsistencies is examined. Depensation effects alone cannot account for the inconsistencies, while a model used to incorporate an additional response delay in recovery from exploitation produces unrealistic population oscillations. Other adjustment factors can, however, produce a 1968-1988 annual population increase rate of 2% or more, and all also correspond to a depletion of the population in 1900 to less than 25% of its size at the onset of commercial whaling in 1846. These are: an increase in the carrying capacity from 1846-1988 of at least 2.5 times; an underestimation of the historic commercial catch from 1846-1900 of at least 60%; or annual aboriginal catch levels prior to the commercial fishery at least three times those estimated by the 1990 Special Meeting of the Scientific Committee (IWC, 1993). These limits weaken if the adjustment factors are considered in combination rather than separately. The results appear insensitive to values assumed for the biological parameters of the population model (natural mortality, age at first parturition, age at recruitment and MSY level). However,

they are sensitive to assumptions concerning data inputs, viz. the accuracy of the 1987-88 census estimate used, and a 2:1 female:male ratio assumed for the commercial catches for which this information is not available. All trajectories which reflect a 1968-88 annual increase rate of 2% or more correspond to MSYR values (in terms of a 5+ exploitable population) of at least 4%. Fits of the population model to the series of gray whale census estimates are mis-specified, unless either or both of the historic commercial and aboriginal catches have been substantially underestimated (or carrying capacity has increased). The precision of these fits, conditional on fixed levels for such underestimation, is quite high, with coefficients of variation of about 10% for historic population sizes and about 20% for MSYR. There are indications that even if allowance was made for the uncertainty about these levels of underestimation, MSYR would remain relatively robustly estimated to be some 5% (or about 4% if expressed in terms of uniform selectivity on the 1+ population). KEYWORDS: ASSESSMENT; GRAY WHALE; MSY; NORTH PACIFIC; NORTHERN HEMISPHERE; WHALING - ABORIGINAL; WHALING - HISTORICAL

Butterworth, D.S., Borchers, D.L. and Punt, A.E. 2002. Dynamic response analysis for the eastern North Pacific gray whale population: An alternative approach. *J. Cetacean Res. Manage.* 4(1):77-83

Gerrodette and DeMaster (1990) conclude that dynamic response analysis indicates that the gray whale population passed through its maximum net productivity level (MNPL, approximately equivalent to MSY level) between 1967 and 1980. Their conclusion is examined using models for population trends which permit a point of inflection; these are fitted globally to the time series of census estimates available up to 1987-88. A cubic and a logistic model are used. The cubic model results indicate with almost 100% confidence that the population passed through MNPL within two years of 1973-74. However, both this conclusion and that of Gerrodette and DeMaster are considered to be unreliable. This is because the curves fitted by both analyses correspond to markedly decreasing population sizes over parts of the periods to which they apply. This is inconsistent with plausible population dynamics behaviour, which is itself an underlying pre-requisite for dynamic response analysis methodology. A suggestion is made as to how applications of dynamic response analysis methodology such as that of Boveng et al. (1988) could be adapted to ensure the necessary respect of such constraints. Results of a parametric bootstrap procedure for confidence interval estimation applied to the logistic model indicate that the probability that the population passed through MNPL during the period of the censuses is not large. The census data are scarcely adequate to allow for reliable estimates of the curvature of the population trajectory to be made. The logistic model dynamic response analysis indicates that there is a somewhat greater likelihood that the gray whale population was below rather than above its MNPL in 1990, given the data available at the time. KEYWORDS: ASSESSMENT; GRAY WHALE; MODELLING; NORTH PACIFIC; NORTHERN HEMISPHERE; TRENDS

Wade, P.R. 2002. A Bayesian stock assessment of the eastern Pacific gray whale using abundance and harvest data from 1967-1996. *J. Cetacean Res. Manage.* 4(1):85-98

Abundance and harvest data since 1966/67 were used to assess the eastern Pacific stock of gray whales. A Bayesian statistical method was used to estimate probability distributions for the parameters of both a simple and an age and sex structured population dynamics model, as well as output quantities of interest. Model comparisons using the Bayes Factor provided conclusive evidence that an additional parameter should be used to account for unexplained variation in the abundance time series. Incorporating the additional variance parameter decreased the precision of the estimates of the other parameters. Point estimates of carrying capacity ranged from 24,640-31,840 for the different models, but the posterior distributions from the selected models were very broad and excluded few values. The current depletion level (population size as a fraction of carrying capacity) was estimated to be about 0.75, with a lower 2.5th percentile of 0.36. The probability that the population was still below one-half of its carrying capacity was estimated to be 0.21, with a corresponding probability of 0.28 that the population was still below its maximum sustainable yield level. Quantities from which catch limits could potentially be calculated were estimated, including current replacement yield, maximum sustainable yield and the quantity Q1 (described in Wade and Givens, 1997). KEYWORDS: INCOMPLETE; GRAY WHALE; HELEN-GRAY; MODELLING; PACIFIC

Punt, A.E. and Butterworth, D.S. 2002. An examination of certain of the assumptions made in the Bayesian approach used to assess the eastern North Pacific stock of gray whales (*Eschrichtius robustus*). *J. Cetacean Res. Manage.* 4(1):99-110

An assessment of the eastern north Pacific stock of gray whales (*Eschrichtius robustus*) is conducted using a variant of the Bayesian stock assessment method of Wade (2002). This variant is based on the BALEEN II population dynamics model and uses parameters whose values are more familiar to members of the International Whaling Commission's Scientific Committee. The sensitivity of the results to changes to some of the specifications used in the assessment is examined. The results are shown to be relatively insensitive to the first year considered in the analysis and the year for which a prior on absolute abundance is specified. An alternative Bayesian assessment method which involves projecting the population forward from pre-exploitation equilibrium in 1600 is also considered. As expected from previous assessments, results from this method are unable to mimic the recent trends in absolute abundance obtained from shore counts and are inconsistent with the fact that the fishery was commercially extinct by the end of the 19th Century. Allowing for underestimation of historical commercial and aboriginal catches provides improved consistency with recent trends in abundance but does not resolve these problems completely. The impact of process error (in the form of temporally correlated fluctuations in calf survival) on the dynamics of the population is found to be largely inconsequential in terms of resolving the inconsistency between historical catches and recent estimates of abundance. KEYWORDS: ABUNDANCE ESTIMATE; BOURNEMOUTH; GRAY WHALE; HELEN-GRAY; MODELLING; PACIFIC

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Chivers, S.J., Dizon, A.E., Gearin, P.J. and Robertson, K.M. 2002. Small-scale population structure of eastern North Pacific harbour porpoises (*Phocoena phocoena*) indicated by molecular genetic analyses. *J. Cetacean Res. Manage.* 4(2):111-22

Concern about the conservation and management of harbour porpoise (*Phocoena phocoena*) populations, which have experienced relatively large incidental fishery kills in localised areas throughout their range, has prompted research to better understand their population structure. Both mitochondrial and nuclear (microsatellites) DNA were used to examine the intra-specific structure of harbour porpoise inhabiting the eastern North Pacific Ocean. Null hypotheses of panmixia were tested after mitochondrial DNA (mtDNA) control region sequence data (402 base pairs; n=249) and allele frequency data (9 polymorphic loci; n=194) were sub-divided into geographic strata

defined a priori. Strata were based on sampling discontinuities and not discontinuities in population distribution. The mtDNA and nuclear gene data revealed statistically significant genetic differentiation between most strata ($\alpha=0.05$) suggesting demographic independence of fairly small sub-units within the population. Since harbour porpoises are essentially continuously distributed in the eastern North Pacific, this degree of genetic differentiation was unexpected and needs to be considered in developing a sound management plan to protect them.

KEYWORDS: CONSERVATION; DISTRIBUTION; GENETICS; HARBOUR PORPOISE; NORTH PACIFIC; STOCK IDENTITY

Cui, G., Punt, A.E., Pastene, L.A. and Goto, M. 2002. Bayes and Empirical Bayes approaches to addressing stock structure questions using mtDNA, with an illustrative application to North Pacific minke whales. *J. Cetacean Res. Manage.* 4(2):123-34

Bayesian methods using mtDNA data are developed to compare single- and multiple-stock hypotheses. The likelihood of the data is assumed to be multinomial and the multivariate prior for the probability of an individual having a particular haplotype is assumed to be of the Dirichlet-b form. The values for the parameters of this prior are either determined using an Empirical Bayes approach or assumed to be distributed according to a log-normal hyper-prior (the 'Full Bayes' approach). The Empirical and Full Bayes methods are examined using simulation. The performance of the Empirical Bayes method is found to be much worse than that of the Full Bayes method. Illustrative comparisons for North Pacific minke whales based on the latter method confirm previous results that sub-areas 6 and 7 contain different stocks. Results of the application of this method to the mtDNA data for the sub-areas to the east of Japan, although generally uninformative, are nevertheless consistent with analyses based on hypothesis testing using allozymes and mtDNA. The results from this method should, however, be used for management purposes with some caution. This is because, although some testing of the Full Bayes method has been completed and suggests that when applied to data for two stocks that differ substantially in haplotype frequency, or when sample sizes are large and there is only one stock, performance is adequate, in common with most other methods for analysing genetics data, its performance has yet to be fully evaluated.

KEYWORDS: BAYESIAN ANALYSIS; DNA; GENETICS; MINKE WHALE; MODELLING; NORTH PACIFIC; NORTHERN HEMISPHERE; STOCK IDENTITY; STOCKS

Barco, S.G., McLellan, W.A., Allen, J.M., Asmutis-Silvia, R.A., Mallon-Day, R., Meacher, E.M., Pabst, D.A., Robbins, J., Seton, R.E., Swingle, W.M., Weinrich, M.T. and Clapham, P.J. 2002. Population identity of humpback whales (*Megaptera novaeangliae*) in the waters of the US mid-Atlantic states. *J. Cetacean Res. Manage.* 4(2):135-41

In recent years, humpback whales (*Megaptera novaeangliae*) have been observed in the waters of the US mid-Atlantic states (USMA; New Jersey to North Carolina), notably in winter. The level of the mortality in this area (52 recorded deaths from 1990-2000), makes it important to understand the nature and population identity of this aggregation. Of the approximately 100 humpback whales documented in this study, photographs of 41 (live or dead) were of sufficient quality to be compared to catalogues from the Gulf of Maine (GOM, the closest feeding ground) and elsewhere in the North Atlantic. Of 22 live whales, 10 (45.5%) matched to the GOM, 5 (22.7%) to Newfoundland and 1 (4.5%) to the Gulf of St Lawrence (GSL). Of 19 dead whales, 6 (31.6%) were known GOM whales. Although the population composition of the USMA is dominated by GOM whales, lack of recent photographic effort in Newfoundland makes it likely that the observed match rates under represent the true presence of Canadian whales in the region. Length data from 48 stranded whales (18 females, 22 males and 8 of unknown sex) suggest that 39 (81.2%) were first-year animals, 7 (14.6%) were immature and 2 (4.2%) were adults. However, sighting histories of five of the dead whales indicate that some were small for their age and histories of live whales further indicate that the population contains a greater percentage of mature animals than is suggested by the stranded sample. The authors suggest that the study area primarily represents a supplemental winter feeding ground that is used by humpbacks for more than one purpose. From a management perspective, although the only successful matches of mortalities to date have been to the GOM, the observed mixing of live whales from different summer stocks might suggest that the high numbers of mortalities occurring there may not be impacting this single stock alone. Although further data are required before conclusions can be drawn, the mortality rate may be significant for the GOM population and this warrants further investigation.

KEYWORDS: HUMPBACK WHALE; MIGRATION; MORTALITY; NORTH ATLANTIC; POPULATIONS; STRANDINGS

O'Hara, T.M., George, J.C., Tarpley, R.J., Burek, K. and Suydam, R.S. 2002. Sexual maturation in male bowhead whales (*Balaena mysticetus*). *J. Cetacean Res. Manage.* 4(2):143-8

Since the mid-1970s, study has focused on reproductive biology of female bowhead whales, while little has been described for males. This study evaluates testicular morphology (mass and length) and histology in relation to body length to determine the onset of male sexual maturity. Mean testis mass and mean testis length were highly correlated. Body length and mean testes mass were significantly correlated and an inflection of increased testicular mass occurred at approximately 12.5-13.0m suggesting the onset of puberty, and also indicated by histologic findings. Biological variability and the fact that few male animals have been examined within this critical length cohort do not allow determination of the onset of maturity with higher precision. Too few mature males have been landed in spring to make statistical comparisons of testes mass with autumn-landed animals within specific size cohorts. Two large (15.7m and 17.7m) males landed in spring had relatively small inactive testes and were diagnosed as pseudohermaphrodites; body length and mean testis length and seminiferous tubule diameter (STD) were not correlated with the other 'normal' whales. The smallest male confirmed as mature based on the presence of spermatocytes was 12.7m. The largest testes measured (combined mass 203kg) were from a whale landed in autumn. Mean STD for individual whales ranged from 33.3-170.9 μ m and increased with mean testis weight and whale length. The STD is similar within a testis regardless of region evaluated, with minor variability. Some variation was noted for transverse sections within a cross section for some whales but no pattern was evident.

KEYWORDS: ARCTIC; BERING SEA; BOWHEAD WHALE; CHUKCHI SEA; MALES; REPRODUCTION; SEXUAL MATURITY;

Miller, D.L., Bossart, G.D., Nadji, M., Tarpley, R., Roberts, B. and O'Hara, T.M. 2002. A note on the possibility of identifying Leydig and Sertoli cells by immunohistochemistry in bowhead whales. *J. Cetacean Res. Manage.* 4(2):149-53

Leydig cells have been found to be either unidentifiable or at apparent low numbers during routine histologic examination of bowhead whale testicles. Therefore, formalin-fixed, paraffin-embedded testicular tissues from 14 bowhead whales were retrospectively examined to determine if immunohistochemical staining could aid in identification of Sertoli and Leydig cells. Multiple intratesticular samples were examined when available. Sertoli and Leydig cells were differentiated using inhibin and calretinin stains. Significant whale length and

seasonal differences were not found; however, a trend toward increased staining intensity was noted for autumn harvested whales. KEYWORDS: BOWHEAD WHALE; HISTOLOGY; IMMUNOHISTOCHEMISTRY; REPRODUCTION

Perryman, W.L. and Lynn, M.S. 2002. Evaluation of nutritive condition and reproductive status of migrating gray whales (*Eschrichtius robustus*) based on analysis of photogrammetric data. *J. Cetacean Res. Manage.* 4(2):155-64

Vertical aerial photographs were collected of gray whales migrating along the California Coast between 1994 and 1998 to readdress some published findings on the biology and life history of this population based on examination of specimens. For each whale, an attempt was made to measure standard total length, the width of the whale at its widest point, the distance from the tip of the rostrum to the widest point, and the width of the flukes. For southbound gray whales, early migrants were longer on average and more likely to be parturient than those migrating later. Near-term pregnant females were wider relative to their length than other southbound gray whales. This difference was easily detected by visual inspection of the images and through statistical evaluation of length and width data. There was 100% agreement between identification of parturient females based on linear regression analysis of length and width and discriminate analysis of all measurements. Based on the proportion of parturient females to those with calves during sampling of southbound whales, the median calving date was estimated to be 13 January. Southbound calves averaged 4.6m in length; those photographed northbound in late April, at an age of about three months, averaged 7.1m. Average length for yearlings, based on combined southbound and northbound data, was 8.5m. Residuals from a regression of width on length were compared, and significant changes in the relationship were detected which were consistent with changes in nutritive condition or fatness described from examination of whales taken along the California Coast between 1959 and 1969 (Rice and Wolman, 1971). Parturient females were the widest relative to their length and northbound cows with calves were the narrowest in the sample. The relationship between length and width for migrating gray whales that were not parturient or associated with a calf, showed that southbound gray whales were significantly wider than northbound whales photographed approximately 60 days later. These results indicate that the predictable but relatively small changes in condition or fatness of gray whales associated with fasting during their winter migration can be reliably detected in measurements from vertical aerial photographs. KEYWORDS: 54-JAPAN; CONDITION; GRAY WHALE; GROWTH/LENGTH DISTRIBUTIONS; MORPHOMETRICS; PHOTOGRAMMETRY; PREGNANCY

Punt, A.E. and Breiwick, J.M. 2002. A framework for evaluating *Strike Limit Algorithms* for population reduced to small numbers. *J. Cetacean Res. Manage.* 4(2):165-77

A generic framework is outlined within which operating models for populations reduced to low numbers but still subject to exploitation (type 3 fisheries) can be developed. This framework is founded on an individual-based operating model that includes temporally correlated environmental variation in births and survival as well as the possibility of occasional catastrophic reductions in survival. Methods are developed to specify the value of the parameter that determines the productivity of the resource from that for MSYR, to enable simulation trials based on this framework to be parameterised in terms of MSYR. Three potential candidate Strike Limit Algorithms are evaluated using 14 'generic' simulation trials that capture a range of factors pertinent to type 3 fishery situations. The 'Maximum-likelihood-like' SLA developed for use in the management of the Bering-Chukchi-Beaufort Seas stock of bowhead whales performs adequately for many of these 14 trials, but not all. In contrast, a variant of the 'PBR approach' is shown to perform adequately in terms of achieving conservation objectives for all of the trials. The information needed to specify trials for actual type 3 fishery situations is outlined. KEYWORDS: INDIVIDUAL-BASED MODEL; MODELLING; STRIKE LIMIT ALGORITHM; WHALING - ABORIGINAL

Gill, P.C. 2002. A blue whale (*Balaenoptera musculus*) feeding ground in a southern Australian coastal upwelling zone. *J. Cetacean Res. Manage.* 4(2):179-84

A localised aggregation of blue whales, which may be pygmy blue whales (*B. m. brevicauda*), occurs in southern Australian coastal waters (between 139°45'E-143°E) during summer and autumn (December-May), where they feed on coastal krill (*Nyctiphanes australis*), a species which often forms surface swarms. While the abundance of blue whales using this area is unknown, up to 32 blue whales have been sighted in individual aerial surveys. Krill appear to aggregate in response to enhanced productivity resulting from the summer-autumn wind-forced Bonney Coast upwelling along the continental shelf. During the upwelling's quiescent (winter-spring) period, blue whales appear to be absent from the region. Krill surface swarms have been associated with 48% of 261 blue whale sightings since 1998, with direct evidence of feeding observed in 36% of all sightings. Mean blue whale group size was 1.55 (SD=0.839), with all size classes represented including calves. This seasonally predictable upwelling system is evidently a regular feeding ground for blue whales, and careful management of human activities is required there. KEYWORDS: AUSTRALASIA; BLUE WHALE; EUPHAUSIIDS/COPEPODS; FEEDING; HABITAT; OCEANOGRAPHY

Olsen, E. 2002. Errors in age estimates of North Atlantic minke whales when counting growth zones in *bulla tympanica*. *J. Cetacean Res. Manage.* 4(2):185-91

Age estimation of common minke whales (*Balaenoptera acutorostrata*) has always been difficult, and the accuracy of the current method of counting growth layer groups (GLGs) in the periosteal zone of the tympanic bulla has been questioned. To evaluate this method, two readers aged three sections from each of right and left bulla tympanica from 35 male and 57 female North Atlantic minke whales. A single age estimate with variance was calculated for each whale using General Linear Mixed Model Poisson based regression, and this estimate was compared with the number of ovulations and body length to evaluate the bias of the age determination method. The results showed a poor fit between age and number of ovulations with $R^2=0.0014$. Bias was estimated to be a 37% underestimate of 'true' age assuming an ovulation rate of one per year and age at sexual maturity of eight years. Precision of the bulla age estimates was lower than those of Antarctic minke whales aged using the earplug method. The high bias reduces the applicability of the bulla method in routine age-determination with a management objective. Other age determination methods for the species should be improved or developed to ensure proper monitoring of demography and life history for the North Atlantic minke whale. KEYWORDS: AGE AT SEXUAL MATURITY; AGE DETERMINATION; ATLANTIC; MINKE WHALE

Evans, K., Hindell, M.A., Robertson, K., Lockyer, C. and Rice, D. 2002. Factors affecting the precision of age determination of sperm whales (*Physeter macrocephalus*). *J. Cetacean Res. Manage.* 4(2):193-201

Teeth from 92 sperm whales were prepared by etching for age determination. The total number of growth layer groups (GLGs) in the dentine of each tooth was determined from three to five reading sessions by a single reader. Four other readers, as part of a cross-reading experiment, read a subset of these teeth (n=5). This study investigated: (1) intra- and (2) inter-reader precision in GLG counts; (3) possible variation in growth structure deposition between different teeth within the same individual; (4) the use of photographs to identify and count GLGs and the effect of this technique on the precision of counts; and (5) mineralisation anomalies in tooth sections and the possible effects these may have on GLG count precision. Intra- and inter-reader precision was determined using coefficients of variation (CV) and indices of precision (D). Total numbers of GLGs estimated from individual teeth ranged from 0.75-64 (± 32.8 , n=92). Intra-reader mean CV was 10.59 and mean D was 4.81. Inter-reader mean CV ranged from 4.77-12.32 and mean D ranged from 2.75-7.12. Differences in final counts between readers appeared to be the result of differing interpretation of GLGs and this was the largest factor affecting the precision of GLG counts. While GLG counts between teeth in the same individual varied, it is possible that this variation was due to within reader variation rather than variation in the development of growth structures, but establishment of this cause is confounded by differential tooth wear. Use of photographs increased the definition of growth structures, decreasing the variation between GLG counts within reading sessions. The incidence of mineralisation anomalies and the closure of the pulp cavity increased with increasing GLG counts in individuals, but were not consistent between teeth from the same individual. These factors, while potentially affecting the accuracy of GLG counts in relation to age estimates, had little effect on the precision of GLG counts. The lack of an ability to validate age estimates in this species and the large inter-reader variation seen in this study suggests that age estimates based on GLG counts in this species are subjective and can only be regarded as relative. High-quality photographs of tooth sections should be used to verify GLG counts with other readers, resulting in 'consensus counts' generated by a number of readers, ensuring interpretation of the same structures and confidence in comparing GLG counts produced in different studies. KEYWORDS: AGE DETERMINATION; AUSTRALASIA; SOUTHERN HEMISPHERE; SPERM WHALE; STRANDINGS

Borrell, A., Tormero, V. and Aguilar, A. 2002. Retinoids in marine mammals and their use as biomarkers of organochlorine compounds. *J. Cetacean Res. Manage.* 4(2):203-11

Retinoids, also known as vitamin A, are non-endogenous molecules that are essential for a number of physiological processes in mammals. Imbalance of retinoids has been associated with reproductive impairment, embryonic mortality, growth retardation and bone deformities, pathologies in skin and the nervous system, and immune suppression. Mammals cannot produce retinoids so their primary source is dietary. They are absorbed by the small intestine and packaged as retinyl esters in chylomicrons, which enter the circulation and end up mostly in the liver and fatty tissues. Plasma retinoid levels are homeostatically regulated, so they remain constant despite variations in dietary supply or tissue stores. Therefore body depletion of retinoids cannot be reliably assessed through levels in blood, and should be evaluated through concentrations in depot tissues. In marine mammals, the main storage sites for retinoids are liver and blubber. Although not a universal rule, the concentration of retinoids often increases with age in both sexes because of progressive build-up of retinyl esters. In addition, sex often affects retinoid levels, but the nature and magnitude of this effect varies between species and populations. Taxonomic, life-style (particularly dietary) and climatic differences may explain dissimilarities in the effect of age and sex on retinoid levels. For this reason, retinoids can be used to distinguish populations or population components showing distinct dietary, behavioural, or other traits. Disease, particularly when affecting organs of physiological importance or inducing malnutrition, may affect retinoid tissue levels, so care should be taken when studying concentrations in stranded animals. Organochlorine compounds, particularly PCBs, dioxin (TCDDs) and DDTs, increase mobilisation of retinoids from hepatic and extrahepatic storage sites into serum, accompanied by enhanced degradation and elimination of retinoids through urine. In terrestrial mammals, this effect increases retinoid concentration. Conversely, in some species of marine mammals plasma retinoid levels have been reported to decrease when exposure to organochlorines increases, although the physiological mechanisms are unclear. However, given the homeostatic regulation of retinoids in blood, variation in plasma is expected to be less than that in liver or blubber. Because retinoid tissue levels vary in marine mammals even at moderate exposure to organochlorines, and original levels are restored when such exposure decreases or disappears, retinoids may be used as a biomarker of the impact of pollutants on populations. Further research is needed to validate their use, particularly in cetaceans. KEYWORDS: BIOMARKERS; MARINE MAMMALS; ORGANOCHLORINES; RETINOL

Gailey, G. and Ortega-Ortiz, J.G. 2002. A note on a computer-based system for theodolite tracking of cetaceans. *J. Cetacean Res. Manage.* 4(2):213-8

Theodolites represent a non-invasive shore-based tool for obtaining data on cetacean movement patterns, habitat use and behavioural disturbance. Despite the common use of theodolites as research tools, relatively few computer-based systems exist to assist researchers with collection of theodolite derived data and the analysis of such information. A recently developed computer program named 'Pythagoras', provides an efficient and user-friendly tool for collecting, managing and subsequent analysis of data obtained with theodolites. Pythagoras provides location of user-defined fix types (e.g. whales, dolphins, boats, etc.) and has a dynamic interface, that can be customised to fit site-specific research needs. Additional information (behaviour, group size and environmental conditions) can be stored with each theodolite fix. Tracking data are immediately available in the form of a real-time graphic representation. All collected data are stored in Microsoft Access and can be exported as Microsoft Excel, ArcInfo, Surfer, MATLAB, or delimited text file formats. An analysis module is included to calculate linearity, reorientation rate and leg speed for each track, and distance and orientation between two or more tracklines. Behavioural data are analysed for frequency, time intervals (i.e. blow interval), duration (i.e. surface time) and rate (number per minute) of particular behaviours. Several other computer-based theodolite systems are reviewed here to evaluate their potential benefits and limitations as a means of providing a basis for future developments. KEYWORDS: BEHAVIOUR; DISTRIBUTION; MANAGEMENT; MOVEMENT; SURVEY - SHORE-BASED; TECHNIQUES

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Reeves, R.R. and Smith, T.D. 2002. Historical catches of humpback whales in the North Atlantic Ocean: an overview of sources. *J. Cetacean Res. Manage.* 4(3):219-34

Humpback whales (*Megaptera novaeangliae*) have been taken in the North Atlantic since the 1600s in a variety of fisheries operating from the Arctic to the tropics. The relative importance of the humpback in these fisheries has varied. In some, it was the main target species, while in others it was a minor component of the catch, with other large rorquals or sperm whales ranking ahead of it. There was an overall trend for large catches of humpbacks to have been made in tropical wintering areas by non-mechanized fisheries during the mid to late 19th

century; as these fisheries declined and modern whaling began in higher latitudes, large numbers of humpbacks were taken on the feeding grounds. Overall catches of humpbacks generally declined in the mid to late 20th century, with many fisheries stopping or scaling down their operations. Information describing the humpback fisheries is published in a wide variety of sources, and approximate locations and periods of operation are reasonably well known for most of the relevant fisheries. In addition, catch and production data are available in commercial records, newspapers and whaling manuscripts (e.g. logbooks). This paper summarizes the data sources and proposes definitions of thirteen 'fisheries', based on the nature of whaling methods, and 20 'sub-fisheries', based mainly on spatial distribution. Catch levels are summarized, often crudely, and gaps are identified in the catch history. Where possible, suggestions are made for filling these gaps and improving the catch history of North Atlantic humpbacks. KEYWORDS: CATCH LEVELS; HUMPBACK WHALE; NORTH ATLANTIC; WHALING - HISTORICAL

Reeves, R.R., Clapham, P.J. and Wetmore, S.E. 2002. Humpback whale (*Megaptera novaeangliae*) occurrence near the Cape Verde Islands, based on American 19th century whaling records. *J. Cetacean Res. Manage.* 4(3):235-53

American 19th century whalers often passed through the Cape Verde Islands (CVI) during the boreal winter and some of them spent a few weeks or months hunting humpback whales (*Megaptera novaeangliae*) in the bays and near-shore waters of the archipelago. Logbooks were examined from 26 voyages that involved some humpback whaling at the CVI, and information was obtained from various sources on approximately 77 additional voyages that definitely or probably humpbacked there. Twenty of the logbooks contained 396 records of an estimated 1,105 humpback whale encounters (catches, strikes and sightings). The largest estimated numbers of encounters and most of the whaling activity were around the islands of Sal, Sao Vicente and Sao Nicolau (272, 269 and 229 encounters, respectively). The peak month for humpback whale occurrence in the region appears to have been March (160 records of an estimated 465 whale encounters), with many records from February (110 records of 282 encounters) and April (86 records of 258 encounters). Catch data from the logbooks were combined with commercial data on landings of oil and reported vessel positions to estimate numbers of humpback whales taken in the CVI by the American fleet. Results suggest that American whaling for humpback whales was most intensive in the Cape Verdes during the 1850s and 1860s when at least a few hundred and perhaps more than 500 whales were killed in at least 45 and perhaps more than 80 vessel-seasons. In many respects, the Cape Verdes fishery was similar to that in the West Indies, with cows and calves frequently taken and a similar seasonal peak in whale occurrence. A crude analysis of encounter rates suggests that humpback whale density in the CVI was comparable to that in the major West Indies grounds, a situation that is clearly not the case today. KEYWORDS: AREA - CAPE VERDE ISLANDS; AREA - NORTH AMERICA; CATCH HISTORY; DISTRIBUTION; HUMPBACK WHALE; NORTH ATLANTIC; WHALING - HISTORICAL; WHALING - MODERN

Garrigue, C., Aguayo, A., Amante-Helwig, V.L.U., Baker, C.S., Caballero, P., Clapham, P., Constantine, R., Denkinger, J., Donoghue, M., Florez-Gonzalez, L., Greaves, J., Hauser, N., Olavarria, C., Pairoa, C., Peckham, H. and Poole, M. 2002. Movements of humpback whales in Oceania, South Pacific. *J. Cetacean Res. Manage.* 4(3):255-60

To investigate movements of humpback whales among breeding and migratory areas of Oceania in the South Pacific Ocean, comparisons of individually identified whales were undertaken using catalogues from New Caledonia, Tonga, New Zealand, the Cook Islands and French Polynesia. These locations probably represent wintering grounds or migratory areas for the Group V and VI stocks, as recognised by the International Whaling Commission for management purposes. Comparisons were also made to small samples of photos from Colombia, Ecuador and the Antarctic Peninsula, representing wintering and feeding grounds of the Group I stock. Overall, the combined catalogues contained photographs of 912 individual whales, 767 of which were from Oceania. Twelve fluke matches were made, indicating movement between the following areas: New Caledonia and New Zealand (2); New Caledonia and Tonga (6, plus one made by dorsal fin); Tonga and the Cook Islands (2); the Cook Islands and French Polynesia (1, plus one made by dorsal fin); and between Ecuador and the Antarctic Peninsula (1). These results add to previously known connections between eastern Australia and the westerly component of Oceania (New Caledonia, Tonga and New Zealand). The data also suggest little movement between Oceania and Area I (western South America and the Antarctic Peninsula), although sample sizes for the latter region were too small to conclude this with certainty. The documented movement of some whales among portions of Oceania indicates that stock assessments based on combining regional estimates of abundance are likely to be positively biased, although this may be countered by problems of heterogeneity in sampling effort and whale distribution. In contrast with the recovery exhibited in Area IV and in the western portion of Area V, humpback whale abundance appears to remain low in Oceania, presumably because of overexploitation in the feeding grounds of Area VI and the easterly component of Area V. KEYWORDS: AREA NEW ZEALAND; BREEDING GROUNDS; HUMPBACK WHALE; MIGRATION; POPULATION-STRUCTURE; SOUTH PACIFIC

McDonald, M.A. and Moore, S.E. 2002. Calls recorded from North Pacific right whales (*Eubalaena japonica*) in the eastern Bering Sea. *J. Cetacean Res. Manage.* 4(3):261-6

Calls from North Pacific right whales (*Eubalaena japonica*) were recorded in the eastern Bering Sea during a visual and acoustic survey aboard the US Coast Guard buoy tender Sweetbrier, in July 1999. Calls were commonly detected to 20km, and in one case approximately 30km, via deployment of arrays of directional sonobuoys. Acoustic detections (clusters of right whale calls separated by time and location) numbered 26, but only five right whales were seen. Only one right whale produced calls while under visual observation. The types of calls recorded from North Pacific right whales were similar in duration and frequency to calls recorded from right whales in the South Atlantic. The predominant call type (85%; 436 of 511 calls) was the 'up' call, a signal sweeping from about 90Hz to 150Hz in 0.7s. Two call types are described as 'down' and 'constant' calls, based upon nomenclature established for southern right whales (*Eubalaena australis*). One call type, the 'down-up' was unique to the North Pacific repertoire. Right whales commonly produced calls in series lasting several minutes and then became silent for an hour or more, with some animals not calling for periods of at least four hours. Other cetaceans detected acoustically by 'random' sonobuoy deployments during the cruise included fin whales (19 times), killer whales (3 times) and sperm whales (once). KEYWORDS: ACOUSTICS; MONITORING; NORTH PACIFIC RIGHT WHALE; SURVEY-ACOUSTIC

Calambokidis, J., Darling, J.D., Deeke, V., Gearin, P., Gosh, M., Megill, W., Tombach, C.M., Goley, D., Toropova, C. and Gisborne, B. 2002. Abundance, range and movements of a feeding aggregation of gray whales from California to southeastern Alaska. *J. Cetacean Res. Manage.* 4(3):267-76

This study documents the range, abundance and movements of a feeding aggregation of gray whales (*Eschrichtius robustus*) in the Pacific northwest. Identification photographs were collected by eight collaborating organisations between March and November 1998. Surveys

extended between northern California and southeastern Alaska. Effort was variable by region and was concentrated off the northern Washington coast and Vancouver Island. Of 1,242 occasions when suitable photographs of gray whales were obtained in 1998, 155 unique whales were identified. Each individual was photographed an average of 8.0 times (SD = 8.4, range 1-42) and the average tenure of whales seen multiple times was 56 days (SD = 41, range 1-170). Whales seen longer than three months generally were seen in multiple regions. Movements among regions in 1998 were documented for 57 whales with the most frequent interchange among three adjacent areas from northern Washington to central Vancouver Island. The overall pattern of movements among regions was complex; whales were not always moving in the same direction at the same time of year. Movements within 1998 among more distant locations did occur but were less frequently observed. Total distances between resighting positions for individual whales ranged from < 1 to 526 n.miles. Most whales photographed in 1998 had been identified in previous years when compared to photographs collected by some of the collaborators. At least 86 (55%) of the whales identified had been seen previously. The rate of inter-year resightings was highest for whales identified off northern Washington and three areas off British Columbia (from southern Vancouver Island to north of Vancouver Island). In these areas, from 70-100% of the whales seen in each region had been photographed previously. Mark-recapture abundance estimates based on comparisons to samples in 1996 and 1997 were 181 and 179, respectively. The management implication for these whales has become controversial due to the resumption of whaling by the Makah tribe in northern Washington, an area used by both migrating and feeding whales. This research shows that there are a few hundred gray whales that range in summer months from at least northern California to southeastern Alaska. The mechanism by which these animals are recruited into this group and the degree to which they should be managed as a separate unit from the overall population is not resolved. KEYWORDS: ABUNDANCE; ABUNDANCE ESTIMATE; AREA - NORTH AMERICA; AREA-ALASKA; AREA-CALIFORNIA; FEEDING; FEEDING GROUNDS; GRAY WHALE; MARK-RECAPTURE; MIGRATION; MOVEMENT; NORTH PACIFIC; PHOTO-ID; SITE-FIDELITY; WHALING - ABORIGINAL

Kato, H. and Kasuya, T. 2002. Some analyses on the modern whaling catch history of the western North Pacific stock of gray whales (*Eschrichtius robustus*). *J. Cetacean Res. Manage.* 4(3):277-82

This study analysed post-1900 published and unpublished records of gray whales in the western North Pacific. Modern whaling recorded a peak annual catch of 100-200 whales in the 1910s, followed by a rapid decline in the 1920s and 1930s and a continued low level (perhaps 10-20 whales/year) for over 40 years to the 1960s. Catches made during the last phase could have been the major factor suppressing recovery until recently. There are reasons to believe that this gray whale stock breeds in Hainan waters. KEYWORDS: GRAY WHALE; MIGRATION; WHALING - MODERN

Clarke, J.T. and Moore, S.E. 2002. A note on observations of gray whales in the southern Chukchi and northern Bering Seas, August-November, 1980-89. *J. Cetacean Res. Manage.* 4(3):283-8

A total of 176 sightings of 488 gray whales (*Eschrichtius robustus*) were made during 85.6 hours of aerial surveys in the southern Chukchi Sea and northern Bering Sea, east of the International Date Line, from August to early November 1980-1989. Surveys were flown infrequently and effort varied considerably between years and geographic areas. Gray whales were sighted in all areas where surveys were flown, with the exceptions of Kotzebue Sound and Norton Sound. Abundance indices of whales per unit effort (WPUE) in the northern Bering Sea were higher than those in the southern Chukchi Sea during every month except September, when survey coverage was inadequate for abundance calculations, indicating comparatively higher overall use of that area or suggesting the onset of the southbound migration. Most gray whales were feeding (57%, n = 276). Incidental sightings of gray whales observed in and near the study area by other researchers were reviewed to better assess gray whale activity and migration patterns. KEYWORDS: BERING SEA; DISTRIBUTION; GRAY WHALE; MIGRATION; NORTH PACIFIC; SURVEY - AERIAL

Baird, R.W., Stacey, P.J., Duffus, D.A. and Langelier, K.M. 2002. An evaluation of gray whale (*Eschrichtius robustus*) mortality incidental to fishing operations in British Columbia, Canada. *J. Cetacean Res. Manage.* 4(3):289-96

Gray whale (*Eschrichtius robustus*) mortality incidental to commercial fishing operations in British Columbia (BC), Canada was evaluated by two methods: a mailed questionnaire survey of all commercial fishing licence holders in the province; and a review of records of incidental catches, strandings and dead floating animals from published and unpublished sources. Of 5,375 surveys sent out, 848 were returned of which 729 could be used (15.8%). Forty-two incidents with gray whales were reported, including three mortalities. From sources other than the questionnaire for the period up to 1989, 41 records of stranded and dead floating gray whales were obtained, of which four were judged to have been killed incidentally in fishing operations. Twenty-six of these animals had not been examined closely, but extrapolation from the 15 detailed records suggests that 27% of the dead gray whales reported in BC die incidentally in fisheries. Collisions with fishing gear are estimated to occur approximately 20 times per year. Mortality occurs in salmon drift gillnet, salmon seine, longline and trap fisheries. There is also one record of an individual entangled and drowned in a herring net pen, as well as an individual entangled in a herring set gillnet. Estimates of annual mortality are approximately two individuals using data obtained from the questionnaire and 2.4 individuals using stranding data. Biases are present for both sampling methods, but the estimated mortality levels are small relative to population size. Subsequent records (n = 40) for the period 1990-95 were also examined for comparison. KEYWORDS: GRAY WHALE; HELEN-GRAY; INCIDENTAL CAPTURE; NORTH PACIFIC; STRANDINGS

McLellan, W.A., Friedlander, A.S., Mead, J.G., Potter, C.W. and Pabst, D.A. 2002. Analysing 25 years of bottlenose dolphin (*Tursiops truncatus*) strandings along the Atlantic coast of the USA: do historic records support the coastal migratory stock hypothesis? *J. Cetacean Res. Manage.* 4(3):297-304

Between June 1987 and March 1988, bottlenose dolphins (*Tursiops truncatus* Montagu 1821) along the US Atlantic coast experienced an epizootic. Monthly interquartile ranges of strandings during the epizootic were used to propose the Coastal Migratory Stock (CMS) of bottlenose dolphins (Scott et al., 1988). To date, the hypothesised CMS remains poorly understood. The goal of this study was to use a 25-year database to compare stranding patterns during the epizootic to those before (1972-1986) and after (1989-1997) the event. These comparisons reveal that monthly interquartile ranges during the epizootic are dissimilar to those before and after the event. The frequency distribution of total monthly strandings during the epizootic is also significantly different from those observed outside the event. Seasonal stranding patterns from 1989-1997 suggest more complex movements of dolphins along the US Atlantic coast than those of a single group ranging seasonally from Florida to New Jersey. In winter, for example, when the current model for the CMS predicts dolphin distributions concentrated in central Florida, the highest number of strandings occurred in North Carolina. Thus, these comparative analyses suggest that the pattern observed during the epizootic was anomalous, and not representative of stranding distributions for any other time period of the

study. During the 15 years before the epizootic, and the nine years following, there was no clear picture of 'migration' of mortality along the coast. This study demonstrates how long-term, systematic collection of strandings data can be useful in testing hypotheses regarding the complex stock structure of coastal bottlenose dolphins. This knowledge will greatly enhance the ability to conserve and manage these animals as they recover from historic (i.e. directed takes and epizootic) and current sources of mortality. KEYWORDS: ATLANTIC OCEAN; BOTTLENOSE DOLPHIN; DISTRIBUTION; EPIZOOTIC; NORTH AMERICA; STOCKS; STRANDINGS

Williams, R., Bain, D.E., Ford, J.K.B. and Trites, A.W. 2002. Behavioural responses of male killer whales to a 'leapfrogging' vessel. *J. Cetacean Res. Manage.* 4(3):305-10

The research and whalewatching communities of Johnstone Strait, British Columbia, Canada have worked closely together to identify whalewatching practices that minimise disturbance to northern resident killer whales. Local guidelines request that boaters approach whales no closer than 100m. Additionally, boaters are requested not to speed up when close to whales in order to place their boat in a whale's predicted path: a practice known as 'leapfrogging'. A land-based study was designed to test for behavioural responses of killer whales to an experimental vessel that leapfrogged a whale's predicted path at distances greater than 100m. Ten male killer whales were repeatedly approached and the animals responded on average by adopting paths that were significantly less smooth and less straight than during preceding, control conditions. This adoption of a less 'predictable' path is consistent with animals attempting to evade the approaching boat, which may have negative energetic consequences for killer whales. The results support local consensus that leapfrogging is a disruptive style of whalewatching, and should be discouraged. Similarly, as the experimental boat increased speed to overtake the whale's path, the source level of engine noise increased by 14dB. Assuming a standard spherical transmission loss model, the fast-moving boat would need to be 500m from the whale for the received sound level to be the same as that received from a slow-moving boat at 100m. Whalewatching guidelines should therefore encourage boaters to slow down around whales, and not to resume full speed while whales are within 500m. KEYWORDS: 54-JAPAN; BEHAVIOUR; DISTURBANCE; KILLER WHALE; REGULATION; WHALEWATCHING

Ferrero, R.C., Hobbs, R.C. and Vanblaricom, G.R. 2002. Indications of habitat use patterns among small cetaceans in the central North Pacific based on fisheries observer data. *J. Cetacean Res. Manage.* 4(3):311-21

Biological specimens and environmental data collected by observers monitoring Japanese squid driftnet fishing operations during the summers of 1990 and 1991 in the central North Pacific (37°N-46°N, and 170°E-150°W) were used to explore habitat use patterns among three small cetacean species common to that area: the Dall's porpoise (*Phocoenoides dalli*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) and northern right whale dolphin (*Lissodelphis borealis*). Sex and maturity status were determined for 805 northern right whale dolphins, 421 Pacific white-sided dolphins and 206 Dall's porpoises incidentally taken in 800 observed gillnet sets, allowing sub-taxon comparisons of habitat use patterns. Habitat variables were based on observer records of sea surface temperature (SST), wind velocity and direction, and swell height. Current velocity and direction and SST gradients were also derived. Canonical Correspondence Analysis (CCA) was used to relate the species categories to the habitat conditions recorded for the gillnet operations in which entanglements occurred. The samples collected from the southern, middle and northern latitudes within the overall study area were examined separately to account for northward movement of the fishing fleets across the summer months. SST was the most dominant and consistent feature; northern right whale dolphins occupied the warmest waters, Dall's porpoises the coldest; Pacific white-sided dolphins were found in-between, but more similar to the latter. Wind velocity and swell height also reflected potentially important habitat features. Young-of-the-year northern right whale dolphin showed a preference for the warmest waters observed in the middle latitude band, coincident with that species summer calving mode. KEYWORDS: BY-CATCH; DALL'S PORPOISE; DISTRIBUTION; ECOSYSTEM; HABITAT; NORTHERN RIGHT WHALE DOLPHIN; PACIFIC WHITE-SIDED DOLPHIN

Pinedo, M.C., Polachek, T., Barreto, A.S. and Lammardo, M.P. 2002. A note on vessel of opportunity sighting surveys for cetaceans in the shelf edge region off the southern coast of Brazil. *J. Cetacean Res. Manage.* 4(3):323-9

Results are presented from vessel of opportunity sighting surveys conducted from 1996 to 1999 aboard the Fundação Universidade Federal do Rio Grande (FURG) Research Vessel Atlântico Sul off the southern Brazil coast (27°-35°S). These surveys were conducted in conjunction with a research sampling project (Argo) of the pelagic living resources within Brazil's southern shelf and slope waters. The cruises entailed pelagic longlining and dedicated searching was conducted during hauling and setting operations as well as when the vessel was transiting. The sighting surveys represent the first attempt to collect quantitative information on the distribution and density of cetaceans in these waters. A total of 109 cetacean sightings were made during a total of 269 hours of dedicated searching effort covering approximately 2,200 miles. Sperm whales were the dominant species accounting for over 40% of the sightings and were concentrated in the slope area in the more southerly region. The high number and fidelity of the sperm whale sightings suggest the year around importance of the shelf border as a possible migration route and/or food resources ground. Killer whales were the second most commonly sighted species and were detected on all of the cruises. 44% of the killer whale sightings were detected during longline hauling or setting operations and observations suggest a positive attraction of killer whales to the vessel at these times. Also of particular interest during the spring cruise was a humpback and two minke whale sightings. Sightings in November-December in sub-tropical and temperate waters were unexpected for both of these species as the South Atlantic populations are generally considered to have fully migrated to Antarctic waters. KEYWORDS: DISTRIBUTION; KILLER WHALE; SOUTH AMERICA; SPERM WHALE; SURVEY-VESSEL

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Mori, M., Butterworth, D.S., Brandao, A., Rademeyer, R.A., Okamura, H. and Matsuda, H. 2003. Observer experience and Antarctic minke whale sighting ability in IWC/IDCR-SOWER surveys. *J. Cetacean Res. Manage.* 5(1):1-11.

The relationship between observer experience and the number of minke whale schools sighted on International Whaling Commission/International Decade of Cetacean Research-Southern Ocean Whale and Ecosystem Research (IWC/IDCR-SOWER) surveys from 1993/94 to 1998/99 is investigated for Independent Observer (IO) mode survey. Observer experience is defined as the number of past sightings surveys in which the observer participated. During the third circumpolar set of surveys (from 1991/92 onwards), about half of the observers had participated in fewer than five previous sightings surveys. Based upon the QAIC model selection criterion, the observers are classified into two groups depending on their experience: 'Beginners' (0-4 surveys) and 'Experts' (>4). The sighting rate for minke whale schools by Beginners is estimated to be 42% lower than that by Expert observers. Furthermore, perpendicular distances to the sightings do not show significant differences in relation to observer experience. These results jointly indicate that the probability of detection on the trackline, $g(0)$, may be less than one when Beginners are amongst those observing. Abundance estimation for minke whales in IO mode involves the sightings made by triple observer combinations, with two observers in the barrel and one observer in the Independent Observer Platform (IOP) all searching simultaneously. Surprisingly, given the result above, no significant trend in sighting rate with the combined experience of this three-observer combination is detected. This might be an artifact of small sample size for some observer combinations, such as Experts in all platforms. When observer combinations in the barrel are pooled across, the estimated trend in the sighting rate with combined observer experience becomes steeper. Furthermore, when like-minke sightings are also taken into account, the trend becomes steeper still. In this case, when observations are pooled across observer combinations in the barrel, a model for sighting rate that includes an observer effect is selected in terms of the QAIC criteria. These analyses thus provide suggestive evidence that the introduction of Beginner observers during the third circumpolar set of surveys may have reduced $g(0)$ and hence negatively biased abundance estimates for minke whales, both in absolute terms and compared with estimates from the second circumpolar set of surveys.

ABUNDANCE ESTIMATE; $G(0)$; METHODOLOGY; MINKE WHALE; SOUTHERN HEMISPHERE; SURVEY; SURVEY-VESSEL; TRENDS

Clapham, P., Barlow, J., Bessinger, M., Cole, T., Mattila, R., Pace, R., Palka, D., Robbins, J. and Seton, R. 2003. Abundance and demographic parameters of humpback whales from the Gulf of Maine, and stock definition relative to the Scotian shelf. *J. Cetacean Res. Manage.* 5(1):13-22.

The Gulf of Maine is one of the principal summer feeding grounds for humpback whales (*Megaptera novaeangliae*) in the North Atlantic, and was one focus of effort in an ocean-basin-wide study known as the Years of the North Atlantic Humpback (YoNAH) project. Data from that project and from subsequent surveys were used to assess stock boundaries, abundance and demographic parameters for Gulf of Maine humpbacks. Surveys on the Scotian Shelf in the summers of 1998 and 1999 produced the first substantial dataset of identified individual humpbacks observed in this region, which lies between the well-studied areas of the Gulf of Maine and Newfoundland. The results gave a match rate of approximately 27% (14 of 52 individuals) between the Scotian Shelf and the Gulf of Maine, with evidence that many of the matched whales were transient in the Gulf of Maine; there were no matches to any other location in the North Atlantic. These data suggest that the range of most whales from the Gulf of Maine usually does not extend as far east as the Scotian Shelf or Newfoundland. Only one whale was observed on the Scotian Shelf in both the 1998 and 1999 surveys, and another seen in 1998 had also been sighted there in 1994. This low inter-annual match rate suggests that the abundance of humpback whales on the Scotian Shelf is larger than previously recognised. Three different but overlapping estimates of abundance for the Gulf of Maine population were calculated. Mark-recapture data from 1992/93 gave an estimate of abundance of 652 (CV=0.29); however, this estimate is likely biased because of heterogeneity in sampling and in animal distribution. Photo-id data also provided a minimum population estimate of 497 humpbacks known to be alive in 1997; this estimate is also likely to be negatively biased because of heterogeneity. Finally, line-transect surveys conducted in 1999 yielded estimates of 816 (CV=0.45) or 902 humpback whales (CV=0.41, including a portion of the eastern Scotian Shelf stratum); these transect-based estimates are more consistent with the number of humpbacks (1,273, including dead animals) in the current photo-id catalogue for the Gulf of Maine. Overall, the size of the Gulf of Maine population is likely to be in the high hundreds, but no more precise estimate can be calculated at this time. The growth rate for the Gulf of Maine population was estimated using an interbirth interval method using data from 1992-2000. The estimate was either 1.00 (for a calf survival rate of 0.51) or 1.04 (for a calf survival rate of 0.875). Although confidence limits are not available (because maturation parameters could not be estimated), both estimates of population growth rate are outside the 95% confidence intervals of the previous estimate of 1.065 for the period 1979-1991 (Barlow and Clapham, 1997). It is unclear whether this apparent decline is an artefact resulting from a shift in distribution or is a real phenomenon; if the latter, it may be related to known high mortality among young-of-the-year whales in the waters of the US mid-Atlantic states. However, calf survival appears to have increased since 1996, presumably accompanied by an increase in population growth. KEYWORDS: HUMPBACK WHALE; NORTH ATLANTIC; ABUNDANCE; STOCK DEFINITION; POPULATION GROWTH; PHOTO-IDENTIFICATION

ABUNDANCE; HUMPBACK WHALE; NORTH ATLANTIC; PHOTO-ID; POPULATION ASSESSMENT; STOCK DEFINITION

Friday, N. and Smith, T. 2003. The effect of age and sex selective harvest patterns for baleen whales. *J. Cetacean Res. Manage.* 5(1):23-8.

The taking of calves and females accompanied by calves is prohibited under the original and current forms of the Schedule of the International Whaling Commission. Proposed regulations under the Revised Management Scheme would reduce catch limits according to the proportion of females in the landings when females make up more than one-half of the landings. The implications of regulations on age, sex and reproductive

status were explored by examining the relative impacts of baleen whale harvests with different age, sex and female reproductive status selectivity patterns using a matrix population model. The effects of 11 harvest patterns with varying selectivity for females and calves were measured by computing the fraction of the population that would have to be killed to reduce the growth rate of the population model to zero and the corresponding fraction of the population that would be landed (harvest fraction). The harvest impact per whale landed was measured for each selectivity pattern by expressing the harvest fraction as a percentage of the value of that fraction for a harvest random across age, sex and reproductive status. The harvest impacts per whale landed of the 11 patterns ranged from 64% greater to 29% lower than a random harvest. The patterns with the lowest harvest impact per whale landed were the pattern consistent with the IWC Schedule of prohibiting harvest of calves and females accompanied by calves, and the pattern of harvesting only calves. The harvest selectivity patterns which increased the vulnerability of females had the greatest impact. Relative to the IWC's Revised Management Procedure, this increased female vulnerability was roughly compensated for by the decrease in catch limits as the proportion of females in the catches increased.

ATLANTIC; BALEEN WHALES; DIRECT CAPTURE; GROWTH/LENGTH DISTRIBUTIONS; HUMPBACK WHALE; MANAGEMENT PROCEDURE; MODELLING; MSY; NORTHERN HEMISPHERE; SUSTAINABILITY

Dereksdóttir, E.H. and Magnússon, K.G. 2003. A strike limit algorithm based on adaptive Kalman filtering with an application to aboriginal whaling of bowhead whales. *J. Cetacean Res. Manage.* 5(1):29-37.

A full and detailed description of a Strike Limit Algorithm (SLA) based on Adaptive Kalman Filtering techniques with an application to the Bering-Chukchi-Beaufort (B-C-B) Seas stock of bowhead whales is presented in this paper. Extended Kalman filters are used to estimate the present stock size and posterior probability distributions for MSY-rate (MSYR) and the pre-exploitation stock size K. A catch control law selected from a one-parameter family of such rules is then used on the conditional estimates of stock size. These conditional strike limits together with the posterior distributions of the various combinations of MSYR and K, give a cumulative distribution function for the strike limit. The eventual strike limit is then determined as a pre-specified percentile of this distribution. The SLA can be tuned to varying degrees of risk by the choice of the parameter characterising the catch control law and the percentile of the distribution for the strike limit. The procedure is tested on the Evaluation Trials set by the Standing Working Group on Aboriginal Whaling Management Procedures

ARCTIC; MANAGEMENT PROCEDURE; MODELLING; STATISTICS; WHALING - ABORIGINAL

Givens, G.H. 2003. Empirical estimation of safe aboriginal whaling limits for bowhead whales. *J. Cetacean Res. Manage.* 5(1):39-43.

ABSTRACT This paper provides a complete description of a Strike Limit Algorithm (SLA) considered by the International Whaling Commission (IWC) for the management of hunting of the Bering-Chukchi-Beaufort Seas stock of bowhead whales by native Alaskans to meet their cultural and subsistence needs. The algorithm applies a statistical estimation and optimisation strategy to extract the best features of selected SLAs to form a Bayes rule estimator. It focuses on safely satisfying moderate subsistence need, while favouring stock protection by setting strike limits below what would be required to fully satisfy need in the final portion of this century if need were more than doubled. **Keywords:** Whaling-Aboriginal; Management Procedure; Statistics; Modelling; Arctic

ARCTIC; MANAGEMENT PROCEDURE; MODELLING; STATISTICS; WHALING - ABORIGINAL

Witting, L. 2003. Reconstructing the population dynamics of eastern Pacific gray whales over the past 150 to 400 years. *J. Cetacean Res. Manage.* 5(1):45-54.

Reconstructing the historic trajectory of the eastern North Pacific gray whale (*Eschrichtius robustus*) is important for the understanding of whale population dynamics and for management of the hunt on the population. Interestingly, the density-regulated BALEEN II model (Punt, 1999) will generally not reconstruct the trajectory because it does not reconcile catch history and abundance data unless additional ad hoc hypotheses are added to the model. Here, an alternative model of inertial dynamics is used to estimate the population trajectory over the past 150 to 400 years. This model is a traditional density-regulated model with superimposed density-dependent changes in the intrinsic life history. Nine different versions of the model are examined and Bayesian assessments performed for the complete catch histories from 1600 and 1846. This reconciles the data, can explain an independent abundance estimate from 1885 and it predicts an over-compensatory population that has increased steadily above the equilibrium abundance for the last three decades. The model predicts that gray whale abundance will begin to decline in a more or less drastic manner in the near future.

DENSITY; FISHERIES; GRAY WHALE; INERTIAL DYNAMICS; MODELLING

Fossi, M.C., Marsili, L. and Notarbartolo-di-Sciara, G. 2003. The role of skin biopsy in the detection of exposure and effect to endocrine disrupting chemicals in Mediterranean cetaceans. *J. Cetacean Res. Manage.* 5(1):55-60.

Use of skin biopsy is proposed as a sensitive non-lethal technique for the hazard assessment of Mediterranean cetaceans exposed to endocrine disrupting chemicals (EDCs). EDCs are a structurally diverse group of compounds that may adversely affect the health of humans and wildlife or their progeny, by interaction with the endocrine system. In the Mediterranean environment top predators accumulate high concentrations of

polyhalogenated aromatic hydrocarbons (PHAHs) and toxic metals, incurring high toxicological hazard. In this paper, the hypothesis that Mediterranean cetaceans are potentially at risk due to PHAH-EDCs is investigated using skin biopsy samples. Benzo-a-pyrene monooxygenase (BPMO) activity in skin biopsies was used as a potential indicator of exposure to different organochlorines (OCs) known to have endocrine disrupting properties. The main objective of this paper was to use this non-destructive ecotoxicological tool to define the potential hazard to Mediterranean odontocete and mysticete species, comparing the present data with values detected in other cetaceans from heavily polluted areas, affected by pseudohermaphroditism and other reproductive dysfunction. Subcutaneous tissue consisting of skin and blubber was obtained from striped dolphins (*Stenella coeruleoalba*), bottlenose dolphins (*Tursiops truncatus*), common dolphins (*Delphinus delphis*) and fin whales (*Balaenoptera physalus*) in the Mediterranean basin. Sampling was performed in the western Ligurian Sea, between Corsica and the French-Italian coast, and in the Ionian Sea. High concentrations of DDT metabolites and PCB congeners (known as Endocrine Disruptors) were detected in the different species. Significant differences in BPMO induction and OC levels were found between odontocetes and mysticetes. Differences in organochlorine bioaccumulation and consequently potential risk due to endocrine disruptors were primarily related to different positions in the marine food web. A statistical correlation was found between BPMO activity and organochlorine (op'DDT, a potent estrogen and antiandrogen and pp'DDE, a potent antiandrogen) levels in skin biopsy specimens of the endangered Mediterranean population of common dolphin. Several conclusions on the potential risk to Mediterranean cetaceans can be drawn from comparison of the levels of OC-EDs detected in Mediterranean odontocetes with those in white whales (*Delphinapterus leucas*) of the St Lawrence estuary and bowhead whales (*Balaena mysticetus*) affected by pseudohermaphroditism and other reproductive dysfunction. Finally, these results suggest that BPMO induction may be an early sign of exposure to EDCs such as OCs and a warning of the possibility of transgenerational effects through exposure of future generations via the placenta and milk.

BIOPSY SAMPLING; BOTTLENOSE DOLPHIN; COMMON DOLPHIN; FIN WHALE; HAMMERSMITH; ORGANOCHLORINES; POLLUTANTS; STRIPED DOLPHIN

Secchi, E.R., Danilewicz, D. and Ott, P.H. 2003. Applying the phylogeographic concept to identify franciscana dolphin stocks: implications to meet management objectives. *J. Cetacean Res. Manage.* 5(1):61-8.

High numbers of franciscanas (*Pontoporia blainvillei*) have been bycaught in gillnets for at least four decades. The impact is strong but not homogeneous along the species distribution range, and there is evidence that at least one local population is declining. Reliable stock determination is important to evaluate how bycatch affects stocks so that they can be preserved through local management actions. Following the phylogeographic approach of Dizon et al. (1992), which applies a hierarchical classification scheme to stock designations, available information relevant for franciscana stock discreteness was reviewed, including data on distribution, population response, phenotype and genotype. Data on mtDNA, morphometrics and population parameters all together provide evidence for splitting the species into four management stocks: two inhabiting coastal waters of Brazil; the third occurring in Rio Grande do Sul State (southern Brazil) and Uruguay, and the fourth inhabiting coastal Argentine waters. The areas where these stocks occur are herein called Franciscana Management Areas or FMA I to IV. Although in some cases the evidence for such sub-division into four stocks is weak due to lack of data, the use of the proposed classification into four FMAs is recommended to warrant effective management on a local scale.

KEYWORDS: FRANCISCANA; CONSERVATION; MANAGEMENT STOCK; SOUTH AMERICA; ATLANTIC OCEAN; DISTRIBUTION; GENETICS; MORPHOMETRICS; POPULATION PARAMETERS; PHYLOGEOGRAPHY; INCIDENTAL CATCHES

Valsecchi, E. and Zanelatto, R.C. 2003. Molecular analysis of the social and population structure of the franciscana (*Pontoporia blainvillei*): conservation implications. *J. Cetacean Res. Manage.* 5(1):69-75.

Fifteen franciscanas, including four members of a putative social group, were genetically typed in order to: (1) obtain insights into the social organisation of this poorly known dolphin species; and (2) clarify its population sub-structure across the species range. Samples were screened for 10 nuclear markers (microsatellites) and sequenced for 269bp of the mitochondrial DNA control region. The results indicate that franciscana dolphins may travel in kin groups which might include, besides mothers with their calves or juvenile offspring, the fathers of the youngest group members. All four individuals from the presumed social group shared the same mitochondrial haplotype, suggesting that the social unit might be matrilineally structured. Comparative analyses of mitochondrial data available from a previous study of two adjacent populations (19 additional haplotypes) suggest the existence of at least three distinct populations. This population fragmentation, together with the relatively low genetic variability, suggests that the franciscana dolphin is a potentially vulnerable species, which may require some management effort to ensure its preservation. Consistent with a previous study, the population occupying the northernmost extremity of the species distribution range was found to be the least variable, most isolated, and therefore potentially the most vulnerable.

CONSERVATION; FRANCISCANA; GENETICS; MANAGEMENT; SOCIAL; SOUTH AMERICA; SOUTH ATLANTIC

Coscarella, M.A., Dans, S.L., Crespo, E.A. and Pedraza, S.M. 2003. Potential impact of unregulated dolphin watching activities in Patagonia. *J. Cetacean Res. Manage.* 5(1):77-84.

Since 1997, dolphin watching activities have increased in Patagonia, with dusky and Commerson's dolphins as the target species. To assess the impact of this activity, dolphin watching tours were monitored. For dusky dolphins, the number of tourists increased from 1,393 in 1997 to 1,840 in 2000. The encounter rate grew from 25% during 1999 to 90% in 2001. Most of the groups observed ranged from 50-100 animals. Data were recorded from both a commercial and a research boat. Dusky dolphins showed a short-term reaction to boats and feeding was the most affected behaviour. For Commerson's dolphins, the number of tourists increased from 532 in 1999 to 2,113 in 2001. The encounter rate averaged 95.58%. There is seasonality in the abundance of Commerson's dolphins in the area during the colder months (May-December), when schools are larger, than in the warmer months. Dolphins showed a short-term reaction to the presence of the boat, performing aerial displays

which are otherwise rarely seen. The direct gross estimated income for the companies carrying out dolphin watching is around US\$60,000 per year. The activity has great potential to become an industry of its own. Nevertheless, the activity is at present undertaken on an irregular basis.

CHANGE - SHORT TERM; COMMERSON'S DOLPHIN; DUSKY DOLPHIN; SOUTH AMERICA; WHALEWATCHING

Teilmann, J. 2003. Influence of sea-state on density estimates of harbour porpoises (*Phocoena phocoena*). *J. Cetacean Res. Manage.* 5(1):82-95.

A ship-based line transect survey was conducted in the Great Belt, Denmark, from 7-20 April 1994, covering an area of 705 linear kilometres. A total of 497 sightings were collected in sea state 0-3. A comparison of relative abundance stratified by sea state revealed that sea state had a significant effect on the estimated sighting rate, effective search width, density and abundance within sea state 0-3. However, no significant difference was found between sea state 2 and 3. Comparison of abundance estimates of the same area on two different days surveyed in sea state 0, revealed no significant difference. The relative abundance estimate was 1,526 harbour porpoises in sea state 0 within the surveyed area (326.2km²) based on the line transect method. This is the highest density of harbour porpoises (4.9 harbour porpoise/km²) reported in Europe. There is a strong indication that sea state has a significant effect on abundance estimation of harbour porpoises in ship-based conventional line transect surveys. This is important for future surveys in two ways: (1) the reliability of a comparison of abundance for different surveys strictly depends on the sea state in which the surveys were conducted; and (2) when estimating absolute abundance, effects of sea state should be explicitly addressed. One way is to separately analyse data from each sea state and apply a g(0) estimate for each sea state.

ABUNDANCE; DENSITY; HARBOUR PORPOISE; LINE-TRANSECT; NORTH ATLANTIC; SEA STATE; SURVEY-VESSEL

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Olsen, E., Øien, N., Leith, A. and Bergflødt, B. 2003. The suitability of mandible growth layers in the common minke whale (*Balaenoptera acutorostrata*) for age determination. *J. Cetacean Res. Manage.* 5(2):93-101.

Ovaries from 82 female minke whales (30 from 1999 and 52 from 2001) caught in the North Atlantic were examined macroscopically and the number of corpora lutea, c. albicantia and c. artetica determined by two or three readers. From these whales and an additional 19 males (13 from 1999 and 6 from 2001), the number of GLGs in the buccal wall of the anterior part of both mandibles were counted. Mandible GLGs were counted by either examining digital images of haematoxylin stained 200-500mm segments, or from high-resolution X-ray images of 3mm thick unstained segments examined by two readers. The readers agreed completely when counting ovarian corpora lutea, but there was disagreement with the interpretation of c. albicantia and c. artetica in some ovaries. The average CV of the number of ovulations (nc.lutea + nc.albicantia) was 6%; when counting only c. albicantia the CV was 16.7%, and 64.9% when counting only c. artetica. The precision when counting mandible GLGs using the digital images was poor, with mean CV of 82%, compared to 41% using the X-ray images. There was poor agreement between the repeated readings of the X-ray images by each reader, as well as between the readers. Mean GLG count using either method did not correlate with the number of ovulations, and provided biologically unreasonable von Bertalanffy growth models. This study shows that there is some uncertainty when examining ovaries, although this is small compared to the variability and bias associated with counting mandible GLGs. New bone is deposited in the mandible in such a way that growth layers do not continuously accumulate, or cannot be distinguished using present technology and methods.

AGE DETERMINATION; ATLANTIC OCEAN; MINKE WHALE; OVULATION; REPRODUCTION

Krahn, M.M., Ylitalo, G.M., Stein, J.E., Aguilar, A. and Borrell, A. 2003. Organochlorine contaminants in cetaceans: how to facilitate interpretation and avoid errors when comparing datasets. *J. Cetacean Res. Manage.* 5(2):103-3.

This paper reviews current scientific literature to provide information for avoiding errors commonly made in comparing and interpreting datasets from laboratories measuring organochlorine contaminants in cetaceans. Before making comparisons and interpretations using heterogeneous datasets (e.g. those from different laboratories or those from different methods in the same laboratory), it is essential to consider specific information about the animals sampled (e.g. age, sex, reproductive status, body condition and health status), sampling procedures (e.g. necropsy of subsistence, stranded or bycaught individuals; remote or surgical biopsy), methods for measuring and conventions for expressing analytical results for lipids and contaminants (e.g. percent lipid, percent dry weight, contaminant concentration units, totals of contaminant groups such as PCB congeners) and quality assurance performance. Reformatting should be carried out, as necessary, to unify the datasets (e.g. into like units and weight basis) and allow a critical evaluation of the data to be made. As part of the data interpretation, caveats or limits in the comparability of the datasets (based on quality assurance results) should be provided. In addition, the biological relevance of the data must be considered in interpreting the datasets.

BIOPSY SAMPLING; CETACEANS - GENERAL; DATA; ORGANOCHLORINES; POLLUTANT BURDEN; POLLUTANTS; POLLUTION

Møller, P., Born, E.W., Dietz, R., Haug, T., Ruzzante, D.E. and Øien, N. 2003. Regional differences in fatty acid composition in minke whales (*Balaenoptera acutorostrata*) from the North Atlantic. *J. Cetacean Res. Manage.* 5(2):115-24.

Variation in fatty acid (FA) composition of blubber collected in 1998 from 170 common minke whales (*Balaenoptera acutorostrata*) was used to study population structure in the North Atlantic. Samples from seven IWC management units were analysed: West Greenland ('WG', n = 69); East Greenland ('CG', n = 3); Jan Mayen ('CM', n = 24); Svalbard ('ES', n = 16); the Barents Sea ('EB', n = 30); Vestfjorden/Lofoten ('EC', n =

7); and the North Sea ('EN', n = 21). FA analyses were conducted on both deep and superficial blubber with a one-step extraction and esterification method followed by gas-chromatography. The 43 FAs identified comprised 93-99% of total FAs. CART and MANOVA analyses on FA signatures in both blubber sections suggested a '3-geographic Regions model' where the regions were Greenland (WG, CG), the Northeast Atlantic (CM, ES, EB, EC) and the North Sea (EN). This is in general agreement with a genetic study on the same samples and suggests that differences in FA signatures can be used for studying population structure in minke whales. Potential variation in FA signatures caused by internal and environmental factors needs to be better understood. It is recommended that future studies of blubber FA signatures in minke whales include samples from their entire North Atlantic range (including Canadian and Icelandic waters). Samples should be collected from a pre-specified body site to rule out possible internal variation and during a narrow time-window in the same year to rule out seasonal exchange between areas.

AREA-GREENLAND; MINKE WHALE; NORTH ATLANTIC; NORTH SEA; POPULATIONS; STOCK DEFINITION

Jann, B., Allen, J., Carrillo, M., Hanquet, S., Katona, S.K., Martin, A.R., Reeves, R.R., Seton, R., Stevick, P.T. and Wenzel, F.W. 2003. Migration of a humpback whale (*Megaptera novaeangliae*) between the Cape Verde Islands and Iceland. *J. Cetacean Res. Manage.* 5(2):125-29.

The movements of individual humpback whales (*Megaptera novaeangliae*) can be tracked by matching photographs of the distinctive markings on the ventral sides of their tail flukes. During the winter-spring seasons of 1990, 1991, 1995, 1996, 1999, 2000, 2001 and 2002 a total of 42 individual humpbacks were identified by fluke photographs from the waters of the Cape Verde Islands. These were compared with photographs taken elsewhere in the North Atlantic. One match was made with a whale previously photographed in the Denmark Strait off Iceland, providing the first direct evidence of a link between the humpbacks in tropical waters of the eastern North Atlantic and a high-latitude feeding ground. This finding is consistent with the mitochondrial DNA evidence of at least two distinct breeding populations of humpback whales in the North Atlantic. The presence of cows with young calves as well as singers during the humpback mating and calving season implies that waters surrounding the Cape Verde archipelago constitute a breeding and calving ground for an eastern North Atlantic population of humpback whales.

AREA - CAPE VERDE ISLANDS; AREA-ICELAND; ATLANTIC OCEAN; BREEDING GROUNDS; FEEDING GROUNDS; HABITAT; HUMPBACK WHALE; MIGRATION; NORTH ATLANTIC; PHOTO-ID; REPRODUCTION

Pitman, R.L. and Ensor, P. 2003. Three forms of killer whales (*Orcinus orca*) in Antarctic waters. *J. Cetacean Res. Manage.* 5(2):131-39.

This paper provides field descriptions and biological observations of three different forms of killer whale (*Orcinus orca*) that occur in Antarctica based on field observations and a review of available photographs. Identifications were based on the relative size and orientation of the white eyepatch and the presence or absence of a dorsal cape. Type A (presumably the nominate form) has a medium-sized eyepatch oriented parallel to the body axis, no dorsal cape, it occurs mainly off-shore in ice-free water, has a circumpolar distribution and apparently preys mainly upon Antarctic minke whales (*Balaenoptera bonaerensis*). Type B also has an eyepatch oriented parallel to the body axis, but the eyepatch is at least twice as large as in Type A, it has a dorsal cape, mainly inhabits inshore waters, regularly occurs in pack-ice, is distributed around the continent and is regularly sighted in the Antarctic Peninsula area. Although it may also prey upon Antarctic minke whales and possibly humpback whales (*Megaptera novaeangliae*), seals seem to be the most important prey item. Type C has a small, forward-slanted eyepatch, a dorsal cape, inhabits inshore waters and lives mainly in the pack-ice; it occurs mostly off East Antarctica, and to date it has been recorded feeding only on Antarctic toothfish (*Dissostichus mawsoni*). Type C appears to be referable to *Orcinus glacialis* as described by Berzin and Vladimirov (1983). Although similar ecological specialisations have been reported for sympatric killer whale populations in the Northeast Pacific (i.e. an inshore mammal-eater, an inshore fish-eater and an offshore form), the extent of morphological divergence, habitat segregation and, perhaps, reproductive isolation, appears to be more pronounced among Antarctic populations. Although under a Biological Species Concept these forms appear to warrant separate species status, it will be important to show that this interpretation is consistent with results of molecular genetic analyses and additional morphological studies.

ANTARCTIC; COLOURATION; DISTRIBUTION; KILLER WHALE; TAXONOMY

Gubbins, C.M., Caldwell, M., Barco, S.G., Rittmaster, K., Bowles, N. and Thayer, V. 2003. Abundance and sighting patterns of bottlenose dolphins (*Tursiops truncatus*) at four northwest Atlantic coastal sites. *J. Cetacean Res. Manage.* 5(2):141-47.

Researchers and managers studying Atlantic coastal bottlenose dolphins along the east coast of the United States have been working on the hypothesis that there are two units within the population. One unit migrates seasonally along the northwest Atlantic coast (moving north during summer and south during autumn and winter), while the other remains in local inshore waters year-round. As part of independent, on-going studies begun in the late 1980s and mid-1990s, the occurrence of dolphins was compared among four separate sites (Virginia, North Carolina, South Carolina and Florida) in 1997. The goals of the study were to test the current working hypothesis of one migrating stock of dolphins using data on abundance, distribution and sighting patterns and to calculate a minimum estimate of the population size of northwest Atlantic coastal bottlenose dolphins at the four sites. Dolphins were consistently present in Virginia from April to October and year-round in North Carolina, South Carolina and Florida. In total, 7,830 dolphins were counted and 2,839 identifications were made. Monthly dolphin counts and water temperatures were positively correlated at the Virginia, South Carolina and Florida sites. After adjusting for effort, monthly dolphin counts were significantly different among the four sites but new identification rates were not. The monthly resighting rates were significantly higher in Florida than at the other sites. Based on mark-recapture analysis, it was estimated that 2,392 coastal bottlenose dolphins were present at the four sites in 1997. This estimate is similar to published abundance estimates for dolphins along the entire US Atlantic coast (2,482). These results

support the hypothesis of multiple population units with distinct movement patterns and suggest that published abundance estimates for coastal bottlenose dolphins are greatly underestimated.

ABUNDANCE ESTIMATE; ATLANTIC OCEAN; BOTTLENOSE DOLPHIN; DISTRIBUTION; MARK-RECAPTURE; MOVEMENT; PHOTO-ID; SIGHTINGS-GENERAL

Mate, B.R., Lagerquist, B.A. and Urban-Ramirez, J. 2003. A note on using satellite telemetry to document the use of San Ignacio Lagoon by gray whales (*Eschrichtius robustus*) during their reproductive season. *J. Cetacean Res. Manage.* 5(2):149-54.

In February 1996, 12 gray whales (*Eschrichtius robustus*), consisting of six animals without calves and six females with calves, were instrumented with Argos satellite-monitored radio tags in San Ignacio Lagoon, Baja California Sur, Mexico. San Ignacio is one of only three major breeding and calving lagoons located along the Pacific Baja Coast. Tracking periods ranged from 1.5 to 20.8 days. Mothers stayed in the lagoon longer than animals without calves and made repeated excursions to and from the lagoon. The experiment took place at a time of year when the number of animals without calves usually declines, which likely influenced the residence time of these animals in the lagoon. The question of residence time and turnover of both animals with and without calves is important in establishing how many whales actually use the lagoon during the winter reproductive season.

AREA-MEXICO; BREEDING GROUNDS; DISTRIBUTION; GRAY WHALE; MOVEMENT; SATELLITE TRACKING; TELEMETRY

Mate, B.R. and Urban-Ramirez, J. 2003. A note on the route and speed of a gray whale on its northern migration from Mexico to central California, tracked by satellite-monitored radio tag. *J. Cetacean Res. Manage.* 5(2):155-57.

A gray whale (*Eschrichtius robustus*) tracked with an Argos satellite-monitored radio tag traveled 1,794 km during the northbound migration season from San Ignacio Lagoon (SIL), Baja California Sur, Mexico to north of San Francisco from 8-23 February 1996. The migration route was predominately nearshore and in water <100 m deep, with 75% of the Argos-acquired locations averaging 7.3 ± 1.22 km from shore. Distances >20 km from shore and water depths >100 m were encountered only when the whale crossed Vizcaino Bay or through the Channel Islands. During migration, the whale maintained an average speed of 134 km/d (5.6 km/h), suggesting a coastal migration of 49 days from SIL to the Bering Sea.

GRAY WHALE; MIGRATION; TRACKING; TELEMETRY

Kinzey, D. and Gerrodette, T. 2003. Distance measurements using binoculars from ships at sea: accuracy, precision and effects of refraction. *J. Cetacean Res. Manage.* 5(2):159-71.

The distances to 1,576 targets between 0.3 and 10.4km from two ships were measured using the reticle scale in 253 binoculars during cetacean surveys in the eastern tropical Pacific Ocean. Distances were measured under a range of conditions representing the environmental variability in three years of field surveys. Alternative formulae for calculating distance from optical devices were applied to the reticle measurements and compared to distances measured by radar. Reticles in 253 binoculars provided unbiased measurements to about a third of the way to the horizon, or from 0-4km for the 10.5m platform heights used for the study. Between 4 and 8km (approximately one-third to two-thirds of the distance to the horizon), distances tended to be slightly underestimated, reaching a maximum bias at the most distant targets of 6% for one ship and 16% for the other. Distances beyond about two-thirds of the way to the horizon were not measurable because the angles were too small. The negative bias in measurements of distances from 4-8km was due to refraction of light and other factors. Refraction had less of an effect than expected for a temperature gradient based on a standard atmosphere, suggesting a mean gradient for the eastern tropical Pacific of $-0.02^{\circ}\text{C m}^{-1}$ in the first 10m above the sea surface rather than the standard value of $-0.0065^{\circ}\text{C m}^{-1}$. Correcting the measurements for refraction improved their accuracy, eliminating the bias for one ship and reducing it for the other. Adjusting for refraction should improve measurements of distance using theodolites or photographic/video imaging as well as measurements using binoculars. An additional regression-based correction suggested that the remaining negative bias for one ship was a complex interaction of Beaufort Sea state, swell height and wind speed. Precision of distance measurements decreased multiplicatively with target distance. Including errors due to bias, the multiplicative standard error was 12%, or a 95% confidence interval from 0.8-1.2km for a target at 1km and from 6.5-9.9km for a target at 8km. Compared with other methods of measuring distance to marine mammals at sea, measurements using binocular reticles are more precise than distances estimated by eye, less precise than distances measured with photographic imaging, and useful over a larger range.

MODELLING; PACIFIC; SIGHTINGS-VESSEL; TELEMETRY

Matsuoka, K., Ensor, P., Hakamada, T., Shimada, H., Nishiwaki, S., Kasamatsu, F. and Kato, H. 2003. Overview of minke whale sightings surveys conducted on IWC/IDCR and SOWER Antarctic cruises from 1978/79 to 2000/01. *J. Cetacean Res. Manage.* 5(2):173-201.

The IWC Southern Hemisphere minke whale assessment cruises (IDCR and SOWER) have been conducted since 1978/79 in the Antarctic regions of all six IWC management Areas for baleen whales (covering all, or more recently, part, of one Area each season). During the 23-year history of the programme to 2000/01, a total search distance on primary effort of 70,340 n.miles has been achieved during 2,448 ship-days in the Antarctic. A total of 6,027 primary minke whale school sightings were recorded. Over the years, there have been two major and some minor

modifications to the survey design as a result of the development of survey procedures. These developments represent the best possible compromise between statistical needs and logistics. This paper outlines the most significant modifications that have occurred to the research equipment, protocols and data collection. Some preliminary results are also included. From 1985/86, the beginning of the second circumpolar set of cruises, the programme (initially a combination of Discovery marking and sightings) became essentially a dedicated line-transect systematic sightings cruise only. Modification of the survey design from the third circumpolar set of cruises (from 1991/92), to cover the whole region south of 60°S in the Antarctic resulted in a change in emphasis of the latitudinal coverage, especially in Areas I, II, III and V; the implications of this are discussed. The paper also describes: guidelines for the identification of minke whales; methods used for assessment of duplicate status in passing mode with independent observer; the protocol used for conducting the estimated angle and distance experiment; and methods used for determining the southern boundary of the research area (ice-edge). The programme has also enabled collection of biopsy, photo-identification, oceanographic and acoustic samples, and can be adapted to research programmes in other parts of the world. It is concluded that the programme has developed and established standard sighting procedures and has also improved the precision of whale identification standards in the Southern Ocean.

ANTARCTIC; DWARF MINKE WHALE; MINKE WHALE; MONITORING; POPULATION ASSESSMENT; SOWER 2000; SURVEY-VESSEL

Gibbons, J., Capella, J.J. and Valladares, C. 2003. Rediscovery of a humpback whale, *Megaptera novaeangliae*, feeding ground in the Straits of Magellan, Chile. *J. Cetacean Res. Manage.* 5(2):203-08.

New information is presented on the summer distribution of southeastern Pacific humpback whales along the Southern Chilean fjords. Sightings of 128 humpback whales observed between December and June from 1997-2001 were analysed. Sightings occurred between 48°50AS to 54°18AS and were concentrated in the waters surrounding Isla Carlos III in the Straits of Magellan (53°37AS, 72°21AW) and in the Canal Wide (49°36AS-5°S). To date, 23 individual whales have been identified from photographs of the ventral surface of the flukes. Throughout the austral summer, seven individuals were resighted near Isla Carlos III over periods between 2-5 months. Two individuals were observed in 1999 and 2000, and two individuals were previously recorded in 1997 in Canal Wide, about 365km north of Isla Carlos III. Historical records show the occurrence of whales in the area from the 16th to the 20th Century. From historic records, scattered whaling data, the small amount of scientific literature available, and the results of this study, it is suggested that the southwestern part of the Straits of Magellan, especially the waters surrounding Isla Carlos III, is the first known feeding ground for humpback whales along the Pacific coast of South America.

AREA-CHILE; FEEDING GROUNDS; HUMPBACK WHALE; PACIFIC; PHOTO-ID; SIGHTING SURVEY; SOUTH AMERICA

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Robineau, D. and de Buffrenil, V. 2003. Early descriptions of whales - D'Orbigny, A, 1834. Note on a new cetacean genus, from the rivers of the central part of South America. *J. Cetacean Res. Manage.* 5(3):209-12.

Martien, K.K. and Taylor, B.L. 2003. Limitations of hypothesis-testing in defining management units for continuously distributed species. *J. Cetacean Res. Manage.* 5(3):213-9.

Estimating the risk to wildlife populations resulting from human-induced mortality relies on adequately defining population structure. For marine populations, including cetaceans, identifying population boundaries is difficult because most species have large continuous distributions with no obvious barriers to dispersal. For many species, the extreme ends of the range differ in morphology, indicating that population structure exists. However, the lack of distributional hiatuses often makes this structure difficult to detect. A common method of defining structure in such situations is to use genetic differentiation as a proxy for limited movement between areas. Genetic analyses of population structure usually take the form of hypothesis testing, which requires the a priori definition of hypothesised units and testing for significant genetic differentiation between them. Simulations are used to examine the performance of hypothesis testing to correctly define population structure. Results show that hypothesis testing is likely to lead the researcher to define fewer management units than are necessary to adequately protect local populations from over-exploitation. The need for the development of new methods of defining management units and for rigorous performance testing of all methods applied in a management context is highlighted.

CONSERVATION; GENETICS; MANAGEMENT; STOCK IDENTITY

Heide-Jorgensen, M.P. 2003. Inshore-offshore movements of two fin whales *Balaenoptera physalus* tracked by satellite off West Greenland. *J. Cetacean Res. Manage.* 5(3):214-45.

Two fin whales (*Balaenoptera physalus*) were tagged with satellite linked radio transmitters in a coastal area near Aasiaat in West Greenland and tracked for 76 and 32 days in 2000 and 2001 respectively. In 2000, one whale was tagged on 30 September; it stayed in the tagging area until at least 13 October. On 16 and 17 October it was found further south off the coast of West Greenland. On 20 October it had moved approximately 250km southeast to another inshore area. It moved another 100km south along the coast and up to 50km off the coast until 2 November, then appeared back in the area it was located on 20 October until contact was lost on 20 December. In 2001, one whale was tagged on 24 August, it stayed in the coastal area until mid September, where it travelled south along the coast to an area approximately 100km off the coast. From here it continued south to the same inshore area occupied by the whale in 2000. It remained in this area until the last position was received on 25

September. The tracking data suggest a connection between inshore and offshore (> 22km) fin whales and indicates the potential range of fin whales in West Greenland.

FIN WHALE; MOVEMENT; NORTH ATLANTIC; NORTHERN HEMISPHERE; SATELLITE TRACKING; TELEMETRY

Frantzis, A., Alexiadou, P., Paximadis, G., Politi, E., Gannier, A. and Corsini-Foka, M. 2003. Current knowledge of the cetacean fauna of the Greek Seas. *J. Cetacean Res. Manage.* 5(3):219-32.

From 1991-2002 data on the presence and distribution of cetaceans in the Greek Seas have been systematically collated in a database (821 sightings and 715 strandings). Data originated from dedicated surveys, stranding reports, opportunistic sightings and published or unpublished photographic and video documents. Twelve cetacean species have been recorded. Seven of them are permanently present and commonly observed in one or more of the Greek Seas: striped dolphin, common bottlenose dolphin, short-beaked common dolphin, Cuvier's beaked whale, sperm whale, Risso's dolphin and fin whale. In addition, the harbour porpoise is present locally in the Thracian and northern Aegean Seas. The humpback whale, false killer whale and common minke whale are occasional Mediterranean species that were sighted or stranded infrequently; the Sowerby's beaked whale is an accidental species that was found floating dead only once. Five other species (white whale, Blainville's beaked whale, long-finned pilot whale, killer whale, blue whale) have been erroneously included in the Greek cetacean fauna in the past due to wrong assumptions, false identifications or lack of supporting evidence. The occasional occurrence of pilot and killer whales in the Greek Seas should still be regarded as unconfirmed. The distributional range, stranding numbers and sighting frequencies of sperm whales, Cuvier's beaked whales and short-beaked common dolphins in the Greek Seas indicate that their local 'sub-populations' are among the most important in the entire Mediterranean Sea. Harbour porpoises in the Thracian and northern Aegean Seas are important from a conservation perspective since this species does not inhabit any other part of the Mediterranean Sea.

BEAKED WHALE-CUVIER'S; BEAKED WHALE-SOWERBY'S; COMMON DOLPHIN; DISTRIBUTION; EUROPE; FALSE KILLER WHALE; FIN WHALE; HARBOUR PORPOISE; HUMPBACK WHALE; INCIDENTAL SIGHTINGS; MEDITERRANEAN; MINKE WHALE; RISSO'S DOLPHIN; SHORT-BEAKED COMMON DOLPHINS; SPERM WHALE; STRIPED DOLPHIN; SURVEY - COMBINED

Kjeld, M., Vikingsson, G.A., Alfredsson, A., Olafsson, O. and Arnason, A. 2003. Sex hormone concentrations in the blood of sei whales *Balaenoptera borealis* off Iceland. *J. Cetacean Res. Manage.* 5(3):233-40.

Blood samples were collected postmortem at sea, from 195 sei whales (127 females and 68 males) caught southwest of Iceland between 1983 and 1988. The reproductive status of the whales was determined by anatomical/histological methods. The blood samples were measured by radioimmunoassays for progesterone (P), testosterone (T) and oestradiol concentrations, which were then related to the reproductive status, the length of the whales and the days of the hunting season. Serum P concentrations in females were found to be clustered mainly into two groups, one with values at or below the detection limit (0.1nmol/L) of the assay (Group I) and the other with values about two orders of magnitude higher (Group III) with intermediate values (Group II) in between. Anatomical results showed that Group I (n = 73) was largely a mixture of immature and anoestrous mature females. Group III (n = 39), with a significantly ($p < 0.01$) greater mean body length than Group I, had a distinct frequency distribution of serum P values with a mean (SD) concentration of 10.3nmol/L (4.1) and consisted predominantly of pregnant females. Many foetuses were lost at sea due to a slit in the abdomen for cooling purposes, but all 13 foetuses (1.5-3.7m in length) recovered belonged to females of Group III. Group II (n = 15) consisted mainly of anoestrous mature animals. When pregnancy was estimated by serum P values and sexual maturity by the anatomical findings, the apparent pregnancy rate of mature females was 0.37, agreeing reasonably with earlier reports. Male sei whales were classified into immature, pubertal and mature groups by anatomical/histological methods and had mean T concentrations (nmol/L, ranges) of 0.85, 0.1-4.5; 3.3, 0.1-14.7 and 4.8, 0.1-14.8, respectively. Serum T concentrations did not correlate significantly with body length in the groups but pubertal and mature males had significantly higher geometric mean T values than immature males. Mean serum T concentrations in males, classified as sexually mature by anatomical/histological methods, rose approximately 3.2-fold every 30 days during July-September indicating a seasonal breeding cycle. It is concluded that measurements of sex hormone concentrations in sei whales make a powerful addition to the earlier anatomical/histological methods for determination of reproductive status, not only corroborating them but apparently surpassing them in sensitivity of detecting pregnancy and cyclical changes in serum T values during the male reproductive cycle.

BREEDING GROUNDS; HORMONES; OVULATION; PREGNANCY; REPRODUCTION; SEASONALITY; SEI WHALE; SEX HORMONES

Hastie, G.D., Swift, R.J., Gordon, J.C.D., Slessor, G. and Turrell, W.R. 2003. Sperm whale distribution and seasonal density in the Faroe Shetland Channel. *J. Cetacean Res. Manage.* 5(3):247-52.

Results from previous surveys suggest that an area of the northeast Atlantic, the Faroe Shetland Channel, is important for cetaceans. This study utilised passive acoustic survey techniques to evaluate the density of sperm whales in the Channel. Two-week surveys were carried out during oceanographic cruises in May and October 2001, and May 2002. A two hydrophone array was towed behind the vessel throughout the majority of the survey routes and was monitored by a two-person team and by software designed to automatically detect and measure bearings to whales. Distances of individual sperm whales from the trackline were determined using target motion analysis. Standard line transect techniques were applied to calculate the density of whales during surveys. The effects of sea conditions and survey vessel on the ability to detect whales were tested; the encounter rate and effective stripwidth (esw) were estimated independently for each sea state and for each of the vessels. A total of 79 individual whales were detected, and their distances from the trackline were calculated. As a probable result of insufficient sample size and a small effects size, neither the esw nor the encounter rates varied significantly with sea state or between the two survey vessels. The density of

sperm whales during each of the surveys was estimated to be 2.05, 0.52 and 1.75 whales per 1,000km² for the May 2001, October 2001 and May 2002 surveys respectively. Sperm whales were distributed across the majority of the Faroe Shetland Channel. This study has provided the basis for meaningful hypothesis generation in future studies and to gain a better understanding of the factors underlying the spatial and temporal distribution patterns of sperm whales in this area; data on oceanographic, biological and anthropogenic determinants should now be examined.

ABUNDANCE; ACOUSTICS; ATLANTIC OCEAN; DISTRIBUTION; SURVEY-ACOUSTIC; SURVEY-VESSEL; VOCALISATION

Best, P.B., Rademeyer, R.A., Burton, C., Ljungblad, D., Sekiguchi, K., Shimada, H., Thiele, D., Reeb, D. and Butterworth, D.S. 2003. The abundance of blue whales on the Madagascar Plateau, December 1996. *J. Cetacean Res. Manage.* 5(3):253-60.

As part of the International Whaling Commission's SOWER blue whale research programme, two sighting vessels, the Shonan Maru and the Shonan Maru No.2, surveyed the Madagascar Plateau between 25° and 35°S, 40° and 45°E, in December 1996. A total of 95 sightings of 110 blue whales (assigned in the field as pygmy blue whales - see discussion), 14 sightings of 21 blue whales (subspecies undetermined) and 12 sightings of 13 'like blue' whales was made in 23 days. In the first half of the survey, the whole research area was covered in a mainly pre-determined zigzag search pattern, and the associated sightings and effort have been used to derive density estimates for blue whales for the area. Sightings in the second half of the survey, where effort was directed at blue whale concentrations, have only been used to provide supplementary data for calculation of the effective search half-width and mean school size. The resulting population estimate is 424 (CV = 0.42), or 472 (CV = 0.48) whales when 'like blue' sightings are included. Dive times and surfacing behaviour recorded in just over 21h of monitoring suggest that the assumption that all groups on the trackline were seen ($g(0) = 1$) is reasonable. As the geographical extent of the survey area was substantially less than that of past catches of blue whales in the region in December, this estimate must refer to only a portion (possibly about one third) of the total population. Some evidence of feeding on euphausiids in the region was detected, possibly as a consequence of a localised upwelling cell at the southern tip of Madagascar.

ABUNDANCE; AREA-SOUTH AFRICA; BLUE WHALE; FEEDING; INDIAN OCEAN; LINE-TRANSECT; RESPIRATION

Hastie, G.D. 2003. Distribution of small cetaceans within a candidate Special Area of Conservation; implications for management. *J. Cetacean Res. Manage.* 5(3):261-6.

Information on cetacean distribution plays an important role in the identification of suitable boundaries for marine protected areas, but is also crucial for developing management and monitoring programmes. In response to the European 'Habitats Directive', a candidate Special Area of Conservation (cSAC) has been established in the Moray Firth, northeast Scotland to protect a small and isolated population of common bottlenose dolphins (*Tursiops truncatus*). Limited data on the distribution of bottlenose dolphins and on temporal changes in distribution have recently constrained attempts to mitigate against the impacts of new developments upon this population. In response to the need for current information on the distribution of dolphins throughout the cSAC, this study aims to provide data on the distribution of dolphins and other small cetaceans throughout the Moray Firth. Changes in the distribution patterns of dolphins in the inner Moray Firth were examined using data collected between 1990 and 2000. In addition, combined passive acoustic and visual survey techniques were used to determine the distribution of dolphins and harbour porpoises (*Phocoena phocoena*) on a broader scale across the whole Moray Firth. Dolphin schools were distributed throughout the inner Moray Firth, but there were concentrations of sightings around three deep, narrow channels that were consistent over the ten year study period. Results from surveys across the whole of the Moray Firth showed that all sightings and acoustic detections of dolphins were made within the area of the cSAC. In contrast, porpoise sightings were widely distributed throughout the Moray Firth. The median encounter rate of porpoises across the whole Moray Firth was 1.69 per 100km. Encounter rates of porpoises were similar in the outer Moray Firth and the cSAC. This combination of distribution studies at differing spatial scales provides a valuable tool for monitoring the distribution of animals and identifying important habitats, and the results of this study have directly supported efforts to manage the cSAC.

ABUNDANCE; AREA-SCOTLAND; CONSERVATION; DISTRIBUTION; MANAGEMENT PROCEDURE; SANCTUARIES; SURVEY-ACOUSTIC

Rugh, D., DeMaster, D., Rooney, A., Breiwick, J., Shelden, K. and Moore, S. 2003. A review of bowhead whale *Balaena mysticetus* stock identity. *J. Cetacean Res. Manage.* 5(3):267-79.

For management purposes, the Scientific Committee of the International Whaling Commission has considered bowhead whales as having five stocks (geographically distinct segments of the population): Spitsbergen, Davis Strait, Hudson Bay, Okhotsk Sea and Bering-Chukchi-Beaufort Seas (B-C-B). These divisions are defined primarily by known distribution and seasonal movements. Historically, bowhead whales had a circumpolar distribution, with several periods of range expansion and contraction depending upon access through Arctic straits. Heavy exploitation by pre-20th century commercial whalers reduced bowhead whale abundance, further segregating stocks. A portion of the B-C-B stock escaped whalers by migrating into the pack ice each spring and summering in the Beaufort Sea. Few bowhead whales are now found in the summer in the Chukchi or Bering Seas. The distribution of this species should be considered labile, affected by sea ice and availability of prey, a factor that improves the likelihood of genetic mixing between stocks. Genetic variability has remained relatively high in spite of the severe depletion of the population, and there is no evidence of any recent genetic bottleneck. Besides geographic distribution and genetics, stock identity may be studied via morphological differences, reidentification of individuals between different stock areas, acoustic signatures, pollutant burdens, parasites and predators, feeding ecology and conception dates. Harpoon heads, research tags and lens racemisation indicate that bowhead whales are long-lived, can travel over large areas and may mix among stocks. Because conception occurs during or near the time of the spring migration, there are opportunities for genetic mixing among whales that might use different summering areas.

ARCTIC; BOWHEAD WHALE; DISTRIBUTION; GENETICS; MOVEMENT; STOCK IDENTITY; WHALING - HISTORICAL

Urban R, J., Rojas-Bracho, L., Perez-Cortes, H., Gomez-Gallardo, A., Swartz, S.L., Ludwig, S. and Brownell, R.L. 2003. A review of gray whales *Eschrichtius robustus* on their wintering grounds in Mexican waters. *J. Cetacean Res. Manage.* 5(3):281-95.

The Eastern North Pacific gray whale (*Eschrichtius robustus*) is one population of large cetacean that has recovered from depletion resulting from commercial harvest in the mid- to late-1800s. It is believed that this population may be approaching, or possibly exceeding its carrying capacity as suggested by recent increases in mortality of all age and sex classes. Research on the breeding biology and phenology of gray whales that spend the winter in the coastal waters and lagoons of Baja California, Mexico has been conducted for many years. These studies contribute valuable information on the reproductive biology of this species, and the importance of their coastal lagoon habitats to their reproductive success. This paper reviews and summarises historical exploitation, conservation measures, the findings of research conducted on gray whales in their winter breeding range, potential natural and anthropogenic threats to this population, and makes recommendations for future research and monitoring. This review concentrates on the findings of research conducted since the mid-1970s.

BIRTH RATE; CONSERVATION; DISTURBANCE; EXPLOITATION; GENETICS; GRAY WHALE; HABITAT; MEXICO; MORTALITY; NORTH PACIFIC

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Clapham, P.J., Good, C., Quinn, S.E., Reeves, R.R., Scarff, J.E. and Brownell, R.L., Jr. 2004. Distribution of North Pacific right whales (*Eubalaena japonica*) as shown by 19th and 20th century whaling catch and sighting records. *J. Cetacean Res. Manage.* 6(1):1-6

North Pacific right whales (*Eubalaena japonica*) were extensively exploited in the 19th century, and their recovery was further retarded (severely so in the eastern population) by illegal Soviet catches in the 20th century, primarily in the 1960s. Monthly plots of right whale sightings and catches from both the 19th and 20th centuries are provided, using data summarised by Scarff (1991, from the whale charts of Matthew Fontaine Maury) and Brownell *et al.* (2001), respectively. Right whales had an extensive offshore distribution in the 19th century, and were common in areas (such as the Gulf of Alaska and Sea of Japan) where few or no right whales occur today. Seasonal movements of right whales are apparent in the data, although to some extent these reflect survey and whaling effort. That said, these seasonal movements indicate a general northward migration in spring from lower latitudes, and major concentrations above 40°N in summer. Sightings diminished and occurred further south in autumn, and few animals were recorded anywhere in winter. These north-south migratory movements support the hypothesis of two largely discrete populations of right whales in the eastern and western North Pacific. Overall, these analyses confirm that the size and range of the right whale population is now considerably diminished in the North Pacific relative to the situation during the peak period of whaling for this species in the 19th century. For management purposes, new surveys are urgently required to establish the present distribution of this species; existing data suggest that the Bering Sea, the Gulf of Alaska, the Okhotsk Sea, the Kuril Islands and the coast of Kamchatka are the areas with the greatest likelihood of finding right whales today. KEYWORDS: NORTH PACIFIC RIGHT WHALE; NORTH PACIFIC; DISTRIBUTION; WHALING-HISTORICAL; WHALING-MODERN; WHALING-ILLEGAL; MIGRATION; CALVING

Neimanis, A.S., Koopman, H.N., Westgate, A.J., Murison, L.D. and Read, A.J. 2004. Entrapment of harbour porpoises (*Phocoena phocoena*) in herring weirs in the Bay of Fundy, Canada. *J. Cetacean Res. Manage.* 6(1):7-17

Harbour porpoises (*Phocoena phocoena*) are small coastal cetaceans vulnerable to mortality in fishing operations. Not all interactions are fatal, however, and each year many porpoises swim into and are subsequently released from herring weirs in the Bay of Fundy, Canada through a targeted release programme. This study examines catch composition, body condition, characteristics associated with mortality and factors affecting entrapment of porpoises in weirs between 1992-2001. A total of 886 porpoises were recorded in weirs during this period. A total of 657 animals were involved in attempted releases: 588 were released alive and 69 were incidentally killed during release. The remainder of the animals swam out on their own or their fates were unknown. Estimated annual mortality represents less than 0.01% of the Bay of Fundy/Gulf of Maine population and only 1.03% of its annual potential biological removal level. The number of porpoises caught in weirs varied from eight in 1996 to 312 in 2001. Of the 390 animals released with a numbered identification tag, 25 were recaptured in weirs and 4 of those porpoises entered a weir a third time. Males comprised 63.5% of entrapments. Weirs and demersal gillnets captured animals from the same population, but the weir bycatch was biased towards younger, smaller animals. Porpoises that became trapped in weirs exhibited measures of body condition similar to those killed in gillnets and by gunshot wounds in the same waters. None were considered emaciated. Mortality in weirs appeared to be random; porpoises that died during release attempts were of the same age and sex composition and body condition as the individuals that survived. The use of a specialised large-mesh seine significantly increased the probability of successful release. Observations of the stomach contents data of porpoises killed in weirs indicate that porpoises feed while trapped in weirs, but perhaps not at the same rate as animals killed in gillnets. Entrapments peaked in August, concurrent with the highest landings of Atlantic herring, the target species of the weir fishery. Based on a logistical regression model, porpoises are 3.3 times more likely to swim into a weir on a night in which high tide falls during darkness. Weir entrapments do not have a significant effect on this population, largely because of on-going efforts to release porpoises from weirs. KEYWORDS: HARBOUR PORPOISE; INCIDENTAL CATCHES; FISHERIES; NORTH AMERICA; ATLANTIC OCEAN; CONSERVATION; MORTALITY RATE

Vinther, M. and Larsen, F. 2004. Updated estimates of harbour porpoise (*Phocoena phocoena*) bycatch in the Danish North Sea bottom-set gillnet fishery. *J. Cetacean Res. Manage.* 6(1):19-24

The bycatch of harbour porpoise in the Danish North Sea bottom-set gillnet fisheries between 1987-2001 is estimated using two methods involving extrapolation of observer data. When observed entanglements are extrapolated to fleet level based on target species landings, the annual bycatch was estimated to be in the range of 2,867-7,566 harbour porpoise with a mean of 5,817. When observations are extrapolated based on fishing effort, estimates are in the range of 3,887-7,366 porpoises with a mean of 5,591. Both methods estimate a significant reduction in bycatch in the most recent years due to a decrease in both effort and landings. However, the reduction is less pronounced with the effort based method. KEYWORDS: HARBOUR PORPOISE; FISHERIES; GILLNETS; BYCATCH; NORTH SEA

Frantzis, A., Nikolaou, O., Bompar, J-O. and Cammedda, A. 2004. Humpback whale (*Megaptera novaeangliae*) occurrence in the Mediterranean Sea. *J. Cetacean Res. Manage.* 6(1):25-28.

Humpback whales were considered extremely rare in the Mediterranean Sea until recently. Only two confirmed records were known from a period of more than 100 years and both were from the western basin. However, nine new observations spread across both Mediterranean basins have been recorded since 1990. This increase in numbers and range during a relatively short period of time seems to be a new, growing trend, suggesting that the occurrence of humpback whales in the Mediterranean Sea is no longer accidental, but occasional. It coincides with the recovery of some stocks of the expanding North Atlantic population after their depletion during a long period of whaling. The true reason behind increased humpback whale entries in the Mediterranean Sea and their exact origin cannot be known until new occurrences are properly photo-identified and sampled genetically. KEYWORDS: HUMPBACK WHALE; MEDITERRANEAN; EUROPE; DISTRIBUTION; RANGE

Drouot, V., Bérubé, M., Gannier, A., Goold, J.C., Reid, R.J. and Palsbøll, P.J. 2004. A note on genetic isolation of Mediterranean sperm whales (*Physeter macrocephalus*) suggested by mitochondrial DNA. *J. Cetacean Res. Manage.* 6(1):29-32

Thirteen sperm whales were sampled, using sloughed skin, in the Mediterranean Sea during six distinct encounters. Individuals were discriminated using the results of molecular sexing, mitochondrial control region sequencing and microsatellite genotyping (3 loci). Samples from 57 specimens were available from sperm whale strandings on northern European coasts. The first ~ 200bp of the mitochondrial DNA (mtDNA) control region of each sample were sequenced and three different haplotypes were identified. The frequency of each haplotype was significantly different between the Mediterranean Sea and the eastern North Atlantic, suggesting that sperm whales in the two areas comprise different maternal entities. KEYWORDS: SPERM WHALE; GENETICS; EUROPE; MEDITERRANEAN SEA; NORTH ATLANTIC; STOCK IDENTITY

Macleod, K. 2004. Abundance of Atlantic white-sided dolphin (*Lagenorhynchus acutus*) during summer off northwest Scotland. *J. Cetacean Res. Manage.* 6(1):33-40.

A shipboard cetacean survey was conducted in July/August 1998 within an area to the west of Scotland, UK, commonly known as the Atlantic Frontier. The aim of the survey was to document the distribution and abundance of cetaceans to provide baseline population data for an area that is being increasingly explored and developed by oil companies. A double platform 'independent observer' (IO) method was used to estimate the abundance of the Atlantic white-sided dolphin (*Lagenorhynchus acutus*) using standard line-transect and distance sampling methodology. Previously, uncorrected Atlantic white-sided dolphin abundance was estimated as 27,194 (CV = 0.29) from this survey. This paper presents abundance estimates corrected for $g(0) < 1$ using a direct duplicate method. The value of $g(0)$ was estimated to be 0.61 (CV = 0.09). The abundance in two strata was estimated as 21,371 (CV = 0.54) to the west of the Outer Hebrides and 74,626 (CV = 0.72) in the Faroe Shetland Channel. The high CVs are the result of small sample sizes, particularly of the duplicate data set. However, the abundance estimates represent the first for this species to the northwest of Scotland and adds to existing baseline abundance estimates for small cetaceans in UK waters. The results could be useful for planning future surveys that aim to calculate more precise abundance estimates. These results, together with opportunistic sightings data collected during other surveys, suggest that the waters to the west of Scotland are an important habitat for the Atlantic white-sided dolphin. Presently, threats to this species in the area are relatively unknown but a baseline population estimate will be an integral part of any management regime should there become a need in future. KEYWORDS: ATLANTIC OCEAN; ABUNDANCE ESTIMATE; $G(0)$; SURVEY-VESSEL; WHITE-SIDED DOLPHIN

Smith, B.D., Beasley, I., Buccat, M., Calderon, V., Evina, R., Lemmuel de Valle, J., Cadigal, A., Tura, E. and Visitation, Z. 2004. Status, ecology and conservation of Irrawaddy dolphins (*Orcaella brevirostris*) in Malampaya Sound, Palawan, Philippines. *J. Cetacean Res. Manage.* 6(1): 41-52.

A geographically isolated population of Irrawaddy dolphins was recently discovered in Malampaya Sound, Palawan, Philippines. Line-transect surveys conducted in April-November 2001 covered 884km of trackline in the entire Sound and resulted in a total population estimate of 77 individuals (CV = 27.4%), confined to the inner portion (133.7km²). For all Irrawaddy dolphin sightings, where ecological data were collected ($n = 48$), the mean temperature was 30.2°C, depth 6.5m, salinity 28.3ppt and turbidity 2.2NTUs. Significantly higher turbidity, lower salinity and shallower depth were recorded in the inner Sound compared to adjacent waters. Bottlenose dolphins *Tursiops* sp. (probably *truncatus*) were observed in waters just outside of where Irrawaddy dolphins were recorded. During the study, at least two Irrawaddy dolphins were accidentally killed in bottom-set nylon gillnets used to catch crabs, locally called *matang quatro*. Reports from local fishermen also indicated that as many as three additional animals may have been killed in these nets during the same period. These findings strongly suggest that the Irrawaddy dolphin population in Malampaya Sound is in immediate danger of extirpation due to low numbers, limited range and high mortality. This is the only known population of the species in the Philippines and the nearest known other population is in northern Borneo, some 550km to the south. Recommendations for conserving the population include that: (1) socioeconomic alternatives be developed to promote the conservation goal of reducing the incidence of dolphin entanglement in *matang quatro* gillnets; (2) gillnet free zones be established in core areas of dolphin distribution; (3) Irrawaddy dolphins be promoted as a flagship species of environmental health in the Sound; (4) a long-term programme be established to monitor the dolphin population; and (5) additional investigations be conducted to determine if Irrawaddy dolphins occur in other areas of the Philippines. KEYWORDS: IRRAWADDY DOLPHIN; SURVEY-VESSEL; ABUNDANCE ESTIMATE; INCIDENTAL CATCHES; GILLNETS; ASIA; CONSERVATION; PHOTO-ID; HABITAT

Norman, S.A., Hobbs, R.C., Foster, J., Schroeder, J.P. and Townsend, F.I. 2004. A review of animal and human health concerns during capture-release, handling and tagging of odontocetes. *J. Cetacean Res. Manage.* 6(1):53-62.

The capture-release of odontocetes allows for tag deployment which provides an opportunity to study behaviour and habitat use by free-ranging animals, as well as clinical assessment of the animal and tissue collection. This review recognises those elements that are common to most capture and tagging projects, identifies collective knowledge of animal and human health concerns during handling of odontocetes and provides guidelines for safer handling techniques. Handling during tagging projects can involve chase, capture, restraint, manipulation, tag application, often removal from the water and release at the capture site. The risk of injury during capture will be reduced by using experienced personnel, adequate technical support and proper equipment. For the duration of the handling process, the animal's stimulus response should be monitored as well as its cardiovascular and respiratory function. Stress response of the odontocete is monitored by behavioural assessments, physiological monitoring and/or blood sampling. Possible complications from tag placement may include infection at the implant site leading to tag failure, behavioural alterations in response to tag placement and tag rejection. During handling of an odontocete, there is the potential for disease transmission between humans and the animal. Exposure to diseases is minimised by wearing protective clothing and gear and exercising caution when working around the animal's blowhole. KEYWORDS: DISEASE; LIVE-CAPTURE; RADIO-TAGGING; SATELLITE TAGGING; STRESS

Scheidat, M., Castro, C., Gonzalez, J. and Williams, R. 2004. Behavioural responses of humpback whales (*Megaptera novaeangliae*) to whalewatching boats near Isla de la Plata, Machalilla National Park, Ecuador. *J. Cetacean Res. Manage.* 6(1):63-68.

Machalilla National Park, on the coast of mainland Ecuador, supports a growing whalewatching industry that focuses on Southern Hemisphere humpback whales, which spend the austral winter (June-September) in this area. This study was designed to measure short-term reactions of whales to the whalewatching vessel activity typically seen in this area for two reasons: (1) to identify the nature of whales' avoidance response, if any, in order to draft whalewatching guidelines that help local mariners identify when they may be disturbing whales; and (2) to quantify the magnitude of any avoidance response, to examine how this relatively understudied population behaves around boats compared with whales in other whalewatching areas. A shore-based theodolite tracking team created a 'natural' experiment to observe relationships between whalewatching traffic and whale behaviour in 1998 and 1999. Swim speed and path directness of humpback whales were measured in the absence of boats, and how those parameters changed when boats arrived was recorded. When whales entered the study area accompanied by boats, a record was made of how their behaviour changed after the boats left. Humpback whales reacted to the approach of whalewatching boats by increasing swim speed significantly, and adopted a much more direct path after boats left. Future research is needed to determine whether responses vary with number, proximity or type of vessel. Similarly, future studies are recommended to determine whether different age-sex classes vary in vulnerability to disturbance. Meanwhile, this study enables provision of much-needed, practical advice to local operators who are concerned that they may be disturbing whales: one way that mariners can tell if they are causing disturbance is if they need to increase their vessel's speed to keep pace. The average behavioural responses measured were strong enough to recommend that Machalilla National Park adopt precautionary management procedures to limit number and proximity of vessels. KEYWORDS: HUMPBACK WHALE, SOUTH AMERICA, WHALEWATCHING, BEHAVIOUR, SHORT-TERM CHANGE

Samuels, A. and Bejder, L. 2004. Chronic interaction between humans and free-ranging bottlenose dolphins near Panama City Beach, Florida, USA. *J. Cetacean Res. Manage.* 6(1):69-77.

'Swim-with' activities, in which humans enter the water to interact with free-ranging cetaceans, are a popular form of nature tourism; however, there is considerable disagreement as to whether these encounters constitute a threat to the animals. At the request of the US Marine Mammal Commission, a systematic study was designed to quantify effects of swim-with activities on the behaviour of bottlenose dolphins in waters near Panama City Beach, Florida. Certain dolphin behaviours were identified as indicative of chronic interaction with humans, and based on presence of these behaviours, at least seven dolphins were identified that permitted people to swim nearby. Because these dolphins accepted food handouts from people, they were considered to be conditioned to human interaction through food reinforcement. Specific human-dolphin interactions that posed a risk for dolphins or humans were identified, and it was calculated that human interaction put a specific juvenile dolphin at risk once every 12 min, including being fed by humans once every 39-59 min. Humans interacting with that dolphin were estimated to be at risk once every 29 min. Although the study was of limited duration, the observations were so clear-cut and the nature of interactions so potentially hazardous it was concluded that food provisioning was the probable basis for swimming with free-ranging dolphins near Panama City Beach, Florida, and therefore, human interaction at this location was likely to be harmful to the dolphins and in clear violation of the US Marine Mammal Protection Act. Of equal importance to the findings of this study is the methodology. A systematic behavioural methodology was designed that can be adapted to study potential impacts of nature tourism on coastal communities of cetaceans in which individuals are readily distinguished. The focus was on the behaviour of individual animals in order to describe and quantify in-water interactions between dolphins and humans, to make behavioural comparisons for the same individual dolphins in the presence and absence of swimmers, and to make behavioural comparisons for individual dolphins in the same region that do and do not interact with swimmers. Coupled with standard photo-identification techniques, these methods can be used to identify the class of animals, or proportion of a local community, that is more likely to interact with, be detrimentally affected by, and/or avoid human interaction. Sequential observations of the same individuals taken over time can be used to document habituation or sensitisation to human interaction. KEYWORDS: BEHAVIOUR; BOTTLENOSE DOLPHIN; CONSERVATION; WHALEWATCHING; HUMAN INTERACTION

MacLeod, C.D., Pierce, G.J. and Begoña Santos, M. 2004. Geographic and temporal variations in strandings of beaked whales (Ziphiidae) on the coasts of the UK and the Republic of Ireland from 1800-2002. *J. Cetacean Res. Manage.* 6(1):79-86.

This study analyses published records of beaked whale strandings from the coasts of the UK and the Republic of Ireland between 1800 and 2002. Strandings of northern bottlenose whales (*Hyperoodon ampullatus*) were lowest in April and highest in September. The number of strandings between months differed significantly from an even spread over all months of the year, with more strandings between July and October. Most strandings in late summer and autumn occurred on North Sea coasts and their stomach contents included the squid *Gonatus fabricii*, which is found only in more northern waters. This suggests that these whales may be migrating southward at this time of year. Most strandings of Sowerby's beaked whales (*Mesoplodon bidens*) also occurred in late summer and autumn, although this was not significant. Strandings of Cuvier's beaked whales (*Ziphius cavirostris*) occurred almost exclusively on the Atlantic coasts of the UK and in Ireland. There were significantly more Cuvier's beaked whale strandings than expected in January and February and in June and July. A Cuvier's beaked whale which stranded in northern Scotland in February contained similar prey to two whales stranded in north-western Spain at the same time of year, suggesting this animal could have been feeding in more southern waters prior to stranding. Seasonal patterns of strandings of northern bottlenose and Cuvier's beaked whales were significantly different with more of the former stranding in August to October and more of the latter from November to July. This is consistent with a hypothesis of temporal segregation between the two species to reduce potential competition for prey. KEYWORDS: DISTRIBUTION; MIGRATION; NORTHERN HEMISPHERE; MOVEMENTS; NORTHERN BOTTLENOSE WHALE; SOWERBY'S BEAKED WHALE; CUVIER'S BEAKED WHALE; STRANDINGS; NORTH ATLANTIC; NORTH SEA

Norman, S.A., Bowlby, C.E., Brancato, M.S., Calambokidis, J., Duffield, D., Gearin, P.J., Gornall, T.A., Gosho, M.E., Hanson, B., Hodder, J., Jeffries, S.J., Lagerquist, B., Lambourn, D.M., Mate, B., Norberg, B., Osborne, R.W., Rash, J.A., Riemer, S. and Scordino, J. 2004. Cetacean strandings in Oregon and Washington between 1930 and 2002. *J. Cetacean Res. Manage.* 6(1):87-99.

The Northwest Region (NWR) Marine Mammal Stranding Network was created in the early 1980s to provide a consistent framework in which to collect and compile data about marine mammal strandings in Oregon and Washington. The NWR includes the nearshore waters and 4,243km (2,632 n.miles) of coastline. For the years 1930-2002, there were 904 stranding events, representing 951 individual animals and 23 species: 4 species of balaeopterids, 1 eschrichtiid, 2 physeterids, 4 ziphiids, 10 delphinids and 2 phocoenids. Gender was determined for 343 males and 266 females. Only one mass stranding was recorded (sperm whales: 1979). A few species comprised the majority (71%) of stranding events in the NWR: harbour porpoise (34%), gray whales (23%), Dall's porpoise (12%) and Pacific white-sided dolphins (4%). There was a steep increase (511%) in the number of stranding reports beginning in the 1980s with over 86% of all records occurring during the last two decades (1980s and 1990s). The general trend of increased reported strandings during the last two decades corresponds to the formation of a formal stranding network and a heightened interest and dedication by the public and government agencies in reporting and documenting strandings. For all events combined, the primary stranding peak was April-July. Since stranding recoveries depend heavily on reports from the general public, most stranding records were in summer when more people are present along the coastline. Individual species or species groups showed varying levels of conformity to this overall seasonal trend. The value and limitations of the use of strandings data in a management context are discussed. KEYWORDS: CETACEANS; STRANDINGS; DISTRIBUTION; OCEANOGRAPHY; GRAY WHALE; HARBOUR PORPOISE; DALL'S PORPOISE; WHITE-SIDED DOLPHIN; TRENDS; HABITAT; NORTH PACIFIC; SPERM WHALE; NORTH AMERICA

Zerbini, A.N., Andriolo, A., da Rocha, J.M., Simões-Lopes, P.C., Siciliano, S., Pizzorno, J.L., Waite, J.M., DeMaster, D.P. and VanBlaricom, G.R. 2004. Winter distribution and abundance of humpback whales (*Megaptera novaeangliae*) off Northeastern Brazil. *J. Cetacean Res. Manage.* 6(1):101-107

The Brazilian coast is recognised as a Southern Hemisphere humpback whale (*Megaptera novaeangliae*) wintering ground (IWC breeding stock 'A'). The northeastern coast of Brazil was an important whaling ground in the 20th century. Shipboard sighting surveys were conducted in this area to evaluate large whales' distribution and density in 1999 and 2000. Humpback whale sightings ($n = 81$, 153 individuals) were recorded using line transect methodology. Data from the 2000 survey were used to estimate abundance over the continental shelf from 5 to 12°S (20,040km²). A total of 872.1km were surveyed on effort. Humpback whales were distributed from nearshore to the 800m isobath, but 93.5% of sightings were recorded shoreward of the 300m isobath. The relatively high density off northeastern Brazil suggests that the species is reoccupying historical areas of distribution and the presence of newborn individuals indicates that calving and nursing occur in the area. The hazard rate model best fit perpendicular distance data. Abundance was estimated

at 628 individuals (CV = 0.335, 95% CI = 327-1,157). This estimate probably corresponds to only a portion of the breeding population. Therefore, additional studies must be conducted to estimate the total size of the humpback whale population wintering off Brazil. KEYWORDS: HUMPBAC WHALE; DISTRIBUTION; BREEDING GROUNDS; ABUNDANCE ESTIMATE; SURVEY-VESSEL; SOUTHERN HEMISPHERE; SOUTH AMERICA

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Stevick, S.T., Aguayo, A., Allen, J., Avila, I.C., Capella, J., Castro, C., Chater, K., Dalla Rosa, L., Engel, M.H., Félix, F., Flórez-González, L., Freitas, A., Haase, B., Llano, M., Lodi, L., Munoz, E., Olavarria, C.Y., Secchi, E., Scheidat, M. and Siciliano, S. 2004. Migrations of individually identified humpback whales between the Antarctic Peninsula and South America. *J. Cetacean Res. Manage.* 6(2):109-113.

Considerable uncertainty exists regarding the migratory destinations of humpback whales (*Megaptera novaeangliae*) from the Antarctic Peninsula region and the breeding grounds off the coasts of South America. Evidence is presented on the migratory patterns of Antarctic humpback whales based upon movements of individuals identified by natural markings as part of a large-scale international collaboration. Recapture rates were compared between animals from the low latitude breeding and calving areas along the northeastern ($n=288$) and northwestern ($n=325$) margins of South America with those identified in the high-latitude feeding areas in the region of the Antarctic Peninsula ($n=535$). The number of individuals re-sighted in the Antarctic Peninsula differed dramatically between eastern and western South America ($\chi^2=40.98$, $p=1.5 \times 10^{-10}$). No individuals from Brazil were re-sighted in either the Antarctic Peninsula or off western South America. In contrast, 43 individuals from western South America were identified off the Antarctic Peninsula. These findings suggest that the northwest coast of South America represents an important breeding ground destination for at least some of the humpback whales that feed near the Antarctic Peninsula, but provide no support for movement between the Antarctic Peninsula and the east coast of South America. KEYWORDS: HUMPBAC WHALE; SOUTH AMERICA; ANTARCTIC; MIGRATION; PHOTO-ID

Hobbs, R.C., Rugh, D.J., Waite, J.M., Breiwick, J.M. and DeMaster, D.P. 2004. Abundance of eastern North Pacific gray whales on the 1995/96 southbound migration. *J. Cetacean Res. Manage.* 6(2):115-120.

Systematic counts of gray whales (*Eschrichtius robustus*) were conducted from 13 December 1995 to 23 February 1996 at Granite Canyon, California. This study was the second of three during the five-year period following the removal of gray whales from the US government list of endangered and threatened wildlife. The counts were made at the same research station used most years since 1975 by the National Marine Mammal Laboratory to observe the southbound migration of the eastern North Pacific stock. Counting methods were kept similar to those used in previous surveys and included double counting to assess observer performance. In addition, aerial surveys and highpowered binoculars provided documentation that a negligible fraction of migrating whales passed beyond the sighting range of the counting observers. A total of 2,151 pods (3,928 whales) was counted during 472.7hrs of standard watch effort with visibility recorded as fair to excellent. Data analysis procedures were substantially the same as in previous years with a modification to account for differential sightability by pod size. Population size is estimated to be 22,263 whales (CV=9.25%; 95% log-normal CI=18,700-26,500). This estimate is similar to the previous estimate of 23,109 (CV=5.42%; 95% CI=20,800-25,700) from the 1993/94 survey. KEYWORDS: GRAY WHALE; ABUNDANCE ESTIMATE; PACIFIC OCEAN; SURVEY-SHORE-BASED

Punt, A.E., Allison, C. and Fay, G. 2004. An examination of assessment models for the eastern North Pacific gray whale based on inertial dynamics. *J. Cetacean Res. Manage.* 6(2):121-132.

Bayesian assessments of the eastern North Pacific stock of gray whales are conducted using the standard BALEEN II model and the inertia model developed by Witting (2000; 2001; 2003). The analyses confirm the increase in gray whale population size since 1968, but indicate that catches up to 256 animals per annum will lead to population decline if the inertia model is correct. However, analyses based on the standard BALEEN II model with a starting year of 1930 or 1968 fit the calf count data better than the inertia model, and indicate a population at its (current) equilibrium level and that the current catches are sustainable. The results of both the BALEEN II model and the inertia model are sensitive to the choice of the functional form used to represent density-dependence and those of the inertia model to the starting year for the analyses. KEYWORDS: GRAY WHALE; POPULATION ASSESSMENT; TRENDS; MODELLING; WHALING-ABORIGINAL

Pérez-Cortés M.H., Urbán R.J. and Loreto C.P.A. 2004. A note on gray whale distribution and abundance in the Magdalena Bay Complex, México during the 1997 winter season. *J. Cetacean Res. Manage.* 6(2):133-138.

The goal of this study was to determine the distribution and abundance of gray whales, distinguishing between cow-calf pairs and single whales, in the different areas forming the Magdalena Bay Complex at Baja California Sur, Mexico. The lagoon complex comprises three well-defined zones: Santo Domingo Channel or Puerto Adolfo López Mateos region in the north; the central part properly known as Magdalena Bay; and the southern portion, Almejas Bay. The study period spanned eight weeks during the 1997 winter season. Fifteen surveys were conducted: 5 at Santo Domingo Channel, 7 at Magdalena Bay and 3 at Almejas Bay. Maximum combined counts by area and date were as follows: Santo Domingo Channel: 100 whales (83 cow-calf pairs and 17 single whales) on 27 February; Magdalena Bay: 81 whales (9 cow-calf pairs and 72 singles) on 14 February; and Almejas Bay: 109 whales (15 cow-calf pairs and 94 single whales) on 28 February. Santo Domingo Channel was the main calving zone within the lagoon complex and had the highest number of cow-calf pairs; for every count in this zone the number of cow-calf pairs was always higher than that of single whales. In contrast, Magdalena and Almejas Bays were mainly used for courtship and mating, or aggregation areas for young and immature whales. It is recommended that these studies continue and attempt to cover the entire season, and complete even coverage of all areas within the Complex. This will allow more effective management and regulation of human activities affecting gray whales within the Magdalena Bay lagoon complex. KEYWORDS: GRAY WHALE; BREEDING GROUNDS; MONITORING; PACIFIC OCEAN

Geertsen, B.M., Teilmann, J., Kastelein, R.A., Vlemmix, H.N.J. and Miller, L.A. 2004. Behaviour and physiological effects of transmitter attachments on a captive harbour porpoise (*Phocoena phocoena*). *J. Cetacean Res. Manage.* 6(2):139-146.

A captive harbour porpoise (*Phocoena phocoena*) was monitored for 80 consecutive days, 10 days before attachment of a satellite dive recorder and a VHF-radio tag, 30 days during attachment and 40 days after removal of the transmitters. Dive data recorded by the satellite transmitter was collected during the attachment. Daily food intake was measured and each week the porpoise was taken out of the water for a physical examination. Behavioural observations logged on the handheld computer showed an immediate effect of the tagging in time spent resting at the surface (logging), which was four to six times higher on the day of attachment. Digital video recordings showed a significant increase in the mean duration of rolls at the surface immediately after attachment. The mean duration of dives was shorter

before attachment than both after the tagging and after removal of the transmitters. Furthermore the frequency of surfacings farthest away from where the porpoise was taken out of the pool for tagging, was highest the first five days following the tagging. Dive data from the satellite tag showed a semidiurnal diving pattern, with increased mean dive depth in the first 24 hours after attachment. The heart rate was fairly constant during the tagging, but the mean heart rate increased significantly from 161 beats per minute (bpm) to 180 bpm after the first hole in the dorsal fin was made. The body weight of the porpoise increased up to the time of tagging (16 May 2000), after which it decreased until six days prior to release (28 July 2000); this was probably due to the seasonal trend in blubber thickness of harbour porpoises rather than an effect from the tagging. After one month of attachment, a reaction occurred around the frontal pinhole and the transmitters were removed. This reaction was probably due to drag from two tags and seaweed attached to the tags during the last part of the attachment period. After the tags were removed epithelia closed the pinholes after two days. KEYWORDS: HARBOUR PORPOISE; BEHAVIOUR; PHYSIOLOGY; CAPTIVITY; SATELLITE TAGGING; TELEMETRY

Larsen, F. 2004. A note on improving the mechanism of pinger attachment for the Danish North Sea gillnet fishery. 2004. *J. Cetacean Res. Manage.* 6(2):147-150.

This paper describes development of a better mechanism for the attachment of pingers to fishing gear, aimed particularly at the Danish bottom-set gillnet fishery. In a cooperative effort involving gillnet fishermen, the fishermen's organisations and researchers, modifications to the physical shape of a pinger and its attachment to the gear were developed, taking into consideration the acoustic functioning of the pinger, battery life, robustness to operational rigours, weight, volume, buoyancy, environmental effects, cost and handling. The suggested attachment (THOR-1) has a number of important advantages in this fishery compared to the more common head rope attachment. THOR-1 was tested for ease of handling on board a gillnet vessel and found to perform very well, with minimal interference with normal fishing operations. The main disadvantage of THOR-1 is the need for an effective range of around 200m. KEYWORDS: GILLNETS; INCIDENTAL CATCHES; EUROPE; FISHERIES; SMALL CETACEANS; HARBOUR PORPOISE

Lennert-Cody, C.E., Minami, M. and Hall, M.A. 2004. Incidental mortality of dolphins in the eastern Pacific Ocean purse-seine fishery: correlates and their spatial association. *J. Cetacean Res. Manage.* 6(2):151-163.

A zero-inflated Poisson model was used to identify typical fishing practices that contributed to incidental mortality of dolphins in the eastern Pacific purse-seine fishery between 1993 and 2001. The presence of hazardous net conditions (net canopies and net collapses), the duration of the backdown procedure (the primary method of releasing dolphins from the net), the size and species composition of the encircled dolphin herd and the amount of tuna encircled, were all found to consistently contribute to increased dolphin mortality per set. In particular, the presence of net canopies and large biomass in the net contributed to both the development of problematic situations in which mortality could occur and to the mean mortality per set, once a problematic situation had developed. On the other hand, lengthy backdown procedures and the presence of net collapses contributed to the development of problematic situations, but had less effect on the mean mortality per set once a problematic situation had developed. Because some of these variables are partially correlated, the overall conclusion of this analysis is that one of the primary causes of dolphin mortality continues to be the encirclement of large herds. Dolphin mortality can increase with the number of dolphins encircled because: (1) the more animals encircled, the greater the likelihood of entanglement and mortality while confined in the net; and (2) the duration of the backdown procedure increases with the number of animals encircled. The duration of the backdown procedure may, in turn, contribute to increased dolphin mortality by: (1) keeping dolphins in close contact with the net for longer periods of time, thereby increasing the chances for entanglement; and (2) leading to the formation of net canopies. Dolphin mortality increases in the presence of net canopies because animals can be trapped below the sea surface in the areas of canopies. Spatial distributions of encircled herd size, duration of the backdown procedure, presence of net canopies and presence of dolphin mortality show similar patterns. Encircled herd size tended to be greatest south of the equator and north of the equator along the offshore margin of the fishery. In these areas, the duration of the backdown procedure tended to be longer and there was often an increased probability of net canopies and dolphin mortality, but also larger catches of tuna. These consistent spatial patterns suggest that reallocation of fishing effort to other areas may be an effective means of reducing the current level of dolphin mortality. Predictive models could be developed to assess tradeoffs between dolphin mortality and tuna catches at varying levels of fishing effort in areas where large herds are targeted by fishermen and different strategies for reallocation of fishing effort to other areas or to purse-seine sets on unassociated tunas. KEYWORDS: DOLPHIN; INCIDENTAL CATCHES; FISHERIES; PACIFIC OCEAN; BYCATCH; MODELLING

Lauriano, G., Fortuna, C.M., Moltedo, G. and Notarbartolo Di Sciara, G. 2004. Interactions between common bottlenose dolphins (*Tursiops truncatus*) and the artisanal fishery in Asinara Island National Park (Sardinia): assessment of catch damage and economic loss. *J. Cetacean Res. Manage.* 6(2): 165-173.

In 1999, the Italian Central Institute for Applied Marine Research (ICRAM), in response to reports made by local fisheries, began a study into the interactions between common bottlenose dolphins (*Tursiops truncatus*) and the artisanal fishery in the Asinara Island National Park (Sardinia). Using onboard observers, fishing boat surveys were carried out to determine the frequency of interactions, variations in the catch of target species and damage to two different types of trammel net caused by dolphins. Interactions occurred primarily with trammel nets targetting striped red mullet (*Mullus surmuletus*); the less valuable peacock wrasse, *Simphodus tinca*, was also caught). Interactions also occurred with trammel nets set for lobster (*Palinurus elephas*), cuttlefish (*Sepia spp.*) and scorpionfish (*Scorpaena spp.*), but these were considered negligible. The target species, catch and damage inflicted on the catch was recorded, both in the presence and absence of dolphins, in an effort to ascertain associated damage and economic cost. Loss of catch was found to be significant only in the case of nets deployed during the red striped mullet fishing season. Although the level of interaction was high relative to the narrow red striped mullet fishery season, the overall economic impact on the fishing community was found to be modest. The presence and regulations of the national park area may provide an opportunity for investigating mitigation activities compatible with both cetacean conservation and the maintenance of the traditional fisheries. KEYWORDS: FISHERIES; COMMON BOTTLENOSE DOLPHIN; COMPETITION; EUROPE

Krahn, M.M., Herman, D.P., Ylitalo, G.M., Sloan, C.A., Burrows, D.G., Hobbs, R.C., Mahoney, B.A., Yanagida, G.K., Calambokidis, J. and Moore, S.E. 2004. Stratification of lipids, fatty acids and organochlorine contaminants in blubber of white whales and killer whales. *J. Cetacean Res. Manage.* 6(2):175-189.

The biopsy - via dart, trocar or surgery - is becoming the preferred protocol for sampling skin and blubber of many cetacean species, because a small sample from a healthy animal may provide better information than a larger sample collected via necropsy from an ill or emaciated animal. Furthermore, the biopsy is often the only means of obtaining samples (e.g. for threatened or endangered species). Because biopsy darts collect only a small sample of tissue - and blubber can be heterogeneous in structure and composition - it is essential to compare the results obtained from biopsies to those found by analysing full-thickness blubber samples obtained via necropsy. This manuscript compares blubber stratification in two odontocete species, white whales (*Delphinapterus leucas*) and killer whales (*Orcinus orca*). Five parameters (i.e. lipid percent and classes, contaminant concentrations and profiles, fatty acid profiles) were measured by

blubber depth. Results of these comparisons strongly suggest that biopsy results must be interpreted with caution and in conjunction with results from species-specific blubber depth profiling. For example, lipid classes measured in biopsy samples of white whales and killer whales were similar to those for equivalent-depth samples obtained by necropsy. In addition, lipid-adjusted contaminant concentrations measured in dart or trocar samples adequately represented those obtained by necropsy of both species. Conversely, the lipid content in biopsy samples was lower than that found in same-depth necropsied samples due to loss of lipid during sampling. Also, because of the high level of fatty acid stratification observed, fatty acid profiles from the outer blubber layer collected via biopsy from both species are less likely than the metabolically active inner layer to be useful in determining the prey species consumed by these odontocetes. This study demonstrates, for white and killer whales, that properly interpreted results from blubber biopsies can provide valuable information about the body condition, health and life history of individual animals. KEYWORDS: POLLUTANTS; ORGANOCHLORINES; STRANDINGS; BIOPSY SAMPLING; KILLER WHALE; WHITE WHALE; PACIFIC OCEAN

Cañadas, A., Desportes, G. and Borchers D. 2004. The estimation of the detection function and $g(0)$ for shortbeaked common dolphins (*Delphinus delphis*), using double-platform data collected during the NASS-95 Faroese survey. *J. Cetacean Res. Manage.* 6(2):191-198.

This paper examines the data for common dolphins collected during a general double-platform line transect cetacean survey carried out in waters around the Faroe Islands in 1995 (from southeastern Iceland to western Ireland) in order to determine the extent to which a correction factor can be estimated to account for animals missed on the trackline and for responsive movement towards the vessel. A major assumption of conventional distance-based methods is that all objects at zero distance from the line are detected (i.e. $g(0)=1$). If this assumption is violated the estimated density and hence abundance will be negatively biased. It also assumes that animals do not respond to the survey vessel before they are detected by the observers. If the animals are attracted to the vessel, for example, this will result in a positively biased estimate. The $g(0)$ estimate was obtained using the method of Borchers *et al.* (1998). Visual inspection of the data suggested that the dolphins were attracted to the vessel and this was accounted for following the Buckland and Turnock (1992) approach. Coefficients of variation (CVs) and confidence intervals (CIs) were estimated using a non-parametric bootstrap procedure. During the survey, almost 1,700 n.miles were sailed on primary research effort. There were 153 common dolphin sightings including 52 duplicates. The chosen model for the detection function incorporated perpendicular distance, group size and Beaufort sea state. The resulting estimate of $g(0)$ was 0.7961 (CV=0.14). Density estimates obtained under an assumption of no responsive movement are almost six times higher than when it is taken into account, highlighting the importance of collecting appropriate data to allow analysis of this potential problem in cetacean surveys. KEYWORDS: ABUNDANCE ESTIMATE; $g(0)$; SURVEY-VESSEL; COMMON DOLPHIN; ATLANTIC OCEAN; EUROPE

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Moore, M.J., Knowlton, A.R., Kraus, S.D., Mclellan, W.A. and Bonde, R.K. 2004. Morphometry, gross morphology and available histopathology in North Atlantic right whale (*Eubalaena glacialis*) mortalities (1970-2002). *J. Cetacean Res. Manage.* 6(3):199-214.

Fifty-four right whale mortalities have been reported from between Florida, USA and the Canadian Maritimes from 1970 to 2002. Thirty of those animals were examined: 18 adults and juveniles, and 12 calves. Morphometric data are presented such that prediction of body weight is possible if the age, or one or more measurements are known. Calves grew approximately linearly in their first year. Total length and fluke width increased asymptotically to a plateau with age, weight increased linearly with age, weight and snout to blowhole distance increased exponentially with total length, whereas total length was linearly related to fluke width and flipper length. Among the adults and juveniles examined in this study, human interaction appeared to be a major cause of mortality, where in 14/18 necropsies, trauma was a significant finding. In 10/14 of these, the cause of the trauma was presumed to be vessel collision. Entanglement in fishing gear accounted for the remaining four cases. Trauma was also present in 4/12 calves. In the majority of calf mortalities (8/12) the cause of death was not determined. Sharp ship trauma included propeller lacerations inducing multiple, deep lacerations that often incised vital organs including the brain, spinal cord, major airways, vessels and musculature. Blunt ship trauma resulted in major internal bruising and fractures often without any obvious external damage. In at least two cases fatal gear entanglements were extremely protracted: where the entanglements took at least 100 and 163 days respectively to be finally lethal. The sum of these findings show two major needs: (1) that extinction avoidance management strategies focused on reducing trauma to right whales from ship collisions and fishing gear entanglement are highly appropriate and need to be continued and; (2) that as mitigation measures continue to be introduced into shipping and fishing industry practices, there is a strong effort to maximise the diagnostic quality of post-mortem examination of right whale mortalities, to ensure an optimal understanding of resultant trends. KEYWORDS: MORPHOMETRICS; CONSERVATION; STRANDINGS; RIGHT WHALE; NORTH ATLANTIC; SHIP STRIKE; INCIDENTAL MORTALITY

Lowry, L.F., Sheffield, G. and George, J.C. 2004. Bowhead whale feeding in the Alaskan Beaufort Sea, based on stomach contents analyses. *J. Cetacean Res. Manage.* 6(3):215-223.

This study examined feeding of bowhead whales (*Balaena mysticetus*) taken by Alaska Natives at Barrow (western Beaufort Sea), Nuiqsut (central Alaskan Beaufort Sea) and Kaktovik (eastern Alaskan Beaufort Sea) during 1969-2000. The objectives were to: (1) identify the proportion of harvested whales that had been feeding; and (2) describe the diet based on stomach contents. Data used were field records for 242 whales whose stomachs were examined and laboratory analysis of samples from 123 animals. There were no significant differences in the proportions of animals that had been feeding during the autumn at Kaktovik (83%) and Barrow (75%), or in sub-adults (78%) versus adults (73%). Copepods occurred significantly more frequently in animals from Kaktovik, while euphausiids and hyperiid amphipods occurred more frequently at Barrow. During the autumn, the percent copepods by volume was greater in animals taken at Kaktovik than at Barrow, while the percent euphausiids by volume was greater in whales taken at Barrow. At Barrow, a larger proportion of animals was feeding in the autumn (76%) than the spring (34%), and copepods occurred more often in the spring. Examination of five whales taken at Nuiqsut in the autumn suggests a feeding pattern similar to that seen at Kaktovik. There were no significant differences in diets of males versus females or of sub-adults versus adults. It is concluded that in the autumn, bowheads feed regularly in the eastern, central and western Alaskan Beaufort Sea, and that feeding during the spring migration is more common than previously thought. KEYWORDS: BOWHEAD WHALE; ARCTIC; NORTH AMERICA; FEEDING; FOOD/PREY; FEEDING GROUNDS; EUPHAUSIIDS; COPEPODS

Freitas, A.C., Kinan, P.G., Martins, C.C.A. and Engel, M.H. 2004. Abundance of humpback whales on the Abrolhos Bank wintering ground, Brazil. *J. Cetacean Res. Manage.* 6(3):225-230.

Abundance estimates are presented for the humpback whales wintering off Brazil which 'visit' a surveyed area off Abrolhos Bank and display fluke-exposing behaviour. The study is based on photo-identification data collected between 1996 and 2000. Chapman-corrected Petersen estimates for all pairs of data result in estimates from 1,948 individuals up to 3,001 with coefficients of variation around 0.25. A

more elaborate closed population multiple-recapture maximum-likelihood estimate is 2,393 with 95% profile-likelihood confidence interval (CI=1,924, 3,060). Replacing the closed-population assumption with a population allowed to grow (or decrease) according to some constant rate over the study period, the maximum-likelihood estimate of population size for the year 2000 becomes 3,871 (CI=2,795, 5,542) associated to an estimated annual growth rate of 31% over the study period and in the surveyed area. Although the inclusion of the growth rate results in a less restrictive assumption about population size, it is unclear at this time how to interpret it since the population around the Abrolhos Bank is some (unknown) fraction of whales wintering off Brazil. Alternatively, a fit of Whitehead's model allowing for emigration and re-immigration gives an estimate of about 3,000 whales (CI=2,500, 3,650). KEYWORDS: ABUNDANCE ESTIMATE; ATLANTIC OCEAN; BREEDING GROUND; HUMPBACK WHALE; PHOTO-ID; SOUTH AMERICA

Burdett, L.G. and Mcfee, W.E. 2004. Bycatch of bottlenose dolphins in South Carolina, USA, and an evaluation of the Atlantic blue crab fishery categorisation. *J. Cetacean Res. Manage.* 6(3):231-240.

In the USA, commercial fisheries that interact with marine mammals are categorised according to the number of incidental takes of marine mammals relative to the defined Potential Biological Removal (PBR) for the population. Three categories exist for such commercial fisheries: Category I, II and III, each varying in the degree of regulation. Fishery categorisation is based on a five-year running average of the number of incidental entanglements in that fishery and is published annually in the Federal Register. The Atlantic blue crab (*Callinectes sapidus*) fishery is one of South Carolina's largest commercial fisheries in terms of volume and value and was recently re-categorised as a Category II fishery, resulting in heightened regulation. The Atlantic blue crab fishery exists in known areas of bottlenose dolphin (*Tursiops truncatus*) habitat; therefore, interaction between the two is probable. This study uses historical marine mammal stranding data and on-board investigations of the blue crab fishery in South Carolina to investigate the degree of fishery and dolphin interaction. Analysis of historical strandings showed that approximately 24% of the 42 entanglement cases in South Carolina from 1992-2003 resulted from the blue crab fishery. In nine of the 12 years examined, bottlenose dolphin mortality rates were found to be greater than or equal to 10% of the South Carolina Management Unit's PBR, which is significant according to the US Marine Mammal Protection Act's (MMPA) definitions for the Atlantic Coastal Stock of bottlenose dolphins. In addition, results from this study showed that the average number of bottlenose dolphin entanglements per year in the South Carolina blue crab fishery has exceeded 1% of PBR across a five-year period (1999-2003), which defines a Category II fishery. Thus, entanglement data from South Carolina from 1992-2003 support the re-categorisation of the blue crab fishery and the introduction of heightened regulations under the MMPA. KEYWORDS: BOTTLENOSE DOLPHIN; FISHERIES; INCIDENTAL CATCHES; CONSERVATION; MANAGEMENT PROCEDURE

De March, B.G.E., Stern, G.A. and Innes, S. 2004. The combined use of organochlorine contaminant profiles and molecular genetics for stock discrimination of white whales (*Delphinapterus leucas*) hunted in three communities on southeast Baffin Island. *J. Cetacean Res. Manage.* 6(3):241-250.

Putative stock differences in white whales (*Delphinapterus leucas*) landed by hunters between 1992 and 1996 from the southeast Baffin Island communities of Kimmirut (KI), Iqaluit (IQ) and Pangnirtung (PA) were examined using organochlorine contaminant (OC) profiles of 124 whales, the molecular genetics of 270 whales and both types of data from 97 whales. OC concentrations were generally lower in whales hunted in PA than those hunted in KI and IQ, and many OCs were lower in KI than IQ. In canonical discriminant function (CDA) using 13 OC predictor variables (10 OC groups, mirex, octachlorostyrene and endosulfan), the first canonical function accounted for 77% of the variance and separated whales from PA with those from IQ and KI; the second canonical function separated whales from KI with those from IQ. A previous study of the molecular genetics of white whales showed that whales hunted in the three communities were significantly differentiated on the basis of haplotype and/or microsatellite allele frequencies (de March *et al.*, 2002). When the results of two studies were combined, many whales were slightly more strongly associated with a particular source hunting community than they were in the component studies. Using *a posteriori* cross-validation probabilities in an analysis with variables from both studies, 72% of white whales were correctly crossvalidated to their source hunting community; 82.5% from PA; 56.5% from IQ; and 58.8% from KI. The highest misclassification rates were KI to IQ (23.5%), IQ to KI and IQ to PA (21.7% in both cases) and the lowest rates were PA to KI (3.5%), PA to IQ (14.0%) and KI to PA (17.6%). This pattern of assignments was not significantly different from those in the genetics or contaminants studies alone. However, the cross-validation probabilities to the most likely source communities were approximately 20% larger in the combined analysis than in the component studies. Canonical scores in the combined analysis were more strongly correlated with variables from the OC Study than with variables from the genetics study. Whales placed to PA and IQ could be identified primarily by their OC signatures, however many whales from PA also had a strong PA genetics signature. Whales from IQ were identifiable only by their OC signatures. Both a strong KI genetics and OC signature described approximately half of whales from KI. We believe that at least three stocks were sampled from the three communities. Some whales in PA were very distinct, confirming previous beliefs that a separate stock occurs in Cumberland Sound. Whales hunted in IQ and KI differed to a lesser degree, and may be from stocks subject to a gradient or from a mixture of stocks. Some whales from PA are more likely to have genotypes and OC signatures that are also found in IQ and KI than the reverse. It is possible that summering areas of the stocks that were identified in KI and IQ are not consistent from year to year or across generations. The main problems in combining results for individuals used in several studies, particularly when there are many measurements for relatively few individuals, is to find a limited number of relevant predictor variables that can be used in the combined analysis, while avoiding both overparameterisation and results blurred by meaningless variables. KEYWORDS: GENETICS; ORGANOCHLORINES; DISTRIBUTION; MIGRATION; ARCTIC; NORTH AMERICA

Scheidat, M., Kock, K-H. and Siebert, U. 2004. Summer distribution of harbour porpoise (*Phocoena phocoena*) in the German North Sea and Baltic Sea. *J. Cetacean Res. Manage.* 6(3):251-257.

Current plans to utilise German offshore waters as sites for windmill parks as well as ongoing investigation of potential areas to implement Natura 2000 have led to an increased research effort on local marine mammal populations. The aim of this study was to determine the spatial distribution of harbour porpoises in the German part of the North Sea and Baltic Sea. Aerial surveys were conducted from May to August 2002 using standard line-transect methodology. A total of 21 days of aerial surveying covered 8,072km tracks on effort; 4,908km were conducted in conditions of good visibility. A total of 785 harbour porpoises (488 sightings) were seen; 597 animals (427 sightings) were detected in conditions of good visibility. The study area was divided into a grid of 3 minute latitude by 6 minute longitude squares. Porpoise relative abundance and distribution were estimated as the number of animals per km on effort in each square. The results showed that in the North Sea, the highest number of porpoises per km was observed in the northeastern part of the surveyed area, close to the Danish border and in the area of Amrum Outerbank. In the Baltic Sea, the highest relative abundance of porpoises was seen in the Pomeranian Bight between the island of Rügen and the Polish border. Pod size in the Baltic was larger than in the North Sea. The aerial surveys were continued in 2003 in order to collect more information on temporal and spatial distribution of harbour porpoise and its intra and inter-annual variability in German waters. These data will serve as a baseline for management decisions. KEYWORDS: HARBOUR PORPOISE; DISTRIBUTION; SURVEY-AERIAL; INDEX OF ABUNDANCE; CONSERVATION; BALTIC SEA; NORTH SEA

Hasselmeier, I., Abt, K.F., Adelung, D. and Siebert, U. 2004. Stranding patterns of harbour porpoises (*Phocoena phocoena*) in the German North and Baltic Seas: when does the birth period occur? *J. Cetacean Res. Manage.* 6(3):259-263.

Stranded harbour porpoises were analysed to investigate differences in stranding patterns along the North and Baltic Sea coasts of Schleswig-Holstein, Germany. A total of 1,015 stranded or bycaught harbour porpoises were recorded between 1990-2000. Most of the stranded animals were found during the summer months: in the North Sea, the peak occurred in the months of June and July, whereas in the Baltic most of the porpoises were found in July and August. Strandings of mature females (>3.9 years) and young animals (<1 year) were positively correlated during the summer months. No significant correlation between mature males and young porpoises nor between mature males and females was observed. By using a non-parametric procedure, a birth period for the North Sea population between 6 June and 16 July was calculated, with 27 June as the mean date of birth. In the Kiel Bight population, births were assumed to take place one month later than in the North Sea. KEYWORDS: HARBOUR PORPOISE; STRANDINGS; REPRODUCTION; EUROPE; INCIDENTAL CATCHES; PARTURITION; AGE AT SEXUAL MATURITY

De Freitas Azevedo, A., Lailson-Brito Jr., J., Cunha, H.A. and Van Sluys, M. 2004. A note on site fidelity of marine tucuxis (*Sotalia fluviatilis*) in Guanabara Bay, southeastern Brazil. *J. Cetacean Res. Manage.* 6(3): 265-268.

Since 1995, photo-identification techniques have been used to study the marine tucuxis (*Sotalia fluviatilis*) found in Guanabara Bay (22°50'S, 43°10'W), southeastern Brazil. The bay is surrounded by a metropolitan complex and is the most degraded area of this species' distribution. From May 1995 to June 2003, 47 photo-identification boat surveys were conducted in the bay. Sixty-nine individuals were identified and catalogued. The results indicate that individual tucuxis have high site fidelity in Guanabara Bay. On average, dolphins were seen for 4.5 consecutive years, with a range of 1 to 8 years. Additionally, calves have remained in the area beyond sexual maturity. Guanabara Bay provides food and breeding grounds for this dolphin population, despite its high degree of degradation. The fact that such a small dolphin population, composed of resident individuals, depends on such a degraded area may pose serious problems for its conservation. KEYWORDS: TUCUXI; SITE FIDELITY; PHOTO-ID; SOUTH AMERICA; SOUTH ATLANTIC; SURVEY-VESSEL

Kreb, D. 2004. Abundance of freshwater Irrawaddy dolphins in the Mahakam River in East Kalimantan, Indonesia, based on mark-recapture analysis of photo-identified individuals. 2004. *J. Cetacean Res. Manage.* 6(3):269-277.

From February 1999 to August 2002 ca 9,000km (840 hours) of search effort and 549 hours of observation on Irrawaddy dolphins (*Orcaella brevirostris*) were conducted by boat in the Mahakam River in East Kalimantan, Indonesia. An abundance estimate based on mark-recapture analysis of individuals photographed during separate surveys is presented here. Petersen and Jolly-Seber analysis methods were employed and compared along with earlier estimates derived from strip-transect analysis and direct counts. These comparisons serve to evaluate the biases of each method and assess the reliability of the abundance estimates. The feasibility of video-identification is also assessed. Total population size calculated by Petersen and Jolly-Seber mark-recapture analyses, was estimated to be 55 (95% CL=44-76; CV=6%) and 48 individuals (95% CL=33-63; CV=15%) respectively. Estimates based on strip-transect and direct count analysis for one sampling period, which was also included in the mark-recapture analysis, were within the confidence limits of the Jolly-Seber estimate ($N_{\text{count}} = 35$ and $N_{\text{strip}} = 43$). Calculated potential maximum biases appeared to be small, i.e. 2% of N for Petersen and 10% of N for the Jolly-Seber method, which are lower than the associated CVs. In addition, a high re-sight probability was calculated for both methods varying between 65% and 67%. Video images were considered a valuable, supplementary tool to still photography in the identification of individual dolphins in this study. For future monitoring of trends in abundance using mark/recapture analyses, a time interval is recommended between the two sampling periods that is short enough to minimise the introduction of errors due to gains and losses. Also, survey area coverage during photoidentification should be similar to avoid violation of the assumption of equal capture probabilities. The alarmingly low abundance estimates presented underline the need for immediate and strong action to preserve Indonesia's only known freshwater dolphin population. KEYWORDS: ABUNDANCE ESTIMATE; CONSERVATION; MARK RECAPTURE; IRRAWADDY DOLPHIN; PHOTO-ID; ASIA

Moore, M.J., Rubinstein, B., Norman, S.A. and Lipscomb, T. 2004. A note on the most northerly record of Gervais' beaked whale from the western North Atlantic Ocean. *J. Cetacean Res. Manage.* 6(3):279-281.

A juvenile male Gervais' beaked whale (*Mesoplodon europaeus*) was found dead in Barnstable Harbor, Cape Cod Bay, Massachusetts, USA. It apparently died from a septicemia, possibly induced by a puncture wound of unknown origin. The previous most northerly stranding for this species in the western North Atlantic ocean was from New York State, USA. KEYWORDS: BEAKED WHALE-GERVAIS'; NORTH ATLANTIC; STRANDINGS; MORPHOMETRICS; DISTRIBUTION; DISEASE

Murase, H., Matsuoka, K., Nishiwaki, S., Hakamada, T. and Mori, M. 2004. Effects of observed covariates (school size, sighting cue, latitude and sea state) on the Antarctic minke whale abundance estimation parameters in the IWC/IDCR-SOWER surveys. *J. Cetacean Res. Manage.* 6(3):283-292.

The effects of observed covariates (school size, sighting cue, latitude and sea state) on Antarctic minke whale abundance estimation parameters (effective search half-width, sighting forward distance and mean school size) were examined qualitatively. As the school size decreased, the effective search half-width and the sighting forward distance decreased. Most single and two animal schools were sighted by body, which was difficult in high sea states in comparison with those sighted by blow. Proportions of single and two animal schools increased as sighting latitude moved north. Small school sizes and bad weather conditions prevailed in the northern part of the survey area. As the survey area was extended to the north, the effects of small school size and bad weather conditions could be substantial in the third circumpolar survey. Observed covariates analysed in this paper should be incorporated into the estimation of effective search half-width and mean school size as covariates. KEYWORDS: ABUNDANCE ESTIMATE; ANTARCTIC MINKE WHALE; $g(0)$; ANTARCTIC; SOWER; SURVEY-VESSEL; TRENDS

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Rugh, D.J., Hobbs, R.C., Lerczak, J.A. and Breiwick, J.M. 2005. Estimates of abundance of the Eastern North Pacific stock of gray whales 1997 to 2002. *J. Cetacean Res. Manage.* 7(1):1-12.

The southbound migration of the Eastern North Pacific stock of gray whales (*Eschrichtius robustus*) was documented by the National Marine Fisheries Service from 13 December 1997 to 24 February 1998, 13 December 2000 to 5 March 2001 and from 12 December 2001 to 5 March 2002. Research protocol was essentially identical to that used in previous surveys. This involved single observers independently searching for whales and recording data on effort and sighting time, location, count and direction headed. In 1997/98, there were 2,346 pods (3,643 whales) counted during 435.0 hrs of standard watch effort when visibility was recorded as fair to excellent. In 2000/01, a total of 1,694 pods (2,754 whales) were counted during 592.4 hrs, and in 2001/02, there were 1,712 pods (2,800 whales) during 531.5 hrs. The southbound migrations in 1997/98 and 2001/02 were normal, beginning in mid-December, centered on mid-January (mean date = 18 January 1998 and 15 January 2002) and ending by mid-February. However, in 2000/01 (mean date = 25 January 2001) the migration was more protracted than any other migration observed in the past 25 years, with many whales still traveling south 3 weeks after the typical end date. Data analysis procedures were comparable to those used in previous years. Abundance estimates were 27,958 whales in 1997/98 (CV = 10.21%; 95% log-normal confidence interval = 22,901 to 34,131), 18,246 in 2000/01 (CV = 9.36%; 95% log-normal confidence interval = 15,195 to 21,910) and 16,848 in 2001/02 (CV = 9.49%; 95% log-normal confidence interval = 13,995 to 20,283). The latter two estimates were well below the estimate in 1997/98, which was the highest estimate since this project began in 1967/68. These low estimates might have been caused by an unusual number of whales that did not migrate as far south as Granite Canyon in these seasons, or the abundance may have declined following high mortality rates observed in 1999 and 2000; KEYWORDS: ABUNDANCE ESTIMATE; GRAY WHALE; MIGRATION; MONITORING; NORTHERN HEMISPHERE; PACIFIC OCEAN; SURVEY-SHORE-BASED; TRENDS.

Rankin, S., Ljungblad, D., Clark, C. and Kato, H. 2005. Vocalizations of Antarctic blue whales, *Balaenoptera intermedia*, recorded during the 2001-2002 and 2002-2003 IWC-SOWER circumpolar cruises, Area V, Antarctica. *J. Cetacean Res. Manage.* 7(1):13-20.

Blue whale vocalizations recorded during the 2001-02 and 2002-03 International Whaling Commission-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) circumpolar cruises are analysed to determine the feasibility of using acoustic recordings for sub-species identification of the true blue whale (*Balaenoptera musculus intermedia*) and the pygmy blue whale (*B. musculus breviceauda*). The research was conducted in IWC Area V, from latitude 60° S to the ice edge and between longitudes 130° E and 150° E on the Shonan Maru (2001-02) and between 150° E and 170° W on the Shonan Maru No.2 (2002-03). A subset of this data, including 15 groups comprising 42 animals as well as opportunistic recordings on an unknown number of animals during evening sonobuoy stations, was examined for this study. Vocalizations include long duration 27 Hz tonal calls and relatively short duration low-frequency frequency-modulated (FM) sounds. The FM sounds were similar to vocalizations recorded in the presence of blue whales in other locations worldwide. Not all recordings contained the 27 Hz calls, considered to be species-specific vocalizations of Antarctic true blue whales; none of the sounds attributed to pygmy blue whales were detected. The 27 Hz tonal sounds included 3-part calls, as well as simple 27 Hz tones and 27 Hz tones followed by a down sweep. The center and peak frequencies of the 27 Hz tone for these three call types were stable regardless of signal strength; however, for the 3-part call, the presence and characteristics of their 2nd and 3rd parts were variable. Temporal examination of two distinct groups of simultaneously vocalizing blue whales showed no evidence of repeated patterns of vocalizations (song units). The results of this study suggest that the peak frequency of the 27 Hz calls may be used as a diagnostic feature to aid in the discrimination between true blue whales and pygmy blue whales in the field; however, examination of vocalizations in relation to group size and behavior are necessary to understand the circumstances in which the 27 Hz calls are produced. KEYWORDS: ACOUSTICS; ANTARCTIC; BLUE WHALE; COMMUNICATION; DISTRIBUTION; MANAGEMENT PROCEDURE; POPULATION ASSESSMENT; SOWER; SURVEY-ACOUSTIC; VOCALISATION.

Felix, F. and Haase, B. 2005. Distribution of humpback whales along the coast of Ecuador and management implications. *J. Cetacean Res. Manage.* 7(1):21-9.

As part of a long-term population study of humpback whales breeding on the coast of Ecuador (2°S, 81°W), four sites on the central coast were surveyed: Puerto Cayo, Puerto López, La Plata Island and Salinas. The spatial, temporal and age class distributions of 322 groups positioned during the period of 1996-2003 were analysed regarding their distance from the shore and water depth with two statistical methods: one-way ANOVA and linear modelling. The average sighting distance from shore varied between 5.31km in Salinas and 10.16km in Puerto Cayo with mid values in Puerto López and La Plata Island. Average water depth was similar in Puerto López, La Plata Island and Salinas (36-39m) but lower in Puerto Cayo (19.43m). Differences were highly significant in both cases ($p < 0.01$). A progressive but not significant increase in the average distance from shore was found (6.2km in June to 7.17km in September). Sighting depth was constant between June and August (average 35-36m) but decreased significantly in September to 27m ($p < 0.01$). This difference was attributed to the presence of mother-calf pairs in shallower water by the end of the season. Age class analyses using ANOVA showed highly significant differences between groups of adults, and adults with subadults with respect to singleton subadults, and groups containing a mother-calf pair for both distance from shore and depth ($p < 0.01$); however, linear modelling analyses showed only depth was significant ($p = 0.026$). This suggests that depth is a more important determinant of differences in distribution between these age classes than proximity to shore. The sightings distribution showed segregation of both mother-calf pairs (towards shallow waters) and of singleton subadults (towards the boundaries of the surveyed area). Since only eight sightings (2.5%) were in waters deeper than 60m, we propose that depth is a major feature determining humpback whale distribution in these waters. Implications of this coastal distribution are discussed, particularly with respect to bycatch in fishing gear and whalewatching. A review of recent southeast Pacific sightings showed

that humpback whales are also abundant in coastal waters to the southwest of Ecuador (3°S) and confirmed that they are scarce offshore. However, whales are more widely distributed in the north of Peru (4°-6°S) where they make the transition between deeper oceanic and shallower coastal waters when arriving at and leaving the breeding area. KEYWORDD: BREEDING GROUNDS; CONSERVATION; DISTRIBUTION; HUMPBACK WHALE; MODELLING; SOUTH AMERICA; STATISTICS.

Koski, W.R., George, J.C., Sheffield, G. and Galginitis, M.S. 2005. Subsistence harvets of bowhead whales at Kaktovik, Alaska (1973-2000). *J. Cetacean Res. Manage.* 7(1):33-7.

Kaktovik is a small community located on Barter Island in the extreme northeast of Alaska, within the boundaries of the Arctic National Wildlife Refuge. The bowhead whale hunt is important to the community from an economic and cultural perspective. The bowhead hunt normally begins the first Monday in September and 83% of harvested whales have been taken in September. In recent years, whales have been taken earlier in the season than in earlier years. The core whaling area extends from the Hulahula River in the west to Tapkaurak Point in the east and offshore as far as 32 km (20 mi). Most whales have been taken within 30 km of the village and the mean distance of harvest locations from Kaktovik has not changed from the 1970s to present. Whaling captains select small whales over large whales and there has been a significant decrease in the average size of whales harvested from the 1970s to the present. The size of whales harvested does not increase with date although other data show that smaller whales become less common in the area as the season progresses. This confirms that whalers tend to select small whales. Male and female bowheads are harvested in very similar numbers, but females make up a significantly higher proportion of whales harvested early in the season and males make up a significantly higher proportion of whales harvested late in the season. KEYWORDS: ARCTIC; BEAUFORT SEA; BOWHEAD WHALE; MIGRATION; NORTH AMERICA; NORTHERN HEMISPHERE; SEX RATIO; WHALING-ABORIGINAL.

Cavatorta, D., Starczak, V., Prada, K. and Moore, M. 2005. A note on the friction of different ropes in right whale (*Eubalaena glacialis*) baleen: an entanglement model. *J. Cetacean Res. Manage.* 7(1):39-42.

Entanglement in fishing gear, particularly fixed trap, constitutes a significant source of North Atlantic right whale (*Eubalaena glacialis*) mortality. Entanglements may initiate with rope fouling baleen plates before snagging other appendages. Low friction between rope and baleen may minimise the risk of a sustained, progressive entanglement. The friction of eight different rope types against right whale baleen was examined by measuring the tension as each rope was pulled through two baleen plates held underwater. Polypropylene rope generated less friction with the baleen than all other fibres tested, including nylon, polyester, and commercial sinking line (a polypropylene/polyester blend). Thus, new commercial floating line (3-strand polypropylene) generates less friction than new commercial sinking line, both of which are commonly used in the fixed gear industry. Therefore, minimising rope friction should be one of the design parameters for whale-safe fixed fishing gear. Further study is required on the impact of rope aging, mouth closing and operator safety before recommendations can be made to industry. KEYWORDS: CONSERVATION; FISHERIES; INCIDENTAL CAPTURE; NORTH ATLANTIC RIGHT WHALE.

Clarke, J.T. and Norman, S.A. 2005. Results and evaluation of US navy shock trial environmental migration of marine mammals and sea turtles. *J. Cetacean Res. Manage.* 7(1):43-50.

A shock trial of a US Navy Destroyer, the USS Winston S. Churchill, was conducted offshore of northern Florida in May and June 2001. The shock trial consisted of three underwater detonation tests, spaced approximately one week apart. Environmental mitigation to minimise the impact of the shock trial on marine mammals and sea turtles was based on a Safety Range of 3.7km (2 n.miles) radius around the detonation site, and a Buffer Zone of an additional 1.85km (1 n.mile) radius beyond the Safety Range. Mitigation included site selection surveys, pre-detonation aerial, vessel and bio-acoustic monitoring, and post-detonation aerial and vessel monitoring. Six species of odontocete and two species of sea turtle were identified during mitigation monitoring, as well as several sightings that could not be identified by species. Site selection aerial surveys were implemented to select a test site with the lowest abundance of marine mammals and sea turtles. Nearly 300 animals were seen during site selection surveys. Pre-detonation aerial and vessel monitoring was implemented to sight any marine mammal and sea turtle within the Safety Range on designated test days, and track the animals until they could be verified to be outside the Safety Range. Approximately 1,200 marine mammals and 32 sea turtles were sighted during pre-detonation monitoring. Pre-detonation bio-acoustic monitoring was implemented to detect large cetaceans within the Safety Range and Buffer Zone; the only calls heard were from dolphins that could not be localised. Post-detonation monitoring was implemented to determine the effectiveness of mitigation procedures. No injured or dead marine mammals or turtles were detected during approximately 185 hours of post-detonation aerial and vessel visual monitoring. Post-detonation monitoring resulted in observations of 767 marine mammals and 42 sea turtles. With only two exceptions, the same marine mammal and sea turtle species were observed prior to, during and after the shock trial test time period. Factors leading to the success of this environmental mitigation effort are summarised, and recommendations for improvements to mitigation efforts of this size and scope are suggested. These recommendations include the use of a simultaneous second aircraft for improved coverage during pre-detonation surveys, increased post-detonation aerial monitoring, equitable survey data for all test sites under consideration during planning stages, and reassessment of bio-acoustic monitoring need and purpose. KEYWORDS: ACOUSTICS; ATLANTIC OCEAN; NOISE; ODONTOCETE; SURVEY-AERIAL; SEA TURTLE.

Gillespie, D., Berggren, P., Brown, S., Kuklik, I., Lacey, C., Lewis, T., Matthews, J., McLanaghan, R., Moscrop, A. and Tregenza, N. 2005. Relative abundance of harbour porpoises (*Phocoena phocoena*) from acoustic and visual surveys of the Baltic Sea and adjacent waters during 2001 and 2002. *J. Cetacean Res. Manage.* 7(1):51-7.

Boat-based acoustic and visual surveys for harbour porpoises (*Phocoena phocoena*) were conducted during the summers of 2001 and 2002 in order to investigate their distribution and relative abundance in the Baltic Sea, and to compare the results with the adjacent Kiel and Mecklenburg Bights and the Little Belt. Harbour porpoises are subject to year-round bycatch in gillnets and other fishing gear in these waters. This is of particular concern in the Baltic Sea where a survey carried out in 1995 indicated that the population is low and current levels of anthropogenic mortality are believed to be unsustainable. Polish coastal waters were not included in the 1995 survey and it has been hypothesised that these unsurveyed waters may contain a significant uncounted part of the Baltic Sea population. Results show that the porpoise detection rate was two orders of magnitude lower in the Baltic Sea than in other waters surveyed. No evidence was found that Polish waters contain a significant, previously uncounted part of the Baltic Sea population. The results confirm the endangered status of the Baltic Sea population, and stress the urgency of preventing future anthropogenic mortalities that threaten the survival of the population. KEYWORDS: ACOUSTICS; BALTIC SEA; CONSERVATION; EUROPE; HARBOUR PORPOISE; INDEX OF ABUNDANCE; SURVEY-ACOUSTIC.

Dawson, S.M. and Slooten, E. 2005. Management of gillnet bycatch of cetaceans in New Zealand. *J. Cetacean Res. Manage.* 7(1):59-64.

Bycatch of dolphins in inshore gillnets first attracted scientific and management attention in New Zealand in the 1980s. During 1984-88, 50-150 dusky dolphins were killed each year at Kaikoura in gillnets set at the surface to catch bait for rock lobster. At the same time, annual catches of 20-100 Hector's dolphins occurred in Canterbury waters in bottom-set commercial and recreational gillnets. These catches resulted in the banning of surface-set gillnetting at Kaikoura in 1989 and in the creation of the Banks Peninsula Marine Mammal Sanctuary in 1988 to protect Hector's dolphin. An additional gillnet closure was established to protect North Island Hector's dolphin in 2003. A key problem is that current information on catches in these and other areas is scant. One observer programme has been successfully implemented in a commercial gillnet fishery (Canterbury area, 1997/98 fishing season). Its estimate of Hector's dolphin bycatch (17) is clearly unsustainable by the local population. Pingers have been voluntarily used in these fisheries, but there are no data establishing their effectiveness, and it has not been possible to ensure consistency of pinger use. There are no reliable estimates of numbers taken in recreational fisheries. Area closures are used to mitigate gillnet bycatch of Hector's dolphin, however it appears that the Banks Peninsula Marine Mammal Sanctuary is not large enough to ensure the persistence of the Canterbury population. There is a bycatch limit in place for this population, although it is unenforced. We argue that management of this species via bycatch limits is not practical, however. Hector's dolphin's low abundance and separation into several distinct populations means that appropriate bycatch limits would be very small, and this necessitates very comprehensive observer coverage to be confident they are not exceeded. We propose that increasing the size of protected areas is the most reliable option for conservation. KEYWORDS: CONSERVATION; FISHERIES; GILLNETS; INCIDENTAL CATCHES; REGULATIONS; SANCTUARIES; STATISTICS; SUSTAINABILITY; TRAWLS.

Paolo Sanino, G., Van Waerebeek, K., Van Bresseem, M.-F. and Pastene, L.A. 2005. A preliminary note on population structure in eastern South Pacific common bottlenose dolphins, *Tursiops truncatus*. *J. Cetacean Res. Manage.* 7(1):65-70.

Previous studies of eastern South Pacific common bottlenose dolphins, *Tursiops truncatus*, defined offshore and inshore ecotypes in Peru based on cranial and tooth morphology, documented the presence of a single resident inshore community ('pod-R') in central-north Chile, and confirmed the presence of offshore bottlenose dolphins off Chile. Here, mtDNA control region (331bp) was examined to evaluate genetic relationships between four geographic areas: inshore pod-R (n=8), Chilean offshore population (n=8), Peruvian inshore (n=3) and offshore (n=12) ecotypes. This is the first genetic analysis of *T. truncatus* in this ocean basin. Phylogenetic analysis grouped the three Peruvian specimens morphologically identified as inshore ecotype in an independent cluster, supported by 100% bootstrap value. The net genetic distance between Peruvian inshore and Peruvian offshore ecotypes was estimated at 2.9%, and even higher when compared with Chilean bottlenose dolphins. Morphological and mtDNA evidence combined argues for considering inshore and offshore ecotypes as evolutionary significant units, to be managed accordingly. Despite its inshore behavioural ecology, pod-R presented a high divergence from the Peruvian inshore ecotype and a relatively closer affinity with the Chilean offshore stock (3.41% and 0.87% net inter-population distance, respectively). However, homogeneity tests showed significant genetic differences of pod-R with all other groups, including Chilean offshore. This, combined with a low nucleotide diversity (0.0069) and behavioural observations, suggest that pod-R may be reproductively isolated and active protection measures are recommended. Only one haplotype from a total of 21 was shared by Peruvian and Chilean offshore animals. Their net genetic distance was estimated at 0.024 and no significant differences were found in haplotype frequencies, suggesting a single, wide-ranging 'Peru-Chile offshore stock'. KEYWORDS: COMMON BOTTLENOSE DOLPHIN; CONSERVATION; GENETICS; MANAGEMENT; PACIFIC OCEAN; SOUTH AMERICA; STOCK IDENTITY; TAXONOMY.

Matsuoka, K., Pitman, R.L. and Marquez, F.C. 2005. A note on a pygmy right whale (*Caperea marginata*) sighting in the southwestern Pacific Ocean. *J. Cetacean Res. Manage.* 7(1):71-3.

There are no previously published sightings of pygmy right whales (*Caperea marginata*) from the southwest Pacific Ocean. This note reports a sighting of 14 pygmy right whales approximately 445km southeast of Christchurch, New Zealand, at 17:30 on 5 January 2001 (46°26'S, 177°18'E). No cow-calf pairs were observed. Although feeding was not directly observed, several animals defecated during the observation period. The faeces were bright red and formed into small red clumps that bobbed at the water's surface which implies that the whales had recently been feeding in the immediate area. It appears that pygmy right whales may aggregate at the Sub-tropical Convergence during the austral summer and that this area may represent an important feeding ground. KEYWORDS: DISTRIBUTION; FEEDING GROUNDS; PACIFIC OCEAN; PYGMY RIGHT WHALE; SOUTHERN HEMISPHERE; SURVEY-VESSEL.

Bearzi, M. 2005. Aspects of the ecology and behaviour of bottlenose dolphins (*Tursiops truncatus*) in Santa Monica Bay, California. *J. Cetacean Res. Manage.* 7(1): 75-83.

The occurrence, distribution, site fidelity, group size and behaviour of common bottlenose dolphins (*Tursiops truncatus*) were assessed during a photo-identification study conducted between 1997-2001 in Santa Monica Bay, California. Bottlenose dolphins occurred year-round in the bay and were encountered on 56.8% of all surveys (n , total surveys=211). This species was found in waters within 0.5km of shore in 80.0% of the sightings (n =157), but sometimes found in deeper waters further offshore (>0.5km). No correlations between anomalies in sea surface temperatures during the 1997-98 El Niño event and sighting frequencies were observed. Group sizes varied significantly between schools observed inshore and offshore in the bay, with the largest groups sighted offshore. A total of 290 dolphins were individually photo-identified based on long-term natural marks on their dorsal fins. Forty-four individuals (15.2%) were encountered in both inshore and offshore waters, showing no exclusive fidelity to inshore waters. The low resighting rates of known individuals provided little evidence of long-term year-round site fidelity for Santa Monica Bay, revealing a range greater than the chosen study area. Several individuals, however, were resighted over one or two year periods, generally during more than one season. This suggested that these dolphins were highly mobile within the inshore waters of the Southern California Bight but they also spent time foraging and feeding in Santa Monica Bay, probably due to the presence of submarine canyons within this area. The behavioural budget for this species showed a predominance of activities characterised by travel and dive-travel (69.0%) and feeding (5.0%), indicating a fairly high proportion of time devoted to searching for prey and feeding in the study area. KEYWORDS: SURVEY – VESSEL; SOCIAL; BEHAVIOUR; FEEDING; HABITAT; SCHOOL SIZE; DISTRIBUTION; MOVEMENTS; PHOTO-ID; EL NINO; CONSERVATION.

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Dereksdottir, E.H. and Magnusson, K.G. 2005. Application of a *Strike Limit Algorithm* based on adaptive Kalman filtering to the eastern North Pacific stock of gray whales. *J. Cetacean Res. Manage.* 7(2): 85-96

The application of a *Strike Limit Algorithm* (SLA) based on Adaptive Kalman Filtering techniques to the eastern North Pacific (ENP) stock of gray whales is described. This SLA is a modification of an earlier one which was designed for the Bering-Chukchi-Beaufort Seas stock of bowhead whales. Extended Kalman filters are used to estimate the present stock size and posterior probability distributions for Maximum Sustainable Yield (MSY) and MSY-rate (MSYR). A catch control law selected from a one-parameter family of such rules is then used on the conditional estimates of stock size. These conditional strike limits together with the posterior distributions of the various combinations of MSYR and MSY, give a cumulative distribution function for the strike limit. The eventual strike limit is then determined as a pre-specified percentile of this distribution. The SLA can be tuned to varying degrees of risk by the choice of internal model parameters – so-called tuning parameters. The procedure is tested based on a set of trials specified by the IWC Scientific Committee Standing Working Group on Aboriginal Whaling Management Procedures, designed to test the performance of potential SLAs for the ENP gray whale stock. KEYWORDS: WHALING-ABORIGINAL; MANAGEMENT; GRAY WHALES; MODELLING; MSY RATE

Hiroshi, O., Kitakado, T. and Mori, M. 2005. An improved method for line transect sampling in Antarctic minke whale surveys. *J. Cetacean Res. Manage.* 7(2): 97-106

The series of abundance estimates for Antarctic minke whales obtained using standard line transect methods from IWC/SOWER surveys imply drastic (and probably unrealistic) changes in true abundance. One possible factor is that the detection probability on the trackline, $g(0)$, may have decreased with the introduction of inexperienced observers in the most recent surveys. Additionally, mean observed school size may have decreased in the third circumpolar survey in comparison with the second survey. This paper introduces an extended and generalised hazard probability model without the assumption that $g(0)=1$ to estimate true school size distribution in the population. The proposed method uses a survey design that combines the use of both passing mode with independent observers and closing mode in which the vessel turns off the trackline and closes with the sighting for confirmation of school size and species. The abundance estimate is based on the Horvitz-Thompson estimator in an unequal detectability sampling scheme. The method is applied to the IDCR/SOWER dataset of Antarctic minke whales for illustrative purposes. KEYWORDS: ANTARCTIC MINKE WHALE; ABUNDANCE ESTIMATE; $g(0)$; SCHOOL SIZE; SURVEY-VESSEL; SOWER; MODELLING

Leduc, R.G., Dizon, A.E., Burdin, A.M., Blokhin, S.A., George, J.C., and Brownell, R.L., Jr. 2005. Genetic analyses (mtDNA and microsatellites) of Okhotsk and Bering/Chukchi/Beaufort Seas populations of bowhead whales. *J. Cetacean Res. Manage.* 7(2): 107-112

Both North Pacific populations of bowhead whales (*Balaena mysticetus*) underwent heavy exploitation by commercial whalers in the 19th century, but their reduction in numbers was unequal and their contemporary population sizes differ by an order of magnitude. To investigate the genetic divergence of the different populations, tissue samples of bowhead whales representing the Okhotsk Sea (OS) population (25 samples) and the Bering/Chukchi/Beaufort Seas (BCBS) population (29 samples) were used to generate mtDNA control region sequences and genotypes for three microsatellite loci. There were 20 haplotypes represented in the contemporary BCBS samples and four in the OS samples, three of which were shared with the BCBS samples. The BCBS samples had a much greater haplotypic diversity (0.93) than the OS samples (0.61). Analyses of both types of data revealed significant genetic differences between the two populations, indicating that the populations represent discrete gene pools. KEYWORDS: BOWHEAD WHALE; GENETICS; CONSERVATION; OKHOTSK SEA; BERING SEA; CHUKCHI SEA; BEAUFORT SEA

Skaug, H.J. and Øien, N. 2005. Genetic tagging of male North Atlantic minke whales through comparison of maternal and foetal DNA-profiles. *J. Cetacean Res. Manage.* 7(2): 113-118

DNA-profiles from 288 mother-foetus pairs were used to obtain partial DNA-profiles for the fathers of the foetuses. The paternal profiles were subsequently matched against those of the males on the Norwegian DNA-register for minke whales using statistical analyses. Three likely instances of paternity were identified. An estimate of the number of reproductively active males in the population was calculated and found to be consistent with previous abundance estimates. However, the associated confidence interval was very broad since it was based on few 'recaptures'. Finally the scope and potential use of such genetic and population data is discussed. KEYWORDS: ATLANTIC OCEAN; GENETICS; MARK-RECAPTURE; MOVEMENTS; REPRODUCTION; EUROPE; DNA FINGERPRINTING; COMMON MINKE WHALE

Anderson, R. 2005. Observations of cetaceans in the Maldives, 1990-2002. *J. Cetacean Res. Manage.* 7(2): 119-136

Cetaceans observed in Maldivian waters were recorded during the period August 1990 to June 2002, from both vessels-of-opportunity and dedicated cetacean-watching cruises. A total of 1,829 cetacean sightings were recorded during 535 days at sea (equivalent to 261 standardised days). There were 83 multispecies sightings, plus a further 58 sightings without associated effort data and 129 strandings were recorded by the author and others, making a total of 2,108 cetacean records. In all, 20 different species were positively identified from sightings. Spinner dolphins were the most abundant species seen, accounting for 35% of sightings and 53% of numbers. This species showed a clear diurnal pattern of behaviour, with many schools entering the atolls in the early morning, and leaving in the late afternoon. Spinner dolphins regularly occurred with pantropical spotted dolphins and both species associated with yellowfin tuna. Bryde's whales also associated with yellowfin tuna and appeared to be most common in Maldivian waters during El Niño Southern Oscillation events. Blue whales were only recorded during November to April. Dwarf sperm whales were especially difficult to locate in rough weather but relatively common, making up one sixth of all sightings in flat-calm conditions. Melon-headed whales were particularly common in the south of the Maldives, but rare in the centre and north. Other species recorded were humpback whale, sperm whale, rough-toothed dolphin, Risso's dolphin, bottlenose dolphin, striped dolphin, Fraser's dolphin, pygmy killer whale, false killer whale, killer whale, short-finned pilot whale, Blainville's beaked whale, Longman's beaked whale and Cuvier's beaked whale. KEYWORDS: INDIAN OCEAN; SANCTUARIES; INCIDENTAL SIGHTINGS; SCHOOL SIZE; MIGRATION; EL NIÑO; BRYDE'S WHALE; BLUE WHALE; DWARF SPERM WHALE; PANTROPICAL SPOTTED DOLPHIN; SPINNER DOLPHIN; MELONHEADED WHALE

Panigada, S., Notarbartolo Di Sciara, G., Zanardelli Panigada, M., Airoidi, S., Borsani, J. F. and Jahoda, M. 2005. Fin whales (*Balaenoptera physalus*) summering in the Ligurian Sea: distribution, encounter rate, mean group size and relation to physiographic variables. *J. Cetacean Res. Manage.* 7(2): 137-146

This paper investigates the distribution of Mediterranean fin whales (*Balaenoptera physalus*) between 1990-99 in the recently-established Pelagos Sanctuary for the Conservation of Mediterranean Marine Mammals. During the study period, 870 days were spent at sea, surveying a total of 73,046km, totalling 540 sightings of fin whales. Mean yearly whale encounter rates showed no significant differences in the first five years, but then steadily decreased between 1995-99. The highest encounter rates and largest mean aggregation size (mean=2.12; SD=1.32; SE=1.15) were in summer 1995 and the mean aggregation size throughout the study period was 1.75 (mode=1; SD=1.11; SE=0.05). Differences in mean aggregation size were significant between years, but not months. This is likely to be related to prey availability and to patchiness of plankton distribution. Generalised Linear Models were used to relate fin whale distribution to physiographic variables (mean, range and standard deviation of depth and slope, and distance from the nearest coast). Water depth was the most significant variable in describing fin whale distribution, with more than 90% of sightings occurring in waters deeper than 2,000m. This study demonstrates the deep water preference of fin whales in this area, emphasises the crucial role that this part of the western Ligurian Sea plays in the ecology of Mediterranean fin whales and provides recommendations for conservation and management measures in the area. KEYWORDS: FIN WHALE; DISTRIBUTION; HABITAT; INDEX OF ABUNDANCE; CONSERVATION; EUROPE; MEDITERRANEAN SEA

Tornero, V., Borrell, A., Pubill, E., Koopman, H., Read, R., Reijnders, P.J.H. and Aguilar, A. 2005. Post-mortem stability of blubber retinoids in by-caught harbour porpoises (*Phocoena phocoena*): implications for the design of biomarker studies. *J. Cetacean Res. Manage.* 7(2): 147-152

The effect of post-mortem time (0-48 hours) on retinoid concentrations in the blubber and liver of harbour porpoises under natural conditions is investigated to assess the stability of samples collected from animals after death. Organochlorine compounds and lipid content were also determined to assess their potential effects on retinoid status. Organochlorine concentrations remained low throughout the postmortem period and were considered unlikely to influence retinoid body dynamics. Retinoid concentrations in liver were 5-6 times higher than those in blubber and both were highly correlated. In contrast with liver, blubber can be easily sampled from live individuals using nondestructive biopsy techniques and is therefore considered an alternative tissue to assess retinoid status in marine mammals. Neither significant differences nor trends were detected in the concentration of retinoids over the studied period, indicating that degradation agents (ultraviolet rays, oxygen exposure and heat) did not affect them. Blubber can thus be regarded as a reliable tissue for the assessment of the retinoid status of unpreserved specimens kept up to 48 hours in conditions similar to those of this study. KEYWORDS: HARBOUR PORPOISE; ORGANOCHLORINES; INCIDENTAL CATCHES; BIOMARKERS; POLLUTANTS; BIOCHEMISTRY

Torres, L.G., Mclellan, W.A., Meagher, M. and Pabst, D.A. 2005. Seasonal distribution and relative abundance of bottlenose dolphins, *Tursiops truncatus*, along the US mid-Atlantic Coast. *J. Cetacean Res. Manage.* 7(2): 153-162

In the US mid-Atlantic, multi-disciplinary studies are underway to elucidate the complex stock structure of coastal bottlenose dolphins (*Tursiops truncatus*), as well as the degree of overlap between coastal and offshore ecotypes. In this study we use geo-referenced data, collected during aerial surveys in 2000-2002, to describe the distribution and relative abundance of bottlenose dolphins along the US mid-Atlantic coast. Two aerial survey designs were used: (1) onshore/offshore surveys out to 35 n.miles during winter from Georgia to Virginia; and (2) coastal surveys throughout the year along North Carolina (NC). The winter onshore/offshore surveys demonstrated that significantly more bottlenose dolphins occur in Raleigh Bay (between Cape Hatteras and Cape Lookout, NC), than in all other regions. Additionally, in winter most bottlenose dolphins occur in the coastal waters of NC; nearly half of all sightings occurred between the shoreline and 3km from shore. The year-round, coastal surveys demonstrated that this winter distribution pattern is the result of a distinct seasonal increase in the number of dolphins within the coastal waters of NC. Circular statistical analyses demonstrated a strong influence of season on dolphin abundance. Relatively few bottlenose dolphins were observed in late spring, summer, and early autumn, with increased numbers observed during winter. In all seasons but summer, dolphin numbers were highest in Raleigh Bay. Thus, the results of both surveys indicate the importance of the habitat surrounding Cape Hatteras to bottlenose dolphins. Dolphins may preferentially use these waters in response to changes in prey distribution and/or abiotic factors such as water temperature. These results reveal an overall seasonal movement pattern along the US Atlantic coast, which appears to be correlated, at least in part, to water temperature gradients and prey availability. Although the stock identity of dolphins sighted during these aerial surveys could not be ascertained, focused photo-identification efforts, together with enhanced genetic sampling, would provide insights into the movement patterns, and, thus, stock identity, of dolphins in this region. KEYWORDS: BOTTLENOSE DOLPHIN; MANAGEMENT PROCEDURE; CONSERVATION; SURVEY-AERIAL; DISTRIBUTION; MOVEMENTS; ATLANTIC OCEAN; SITE FIDELITY; FOOD/PREY

Alava, J.J., Barragán, M.J., Castro, C. and Carvajal, R. 2005. A note on strandings and entanglements of humpback whales (*Megaptera novaeangliae*) in Ecuador. *J. Cetacean Res. Manage.* 7(2): 163-168

Between June and September of each year, southeastern Pacific humpback whales, *Megaptera novaeangliae*, arrive on the Ecuadorian coast to reproduce. Between July 2001 and September 2002, seven new strandings of humpback whales were found at different places along the Ecuadorian coast. Three of them were related to incidental catches caused by fishing nets (gillnets) and one of them occurred outside of the humpback whales' reproductive season. Using non-proportional and proportional 95% confidence interval calculations, it is estimated that the average frequency of strandings of humpback whales is 1.55 individuals per year (95% CI: 0.27,2.83; range: 1-4) since 1994, principally in the central and southern parts of the Ecuadorian coast, and the proportion of strandings due to bycatch is estimated at 0.286 (95% CI: 0.105,0.533). A preliminary mortality rate of 0.035(95% CI: 0.019,0.055), including both unknown and anthropogenic causes is estimated for this stock. 50% of the strandings took place in August and most were registered in 2001 ($n=4$). Six humpback whales with fishing nets embedded in their pectoral fins and tails were also observed in the marine area of the Machalilla National Park and the island of La Plata July-September. 67% of these entanglements occurred in July, and in one case a mother, accompanied by her calf, was observed with cables and a net on her head. These incidental catches are possibly related to the strandings occurring at the same time along the Ecuadorian shoreline. The fishery device most frequently linked to bycatch is the surface gillnet. Technological changes in fishing gear are vital for the conservation of marine mammals. It is imperative that the Ecuadorian coast be divided into zones and certain areas be delimited for the conservation of humpback whales through agreements with local users of the marine areas. KEYWORDS: HUMPBACK WHALE; STRANDINGS; INCIDENTAL CATCHES; GILLNETS; MONITORING; SOUTHERN HEMISPHERE; PACIFIC OCEAN; SOUTH AMERICA; MORTALITY RATE; FISHERIES

Zeh, J.E. and Punt, A.E. 2005. Updated 1978-2001 abundance estimates and their correlations for the Bering-Chukchi-Beaufort Seas stock of bowhead whales. *J. Cetacean Res. Manage.* 7(2): 169-175

The method of Cooke (1996) and Punt and Butterworth (1999) for computing abundance estimates for bowhead whales of the Bering-Chukchi-Beaufort Seas stock is reviewed. These abundance estimates are computed from estimates N_4 of the number of whales that passed within the 4km visual range of the observation 'perch' from which the whales are counted, the estimated proportions P_4 of the whales that passed within this range and the estimated standard errors (SE) of N_4 and P_4 . Errors discovered while assembling the data used in developing previous estimates were corrected, and new estimated detection probabilities, N_4 and P_4 values and SEs were computed using the corrected data. The method of Cooke (1996) and Punt and Butterworth (1999) was then applied. The resulting 2001 abundance estimate was 10,545 (95% confidence interval 8,200 to 13,500), extremely close to the 2001 N_4/P_4 abundance estimate of 10,470 (95% confidence interval 8,100 to 13,500) (George *et al.*, 2004). The estimated rate of increase of this population from 1978 to 2001 was 3.4% per year (95% confidence interval 1.7% to 5%). KEYWORDS: BOWHEAD WHALE; ABUNDANCE ESTIMATE; SURVEY-SHORE-BASED; ACOUSTICS; SURVEY-AERIAL; TRENDS

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Cox, T.M., Ragen, T.J., Read, A.J., Vos, E., Baird, R.W., Balcomb, K., Barlow, J., Caldwell, J., Cranford, T., Crum, L., D'Amico, A., D'Spain G., Fernández, A., Finneran, J., Gentry, R., Gerth, W., Gulland, F.,

Hildebrand, J., Houserp, D., Hullar, T., Jepson, P.D., Ketten, D., Macleod, C.D., Miller, P., Moore, S., Mountain, D.C., Palka, D., Ponganis, P., Rommel, S., Rowles, T., Taylor, B., Tyack, P., Wartzok, D., Gisiner, R., Meads, J. and Benner, L. 2005/06. Understanding the impacts of anthropogenic sound on beaked whales. *J. Cetacean Res. Manage.* 7(3): 177-187

This paper is dedicated to the memory of Dr. Edward Thalmann (1945-2004). This review considers the effect of anthropogenic sound on beaked whales. Two major conclusions are presented: (1) gas-bubble disease, induced in supersaturated tissue by a behavioural response to acoustic exposure, is a plausible pathologic mechanism for the morbidity and mortality seen in cetaceans associated with sonar exposure and merits further investigation; and (2) current monitoring and mitigation methods for beaked whales are ineffective for detecting these animals and protecting them from adverse sound exposure. In addition, four major research priorities, needed to address information gaps on the impacts of sound on beaked whales, are identified: (1) controlled exposure experiments to assess beaked whale responses to known sound stimuli; (2) investigation of physiology, anatomy, pathobiology and behaviour of beaked whales; (3) assessment of baseline diving behaviour and physiology of beaked whales; and (4) a retrospective review of beaked whale strandings. KEYWORDS: BEAKED WHALES; ZIPHIIDAE; NOISE; MANAGEMENT; ACOUSTICS; CONSERVATION; STRANDINGS

Rommel, S.A., Costidis, A.M., Fernández, A., Jepson, P.D., Pabst, D.A., Mclellan, W.A., Houser, D.S., Cranford, T.W., Van Helden, A.L., Allen, D.M. and Barros, N.B. 2005/06. Elements of beaked whale anatomy and diving physiology and some hypothetical causes of sonar-related stranding. *J. Cetacean Res. Manage.* 7(3): 189-209

A number of mass strandings of beaked whales have in recent decades been temporally and spatially coincident with military activities involving the use of midrange sonar. The social behaviour of beaked whales is poorly known, it can be inferred from strandings and some evidence of at-sea sightings. It is believed that some beaked whale species have social organisation at some scale; however most strandings are of individuals, suggesting that they spend at least some part of their life alone. Thus, the occurrence of unusual mass strandings of beaked whales is of particular importance. In contrast to some earlier reports, the most deleterious effect that sonar may have on beaked whales may not be trauma to the auditory system as a direct result of ensonification. Evidence now suggests that the most serious effect is the evolution of gas bubbles in tissues, driven by behaviourally altered dive profiles (e.g. extended surface intervals) or directly from ensonification. It has been predicted that the tissues of beaked whales are supersaturated with nitrogen gas on ascent due to the characteristics of their deep-diving behaviour. The lesions observed in beaked whales that mass stranded in the Canary Islands in 2002 are consistent with, but not diagnostic of, decompression sickness. These lesions included gas and fat emboli and diffuse multiorgan haemorrhage. This review describes what is known about beaked whale anatomy and physiology and discusses mechanisms that may have led to beaked whale mass strandings that were induced by anthropogenic sonar. Beaked whale morphology is illustrated using Cuvier's beaked whale as the subject of the review. As so little is known about the anatomy and physiology of beaked whales, the morphologies of a relatively well-studied delphinid, the bottlenose dolphin and a well-studied terrestrial mammal, the domestic dog are heavily drawn on. KEYWORDS: BEAKED WHALES; STRANDINGS; BOTTLENOSE DOLPHIN; ACOUSTICS; DIVING; RESPIRATION; NOISE; METABOLISM

MacLeod, C.D. and D'Amico, A. 2005/06. A review of beaked whale behaviour and ecology in relation to assessing and mitigating impacts of anthropogenic noise. *J. Cetacean Res. Manage.* 7(3): 211-221

Little is known about the ecology and behaviour of species within the family Ziphiidae. In this paper, five aspects of beaked whale ecology and behaviour are reviewed in relation to possible anthropogenic impacts upon them: social structure; life history; foraging/diving ecology; form and function of beaked whale sounds; and habitat characteristics. Differences in social structure within and between species may affect how anthropogenic activities affect local populations. Life history parameters may likewise vary within and between species and may influence the extent of and ability to recovery from population level impacts. Foraging and diving ecology determine where beaked whales spend most of their time and therefore, where in the water column they are most likely to encounter anthropogenic activities. The form and function of beaked whale sounds may be important in determining whether and how beaked whales are affected by anthropogenic noise. Finally, habitat characteristics determine whether beaked whales are likely to occur in a specific area where anthropogenic activities are to be undertaken and may also determine exactly how beaked whales are affected by it within a local area. To help fill the gaps in our knowledge of beaked whale behaviour and ecology, available opportunities for data collection must be maximised. This includes greater levels of co-operation between research groups to build up large datasets, the use of platforms of opportunity to study beaked whales in areas where little research has previously been undertaken and maximising the amount of information that can be learned from each possible source of data, such as stranded animals, through co-ordinated national and international research programmes. KEYWORDS: BEAKED WHALES; NOISE; SOCIAL; REPRODUCTION; FEEDING; ECHOLOCATION; DISTRIBUTION; DIVING; COMMUNICATION; HEARING; HABITAT

D'Spain, G.L., D'Amico, A. and Fromm, D.A. 2005/06. Properties of the underwater sound fields during some well documented beaked whale mass stranding events. *J. Cetacean Res. Manage.* 7(3): 223-238

Recent mass strandings of marine mammals, mostly Cuvier's beaked whales (*Ziphius cavirostris*) from the family of ziphiidae, have occurred coincident in space and time with human production of high levels of underwater sound. Three of

these events, the May 1996 mass stranding along the Greek coast, the Bahamas mass stranding event in March 2000 and the September 2002 event in the Canary Islands, were selected for consideration here since pertinent information was readily available. The purpose of this paper is to summarise the probable characteristics of the sound fields during these events and to search for common features. The acoustic sources in all three cases moved at speeds of 5 knots or greater and generated periodic sequences of high amplitude, transient pulses 15-60s apart that contained significant energy in the 1-10kHz frequency band. The environmental conditions included water depths exceeding 1km close to land. In addition, the depth dependence of the ocean sound speed created an acoustic waveguide whose lower boundary was formed by refraction within the water column. The anthropogenic sources in all cases were located within such waveguides. Under these conditions, sound levels decrease more slowly with increasing range after a certain transition range than otherwise, due to sound focusing and to decreased attenuation because of isolation over extended ranges from the ocean bottom. In addition, the frequency dispersion is such that pulses tend to remain as pulses during propagation. For those events involving near-surface sources in surface ducts, weather conditions were calm leading to minimal sound attenuation and scattering by near-surface bubbles and ocean surface roughness. Quantitative prediction of the actual sound field properties during these events is limited primarily by the lack of knowledge of prevailing environmental conditions. Results from simple numerical modelling show that received sound level increases of up to 20dB occur after the transition range for sources and receivers within refractive waveguides. Data-based semi-empirical models of surface duct propagation provide simple, realistic, quantitative estimates of the mean acoustic field in the duct and the effects of changes in environmental conditions. Numerical modelling of total sound exposure (pressure squared integrated with respect to time) illustrates the importance of the relative velocity and minimum range between source and receiver, indicating that realistic animal motion models are required to obtain representative results. Although several features of the sound fields during these three mass stranding events are very similar, their actual relationship to the strandings is unknown. KEYWORDS: NOISE; STRANDINGS; MODELLING; ACOUSTICS; BEAKED WHALES

Barlow, J. and Gisiner, R. 2005/06. Mitigating, monitoring and assessing the effects of anthropogenic sound on beaked whales. *J. Cetacean Res. Manage.* 7(3): 239-249

Certain anthropogenic sounds are widely believed to cause strandings of beaked whales, but their impacts on beaked whale populations are not known and methods for mitigating their effects are largely untested. The sound sources that have been coincident with beaked whale strandings are military, mid-frequency sonar (2-10kHz) and airgun arrays, both of which are used widely throughout the world for defence and geophysical exploration, respectively and for which alternative technologies are not readily available. Avoidance of beaked whale habitats is superficially a straightforward means of reducing the potential effects, but beaked whales are widely distributed and can be found in virtually all deep-water marine habitats that are free of ice. Some areas of high beaked whale abundance have been identified, but the geographic distribution is poorly known for most species. Beaked whales are both visually and acoustically difficult to detect. Commonly used mitigation measures (e.g. 'ramp-up' and 'detection-modification-avoidance') have not been assessed for their effectiveness. Surveys to detect population-level impacts would likely require many years of regular monitoring and for most areas where beaked whale strandings have occurred, there are no pre-exposure estimates of population sizes. Risk assessment models can be used to estimate the sound levels to which beaked whales might be exposed under a variety of scenarios, however, the lack of information on the causal mechanism for sound-related beaked whale strandings makes it difficult to identify exposure levels that would warrant mitigative actions. Controlled exposure experiments which measure the behavioural responses of animals to fully characterised sound sources, may hold the greatest potential for understanding the behavioural responses of beaked whales to sound and for designing mitigation methods to avoid future impacts. KEYWORDS: MONITORING; POPULATION ASSESSMENT; BEAKED WHALE; ACOUSTICS; NOISE; STRANDINGS; SURVEY-AERIAL; SURVEY-ACOUSTIC; SURVEY-VESSEL

Podesta, M., D'Amico, A., Pavan, G., Drougas, A., Komnenou, A. and Portunato, N. 2005/06. A review of Cuvier's beaked whale strandings in the Mediterranean Sea. *J. Cetacean Res. Manage.* 7(3): 251-261

Cuvier's beaked whale (*Ziphius cavirostris*) is the only species of beaked whale commonly found in the Mediterranean Sea, a deep, semi-enclosed basin. Beaked whales are generally an offshore family often found in association with the canyons and steep escarpments common to the area. Much of the current knowledge of this species has been derived from strandings data. Historically, strandings data for the Mediterranean Sea has been collected by individual researchers and more recently, over the last two decades, by national strandings networks. We reviewed strandings data collected by strandings networks from Italy, Greece, Spain and France. Additionally, we compiled strandings information gleaned from the literature, personal communications, regional newspapers and the world wide web from countries that border the Mediterranean Sea. While this review is certainly not exhaustive, it has allowed the creation of an extensive geo-referenced basin wide database using a geographic information system (GIS) of over 300 stranding events. The acquired data permit documentation of the number of mass stranding events, allow general observations about distribution and chronology of stranding events dating back to 1803 and enables evaluation of strandings based on several different criteria. The first recorded mass stranding event was in 1963 off Genova, Italy. Analysis shows that specific geographic stranding areas can be identified, even though the level of effort undertaken in the different countries may vary. KEYWORDS: CUVIER'S BEAKED WHALE; STRANDINGS; EUROPE; MEDITERRANEAN SEA; DISTRIBUTION

Barlow, J., Ferguson, M.C., Perrin, W.F., Ballance, L., Gerrodette, T., Joyce, G., Macleod, C.D., Mullin, K., Palka, D.L. and Waring, G. 2005/06. Abundance and densities of beaked and bottlenose whales (family Ziphiidae). *J. Cetacean Res. Manage.* 7(3): 263-270

Estimating the abundance and density of beaked whales is more difficult than for most other cetacean species. Consequently few estimates appear in the published literature. Field identification is problematic, especially for the smaller species, and visual detection rates decrease dramatically with Beaufort sea state; prior experience is very important to an observer's ability to detect beaked whales. Passive acoustics may hold future promise for detecting beaked whales from their vocalisations, especially for the larger species. Most published estimates of abundance or density are based on visual line-transect studies that found narrower effective strip widths and lower trackline detection probabilities for beaked whales than for most other cetaceans. Published density estimates range from 0.4-44 whales per 1,000km² for small beaked whales and up to 68 whales per 1,000km² for large beaked whales. Mark-recapture methods based on photo-identification have been used to estimate abundance in a few cases in limited geographical areas. Focused research is needed to improve beaked whale abundance and density estimates worldwide. KEYWORDS: ABUNDANCE ESTIMATE; $g(0)$; MARK-RECAPTURE; SURVEY-VESSEL; SURVEY-AERIAL; SURVEY-ACOUSTIC; BEAKED WHALE; MODELLING; DISTRIBUTION; ACOUSTICS; PHOTO-ID

MacLeod, C.D., Perrin, W.F., Pitman, R., Barlow, J., Balance, L., D'Amico, A., Gerrodette, T., Joyce, G., Mullin, K.D., Palka, D.L. and Waring, G.T. 2005/06. Known and inferred distributions of beaked whale species (Cetacea: Ziphiidae). *J. Cetacean Res. Manage.* 7(3): 271-286

Information regarding beaked whales is so sparse that even the most basic aspects of their biology, such as their distribution, remain poorly defined for some species. We have reviewed the known distribution of each beaked whale species and where possible, used this information to infer its global distribution. While for some species, such as the relatively commonly recorded Cuvier's beaked whale, the inferred distribution is likely to be an accurate reflection of the species' actual distribution, for other lesser known species, such as the spade-toothed whale, the inferred distribution is more tentative. However, even such limited distribution information is essential when assessing and mitigating potential anthropogenic impacts on beaked whales and serves to highlight gaps in our knowledge that need to be filled if assessment and mitigation are to be successfully conducted. KEYWORDS: DISTRIBUTION; NORTHERN HEMISPHERE; SOUTHERN HEMISPHERE; CONSERVATION

Ferguson, M.C., Barlow, J., B. Reilly, S.B and Gerrodette, T. 2005/06. Predicting Cuvier's (*Ziphius cavirostris*) and *Mesoplodon* beaked whale population density from habitat characteristics in the Eastern Tropical Pacific Ocean. *J. Cetacean Res. Manage.* 7(3): 287-299

Temporally dynamic environmental variables and fixed geographic variables were used to construct generalised additive models to predict Cuvier's (*Ziphius cavirostris*) and *Mesoplodon* beaked whale encounter rates (number of groups per unit survey effort) and group sizes in the eastern tropical Pacific Ocean. The beaked whale sightings and environmental data were collected simultaneously during the Southwest Fisheries Science Center's cetacean line-transect surveys conducted during the summers and autumns of 1986-90 and 1993. Predictions from the encounter rate and group size models were combined with previously published estimates of line-transect sighting parameters to describe patterns in beaked whale population density (number of individuals per unit area) throughout the study area. Results provide evidence that the previously proposed definition of beaked whale habitat may be too narrow and that beaked whales may be found from the continental slope to the abyssal plain, in waters ranging from well-mixed to highly stratified. Areas with the highest predicted population densities were the Gulf of California, the equatorial cold tongue and coastal waters, including the west coast of the Baja Peninsula and the Costa Rica Dome. Offshore waters in the northern and southern subtropical gyres had the lowest predicted *Mesoplodon* densities, but density predictions were high for Cuvier's beaked whales in the waters southeast of the Hawaiian Islands. For both encounter rate and group size models, there was no geographic pattern evident in the residuals as measured by the ratio of pooled predicted to pooled observed values within geographic strata. KEYWORDS: OCEANOGRAPHY; PACIFIC OCEAN; MODELLING; CUVIER'S BEAKED WHALE; MESOPLODON BEAKED WHALES; HABITAT; DISTRIBUTION

MacLeod, C.D. 2005/06. How big is a beaked whale? A review of body length and sexual size dimorphism in the family Ziphiidae. *J. Cetacean Res. Manage.* 7(3): 301-308

There is a paucity of data on the family Ziphiidae (the beaked whales) and even basic information, such as body length, is not available for some species. This review examines published records of body length for 20 of the 21 currently recognised species of beaked whale. It considers maximum, median and modal body lengths, where possible by sex. For Cuvier's, Blainville's and Gray's beaked whales, modal and median lengths were much shorter than the maximum reported lengths; this may reflect misidentification of the largest animals. Although males of some species reached a greater maximum size, there was only a significant difference in median body length for three species: True's beaked whale; the strap-toothed whale; and Gervais' beaked whale. In all three cases, females had a significantly larger median length. The apparent lack of consistent sexual dimorphism in body length suggests that, while male beaked whales use their tusks as weapons to compete aggressively for access to receptive females, large size does not give a competitive advantage. This may be a result of the way the sexually dimorphic tusks are used during combat. The only exception to this rule appears to be the northern bottlenose whale, for which males consistently reach greater body lengths than the largest females. Male-male combat appears to take a different form in this species. KEYWORDS: MORPHOMETRICS; REPRODUCTION; AGGRESSION; BEAKED WHALES; STRANDINGS; WHALING

MacLeod, C.D. and Mitchell, G. 2005/06. Key areas for beaked whales worldwide. *J. Cetacean Res. Manage.* 7(3): 309-322

Beaked whales represent one of the groups of large mammals about which relatively little is still known. Many beaked whale species are known of from less than 50 records and one is known only from three partial skeletons. Beaked whales are subject to bycatch by fisheries, ingestion of plastics, accumulation of biocontaminants and adverse effects from anthropogenic noise. However, the inadequacy of knowledge about their biology means that developing effective conservation strategies can be difficult. We suggest that beaked whale conservation can best be achieved if, in consort with other approaches, key areas for beaked whales around the world can be identified. We suggest five criteria that can be used to identify key areas for beaked whales where, if human impacts were to occur, they would cause conservation concerns for beaked whales at a regional or global level. Using these criteria, 23 beaked whale key areas have been identified, based on existing knowledge contained in a database created from published and unpublished beaked whale records. In total, these 23 key areas covered the locations of almost 70% of all the beaked whale records in the database. However, for the identification of key areas to provide a useful tool for beaked whale conservation it is important not only that they are identified but that appropriate assessment and mitigation strategies are implemented within them to ensure that beaked whales are not adversely affected by human activities. KEYWORDS: CONSERVATION; DISTRIBUTION; MONITORING; ATLANTIC OCEAN; BEAKED WHALES; HABITAT; GEOGRAPHY

Zacharias, M.A., Gerber, L.R. and Hyrenbach, K.D. 2006. Review of the Southern Ocean Sanctuary: Marine Protected Areas in the context of the International Whaling Commission Sanctuary Programme. *J. Cetacean Res. Manage.* 8(1):1-12.

This scientific review of the Southern Ocean Sanctuary (SOS) was commissioned by the IWC Scientific Committee and presented to the IWC Steering Committee on 27-28 June 2004. This review addresses a number of questions related to the effectiveness of the SOS and provides recommendations on how to incorporate Marine Protected Area (MPA) concepts into the SOS and the IWC Sanctuary programme. Overall, the SOS – and IWC Sanctuaries in general – are based on vague goals and objectives that are difficult to measure, lack a rigorous approach to their design and operation and do not have an effective monitoring framework for evaluation. In particular, the SOS represents a 'shotgun' approach to conservation, whereby a large area is protected with little apparent rationale for boundary selection and management prescriptions within the sanctuary. While a vast array of ecosystem-level and precautionary conservation benefits have been invoked for the establishment of the SOS, in reality this sanctuary does little more than provide a false sense of security by assuming that broad protections for whale populations are in place. The SOS was designed to restrict commercial harvests from the low latitude feeding grounds occupied by large whales during the austral summer. However, the SOS does not protect against or mitigate other threats to Southern Ocean whale stocks and the marine ecosystems upon which these populations depend, including pollution, habitat degradation and loss, introduced species and global climate change. We thus contend that sanctuary establishment and evaluation should be guided by a series of measurable and tangible goals, aimed at quantifying the status of both the 'protected' species under consideration and their role in the broader marine ecosystem. In particular, the SOS could be improved substantially to become an important part of IWC management and the larger conservation of Southern Ocean marine ecosystems, if the following steps were implemented: (a) development of formally stated goals (e.g. biodiversity protection, fisheries enhancement); (b) establishment of measurable objectives with which to assess progress towards attaining these goals; (c) creation of a formal management plan, including the establishment of a monitoring framework; and (d) development of more appropriate review criteria, reflecting the ecological objectives of the management plan. KEYWORDS: SOUTHERN OCEAN; SANCTUARIES; CONSERVATION; MARINE PROTECTED AREA; MARINE RESERVE.

Cañadas, A. and Hammond, P.S. 2006. Model-based abundance estimates for bottlenose dolphins off southern Spain: implications for conservation and management. *J. Cetacean Res. Manage.* 8(1):13-27.

An EU-funded Life project was initiated off southern Spain in 2002, with the objective of developing a Conservation Plan for bottlenose dolphins in the area. Baseline information and monitoring of abundance and distribution is needed to determine if the conservation objectives are met in the long-term. To estimate abundance, 12,568km of non-systematic line transects conducted from 2000 to 2003, with 72 sightings, were analysed using spatial modelling methods. Transects were divided into 4,575 small segments (average 2.8km) with similar values for sightability conditions and environmental variables. The point estimate of bottlenose dolphin abundance in the area was 584 dolphins (95% CI=278-744). The same method was applied to investigate changes in abundance since 1992 in the eastern section of the research area, where most dolphins were concentrated, stratifying by three groups of years. Point estimates were 111 dolphins for 1992-97, 537 for 1998-2000 and 279 for 2001-03. The higher abundance between 1998 and 2000 corresponded with the observation of an 'immigrant' group of dolphins in these years. These results highlight the importance of long-term studies to understand natural variation in abundance in a specific area subject to conservation activities. KEYWORDS: ABUNDANCE ESTIMATE; BOTTLENOSE DOLPHIN; ALBORAN SEA; TRENDS; CONSERVATION; MODELLING; EUROPE; NORTHERN HEMISPHERE; SURVEY-VESSEL.

Reeves, R.R., McKenzie, M.G. and Smith, T.D. 2006. History of Bermuda shore whaling, mainly for humpback whales. *J. Cetacean Res. Manage.* 8(1):33-43.

From its first colonisation in the early 1600s, Bermuda was known as a potentially profitable whaling site. Humpback whales (*Megaptera novaeangliae*) were common in coastal waters during the late winter and spring (March-May); sperm whales (*Physeter macrocephalus*), in offshore waters probably throughout much of the year. Initial efforts at shore whaling in 1616-17 were not very successful but whaling continued at least intermittently until 1685 when Bermuda became a Crown Colony and the whaling industry was placed on a firm footing. The shore whaling industry in Bermuda was never particularly large or profitable. Although it continued into the 20th century and was episodically re-invigorated with new financing and equipment, shore whaling never met the high expectations of those who invested in it. In the 1780s and for several decades thereafter, a few whaling voyages sailed from Bermuda for distant whaling grounds in the South Atlantic and Indo-Pacific, targeting sperm whales and right whales (*Eubalaena* spp.). There is no evidence to suggest that local catches by Bermudian shore whalers exceeded more than a few tens of whales per year, the vast majority of them humpback whales. KEYWORDS: HUMPBACK WHALE; DIRECT CAPTURE; WHALING - HISTORICAL; ATLANTIC OCEAN; BERMUDA; SPERM WHALE.

Koski, W.R., Rugh, D.J., Punt, A.E. and Zeh, J. 2006a. An approach to minimise bias in estimation of the length-frequency distribution of bowhead whales (*Balaena mysticetus*) from aerial photogrammetric data. *J. Cetacean Res. Manage.* 8(1):45-54.

Past attempts to estimate the length structure of the Bering-Chukchi-Beaufort (B-C-B) stock of bowhead whales have yielded quite different results from one study to the next because of size segregation on the summering areas or because of size segregation during the spring migration combined with inconsistent sampling during the migration period. A new approach is presented to document the length-frequency distribution of the B-C-B stock using length measurements from 3,107 whale images collected during the spring migrations of 1985, 1986, 1989-1992 and 1994. This method provides estimates of the proportion of calves (length <6m), subadults (length 6-13m) and adults (length !13m). The data from all years are combined by weekly period and a bootstrap sampling procedure is used to construct the length-frequency by week. The distributions for each week are then combined to obtain the overall distribution, with each week's contribution being in proportion to the fraction of the migration estimated from ice-based census studies to pass during that week. Corrections for differential detectability of mother/calf pairs and for calves born after they pass Point Barrow, Alaska, are allowed for in the analysis. This new approach eliminates some of the biases that affected past attempts to estimate the length-frequency distribution for the B-C-B population of bowhead whales. It is robust to inclusion or exclusion of data for any given year and the time interval chosen to define repeat images. The new approach estimates a slightly higher proportion of subadults and lower proportion of adults in the population than most previous studies. The proportion of calves is also lower, but that is suspected to result from our inability to accurately estimate the proportion of the migration late in the season when many of the mother-calf pairs pass Point Barrow. These late season migrants have not been accounted for during past photogrammetry studies or the ice-based census. Although the results do not differ substantially from those of most previous studies, sensitivity analyses indicate that several biases existed in the previous methods, but largely cancelled each other out. KEYWORDS: BOWHEAD WHALE; ARCTIC; PHOTOGRAMMETRY; PHOTO-ID; POPULATION PARAMETERS; LENGTH DISTRIBUTION; BERING SEA; CHUKCHI SEA; BEAUFORT SEA.

McDonald, M.A., Mesnick, S.L. and Hildebrand, J.A. 2006. Biogeographic characterisation of blue whale song worldwide: using song to identify populations. *J. Cetacean Res. Manage.* 8(1):55-65.

Blue whale songs provide a measure for characterising worldwide blue whale population structure. These songs are divided into nine regional types, which maintain a stable character. Five of the nine song types have been recorded over time spans greater than 30 years showing no significant change in character. The nine song types can be divided into those containing only simple tonal components (high latitude North Pacific, North Atlantic and Southern Ocean song types), those comprised of complex pulsed units in addition to the tonal components (Pacific Ocean margin song types from California, Chile and New Zealand), and those which have the greatest complexity of all and the longest cycling times (Indian Ocean song types from Sri Lanka, Fremantle and Diego Garcia). We suggest that temporally stable differences in song provide another characteristic for comparison with genetic and morphological data when defining blue whale populations. Furthermore, as Mellinger and Barlow (2003) recommend, when there is a lack of other data or lack of clarity in other data sets, evidence of distinct differences in songs between areas should be used as a provisional hypothesis about population structure when making management decisions. Worldwide study is needed to better understand the various populations and subspecies within species like the blue whale that have large geographic distributions and have both migrating and resident populations. KEYWORDS: 55-BERLIN; BLUE WHALE; ELECTRONIC; IWC MEETING; POPULATION-ESTIMATES; SONGS; SOWER 2003; ACOUSTICS; VOCALISATION; COMMUNICATION; DISTRIBUTION; TAXONOMY; EVOLUTION; GENETICS.

Lesage, V., Keays, J., Turgeon, S. and Hurtubise, S. 2006. Bycatch of harbour porpoises (*Phocoena phocoena*) in gillnet fisheries of the Estuary and Gulf of St. Lawrence, Canada, 2000-02. *J. Cetacean Res. Manage.* 8(1):67-78.

The incidental catch of harbour porpoises (*Phocoena phocoena*) in the gillnet fishery of the Estuary and Gulf of St. Lawrence, Canada, was examined using: (1) questionnaires mailed to fishermen inquiring about bycatches in 2000 and 2001 ($n=2,277$ or 44% of the fishermen with valid licenses); and (2) using data from an at-sea observer programme and sentinel fishery programme in 2001 and 2002. The questionnaire survey had a low response rate (22%) and provided bycatch estimates of 2,215 (95% CI 1,151-3,662) and 2,394 (95% CI 1,440-3,348) porpoises in 2000 and 2001, respectively. The low number of hauls monitored by at-sea observers prevented the estimation of bycatch levels for several zones and the study area as a whole, and provided only imprecise estimates for all other zones. The results from questionnaires indicated a 24-63% reduction in harbour porpoise bycatches since the late 1980s, whereas the at-sea observer programme provided bycatch levels for 2001 and 2002 that were unreliable and underestimated, approaching one quarter of those documented in the late 1980s. Although both indices indicated a decrease in bycatches since the late 1980s, the magnitude of this change remains uncertain given the weaknesses associated with the two approaches. Considering the maximum population rate of increase (R_{max}) for harbour porpoises as 4% and the lower and upper 95% confidence limits (1,440-3,348) of our most reliable estimate of bycatches (i.e. the 2001 questionnaire survey results), the harbour porpoise population in the Gulf of St. Lawrence would need to be at least 36,000-83,700 individuals for current incidental catches to be sustainable. If the rate of increase is less than maximal, e.g. 0.5 R_{max} or 2%, then 72,000-167,400 harbour porpoises would be needed to attain sustainability. Kingsley and Reeves (1998) estimated that an average 36,000 to 125,000 porpoises occupied the Gulf of St. Lawrence during the summers of 1995 and 1996. Although the trajectory of the population since it was last surveyed in 1996 is uncertain, these findings suggest that bycatch levels might remain a cause for concern for the harbour porpoise population in the Gulf of St. Lawrence. The results from the comparison between the sentinel fishery and the commercial fishery subjected and not subjected to at-sea observations suggest that fine-scale temporal and spatial changes in fishing activities may greatly affect harbour porpoise bycatch levels. KEYWORDS: GILLNETS; INCIDENTAL CAPTURE; HARBOUR PORPOISE; ATLANTIC OCEAN; NORTH AMERICA; CONSERVATION; SUSTAINABILITY; FISHERIES.

Du Fresne, S., Fletcher, D. and Dawson, S. 2006. The effect of line-transect placement in a coastal distance sampling survey. *J. Cetacean Res. Manage.* 8(1):79-85.

Distance sampling surveys are commonly used to estimate animal abundance (N). The choice of survey design has only recently received attention in the line-transect research literature, which has tended to focus more on the violation of assumptions. In this study, simulation methods were used to assess the effect of line placement on the accuracy and precision of a line-transect survey for estimating dolphin abundance. In 1998, a vessel-based line-transect survey of Hector's dolphin (*Cephalorhynchus hectori*) was carried out around Banks Peninsula (New Zealand). These data were used to generate a spatially realistic dolphin distribution onto which different survey designs were overlaid. Eight types of design were considered, consisting of four types of stratification and two methods for allocating lines: random or systematic. None of the designs showed any evidence of significant bias in the estimate of $N(N^*)$. Systematic placement of lines generally provided more precise estimates of N , with an average reduction (over all designs) of 14% in the coefficient of variation of N^* , [$CV(N^*)$]. These results correspond well with those expected from classical sampling theory for the case of estimating a population mean. However, these designs also overestimated $CV(N^*)$ by 10-28% (mean=22%). Systematic line-placement has several practical advantages over random placement, including more uniform spatial coverage. For coastal cetacean populations with spatial dynamics similar to the one considered here, we recommend the use of systematic line-placement, with the proviso that the estimate of $CV(N^*)$ is likely to be overestimated by 10-28%. KEYWORDS: ABUNDANCE ESTIMATE; DISTRIBUTION; SURVEY-VESSEL; SURVEY DESIGN; MODELLING.

Aliaga-Rossel, E., McGuire, T.L. and Hamilton, H. 2006. Distribution and encounter rates of the river dolphin (*Inia geoffrensis boliviensis*) in the central Bolivian Amazon. *J. Cetacean Res. Manage.* 8(1):87-92.

The ecology and conservation status of river dolphins (*Inia* sp.) distributed in the lowland rivers of Bolivia are poorly understood and only recently have basic studies been conducted to investigate their population size, taxonomic status, distribution, behaviour, environmental threats and ecology in this region. This paper examines the distribution and encounter rates of the bufeo (*Inia* sp.) in the middle reach of the Bolivian Amazon and was conducted in the Mamoré River and four of its tributaries during the low water season. Methods were employed which can be replicated during future surveys of Bolivian river dolphins and the results can be compared with those from surveys of *Inia* throughout its range. Sixty-two hours were spent surveying for dolphins, with 68% of the effort in Mamoré River and 32% in its tributaries. The *Inia* encounter rates reported here (1.6-5.8 dolphins km²¹) are the highest recorded anywhere in its broad geographic range; and indicate the importance of continuing and expanding surveys in this area. The mean group size was greatest in the Tijamuchi River (3.3±2.96) and smallest in the Yacuma River (1.8±0.75) and the maximum group size was 14. The high bufeo encounter rates in the central Bolivian Amazon can be taken as a reflection of the general environmental status of the region; however, a growing human population, associated with an increase in boat traffic and fishing activity, poses a future threat to bufeos and their aquatic habitats. KEYWORDS: BOLIVIA; RIVER DOLPHIN; DISTRIBUTION; ABUNDANCE ESTIMATE; MAMORE RIVER; HABITAT; SURVEY-VESSEL.

Dolar, M.L.L., Perrin, W.F., Taylor, B.L., Kooyman, G.L. and Alava, M.N.R. 2006. Abundance and distributional ecology of cetaceans in the central Philippines. *J. Cetacean Res. Manage.* 8(1):93-111.

In general, little is known about cetacean abundance and distribution in Southeast Asia. This paper investigates the species composition, interactions/associations, abundance and distribution of cetaceans in an archipelagic tropical habitat characterised by deep, oceanic waters approaching the shore, high water temperatures and deep, stable thermoclines. Abundance is estimated using line transect

methods. In addition, the cetacean fauna of the Sulu Sea is compared with those of other tropical marine ecosystems: the eastern tropical Pacific, the western Indian Ocean and the Gulf of Mexico. The most abundant species in the two study sites (eastern Sulu Sea and the Tañon Strait) was the spinner dolphin, *Stenella longirostris*; with a population estimate of 31,512 (CV=26.63%) in the eastern Sulu Sea and 3,489 (CV=26.47%) in the Tañon Strait. Other abundant species were the pantropical spotted dolphin (*S. attenuata*), Fraser's dolphin (*Lagenodelphis hosei*) and the short-finned pilot whale (*Globicephala macrorhynchus*). Density and species-abundance rank varied between the two study sites, with generally higher densities in the Sulu Sea than in the Tañon Strait. An exception was the dwarf sperm whale, *Kogia sima*, whose density was 15 times higher in the Tañon Strait. Fraser's dolphin ranked third in abundance in the Sulu Sea but was absent from the Tañon Strait. Environmental factors such as depth, site and temperature were observed to have a significant influence on the distributions of various species. KEYWORDS: SPINNER DOLPHIN; PANTROPICAL SPOTTED DOLPHIN; FRASER'S DOLPHIN; PILOT WHALE; DWARF SPERM WHALE; MELON-HEADED WHALE; RISSO'S DOLPHIN; BOTTLENOSE DOLPHIN; BRYDE'S WHALE; ROUGH-TOOTHED DOLPHIN; PYGMY KILLER WHALE; SPERM WHALE; ECOLOGY; HABITAT; SULU SEA; TANOON STRAIT; ASIA; SURVEY-VESSEL; G(0); ABUNDANCE ESTIMATE; DISTRIBUTION; SCHOOL SIZE.

Garcia-Godos, I. 2006. A note on the occurrence of sperm whale (*Physeter macrocephalus*) off Peru, 1995-2002. *J. Cetacean Res. Manage.* 8(1):113-19.

Thirty-eight sightings of sperm whales (*Physeter macrocephalus*) were recorded off Peru (3-18°S) during 21 surveys conducted aboard platforms of opportunity, 1995-2002, with a search effort of 33,407 nautical miles of observation. Two main areas of concentration were detected: northern Peru (19 sightings) and southern Peru (16 sightings). Almost 58% of sightings occurred during the same or consecutive days. Group size ranged 1-18 individuals, with a mean of 3.5 (SD=3.9). The modal group size was one, accounting for 36.8% of sightings. Groups of three or more individuals accounted for 39.5%. An important increase in sightings occurred between 2001 and 2002, accounting for 68% of the records and suggesting migration into Peruvian waters from other regions. Positive correlations between indices of relative abundance and the anomaly of sea surface temperature were found, although warm events such as El Niño increased the uncertainty in sighting rates, reducing correlation values. The positive relationship between indices of relative abundance and commercial catch per unit effort for the squid *Dosidicus gigas* suggests some degree of interaction, although the extent of the role of this squid in the diet of sperm whales in the area requires further study. KEYWORDS: SPERM WHALE; PACIFIC OCEAN; SOUTH AMERICA; DISTRIBUTION; CONSERVATION; SURVEY-VESSEL; MOVEMENT; SQUID; WHALING-HISTORICAL; FISHERIES; FEEDING.

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Rolland, R.M., Hamilton, P.K., Kraus, S.D., Davenport, B., Gillett, R.M. and Wasser, S.K. 2006. Faecal sampling using detection dogs to study reproduction and health in North Atlantic right whales (*Eubalaena glacialis*). *J. Cetacean Res. Manage.* 8(2):121-25.

Conservation and management of many cetaceans is hindered by the difficulty of acquiring samples from free-swimming individuals to obtain essential data on health, diet, reproduction and physiological impacts of environmental and anthropogenic stressors. This is particularly true for large whales, which are logistically difficult to live-capture for sampling. In North Atlantic right whales (*Eubalaena glacialis*), a significant decline in reproduction and health in the 1990s led to the application of faecal-based analyses to study stress and reproductive endocrinology, marine biotoxin exposure and prevalence of disease-causing protozoa. However, this approach was limited by low sample acquisition rates with opportunistic faecal (scat) collection methods. The work presented here evaluates the relative sampling efficiency of scent detection dogs trained to locate North Atlantic right whale scat versus opportunistic scat collection during photoidentification surveys. Three years of sample collection using both detection dogs and opportunistic methods are summarised. Faecal sample collection rates using detection dogs were over four times higher than opportunistic methods. The use of detection dogs for scat collection from free-swimming right whales has for the first time provided adequate numbers of samples for statistical analyses. The endocrine, disease, genetic and biotoxin studies currently being performed on these samples markedly improve the ability to address fundamental questions vital to effective conservation and management of highly endangered right whales. KEYWORDS: SAMPLING STRATEGY; NORTH ATLANTIC RIGHT WHALE; HORMONES ; REPRODUCTION; GENETICS; DISEASE.

Koski, W., Heide-Jørgensen, M.P. and Laidre, K. 2006b. Winter abundance of bowhead whales, *Balaena mysticetus*, in the Hudson Strait, March 1981. *J. Cetacean Res. Manage.* 8(2):139-44.

Satellite tracking studies of bowhead whales (*Balaena mysticetus*) in West Greenland and the eastern Canadian Arctic have documented that Hudson Strait is an important wintering ground for animals summering in the Baffin Bay-Davis Strait area and the Hudson Bay-Foxe Basin area. In light of this new information, data were re-examined on abundance of bowhead whales at this wintering ground derived from a systematic strip census survey conducted in March 1981. Three strata in Hudson Strait were covered by equally spaced north-south transect lines. Most sightings were in the western stratum, with one and none in the central and eastern strata, respectively. Abundance estimates were corrected for whales at the surface missed by observers using data from a similar survey in the Beaufort Sea. Corrections for whales submerged when the survey aircraft passed were developed using new data from time-depth recorders deployed on seven bowhead whales in Disko Bay, West Greenland, in April-May 2002-05. The fully corrected abundance estimate for the Hudson Strait in March 1981 was 1,349 (95% CI 402-4,529) whales. Similar surveys were conducted along West Greenland in March 1981 and 1982; the combined estimate was 1,549 (95% CI 589-4,072). Other unsurveyed areas in Baffin Bay may contribute an additional 8% to this combined estimate. The projected population size for both areas was 3,633 (95% CI 1,382-9,550) in 2004, assuming a population growth rate of 3.4% per year (George et al., 2004), which may not be appropriate for this population. However, increased sighting rates and traditional knowledge reports confirm that the population is growing. The use of availability and detection biases together with the restricted seasonal distribution of whales in March makes this the most complete estimate of this population in the 1980s to date. KEYWORDS: BOWHEAD WHALE; ARCTIC; ABUNDANCE ESTIMATE; HUDSON STRAIT; BAFFIN BAY; SURVEY - AERIAL; BEAUFORT SEA; DISTRIBUTION.

Punt, A.E., Friday, N. and Smith, T.D. 2006. Reconciling data on the trends and abundance of North Atlantic humpback whales within a population modelling framework. *J. Cetacean Res. Manage.* 8(2):145-59.

Populations of humpback whales (*Megaptera novaeangliae*) in the North Atlantic appear to have been increasing at least during the last few decades, following the cessation of substantial hunting almost 100 years ago. Several sources of data are available for these populations (survey and mark-recapture estimates of absolute and relative abundance, estimated catches, and estimates of the proportion of the animals on two feeding grounds that are from the West Indies breeding ground). These data were analysed using an age- and sex-structured population dynamics model that is spatially-explicit to the extent that abundance is tracked on five feeding and two breeding grounds. Several alternative hypotheses, including depensation and changes over time in carrying capacity, were captured within the model framework. Two scenarios form the focus of the analyses, based on alternative interpretations of the size of the breeding population off the Cape Verde Islands. The results of these analyses confirm the increase in the number of humpback whales in the North Atlantic, although it is not possible to determine the extent of such increases. Whether both the West Indies and

Cape Verde Islands breeding stocks have increased depends on whether the estimate of abundance for the Cape Verde Islands population of approximately 100 animals is valid. Although many of the data sources can be reconciled given the model applied, some conflicts remain; resolution of these conflicts will require collection of additional data. KEYWORDS: HUMPBACK WHALE; MODELLING; ATLANTIC OCEAN.

Sirovic, A., Hildebrand, J.A. and Thiele, D. 2006. Baleen whales in the Scotia Sea during January and February 2003. *J. Cetacean Res. Manage.* 8(2):161-71.

Different species of baleen whales display distinct spatial distribution patterns in the Scotia Sea during the austral summer. Passive acoustic and visual surveys for baleen whales were conducted aboard the RRS *James Clark Ross* in the Scotia Sea and around South Georgia in January and February 2003. Identified calls from four species were recorded during the acoustic survey including southern right (*Eubalaena australis*), blue (*Balaenoptera musculus*), fin (*B. physalus*) and humpback whales (*Megaptera novaeangliae*). These acoustic data included up calls made by southern right whales, downswep D and tonal calls by blue whales, two possible types of fin whale downswep calls and humpback whale moans and grunts. Visual detections included southern right, fin, humpback and Antarctic minke whales (*B. bonaerensis* sp.). Most acoustic and visual detections occurred either around South Georgia (southern right and humpback whales) or south of the southern boundary of the Antarctic Circumpolar Current (ACC) and along the outer edge of the ice pack (southern right, blue, humpback and Antarctic minke whales). Fin whales were the exception, being the only species acoustically and visually detected primarily in the central Scotia Sea, along the southern ACC front. In addition to identifiable calls from these species, two types of probable baleen whale calls were detected: 50Hz upswept and pulsing calls. It is proposed that minke whales may produce the pulsing calls, based on their similarities with minke whale calls recorded in the North Atlantic Ocean. There was an overlap between locations of fin whale sightings and recordings and locations of 50Hz upswept calls in the central Scotia Sea, but these calls were most similar to calls attributed to blue whales in other parts of Antarctica. More study is required to determine if baleen whales produce these two call types, and if so, which species. The efficiency of acoustics and visual surveys varied by species, with blue whales being easier to detect using acoustics, Antarctic minke whales being best detected during visual surveys and other species falling in between these two extremes. KEYWORDS: BALEEN WHALES; SURVEY-ACOUSTIC; SURVEY-VESSEL; ANTARCTIC; SOUTHERN RIGHT WHALE; BLUE WHALE; FIN WHALE; HUMPBACK WHALE; ANTARCTIC MINKE WHALE; OCEANOGRAPHY.

Charlton, K., Taylor, A.C. and McKechnie, S.W. 2006. A note on divergent mtDNA lineages of bottlenose dolphins from coastal waters of southern Australia. *J. Cetacean Res. Manage.* 8(2):173-79.

Bottlenose dolphins have a global distribution throughout tropical and temperate waters, both inshore and offshore. Many studies demonstrate the existence of at least two *Tursiops* species: *Tursiops truncatus*, consisting of inshore and offshore eco-types and *T. aduncus*, a coastal Indo-Pacific type known to extend south into temperate waters down the east coast of Australia. To clarify the taxonomic status of two populations (Port Phillip Bay and Gippsland Lakes) of coastal bottlenose dolphins along Australia's south coast (Victoria), a 346bp region of the mitochondrial-DNA (mtDNA) control region was sequenced from ten individuals and they were incorporated into phylogenetic analyses involving published sequences of other *Tursiops* spp., *Stenella* spp. and *Delphinus* spp., found worldwide. Both neighbour-joining and maximum parsimony trees place Victorian coastal haplotypes in a highly-supported group separate to those from the other dolphins, including those from the southern part of the Australian eastern coast. Victorian haplotypes are least divergent from *T. truncatus* (average 5.5%) and most divergent from *T. aduncus* (9.1%), with intermediate levels of divergence from *Stenella* and *Delphinus* spp. These data suggest that the Victorian coastal dolphins, similar to other world-wide coastal populations, are genetically unique, long isolated and therefore likely to be locally adapted. This has important implications for management and conservation. KEYWORDS: GENETICS; TAXONOMY; CONSERVATION; BOTTLENOSE DOLPHIN; AUSTRALASIA.

Jefferson, T.A., Hung, S.K. and Lam, P.K.S. 2006. Strandings, mortality and morbidity of Indo-Pacific humpback dolphins in Hong Kong, with emphasis on the role of organochlorine contaminants. *J. Cetacean Res. Manage.* 8(2):181-93.

Factors related to mortality and disease in Indo-Pacific humpback dolphins (*Sousa chinensis*) from Hong Kong waters were investigated by detailed examination of dolphin specimens found stranded from 1995-2004. In total, 86 specimens were necropsied, but many of these were too badly decomposed to provide much information. Skin and blubber biopsies were also collected from six identified living individuals and concentrations of organochlorines (DDTs, PCBs and HCHs) were determined from blubber samples of stranded and biopsied dolphins. A large proportion of the strandings (53.2%) were young-of-the-year. The most commonly diagnosed causes of death were net entanglement and vessel collision. The pesticide DDT showed the highest concentrations and the ratio of DDT to its breakdown products (and other information) suggests that there may be a recent or nearby source of DDT into the dolphins' ecosystem. Concentrations of both DDTs and PCBs showed a pattern of increasing with age in males. In females, they increased until sexual maturity, then decreased, and finally increased again in late life. This is consistent with a hypothesised transfer of pollutants from mother to offspring during gestation and lactation. Inter-laboratory differences and effects of decomposition of specimens are two potential biases that may significantly affect the quality of the present data. In order to resolve the potential problems associated with these issues, a long-term biopsy collection programme has recently been initiated. KEYWORDS: INDO-PACIFIC HUMPBACKED DOLPHIN; BIOPSY SAMPLING; MORTALITY RATE; POLLUTANTS; ORGANOCHLORINES; CONSERVATION.

McFee, W.E., Hopkins-Murphy, S.R. and Schwacke, L.H. 2006. Trends in bottlenose dolphin (*Tursiops truncatus*) strandings in South Carolina, USA, 1997-2003: implications for the Southern North Carolina and South Carolina Management Units. *J. Cetacean Res. Manage.* 8(2):195-201.

Trends in marine mammal stranding rates over multiple years can provide useful information on life history parameters, seasonal and spatial distribution and both natural and human-induced mortality rates when compared with baseline data. Data of bottlenose dolphin (*Tursiops truncatus*) stranding rates in South Carolina, USA from 1997-2003 were analysed. The objectives of this study were to: (1) compare recent trends in strandings with baseline data (1992-1996) for South Carolina; (2) compare strandings between the Southern North Carolina Management Unit (SNCMU) and the South Carolina Management Unit (SCMU); (3) determine annual, seasonal and spatial trends in bottlenose dolphin strandings; (4) investigate seasonal reproductive trends; and (5) determine the extent to which humans may affect stranding rates (human interactions). Bottlenose dolphins stranded in South Carolina are assumed to be from at least two of the seven management units recognised by the National Marine Fisheries Service in the Western North Atlantic: the SNCMU and the SCMU. During the study period, 302 bottlenose dolphin strandings were reported in South Carolina and stranding counts were analysed using a Generalised Linear Model. Results showed that there were significantly more bottlenose dolphin strandings in the spring and autumn as compared with summer and winter. The effect of season was highly significant for the number of neonate strandings, suggesting a bimodal reproductive cycle in spring and autumn for the study area. A significant increase in the number of strandings of all age classes was found in the autumn for the northern portion of the State (SNCMU), supporting the assumption that bottlenose dolphins from the north migrate into South Carolina waters during this time of year. Rope entanglements was the most common source of human interaction, with the crab pot fishery the most prevalent source of fishery mortality in South

Carolina. This study demonstrates the usefulness of a long-term stranding database by increasing knowledge of temporal and spatial patterns and for monitoring neonate and human-induced mortality. KEYWORDS: STRANDINGS; BOTTLENOSE DOLPHIN; TRENDS; DISTRIBUTION; REPRODUCTION; SEASONALITY; FISHERIES; NORTH AMERICA; ATLANTIC OCEAN.

Maze-Foley, K. and Mullin, K.D. 2006. Cetaceans of the oceanic northern Gulf of Mexico: distributions, group sizes and interspecific associations. *J. Cetacean Res. Manage.* 8(2):203-13.

The Gulf of Mexico is a subtropical ocean basin with a diverse oceanic cetacean community. Cetacean research in the Gulf of Mexico has been driven by mandates of the US Marine Mammal Protection Act as well as concerns over the rapidly expanding oil and natural gas industry and related potential threats (e.g. seismic surveys, increased ship traffic, oil spills). Previously, cetacean distribution and abundances for specific Gulf of Mexico areas or species have been described based on work over periods of several years, and recently abundance estimates were made for the entire oceanic northern Gulf of Mexico (1996-2001). For each cetacean species, the paper describes distribution, group size, associated sea surface temperature and water depth and interspecific associations based on surveys conducted over 11 years that span the entire northern Gulf of Mexico. This dataset is the most comprehensive to date for the oceanic northern Gulf. Nine ship surveys totalling 45,462km of effort were conducted during spring seasons (1991-2001) in continental shelf-edge and oceanic waters (> 100m) of the northern Gulf of Mexico. Eighteen species were identified from 1,868 sightings. Cetaceans were found throughout the area although some species had localised distributions or occurred in restricted ranges of water depths. Spinner dolphins (*Stenella longirostris*) had the largest mean group size ($n = 40$, $\bar{x} = 151.5$, $SE = 30.90$), followed by melon-headed whales (*Peponocephala electra*), clymene dolphins (*S. clymene*), pantropical spotted dolphins (*S. attenuata*), Fraser's dolphins (*Lagenodelphis hosei*) and striped dolphins (*S. coeruleoalba*) (range of means 46.1-99.6). Beaked whales (Ziphiidae), Bryde's whales (*Balaenoptera edeni/brydei*), sperm whales (*Physeter macrocephalus*) and pygmy/dwarf sperm whales (*Kogia* spp.) were found in the smallest groups ($\bar{x} < 3$). Twenty-seven sightings (1.4% of all sightings) were composed of two cetacean species. Common bottlenose dolphins (*Tursiops truncatus*) were recorded in mixed-species groups with more species than any other cetacean. Forty-five cetacean sightings (2.4% of all sightings) were associated with at least one bird species, and 21 (1.1% of all sightings) were associated with schools of fish. Contrary to previous reports, pantropical spotted dolphins were observed in association with both fish (including surface tunas) and seabirds, although to a lesser extent than for other tropical oceans. No mixed pantropical spotted and spinner dolphin groups were sighted despite their regular co-occurrence in other tropical oceans. KEYWORDS: CETACEANS; GULF OF MEXICO; SURVEY-VESSEL; DISTRIBUTION; GROUP SIZE.

Gilman, E., Brothers, N., McPherson, G.R. and Dalzell, P. 2006. A review of cetacean interactions with longline gear. *J. Cetacean Res. Manage.* 8(2):215-23.

Fishery-cetacean interactions, including those with longline gear, give rise to economic, ecological and social concerns. This paper reviews problems resulting from cetacean-longline interactions, considers potential strategies to reduce interactions and identifies research priorities and approaches. Depredation by cetaceans (removal and damage of hooked fish and bait from fishing gear) and damage and loss of fishing gear create economic problems; however, the magnitude of this problem is poorly understood. There is also insufficient information to determine whether there are population-level effects resulting from injury and mortality of cetaceans (from incidental entanglement and hooking and from deliberate actions to discourage depredation). Fishery-cetacean interactions may also: change cetacean foraging behaviour and distribution; increase fishing effort to make up for fish taken from gear by cetaceans; and create errors in fish stock assessments that do not account for cetacean depredation. Negative public perceptions of longline fishing can result from news of incidental and deliberate injury and mortality of cetaceans associated with longlining. Information on how to reduce cetacean interactions with longline gear is also limited, as is the understanding of the mechanisms responsible for them. Strategies already employed in some fleets include refraining from setting or cutting sets short when problematic species of cetaceans are observed and fleet coordination of daily fishing times and positions. Many fishermen perceive depredation as an inevitable part of fishing. This paper discusses a number of other possible cetacean avoidance strategies that warrant consideration, including: (1) fleet communication to enable vessels to avoid temporally and spatially unpredictable and sporadic hotspots of aggregations of cetaceans; (2) underwater acoustic masking devices to conceal the sound of the vessel, gear, and setting and hauling activities; (3) quieter vessels to reduce cetaceans' ability to target longline vessels; (4) encasement of caught fish to reduce cetacean access to or interest in the catch; (5) use of bait or gear with an unpleasant smell or taste to reduce the attractiveness of gear, bait and catch to cetaceans; (6) use of pre-recorded fishing vessel sounds played from stations throughout a fleet's fishing grounds to distract cetaceans from actual fishing vessels; (7) use of acoustic devices to mask returning cetacean echolocation signals; and (8) use of tethered sonobuoys to track cetaceans and enable fleet avoidance. Vessels with relatively low cetacean interaction rates should be examined for design and operational differences from vessels with high interaction rates, possibly allowing identification of effective avoidance methods. There is a need for experimentation in individual longline fisheries over several seasons to assess fishery-specific efficacy and commercial viability of cetacean avoidance strategies. This is necessary as different cetacean species likely respond differently to an avoidance method and cetaceans may habituate to an avoidance strategy, especially in fisheries interacting with resident cetaceans. KEYWORDS: DEPREDACTION; FISHERIES; INCIDENTAL CATCHES; ACOUSTICS; ECHOLOCATION; FEEDING.

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Brandon, J. and Wade, P.R. 2006. Assessment of the Bering-Chukchi-Beaufort Sea stock of bowhead whales using Bayesian model averaging. *J. Cetacean Res. Manage.* 8(3):225-40.

Bayesian estimation methods are used to fit an age- and sex-structured population model to available data on abundance and stage proportions (i.e. calves/mature animals in the population) for the Bering-Chukchi-Beaufort Seas stock of bowhead whales (*Balaena mysticetus*). The analyses consider three alternative population modelling approaches: (1) modelling the entire population trajectory from 1848, using the 'backwards' method where the trajectory is back-calculated based on assigning a prior distribution to recent abundance; (2) modelling only the recent population trajectory, using the 'forwards from recent abundance' method, where the population is projected forwards from a recent year and the abundance in that year is not assumed to be at carrying capacity; and (3) a version of (2) that ignores density-dependence. The 'backwards' method leads to more precise estimates of depletion level. In contrast, the 'forwards from recent abundance' method provides an alternative way of calculating catch-related quantities without having to assume that the catch record is known exactly from 1848 to the present, or having to assume that carrying capacity has not changed since 1848. Not only are all three models able to fit the abundance data well, but each is also able to remain consistent with available estimates of adult survival and age of sexual maturity. Sensitivity to the stage-proportion data and the prior distributions for the life history parameters indicates that use of the 1985 stage-proportion data has the greatest effect on the results, and that those data are less consistent with data on trends in abundance and age of sexual maturity. The analyses indicate that the population has approximately doubled in size since 1978, and the 'backwards' analyses suggest that the population may be approaching carrying capacity, although there is no obvious sign in the data that the population growth rate has slowed. Bayes factors are calculated to compare model fits to the data. However, there is no evidence for selecting one model over another, and furthermore, the models considered in this study result in different posterior distributions for quantities of interest to management. Posterior model probabilities are therefore calculated and used as weights to construct Bayesian model-averaged posterior distributions for outputs shared among models to take this ambiguity into account. This study represents the first attempt to explicitly quantify model uncertainty when conducting a stock assessment of bowhead whales. KEYWORDS: ARCTIC; BOWHEAD WHALE; MODELLING; WHALING-ABORIGINAL; NORTHERN HEMISPHERE, BERING SEA; BEAUFORT SEA; CHUKCHI SEA.

Summers, E.L., Estrada, J.A. and Zeeman, S.I. 2006. A note on geographic and seasonal fluctuations in the isotopic composition of baleen in four North Atlantic right whales (*Eubalaena glacialis*). *J. Cetacean Res. Manage.* 8(3):241-45.

Despite management efforts, studies suggest that the North Atlantic right whale (*Eubalaena glacialis*) population may still be in decline. Due to its endangered status and propensity for human interactions, it is critical that all habitats and migratory routes utilised by the right whale are identified and protected. We conducted incremental stable isotope analysis along the baleen plates of three North Atlantic right whales, an adult female, a juvenile male and a neonate male, showing seasonal oscillation patterns in $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values associated with migrations between summer and winter habitats. The $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values displayed seasonal variability with enriched values occurring in the winter and depleted during the summer. Comparisons with published values for a fourth adult female (NEAq1014) showed that summer values differed significantly between adults. While the small sample size prevents firm conclusions, these data suggest differential habitat use between adult individuals as well as age classes. Isotopic ratios from plankton in the Labrador Sea indicate that portions of the population may be utilising this habitat as an alternative summer feeding ground. KEYWORDS: NORTH ATLANTIC RIGHT WHALE; MIGRATION; MOVEMENTS; FEEDING GROUNDS; HABITAT; NORTHERN HEMISPHERE.

Macleod, K., Simmonds, M.P. and Murray, E. 2006. Abundance of fin (*Balaenoptera physalus*) and sei whales (*B. borealis*) amid oil exploration and development off northwest Scotland. *J. Cetacean Res. Manage.* 8(3):247-54.

A ship-based line transect survey was conducted during July-August 1998 to assess the distribution and abundance of cetaceans off northwest Scotland. Limited information from dedicated surveys exists for this area and the lack of baseline data is cause for concern given the expanding oil industry in these waters. Historical whaling records show that large numbers of baleen whales, particularly fin and sei whales, were captured in these waters during summer. The waters surveyed included former whaling grounds and currently licensed oil blocks to the west of the Outer Hebrides and the Faroe-Shetland Channel and both fin and sei whales were encountered. Neither species was recorded to the west of the Outer Hebrides whereas relatively high densities of both were recorded further north in the Faroe-Shetland Channel. The density of fin and sei whales was 0.021km^{-2} and 0.022km^{-2} , respectively. Abundance was estimated as 933 (CV=0.38) fin whales, 1,011 (CV=0.35) sei whales and 1,923 (CV=0.33) 'large whales'. The high density of whales recorded in the Faroe-Shetland Channel supports the idea that it is an important summer feeding ground for both species and the potential for acoustic disturbance associated with increasing industrialisation of this area is a concern. Factors affecting the distribution and abundance of these whales are discussed. KEYWORDS: FIN WHALE; SEI WHALE; ABUNDANCE ESTIMATE; ATLANTIC OCEAN; SURVEY-VESSEL; MOVEMENTS; DISTRIBUTION; WHALING-HISTORICAL.

Stone, C.J. and Tasker, M.L. 2006. The effects of seismic airguns on cetaceans in UK waters. *J. Cetacean Res. Manage.* 8(3):255-63.

Observations undertaken during 201 seismic surveys in UK and adjacent waters were analysed to examine effects on cetaceans. Sighting rates, distance from the airguns and orientation were compared for periods when airguns were active and when they were silent, both for surveys with airgun arrays of large volume and surveys with smaller volume arrays. The results demonstrate that cetaceans can be disturbed by seismic exploration. Small odontocetes showed the strongest lateral spatial avoidance (extending at least as far as the limit of visual observation) in response to active airguns, while mysticetes and killer whales showed more localised spatial avoidance. Long-finned pilot whales showed only a change in orientation and sperm whales showed no statistically significant effects. Responses to active airguns were greater during those seismic surveys with large volume airgun arrays than those with smaller volumes of airguns. It is suggested that the different taxonomic groups of cetaceans may adopt different strategies for responding to acoustic disturbance from seismic surveys; some small odontocetes move out of the immediate area, while the slower moving mysticetes orient away from the vessel and increase their distance from the source but do not move away from the area completely. KEYWORDS: NOISE; EUROPE; CONSERVATION; SURVEY-VESSEL; SHORT-TERM CHANGE; MONITORING.

Sekiguchi, K., Olavarria, C., Morse, L., Olson, P., Ensor, P., Matsuoka, K., Pitman, R., Findlay, K. and Gorter, U. 2006. The spectacled porpoise (*Phocoena dioptrica*) in Antarctic waters. *J. Cetacean Res. Manage.* 8(3):265-71.

Most knowledge on the biology and ecology of the spectacled porpoise (*Phocoena dioptrica*) has been obtained from stranded specimens, with less than fifteen confirmed sightings in the sea. Published photographs of live animals in their natural environment are also very rare. In this study, 28 live sightings are summarised, from Antarctic and sub Antarctic waters (mainly from the 1978-2004 IWC-IDCR/SOWER cruises). These sightings supported the suggested circumpolar and offshore distribution of this species; however, this was extended further south than previously thought, into Antarctic waters. The sea surface temperature recorded at the time of each sighting ranged from $0.9\text{--}10.3^{\circ}\text{C}$, with most of the sightings (52.0%) in waters $4.9\text{--}6.2^{\circ}\text{C}$. Group size was small, averaging 2.0 (SD=0.92) animals per group. A total of six cow-calf pairs were observed and all such pairs were accompanied by one or two additional adults, always including a mature male. Based on observations at sea and new photographs of live animals, a pale 'saddle' around the dorsal fin was noticed and is described for the first time. The porpoises generally showed fast swimming behaviour when the vessel approached, resembling the swimming behaviour of harbour porpoises. KEYWORDS: SPECTACLED PORPOISE; SOUTHERN OCEAN; ANTARCTIC; SCHOOL SIZE; SURVEY-VESSEL; DISTRIBUTION; COLOURATION.

Hauser, D.W., VanBlaricom, G.R., Holmes, E.E. and Osborne, R.W. 2006. Evaluating the use of whalewatch data in determining killer whale (*Orcinus orca*) distribution patterns. *J. Cetacean Res. Manage.* 8(3):273-81.

Commercial whalewatching has been used as an opportunistic data source for studies of cetacean distribution, but there are few comprehensive analyses of the biases and assumptions implicit in such methodology. The goal of this study was to evaluate the use of data generated by commercial whalewatch operators using a case study of whalewatchers targeting killer whales (*Orcinus orca*) within Washington and British Columbia inshore waters. In this region, many whalewatch vessels work cooperatively in a small, semi-enclosed area to locate and identify well-known killer whales. To address search biases and cross-examine the accuracy in killer whale locations and pod identifications by whalewatchers, an independent field study was conducted. The whalewatch data were 91.7% accurate in locating killer whales, but only 74.1% of those sightings were correctly identified to the pod level. However, identification accuracy increased to 92.6% when errors due to sub-pod mis-identification were excluded and 96.3% when early morning (before 10:30), unknown pod sightings were also excluded. It is suggested that these data can be used to describe spatial use patterns by killer whales, with recognition of the dataset's limitations. Results of this study indicate that examination of biases is necessary before initiating research using data generated by commercial whalewatchers, but such data sources can be effective for specific study questions if the limitations are known. Although the whalewatch situation described here is relatively unique because it targets a small, well-known population, this study presents a practical methodology for evaluating the efficiency of whalewatch vessels in detecting and identifying cetaceans. Globally, whalewatching industries are increasing in numbers and geographic scope, and capitalising on these platforms of opportunity represents potentially valuable and accurate data for studies of cetacean distribution. KEYWORDS: WHALEWATCHING; KILLER WHALES; NORTH AMERICA; MONITORING; DISTRIBUTION; SAMPLING STRATEGY; PACIFIC OCEAN; NORTHERN HEMISPHERE; SURVEY-SHORE-BASED.

Wang, J.Y. and Yang, S.C. 2006. Unusual cetacean stranding events of Taiwan in 2004 and 2005. *J. Cetacean Res. Manage.* 8(3):283-92.

In early 2004 and in 2005, several unusual stranding events occurred in Taiwan during a period when large-scale naval exercises were conducted in and on nearby waters. Gross examination of the partial remains of two carcasses (a ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*) and a pygmy killer whale (*Feresa attenuata*)) and an intact Risso's dolphin (*Grampus griseus*) revealed that the former two had internal injuries to structures associated with or related to acoustics or diving. The several unusual stranding events and the findings of the gross post mortem examination of the only specimens that were available for study were suggestive that nearby naval exercises may have contributed to or caused the death of at least one cetacean in this region and that species other than beaked whales may also be susceptible to such activities. With an increasing number of military exercises in this region, more attention to the impacts of such activities on cetaceans is needed. KEYWORDS: ASIA; STRANDINGS; BEAKED WHALE-GINKGO-TOOTHED; SHORT-FINNED PILOT WHALE; PYGMY KILLER WHALE; DWARF SPERM WHALE; BEAKED WHALE-BLAINVILLES; BEAKED WHALE-LONGMANS; PANTROPICAL SPOTTED DOLPHIN; STRIPED DOLPHIN; RISSOS DOLPHIN; DISTRIBUTION.

Stevick, P.T., Pacheco de Godoy, L., McOsker, M., Engel, M.H. and Allen, J. 2006. A note on the movement of a humpback whale from Abrolhos Bank, Brazil to South Georgia. *J. Cetacean Res. Manage.* 8(3):297-300.

Most models of population structure for Southern Hemisphere humpback whales (*Megaptera novaeangliae*) assume that individuals feeding in the Scotia Sea migrate primarily to breeding and calving areas off Brazil. However data to support this are few and mostly indirect. Abrolhos Bank, Brazil, is the largest breeding and calving ground for humpback whales in the western South Atlantic Ocean. Historically, the waters near South Georgia held the largest concentrations of humpback whales in Antarctic Area II and were among the largest in the Southern Ocean. Photographs of individually distinctive natural markings on humpback whale flukes collected from the Scotia Sea (n=9) were compared with two collections of photographs from Brazilian waters (n=829 and n=735) to identify re-sightings. A humpback whale photographed in August 2000 at Abrolhos Bank was subsequently photographed in December 2004 near Shag Rocks off South Georgia. The migratory distance between these sightings is 3,945km. This finding constitutes the first long-distance individual resighting to be documented from either of these areas. KEYWORDS: HUMPBACK WHALE; MIGRATION; PHOTO-ID; SOUTHERN HEMISPHERE.

Rock, J., Pastene, L.A., Kaufman, G., Forestell, P., Matsuoka, K. and Allen, J. 2006. A note on East Australia Group V Stock humpback whale movement between feeding and breeding areas based on photo-identification. *J. Cetacean Res. Manage.* 8(3):301-05.

Documentation of humpback whale migratory movements between Australasia and the Southern Ocean has been limited almost exclusively to historical whaling data. This study examines photographic evidence documenting the movements of three individual humpback whales between their breeding grounds on the northeast coast of Australia and feeding grounds in Area V of the Southern Ocean. Although these individuals exhibited marked site fidelity to the same low latitude breeding grounds, their sightings in high latitude feeding grounds vary by 35° longitude, confirming dispersal of Eastern Australia Group V Stock humpback whales in the Antarctic feeding ground. KEYWORDS: MIGRATION; DISTRIBUTION; PHOTO-ID; AUSTRALASIA; ANTARCTIC; HUM06; HUMPBACK WHALE.

Andriolo, A., Martins, C.C.A., Engel, M.H., Pizzorno, J.L., Mas-Rosa, S., Freitas, A.C., Morete, M.E. and Kinan, P.G. 2006. The first aerial survey to estimate abundance of humpback whales (*Megaptera novaeangliae*) in the breeding ground off Brazil (Breeding Stock A). *J. Cetacean Res. Manage.* 8(3):307-11.

In the Southern Hemisphere, humpback whales (*Megaptera novaeangliae*) were heavily exploited from both coastal stations and in pelagic waters in all major ocean basins. About 200,000 whales were taken after 1900, causing declines of populations to small percentages of their pre-exploitation levels. The study presented here aimed to investigate humpback whale abundance in the Brazilian coastal breeding ground, in order to provide information to support further analysis of the population recovery. Between 25 August and 2 September 2001, a fixed wing, flat window, aircraft was used to survey transect lines along the northern limit of Bahia State (12°10'S), to the southern limit of Espírito Santo State (20°42'S). All on-effort sightings were recorded and abundance was estimated according to standard distance sampling methodology (Burnham et al., 1980; Buckland et al., 1993). Group sizes of humpback whales ranged between 1-5 and the mean group size was 1.52 (± 0.06). The model that best fitted the perpendicular distance data, based on the minimum Akaike Information Criterion, was the hazard rate model. The population size estimated using uncorrected data was 1,493 (CV=0.21) whales. Surface time was used to correct the estimates for $g^*(0)$, resulting in a correction factor of 0.67 (± 0.15). The corrected analysis for each block and combined result, increased the population size estimate to 2,229 (CV=0.31) individuals. The data from this study could be used to identify new areas appropriate for whalewatching, to monitor the status and dynamics of the humpback whale population off the Brazilian coast and to provide information for the establishment of new protected areas. KEYWORDS: SURVEY-AERIAL; HUMPBACK WHALE; ABUNDANCE ESTIMATE; BREEDING GROUND; SOUTH AMERICA; SOUTHERN HEMISPHERE.

VOLUME 9 ISSUE 1

Thomas, L., Williams, R. and Sandilands, D. 2007. Designing line transect surveys for complex survey regions. *J. Cetacean Res. Manage.* 9(1): 1-13.

Line transect surveys are widely used to estimate the density and/or size of cetacean populations. Good survey design is essential for obtaining reliable results using standard (design-based) analysis methods. Even for more complex (model-based) analysis methods, a good survey design is valuable. A 'good' design is one (a) that employs randomisation in laying out transects; (b) that is stratified if density is known to vary on a large scale; (c) where each location within a stratum has an equal probability of being surveyed (uniform coverage probability); (d) that produces an even distribution of transects throughout each stratum (e.g. systematic random designs); (e) that produces at least 10-20 transects per stratum; (f) that, given the previous points, gives maximum efficiency per unit effort – for example by minimising time spent travelling between survey lines (off-effort time). We discuss strategies for creating good designs given the constraints inherent in many shipboard surveys of cetaceans: severely limited ship time and complex topography. We advocate the use of computer software, such as the program *Distance*, to create designs and compare their properties using simulation. We provide a link between the concepts and their implementation through a concrete example of survey design: a multi-species survey of cetaceans in coastal British Columbia. The design uses an equally spaced zig-zag configuration of transects in more open strata combined with sub-stratification to minimise off-effort time. In the highly convex inshore stratum we develop a systematic cluster sampling algorithm, and within the selected clusters use a systematic parallel line layout to ensure equal coverage probability in the long, narrow fjords. To aid those wishing to learn automated design methods, we provide *Distance* project files online. KEYWORDS: ABUNDANCE ESTIMATE; PACIFIC OCEAN; NORTH AMERICA; SAMPLING STRATEGY; SURVEY-VESSEL.

Williams, R. and Thomas, L. 2007. Distribution and abundance of marine mammals in the coastal waters of British Columbia, Canada. *J. Cetacean Res. Manage.* 9(1): 15-28.

Information on animal distribution and abundance is integral to wildlife conservation and management. However abundance estimates have not been available for many cetacean species inhabiting the coastal waters of Canada's Pacific coast, including those species that were heavily depleted by commercial whaling. Systematic sightings surveys were conducted in the inshore coastal waters of the Inside Passage, between the British Columbia (BC)-Washington and the BC-Alaska borders. A total of 4,400km (2,400 n.miles) of trackline were surveyed in the summers of 2004 and 2005. Abundance estimates (with 95% confidence intervals) assuming certain trackline detection for seven cetacean species were as follows: harbour porpoise, 9,120 (4,210-19,760); Dall's porpoise, 4,910 (2,700-8,940); Pacific white-sided dolphin, 25,900 (12,900-52,100); humpback whale, 1,310 (755-2,280); fin whale, 496 (201-1,220); common minke whale, 388 (222-680); and 'northern resident' killer whale, 161 (45-574). The potential for responsive movement to have affected the accuracy and precision of these estimates is difficult to assess in small-boat surveys. However, the analyses were designed to minimise this factor in the most obvious case (Pacific white-sided dolphins) and pilot data collection has begun to assess the magnitude of the effect and to calculate correction factors for other species. The density of harbour seals, both along the shoreline and at sea, was calculated and it was estimated that total abundance of harbour seals in the study area was at least 19,400 (14,900-25,200). These are new abundance estimates for this region for all cetacean species except killer whales. The small sample size makes the killer whale estimate tenuous, but one worth noting, as it is close to the known number of northern resident killer whales (2004 census was 219 animals, Cetacean Research Program, Pacific Biological Station, Fisheries and Oceans Canada). The common minke whale abundance estimate is similarly tentative, however the results do reveal that common minke whales were relatively rare in this region. While the majority of harbour seals were found as expected in the southern straits and in the mainland inlets, a substantial number of animals were on the north coast and in the Queen Charlotte Basin as well. These data provide a systematic snapshot of summertime distribution and abundance of marine mammals in the Queen Charlotte Basin, where offshore oil and gas development and seismic surveys for geophysical research have been proposed to take place. Similarly, the abundance estimates could be used to form the basis of a simulation exercise to assess the sustainability of observed levels of incidental bycatch of small cetaceans in commercial fisheries. The results described here provide a useful reference point to which future survey data can be compared. KEYWORDS: SURVEY-VESSEL; NORTHEAST PACIFIC; ABUNDANCE ESTIMATE; DISTRIBUTION; HARBOUR PORPOISE; HUMPBACK WHALE; PACIFIC WHITE-SIDED DOLPHIN; MINKE WHALE; DALL'S PORPOISE; KILLER WHALE.

Melnikov, V. and Zeh, J. 2007. Chukotka Peninsula counts and estimates of the number of migrating bowhead whales (*Balaena mysticetus*). *J. Cetacean Res. Manage.* 9(1): 29-35.

In May and June 2000-01, shore-based counts of migrating bowhead whales (*Balaena mysticetus*) were conducted from Cape Pe'ek on the Chukotka Peninsula, Russia. These counts, designed to permit estimation of the number of whales migrating past Cape Pe'ek from mid-May to mid-June, were similar to those of bowhead whales migrating past Barrow, Alaska and of gray whales migrating past Granite Canyon, near Monterey, California, except that no experiments designed for estimating detection probabilities P were conducted at Cape Pe'ek. Under the assumption that $P=1$ (all whales passing during watch with acceptable visibility conditions were seen), the estimated number of migrating bowheads was 430 (CV 22%) in 2000 and 558 (CV 31%) in 2001. The weighted geometric mean of these estimates is 470 with 95% confidence interval 332-665. If P was assumed to be similar to the detection probabilities estimated from the Barrow bowhead count or the Granite Canyon gray whale count, the weighted geometric mean estimate was approximately twice as large. Of at least 94 bowhead whales seen from Cape Pe'ek in June of 2001, at most one could have been among those counted by the survey near Barrow that year. KEYWORDS: ABUNDANCE ESTIMATE; BERING SEA; BOWHEAD WHALE; MIGRATION; SURVEY-SHORE-BASED.

Acebes, J.M.V., Darling, D.J. and Yamaguchi, M. 2007. Status and distribution of humpback whales (*Megeptera novaeangliae*) in northern Luzon, Philippines. *J. Cetacean Res. Manage.* 9(1): 37-43.

Since the verification of the occurrence of humpback whales in the Babuyan Islands, Philippines in 1999, studies have been carried out on their status and distribution. Boat-based surveys of the waters around the islands were conducted from 2000-03. In 2003, a survey was also conducted off the eastern coast of Northern Sierra Madre. Once the whales were sighted, the location,

group composition and behaviour were noted, fluke photo-identifications taken, sloughed skin and biopsy samples collected and songs recorded. A total of 367 humpback whale sightings were documented in four seasons around the Babuyan Islands. However, a cow-calf pair sighting off the coast of Northern Sierra Madre indicates that this breeding area may extend farther south. A total of 69 individuals have been photo-identified from 1999-2003. Re-sightings across years are as follows: one individual was sighted for three consecutive years (2001-03); two individuals for two consecutive years (2001-02 and 2002-03); while three individuals were sighted in two different years (1999 and 2002; 2001 and 2003). Twelve of the 40 individuals photo-identified in the Philippines from 1999-2002 were matched to humpback whales identified in Ogasawara and Okinawa, Japan, including one whale that moved between these regions in one season. These matches indicate that the Philippine humpback whales are part of this greater western Pacific population. A subjective comparison between humpback whale songs recorded in the Philippines and Hawaii in 2002 indicated marked similarities. A total of nine distinctive themes were identified; seven of these were common to songs from both regions. The similarity in songs suggests humpback whales in the Philippines mix to some degree, at least acoustically, with the whales in Hawaii and the rest of the Pacific basin. KEYWORDS: HUMPBAC WHALE; MOVEMENTS; BREEDING GROUNDS; PHOTO-ID; SURVEY-VESSEL; VOCALISATION; BIOPSY SAMPLING; CONSERVATION; WHALING.

Costa, P., Piedra, M., Franco, P. and Paez, E. 2007. Distribution and habitat use patterns of southern right whales, *Eubalaena australis*, off Uruguay. *J. Cetacean Res. Manage.* 9(1): 45-51.

Aerial surveys and behavioural observations from land were conducted 2001-03, between July and November, to evaluate the status and habitat use patterns of the southern right whale (*Eubalaena australis*) along 220km of the Uruguayan Atlantic coast. Photo-identification was carried out only during the aerial surveys, and group composition as well as spatial and temporal distribution was studied. For the analysis of distribution, the area was divided into four zones. Behaviour was studied from nine fixed points along the coast, analysing the relative frequency of three states (interacting, travelling and resting) and five events (flipper, spy hopping, tail-up, belly-up and flipper slap). Most individuals (90%) were seen from August to October ($H=16.446$, $p=0.003$) and there was no significant difference in sightings between the four zones ($H=5.11$, $p=0.163$). In 80 sightings, 174 individuals were observed, of which 8% ($n=14$) were cow-calf pairs and 92% ($n=160$) were unaccompanied whales (whales without calf). Out of these, 76.9% ($n=123$) were found in groups that ranged 2-13 individuals (mean=3.4; SD=2.7) and the rest (23.1%; $n=37$) were solitary. Sixty individuals were identified, one of which was re-identified within a season. Focal sampling on unaccompanied whales took place on ninety-three occasions; 64 on groups and 29 on solitary individuals. For groups, the most frequent behavioural state was interaction (57.8%), and all events were observed, spy hopping being the most frequent. Given the high proportion of unaccompanied whales and interacting groups recorded, Uruguay is thought to be an important social area for the species, where behaviour similar to those previously described as courtship and mating were observed. The dynamics of the different categories of individuals off the Uruguayan coast is discussed and investigation priorities are suggested. KEYWORDS: SOUTHERN RIGHT WHALE; SOUTH AMERICA; PHOTO-IDENTIFICATION; BEHAVIOUR; SOCIAL; SOUTHERN HEMISPHERE; MOVEMENTS; ATLANTIC OCEAN; SITE FIDELITY.

Melnikov, V.V., Zagrebin, I.A., Zelensky, M.A. and Ainana, L.I. 2007. Killer whale (*Orcinus orca*) in waters adjacent to the Chukotka Peninsula. *J. Cetacean Res. Manage.* 9(1): 53-63.

Chukotkan hunters were employed as observers between 1990 and 2000 to document the occurrence of killer whales off the coast of the Chukotka Peninsula throughout the year. The study area was divided into three parts: the south, north and east coasts and all showed a significant negative correlation between sea-ice coverage and number of killer whales sighted ($r=-0.76$, -0.64 and -0.74 respectively). For all areas, the majority of whales were sighted during the summer months (June-September), but during years with late ice-destruction, whales arrived a month later than in 'warm' years. Killer whales were sighted three times as often per observation off the north coast than the east and twice as often when compared with the south coast and were also more likely to be part of a group off the north coast. The former was thought to be due to prey availability and the latter to increase the success of the hunt when targeting large prey species. Although the aim was not to determine abundance, a crude estimate of 56 was obtained, since this was the maximum number of killer whales ever reported independently on the same day. The data presented could be used to improve predictions of the most likely/unlikely times that killer whales are present off the Chukotka Peninsula, which would be beneficial to those conducting, for example, photoidentification surveys, or conversely seismic surveys. KEYWORDS: KILLER WHALE; NORTHERN HEMISPHERE; CHUKCHI SEA; BERING SEA; DISTRIBUTION; SURVEY-SHORE-BASED; SURVEY-VESSEL.

Yates, O. and Brickle, P. 2007. On the relative abundance and distribution of sperm whales (*Physeter macrocephalus*) and killer whales (*Orcinus orca*) in the Falkland Islands longline fishery. *J. Cetacean Res. Manage.* 9(1): 65-71.

The relative abundance and distribution of sperm whales (*Physeter macrocephalus*) and killer whales (*Orcinus orca*) in the Falkland Islands Conservation Zone was investigated by the analyses of scientific observer records from longline fishing vessels between 2002 and 2004. Thematic maps were created of observed spatial and temporal fishing effort and whale sightings. These suggested that killer whales were restricted to the northeast of the zone, whereas sperm whales were present throughout the east along the 1,000m depth-contour. A likelihood ratio test showed sperm whales to be relatively more abundant in the north and south of the zone than in the middle region ($p<0.01$). Group size and distribution is discussed relative to monthly fishing effort and temporal analysis of sightings considered. 32.4% of observed stations had sperm whales present but no significant difference was found between catches with whales present and catches with no whales present ($p=0.8743$, $t=0.1598$, $df=25$). KEYWORDS: INDEX OF ABUNDANCE; DISTRIBUTION; SPERM WHALE; KILLER WHALE; FALKLAND ISLANDS; FISHERIES; MOVEMENTS; SOUTHERN HEMISPHERE; SURVEY-VESSEL.

Leduc, R.G., Dizon, A.E., Goto, M., Pastene, L.A., Kato, H., Nishiwaki, S., Leduc, C.A. and Brownell, R.L. 2007. Patterns of genetic variation in Southern Hemisphere blue whales, and the use of assignment test to detect mixing on the feeding grounds. *J. Cetacean Res. Manage.* 9(1): 73-80.

A total of 111 samples from Southern Hemisphere blue whales were sequenced for 420 base pairs of the mitochondrial control region and all but one of those were genotyped over seven microsatellite loci. Comparisons were made between samples from three broad geographic regions: the southeast Pacific Ocean; Indian Ocean; and around the Antarctic continent. Each of these strata was found to be highly differentiated from the others, in both mitochondrial and nuclear data. The genetic differentiation between the geographic ranges of the nominal subspecies (i.e. true blue whales in Antarctica vs. pygmy blues in Pacific and Indian Oceans) was not markedly greater than between the populations of pygmy blue whales. Assignment tests using the microsatellite data provide some insight into detection of feeding-season mixing, although existing methods have some limitations. KEYWORDS: BLUE WHALE; GENETICS; FEEDING GROUNDS; SOUTHERN HEMISPHERE; PACIFIC OCEAN; INDIAN OCEAN.

Øen, E.O. and Knudsen, S.K. 2007. Euthanasia of whales: the effect of .375 and .458 calibre round-nosed, full metal-jacketed rifle bullets on the central nervous system of common minke whales. *J. Cetacean Res. Manage.* 9(1): 81-88.

The effect of rifle projectiles used for the euthanasia of stranded or hunted whales has been an issue for debate, in particular in the International Whaling Commission (IWC) and the North Atlantic Marine Mammal Commission (NAMMCO). In the Norwegian hunt for common minke whales, 9.3mm, .375 or .458 calibre rifles are used as backup weapons to euthanise whales that are not deemed dead after being hit with a harpoon grenade. When using the rifle, the hunters aim at the brain of the animal. The present study investigates the effects of the two rifle calibres .375 and .458 and round-nosed, full-metal jacketed bullets in 29 common minke whales. The whales were examined *post mortem* shipboard and 22 of the brains were fixed *in situ* and later subjected to gross and light microscopic examination. The results show that the two types of bullets are fully capable of penetrating the skull and spinal bones of common minke whales and fatally damaging the central nervous system, resulting in immediate or very rapid loss of consciousness. KEYWORDS: WHALING-MODERN; EUTHANASIA; BRAIN; HISTOLOGY; COMMON MINKE WHALE.

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Kishiro, T. 2007. Geographical variations in the external body proportions of Baird's beaked whales (*Berardius bairdii*) off Japan. *J. Cetacean Res. Manage.* 9(2): 89-94.

The use of morphometrics in stock identification studies for cetaceans has been widely employed. In this study, 14 measurements of external body proportions of 172 Baird's beaked whales caught by small-type whaling operations off the Pacific coast of Japan, the Sea of Japan and the Sea of Okhotsk from 1988 to 2004 were examined using canonical discriminant analysis (CANDISC) and ANCOVA with body length as a covariate. The canonical variates obtained from the CANDISC could discriminate between whales from the Pacific coast and the Sea of Japan for both males and females, although some overlap was observed. The flipper size (maximum width and straight length) of the Pacific coast whales was significantly larger (3.9-8.3%) than that of the Sea of Japan whales. The canonical variates of the Sea of Okhotsk whales were located in the middle area between the Pacific coast and the Sea of Japan and a significant difference was not observed, however the Sea of Okhotsk samples consisted of data measured by several researchers and so a sampling error may have been introduced. The morphological differences observed between the Pacific coast and the Sea of Japan whales suggest different stocks occur in these two waters. KEYWORDS: BEAKED WHALE-BAIRD'S; WHALING-SMALL-TYPE; MORPHOMETRICS; PACIFIC OCEAN; SEA OF JAPAN; OKHOTSK SEA; NORTHERN HEMISPHERE; ASIA; MIGRATION; DISTRIBUTION.

Heide-Jørgensen, M.P., Simon, M.J. and Laidre, K.L. 2007. Estimates of large whale abundance in Greenland waters from a ship-based survey in 2005. *J. Cetacean Res. Manage.* 9(2): 95-104.

A ship-based line transect survey of large whales in East and West Greenland was conducted in September 2005. The survey platform primarily targeted capelin, *Mallotus villosus*, using acoustic methods and systematically covered the east and west coasts of Greenland from the coast to the shelf break (approximately 200m). The surveyed area comprised 81,000km² in East Greenland and 225,000km² in West Greenland. A total of 194 sightings of 13 cetacean species were obtained and standard line transect methods were used to derive abundance estimates of the four most commonly encountered large cetaceans. Fin whales, *Balaenoptera physalus*, were most abundant in East Greenland (3,214, 95% CI=980-10,547) with lower abundances estimated for West Greenland (1,980, 95% CI=913-4,296). Sei whales, *B. borealis*, were frequently encountered in the same areas as fin whales, but the estimated abundance in East Greenland (763, 95% CI=236-2,465) was lower than in West Greenland (1,599, 95% CI=690-3,705). Humpback whales, *Megaptera novaeangliae*, were found both in offshore and coastal areas of West Greenland (1,306, 95% CI=570-2,989) and in low numbers in East Greenland (347, 95% CI=48-2,515). Finally, common minke whale, *B. acutorostrata*, abundance was estimated at 1,848 (95% CI=197-17,348) for East Greenland and 4,479 (95% CI=1,760-11,394) for West Greenland. Inclusion of sightings of unidentified large baleen whales in West Greenland distributed in proportion to species and strata increased abundance estimates for fin, sei, and humpback whales to 2,824 (95% CI=1,346-5,925), 2,009 (95% CI=948-4,260), and 1,514 (95% CI=560-4,089), respectively. Despite good conditions and considerable effort, few cetaceans were observed in the northernmost strata in West Greenland. This suggests that the southbound fall migration of large whales from North West Greenland had already started by the time the survey was initiated. The abundance estimates presented in this study are negatively biased. No corrections were applied for whales missed by observers or for whales submerged during the passage of the survey platform, which should cause a particularly large negative bias, for the estimates of common minke whale abundance. KEYWORDS: ABUNDANCE ESTIMATE; AREA-GREENLAND; FIN WHALE; HUMPBACK WHALE; COMMON MINKE WHALE; NAMMCO FIN WHALES; SEI WHALE; SURVEY-VESSEL; NORTHERN HEMISPHERE; G(0); DISTRIBUTION.

Kiszka, J., Ersts, P.J. and Ridoux, V. 2007. Cetacean diversity around the Mozambique Channel island of Mayotte (Comoros Archipelago). *J. Cetacean Res. Manage.* 9(2): 105-10.

The Indian Ocean was designated as a whale sanctuary in 1979. While cetacean research has been conducted throughout the sanctuary, few studies have been conducted to assess the diversity, distribution and abundance of cetaceans inhabiting the waters surrounding the islands in the northern Mozambique Channel. In order to contribute to management and conservation efforts in

this area, a series of small boat-based surveys were undertaken around the island of Mayotte from July 2004 to August 2005 to assess the diversity of cetaceans in the lagoon and surrounding waters, i.e. external barrier reef slope, insular slope (200-1,000m) and oceanic (>1,000m) waters. During this period, more than 284 hours were spent at sea on-effort and 17 cetacean species were recorded around Mayotte (n=286 sightings). One mysticete (1 Balaenopterid) and sixteen odontocetes (1 Kogid, 1 Physterid, 13 Delphinids and 2 Ziphiids) were observed: spinner dolphin, n=118; pantropical spotted dolphin, n=61; Indo-Pacific bottlenose dolphin, n=44; humpback whale, n=37; melon-headed whale, n=5; Blainville's beaked whale, n=4; Indo-Pacific humpback dolphin, n=4; common bottlenose dolphin, n=2; Risso's dolphin, n=2; false killer whale, n=2; dwarf sperm whale, n=2; sperm whale, n=1; pygmy killer whale, n=1; short-finned pilot whale, n=1; Fraser's dolphin, n=1; and Longman's beaked whale, n=1. In addition to these 17 species recorded during dedicated surveys, two other cetacean species were observed opportunistically and subsequently identified as the Ginkgo-toothed beaked whale and the blue whale. The relatively large diversity of cetaceans around Mayotte is attributed to the wide range of marine habitats, such as coastal, reef-associated and oceanic, within close proximity to one another. KEYWORDS: INDIAN OCEAN; MOZAMBIQUE CHANNEL; ODONTOCETES; DIVERSITY; SURVEY-VESSEL; SPINNER DOLPHIN; PANTROPICAL SPOTTED DOLPHIN; INDO-PACIFIC BOTTLENOSE DOLPHIN; HUMPHACK WHALE; MELON-HEADED WHALE; BEAKED WHALE-BLAINVILLES; INDO-PACIFIC HUMPHACKED DOLPHIN; COMMON BOTTLENOSE DOLPHIN; RISSO'S DOLPHIN; FALSE KILLER WHALE; DWARF SPERM WHALE; SPERM WHALE; PYGMY KILLER WHALE; SHORT-FINNED PILOT WHALE; FRASER'S DOLPHIN; BEAKED WHALE-LONGMANS; HABITAT; DISTRIBUTION; SOUTHERN HEMISPHERE.

Best, P.B. and Mate, B. 2007. Sighting history and observations of southern right whales following satellite tagging off South Africa. *J. Cetacean Res. Manage* 9(2): 111-14.

In September 2001, satellite tags were deployed on 21 southern right whales (*Eubalaena australis*) in South African coastal waters, including eight cows accompanied by newborn calves. To date there have been 26 re-sightings of 11 of these individuals (or their calves) at intervals of 27-1,502 days. So far, 85.7% of the females with calves have been re-sighted with a second calf, at intervals comparable to those that the same individuals showed before tagging. All tags seem to have been shed between 27 and 36 months of tagging. Superficial and remote examination of wound sites indicated the frequent formation of divots with accompanying scarring and cyamids, but little sign of localised (and none of regional) swelling. KEYWORDS: AFRICA; SOUTHERN RIGHT WHALE; SATELLITE TAGGING; REPRODUCTION; SURVIVORSHIP; SOUTHERN HEMISPHERE.

Mikkelsen, B., Bloch, D. and Heide-Jørgensen, M.P. 2007. A note on movements of two fin whales (*Balaenoptera physalus*) tracked by satellite telemetry from the Faroe Islands in 2001. *J. Cetacean Res. Manage* 9(2): 115-20.

In August 2001, two fin whales were tagged with satellite linked radio transmitters 90km east of the Faroe Islands (62°N, 7°W). One whale that was tracked for 48 days resided on the Faroe shelf inside the 500m depth contour, with movements ranging within 190km from the tagging site. Another whale that was tracked for 116 days moved south to 46°N, 21°W, i.e. the same latitude as the Bay of Biscay, during the first 16 days of the tracking, which corresponds to a straight line distance of 2,830km. After residing at this latitude for three weeks, it moved northeast again, during two weeks, to an area north-west of Ireland. For the following two month period, it mainly moved within 54-58°N, at depths of 1,000-2,500m. A total of 132 positions were received from the two whales, most of relatively low accuracy, but still applicable for depicting large scale movements. KEYWORDS: FIN WHALE; MOVEMENT; NAMMCO FIN WHALES; SATELLITE TRACKING; TELEMETRY; NORTHERN HEMISPHERE; ATLANTIC OCEAN.

Heide-Jørgensen, M.P. and Laidre, K. 2007. Autumn space-use patterns of humpback whale (*Megaptera novaeangliae*) in West Greenland. *J. Cetacean Res. Manage* 9(2): 121-26.

Five humpback whales were tagged with satellite transmitters on their summer feeding grounds in West Greenland in August between 2002 and 2005. Tracking durations lasted between 13 and 111 days and the locations obtained from the whales provided the first insight on the autumn distribution patterns of this species in West Greenland. Whales demonstrated a consistent pattern of rapid and long-distance movements along the West Greenland coast separated by longer-term, focal area use where feeding occurred. Humpback whales in West Greenland feed on capelin (*Mallotus villosus*), sand eels (*Ammodytes* sp.), and krill and these three prey species require different foraging strategies. Generally whales showed high affinity to the coast due to shallow aggregations of capelin. However some use of offshore regions was detected, likely due to concentrations of sand eels. One whale crossed Baffin Bay to Baffin Island, an area not known to support humpback whales. The rapid movements of humpback whales between feeding sites in Greenland and Canada may be a response to variable and dynamic prey resources throughout the summer and autumn seasons. KEYWORDS: SATELLITE TAGGING; MOVEMENT; HUMPHACK WHALE; GREENLAND; NORTHERN HEMISPHERE; FEEDING; FOOD/PREY.

Teloni, V., Zimmer, W.M.X., Wahlberg, M. and Madsen, P.T. 2007. Consistent acoustic size estimation of sperm whales using clicks recorded from unknown aspects. *J. Cetacean Res. Manage* 9(2): 127-36.

The multipulse structure of sperm whale clicks offers a unique way to acoustically estimate body length, as the inter-pulse intervals within the clicks relate to the two-way travel time within and thereby to the size of the hypertrophied nose in this species. Despite its large potential to allow the estimation of length acoustically, the technique has only been used in a few studies to assess the length composition of sperm whale populations. Its limited use may relate to the fact that only some clicks within a click series normally display the regular multipulsed structure required for size estimation. The inter-pulse intervals of usual clicks vary with the recording aspect to the clicking whale and the pulse delays are not necessarily directly related to the length of the spermaceti organ. To overcome these difficulties, a method is provided to estimate sperm whale body lengths, based on averages of cepstra derived from a large number of clicks recorded from whales in unknown recording aspects. This study shows that the two-way travel time in the spermaceti organ can consistently be estimated by a peak in the averaged cepstra when a large number of clicks are analysed. This method is shown to give a consistent estimation of the size of the spermaceti organ when recording the whale in an unknown orientation and also when recordings are heavily influenced by surface reflections. KEYWORDS: SPERM WHALE; VOCALISATION; SURVEY; ACOUSTICS; MONITORING.

Lauriano, G. and Bruno, S. 2007. A note on the acoustic assessment of bottlenose dolphin behaviour around fishing gears in the Asinara Island National Park, Italy. *J. Cetacean Res. Manage* 9(2): 137-41.

Common bottlenose dolphins co-exist with artisanal fisheries in the Asinara Island National Park area (northwestern Sardinia, Italy) and are blamed for damage to some fisheries. To investigate this, two T-POD echolocation loggers were used between July 2003 and October 2004 to monitor the occurrence and behaviour of dolphins in the proximity of three different fishing gear types. With the support of local fishermen, the T-PODs were opportunistically deployed on trammel nets set for striped red mullet or for lobster and on bottom traps set to catch benthic fish species. Inter-click Intervals (ICI) and the Pulse Repetition Frequency (PRF) have been adopted as indicators of dolphins echolocation behaviour in the proximity of fishing gears (Leeney and Tregenza, 2006). PRF values were found to be consistently higher in proximity to trammel nets for striped red mullets compared to the other gears. Moreover, ICI values in the proximity of red mullet trammel nets were found to be statistically lower than those recorded both around trammel nets for lobster ($p < 0.01$) and around traps ($p < 0.01$). These findings suggest that feeding related activities by dolphins could be absent or take place at very low levels in the proximity of traps and, to a lesser extent, in the proximity of trammel nets set for lobster, but may occur more regularly around nets for striped red mullet. The results show that static acoustic monitoring can detect significant differences in dolphin echolocation behaviour around different fishing gears. The findings seem to be consistent with previous evidence of interactions between bottlenose dolphins and fishing gear types in the area. KEYWORDS: VOCALISATION; FEEDING; ACOUSTICS; EUROPE; FISHERIES; COMMON BOTTLENOSE DOLPHIN; ECHOLOCATION; NORTHERN HEMISPHERE; FOOD/PREY.

Gero, S., Gordon, J., Carlson, C., Evans, P. and Whitehead, H. 2007. Population, estimate and inter-island movement of sperm whales, *Physeter macrocephalus*, in the Eastern Caribbean Sea. *J. Cetacean Res. Manage* 9(2): 143-50.

When a population extends across international boundaries, management becomes more complex. This is especially true within a confined multinational area such as the Caribbean Sea. The population size of sperm whales in the Eastern Caribbean is estimated and the inter-island movements of individuals are quantified using a database of 1,394 photographic identifications taken between 1984 and 2006 by several research groups. A total of 194 individual sperm whales were identified off the leeward coasts of the islands of Dominica, Guadeloupe, Grenada, St. Lucia and Martinique. Population size was estimated using two-component finite mixture models. About 145 (95% CI=94-219) sperm whales used Lesser Antillean waters in 1995 and this population appears to be growing slowly. There are differences amongst the individuals in their probability of identification. Of all individuals, 57 (29.4%) were identified during more than one year between 1995 and 2006. Long-term reidentification of associated females suggests that social units may be using the area for periods of at least 11 years. Twenty seven confirmed matches were made between islands, the majority (92.6%) of which were between Guadeloupe and Dominica, although there were two longer movements by single individuals between Dominica and the islands of St. Lucia and Grenada. High reidentification rates within the Lesser Antilles and no matches with identifications from nearby seas suggest the population in the Eastern Caribbean Sea is small and quite isolated. As such, we recommend that management actions be taken on a multi-island basis for the Eastern Caribbean, by encouraging the ratification of the SPAW protocols and that the current stock classification for the North Atlantic be reconsidered. KEYWORDS: ABUNDANCE ESTIMATE; MOVEMENT; SPERM WHALE; CARIBBEAN SEA; PHOTO-ID; MODELLING; MANAGEMENT; STOCK IDENTITY.

Pitman, R., Fearnbach, H., LeDuc, R., Gilpatrick, J.W., Ford, J.K.B. and Ballance, L.T. 2007. Killer whales preying on a blue whale calf on the Costa Rica Dome: genetics, morphometrics, vocalizations and composition of the group. *J. Cetacean Res. Manage* 9(2): 151-58.

Killer whale (*Orcinus orca*) populations in high latitude, nearshore areas appear to regularly exhibit prey specialisation among two or more sympatric ecotypes, but nearly nothing is known about populations that inhabit open ocean areas or tropical latitudes. On 26 September 2003, during a cetacean survey in the eastern tropical Pacific Ocean, a group of an estimated 19 killer whales was encountered feeding on a calf of a blue whale (*Balaenoptera musculus*); the location was 10°58'N, 88°40'W, 230km west of Nicaragua. The whales were studied for 2.5 hours and during this time skin biopsy samples were collected, acoustic recordings made, aerial and lateral photographs taken and behavioural observations recorded. The 19 individuals identified included 4 males (3 adults, 1 subadult), 5 cow-calf pairs and 5 other females/subadult males. Using aerial photogrammetry, body lengths of 17 different animals were measured: the largest male (who carried the carcass most of the time) was 8.0m long; and the largest female (with a calf) was 6.1m. From 10 biopsy samples, two distinct haplotypes were identified that differed from resident (i.e. fish-eating ecotype) killer whales in the northeastern Pacific by one and two base pairs, respectively. The single discrete call recorded was a typical killer whale call but it had a two-part pitch contour that was structurally distinct from calls recorded to date in the North Pacific. These observations reaffirm that calves of even the largest whale species are vulnerable to predation, although by migrating to calving areas in the tropics, where killer whale densities are lower, baleen whales should be able to increase their overall reproductive fitness, as suggested by Corkeron and Connor (1999). KEYWORDS: KILLER WHALE; PREDATION; GENETICS; MORPHOMETRICS; VOCALISATION; BLUE WHALE; MIGRATION; PACIFIC OCEAN; NORTHERN HEMISPHERE.

Allen, S., Smith, H., Waples, K. and Harcourt, R. 2007. The voluntary code of conduct for dolphin watching in Port Stephens, Australia: is self-regulation an effective management tool? *J. Cetacean Res. Manage* 9(2): 159-66.

In the absence of guidelines or government regulation for a rapidly expanding industry, dolphin watching operators in Port Stephens, New South Wales, Australia, formulated and adopted a voluntary code of conduct in 1996. This code was designed to reduce perceived pressures on dolphins and was updated to conform to the Australian National Guidelines for Cetacean Observation when they were released in 2000. Compliance to this code of conduct was assessed in a shore-based survey over the austral summer of 2002/03. Operator compliance was generally high for: number of dolphin watching boats per dolphin school; time spent by individual operators with dolphins; method of approach to dolphins; and frequency of cruises conducted per day. However, operators did not discriminate between dolphin schools containing calves and those that did not (equating to a breach of the national guidelines) and three of nine regular operators committed most breaches of the code, particularly with regard to boat-handling around dolphins and frequency of cruises conducted per day. The code's aim in reducing exposure of dolphins to

boats was not achieved as dolphin schools were subject to consecutive approaches by numerous boats and interactions also involved boats to which the code did not apply. This voluntary code is thus of limited value without revision, education and enforcement. The inability of a voluntary code to manage the number of operators and other watercraft highlights the need for management alternatives that will increase compliance by all users of the waterways. Furthermore, widespread assessments of compliance are necessary, particularly where assessments of the effects of cetacean-based tourism are being conducted. To determine whether identified impacts are a result of inappropriate management strategies, or non-compliance with suitable management, requires that management strategies are tested while simultaneously testing or ensuring compliance. KEYWORDS: INDO-PACIFIC BOTTLENOSE DOLPHIN; REGULATION; SURVEY-SHORE-BASED; SUSTAINABILITY; WHALEWATCHING; SOUTHERN HEMISPHERE; AUSTRALASIA.

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Windsland, K., Lindstrøm, U., Nilssen, K.T. and Haug, T. 2007. Relative abundance and size composition of prey in the common minke whale diet in selected areas of the northeastern Atlantic during 2000-04. *J. Cetacean Res. Manage* 9(3):167-78.

A total of 210 common minke whales (*Balaenoptera acutorostrata*) were sampled in five different areas in the northeastern Atlantic during May-June 2000-04. Analysis of forestomach contents revealed a relatively mixed diet at the population level, whereas on an individual level, each whale had fed upon mainly one species. There were significant differences in diet composition between areas and some differences between years. The importance of krill in the Barents Sea increased with latitude and krill dominated the Spitsbergen diet. Capelin dominated the diet around Bear Island and contributed considerably to the diet along the coast of northern Norway. In the latter area, herring and haddock were also a great part of the diet. The diet in the Norwegian Sea consisted of mainly mature herring, while the diet in the North Sea was dominated by sand eels and mackerel. The minke whales were found to feed on a wide range of prey sizes, apparently determined by the availability of different size classes. KEYWORDS: COMMON MINKE WHALE; ECOSYSTEM; FEEDING GROUNDS; FOOD/PREY; NORTH ATLANTIC; NORTHERN HEMISPHERE; BARENTS SEA; NORWEGIAN SEA; NORTH SEA

Leaper, R. and Lavigne, D. 2007. How much do large whales eat? *J. Cetacean Res. Manage* 9(3):179-88.

Estimates of the amount of prey consumed by cetaceans have been used in ecological models and also directly compared to human fisheries yields. Most of these estimates have been based on assumptions about energy requirements. However, the lack of direct measurements for large whales has necessitated extrapolation beyond the data points available from smaller species. A number of different parameterisations of general regressions in which energy requirements or consumption are estimated as proportional to body mass raised to some power B , were compared with estimates of Basal Metabolic Rate (BMR) from the widely used Kleiber equation. The choice of values has a large impact on estimates, which can differ by an order of magnitude, but modellers are frequently forced to make rather arbitrary decisions due to lack of data. Nevertheless, neither data nor theory appear to support values of $B > 0.75$. Although some parameter values have obtained status through common usage, these have not always been based on actual data and estimates of consumption by whales need to reflect this uncertainty. Comparison of generalised relationships with data from other sources, including rates of filter feeding, oxygen consumption and seasonal changes in energy stores, suggest upper bounds on average daily metabolic rate of large whales. Estimates based on stomach contents also indicated average daily metabolic rates of less than four times the BMR from the Kleiber formula, but these are critically dependent on estimates of digestion time for which there appear to be little data. Estimates of stored energy suggest that large whales that migrate to seasonally productive feeding areas either have relatively low energy requirements for their size or need to meet a considerable proportion of their annual energy requirements outside of the feeding grounds. KEYWORDS: ENERGETICS; FOOD/PREY; FEEDING; MODELLING; MANAGEMENT; NORTHERN BOTTLENOSE WHALE; NORTH ATLANTIC RIGHT WHALE; BLUE WHALE; BOTTLENOSE DOLPHIN; NARWHAL; ANTARCTIC MINKE WHALE; COMMON MINKE WHALE; SPERM WHALE; SEI WHALE; KILLER WHALE; FIN WHALE.

Benjamins, S., Lawson, J. and Stenson, G. 2007. Recent harbour porpoise bycatch in gillnet fisheries in Newfoundland and Labrador, Canada. *J. Cetacean Res. Manage* 9(3):189-99.

Despite reduced fishing effort in many North Atlantic fisheries following collapse of fish stocks, concerns remain about levels of direct mortality of harbour porpoise (*Phocoena phocoena*), primarily through incidental catches in fishing gear. Although harbour porpoise incidental catch is known to occur in several fisheries along the coast of Newfoundland and Labrador, Canada, there are no reliable quantitative estimates for the last decade when the commercial fisheries have undergone major changes in effort and target species. Based on incidental catch rates derived using different reporting methods, with net-days as measures of effort and fishing trips as sampling units, the potential number of incidental catches of harbour porpoises in several gillnet fisheries in Newfoundland waters was estimated for the years 2001, 2002 and 2003. Confidence intervals were calculated using re-sampling techniques. Incidental catches of small cetaceans were estimated to be 862 in 2001, 1,428 in 2002 and 2,228 in 2003 in Newfoundland gillnet fisheries; virtually all cetaceans reported were harbour porpoises. Annual estimates of incidental catch of small cetaceans varied greatly between fisheries and areas. Confidence intervals were large due to variation in reported incidental catch rates among individual fishers and geographic areas. Most small cetaceans were reported in the nearshore cod fishery, although there were also numerous reports of catches in nearshore fisheries for lumpfish, herring and Greenland halibut. Incidental catch of small cetaceans was also identified in offshore fisheries for monkfish, white hake and Greenland halibut. Most incidental catch events occurred during the third quarter of the year (July-September) along the south coast, although catches of harbour porpoises were also reported during the second and fourth quarters. Several strategies could be implemented to better monitor small cetacean incidental catch in Newfoundland and Labrador waters. However, harbour porpoise population estimates are required before it can be determined if this fisheries-related mortality occurring in Newfoundland is sustainable. KEYWORDS: HARBOUR PORPOISE; INCIDENTAL CATCHES; GILLNETS; NORTH ATLANTIC; FISHERIES; NORTHERN HEMISPHERE.

Teilmann, J., Larsen, F. and Desportes, G. 2007. Time allocation and diving behaviour of harbour porpoises (*Phocoena phocoena*) in Danish and adjacent waters. *J. Cetacean Res. Manage* 9(3):201-10.

To gain insight into the time allocation and diving behaviour of harbour porpoises in Danish and adjacent waters, satellite linked dive recorders were mounted on 14 harbour porpoises. The animals were incidentally caught alive by fishermen using pound nets during 1997-99 in the Danish Belt seas. Information on diving behaviour was collected from April to November. Contact with individual porpoises remained for up to 130 days. The average number of dives per hour was 29 during April-August and 43 during October-November. Daily

maximum dive depth corresponds to the depth of the Belt seas and Kattegat where depth generally does not exceed 50m. Maximum dive depth recorded was 132m from animals moving north into Skagerrak. Dives were frequently recorded in the category 10-15min, but could potentially be an artefact of the sampling regime. The diurnal pattern shows that harbour porpoises dive continuously both day and night, but with peak activity during daylight hours. On average they spent 55% of their time in the upper 2m during April-August. These values have implications for aerial abundance surveys when correcting for animals not visible. A mature female and its approximately 10 months old calf were both tagged and swam together for 43 days until contact was lost. The calf made more frequent but shorter dives than the mature female. The number of dives per hour decreased, while the dive depth and duration increased for both animals from May to June, suggesting a change in feeding behaviour. It is not known whether the female and calf synchronised their dives, but the diurnal dive pattern shows a correlated dive rhythm in May, but not in June. This change in mother-calf behaviour suggests that the calf foraged more independently, corresponding to the time of year when porpoise calves leave their mother. KEYWORDS: SATELLITE TAGGING; TELEMETRY; DIURNAL; BEHAVIOUR; DIVING; HARBOUR PORPOISE; NORTHERN HEMISPHERE; ATLANTIC OCEAN.

Heide-Jørgensen, M.P. and Simon, M. 2007. A note on cue rates for common minke, fin and humpback whales off West Greenland. *J. Cetacean Res. Manage.* 9(3):211-14.

Field observations of cue rates for common minke whales, fin whales and humpback whales were conducted in July 1996 and May-September 2006. The cue's for minke whale was usually the dorsal ridge breaking the surface. A total of 295 minutes of Surfacings of five minke whales ranging from 27 to 106 minutes were observed and the simple mean was 46.1 surfacings per hour (CV=0.11). The cue for fin and humpback whale surfacings was either the head breaking the surface but most often a blow. Twentythree trials of fin whale groups ranging from 1 to 4 individuals provided 620 minutes of observations. The simple mean of all the trials was 52 blows/hr (CV=0.06), and if only trials >10 min are included the surfacing rate remain unchanged, but if only surfacings >30 min are included the surfacing decreases to 50 blows/hr (CV=0.07, N=8 trials). A total of 860 min (N=39 trials) and 1232 blows from surfacing humpback whales were collected from groups of 1-4 individuals. The simple mean of all trials was 71 blows/hr (CV=0.07). Both the minke, fin and humpback whale cue rate estimates are close to values obtained from other studies, but they are the first that are specific to West Greenland and it is suggested that they should be used for correcting abundance estimates obtained from the aerial cue counting method. KEYWORDS: COMMON MINKE WHALE; FIN WHALE; HUMPBACK WHALE; CUE RATES; WEST GREENLAND.

Dunstan, A., Soltzick, S., Birtles, A. and Arnold, P. 2007. Use of videogrammetry to estimate length to provide population demographics of dwarf minke whales in the northern Great Barrier Reef. *J. Cetacean Res. Manage* 9(3):215-23.

Commercial swim-with-whale programmes, based on the dwarf minke whale (*Balaenoptera acutorostrata*), have been conducted in Great Barrier Reef waters since 1996 and under permit since 2003. Evaluating the effectiveness of management requires information on the biology of the whales, including possible impacts on their critical life stages, such as mating or calving. In this study, length measurements have been used as the best available proxy for age and thus state of sexual maturity. Underwater videogrammetry was used to estimate the lengths of dwarf minke whales interacting with boats and swimmers during June/July 2003 and 2004. The calibrations used to correct systematic biases in distance and length estimates are presented and other sources of error associated with the methodology and the behaviour of the whales are discussed. Mean lengths (from replicate measurements of individually identified whales) ranged 4.82-6.61m in 2003 (n=23, from five encounters) and 4.48-7.18m in 2004 (n=56, from 29 encounters). The overall mean length (2003: 5.90m, 2004: 5.73m) did not differ significantly between years. In both years, the mean lengths of the majority of whales (2003: 57%; 2004: 59%) were less than 6m, which is regarded as sexually immature based on available life history data. The size ranges within a single encounter were broad; no encounter was dominated by one size class. Segregation by size was not observed. This paper presents the first field measurements of dwarf minke whales on their tropical wintering grounds. While most whales interacting with vessels or swimmers were immature, adult whales, including cow-calf pairs, also were involved. More information, especially on cumulative effects, is needed to assess the impact of these swim-with programmes. KEYWORDS: AGE DISTRIBUTION; AUSTRALASIA; DWARF MINKE WHALE; MONITORING; PHOTOGRAMMETRY; PHOTO-ID; SEGREGATION; SOCIAL; WHALEWATCHING; SOUTHERN HEMISPHERE; SURVEY-VESSEL.

Weir, C.R. 2007. Occurrence and distribution of cetaceans off northern Angola, 2004/05. *J. Cetacean Res. Manage* 9(3):225-39.

The occurrence and distribution of cetacean species off northern Angola was examined using dedicated survey data and incidental sighting records. Dedicated surveys for cetaceans were carried out during two geophysical seismic surveys off northern Angola between August 2004 and September 2005. A total of 3,268hr of survey effort data were collected, resulting in 779 on-effort cetacean sightings. There were 263 sightings reported off-effort and incidentally from other platforms and sports fishermen. With 21 cetacean species confirmed, the cetacean community off northern Angola is diverse and primarily tropical in characteristic, comprising four species of baleen whale, two sperm whale species, at least two beaked whale species, and 13 species of delphinid. Humpback and sperm whales were the most frequently recorded cetaceans. The occurrence of humpback whales was significantly higher within neritic waters, and during the winter and spring months in association with seasonal occupancy of their West African breeding grounds. Sperm whales were recorded in water depths exceeding 1,000m and demonstrated significant seasonality, with peak occurrence during the summer and autumn. Atlantic spotted dolphins and common dolphins (*Delphinus* sp.) were the most numerous delphinids recorded, with spotted dolphins showing a significant seasonal peak during the spring and summer, and common dolphins in the winter. Other species recorded included fin whale, sei whale, Bryde's whale, dwarf sperm whale, Cuvier's and Mesoplodon beaked whales, killer whale, short-finned pilot whale, false killer whale, melon-headed whale, Atlantic humpback dolphin, rough-toothed dolphin, Risso's dolphin, bottlenose dolphin, Pantropical spotted dolphin, spinner dolphin, Clymene dolphin and striped dolphin. Further research is required to document the cetacean community in Angola, particularly given the unknown threat from fishery bycatch and the increasing level of oil and gas exploration in the region. KEYWORDS: CETACEANS; DISTRIBUTION; HABITAT; SCHOOL SIZE; ANGOLA; ATLANTIC OCEAN; SURVEY-VESSEL; INCIDENTAL SIGHTINGS; FIN WHALE; SEI WHALE; BRYDE'S WHALE; DWARF SPERM WHALE; HUMPBACK WHALE; COMMON DOLPHIN; CUVIER'S BEAKED WHALE; KILLER WHALE; SHORT-FINNED PILOT WHALE; FALSE KILLER WHALE; MELON-HEADED WHALE; ATLANTIC HUMPBACK DOLPHIN; ROUGH-TOOTHED DOLPHIN; RISSO'S DOLPHIN; BOTTLENOSE DOLPHIN; PANTROPICAL SPOTTED DOLPHIN; SPINNER DOLPHIN; CLYMENE DOLPHIN; STRIPED DOLPHIN WATCHING.

Morete, M.E., Bisi, T.L. and Rosso, S. 2007. Mother and calf humpback whale responses to vessels around Abrolhos Archipelago, Bahia, Brazil. *J. Cetacean Res. Manage* 9(3):241-48.

As the humpback whale population spreads along the Brazilian coast, whalewatching activities are becoming more frequent in special along the coast of the state of Bahia. In order to evaluate the appropriateness of the Brazilian legislation that regulates vessel approaches to cetaceans, the behavior of humpback whale mothers and calves was studied around the Abrolhos Archipelago, an area with high concentration of tourism vessels. Mother and calf groups were observed by means of continuous sampling and tracked along with vessels using a theodolite. Three whale-vessel categories of distances were analyzed: closer than 100m (category 1), between 100 - 300m (category 2) and further than 300m (category 3). Rates of behavioral events and time spent in behavioral states of mothers and calves were compared separately in those 3 categories to observations of randomly selected mother and calf groups not involved in an interaction with a vessel (category 0). A total effort of 39h was analyzed including observations in each of the four categories. Our results showed that differences in humpback whale mother and calf behavior occurred mostly in the presence of vessels within distances of 100-300m. Mothers increased linearity and mean speed of movement, and decreased blow intervals and time spent resting. Calves exhibited less rolling, fluke-ups and others active behavioral events as well as diminished resting time. During the interaction with a vessel, the frequency of potentially important behaviors, both for mothers and calves, reduced, probably as a response to the approaching whalewatching vessels. Repeated short-term behavioral disturbances might lead to cumulative effects that may result in risks for the species conservation. Inasmuch, it is recommended that the Brazilian Legislation should include a 300-meter caution zone, where boats should reduce speed and avoid sudden changes in engine status and direction. The environmental education work with local communities along the coast must be continued and constant. KEYWORDS: CHANGE-SHORT-TERM; HUMPBACK WHALE; WHALEWATCHING.

Skaug, H.J., Bérubé, M., Rew, M.B. and Palsbøll, P. 2007. Genetic analyses reveal promiscuous mating in female common minke whales, *Balaenoptera acutorostrata*. *J. Cetacean Res. Manage* 9(3):249-51.

Based on 25 microsatellites, first order relatedness was established for three dyads of individuals contained in the Norwegian minke whale DNA-register. One large female minke whale was a member of all three dyads. Two competing genealogies were considered and under both of these the quartet contained siblings that with high probability must be half-siblings, as opposed to being full siblings. KEYWORDS: COMMON MINKE WHALE; DNA FINGERPRINTING; NORTH ATLANTIC; REPRODUCTION; GENETICS; NORTHERN HEMISPHERE.

Branch, T.A. 2007. Abundance of Antarctic blue whales south of 60°S from three complete circumpolar sets of surveys. *J. Cetacean Res. Manage* 9(3):253-62.

Sightings from the IDCR and SOWER austral summer surveys were analysed to provide abundance estimates for Antarctic (true) blue whales (*Balaenoptera musculus intermedia*) south of 60°S. The IDCR/SOWER ship-borne surveys have completely circled the Antarctic three times: 1978/79–1983/84 (CPI), 1985/86–1990/91 (CPII) and 1991/92–2003/04 (CPIII), covering strata totalling 64.3%, 79.5% and 99.7% of the ocean surface between the pack ice and 60°S. During the surveys, blue whales were only rarely sighted but were present around the Antarctic. Average sighting rates (schools per 1,000 km of primary search effort) were 0.24 (CPI), 0.36 (CPII) and 0.78 (CPIII). Respective circumpolar abundance estimates were 453 (CV=0.40), 559 (CV=0.47) and 2,280 (CV=0.36), with mid-years of 1980/81, 1987/88 and 1997/98. When adjusted simply for unsurveyed regions, the circumpolar rate of increase was 8.2% (95% CI 3.8–12.5%) per year, although they are still under 1% of their pre-exploitation abundance. These abundance estimates are negatively biased because they exclude some Antarctic blue whales that are north of 60°S, and because a low number of blue whales on the trackline may be missed. Additionally, estimates may include a small proportion of pygmy blue whales, probably less than 1%. Abundance estimates were also provided for each IWC Management Area and for each individual survey, but these have high associated uncertainty. KEYWORDS: BLUE WHALE; SOWER; WHALING-HISTORICAL; ANTARCTIC; SOUTHERN HEMISPHERE; SURVEY-VESSEL; ABUNDANCE ESTIMATE.

Jayasankar, P., Krishnan, A.A., Rajagopalan, M. and Krishnakumar, P.K. 2007. A note on observations on cetaceans in the western Indian sector of the Southern Ocean (20-56°S and 45-57°30'E), January to March 2004. *J. Cetacean Res. Manage* 9(3):263-67.

A multi-disciplinary and multi-institutional pilot expedition was organised by the National Centre for Antarctic and Ocean Research (NCAOR) to the ice-free areas of the Western Indian Ocean sector of the Southern Ocean onboard ORV Sagar Kanya during the austral summer of 2004 (January-March). This survey, conducted by the Central Marine Fisheries Research Institute (CMFRI), is the first Indian attempt to survey for cetacean diversity in the Southern Ocean. The ultimate objective is to determine distribution, relative abundance, migration patterns and critical habitat parameters. 68% of a total of 13 sightings (22 individuals) were positively identified and species observed included Antarctic minke whales (*Balaenoptera bonaerensis*), fin whales (*B. physalus*), sei whales (*B. borealis*) and blue whales (*B. musculus*). The blue whales were not identified to the sub-species level. The highest concentration of cetaceans was between 35° and 37°S (along 45°E) and between 48° and 53°S (along 45°E). Relatively small numbers of cetaceans were observed during the present cruise, possibly because most of the cetacean sighting effort was made during inclement sea conditions. Results on the sighting characteristics and occurrence patterns of the cetaceans in relation to the region and hydrographical parameters are discussed briefly vis a vis published information from the Southern Ocean. KEYWORDS: SOUTHERN OCEAN; CETACEAN SIGHTINGS; ANTARCTIC MINKE WHALE; FIN WHALE; HUMPBACK WHALE; SEI WHALE; BLUE WHALE; SOUTHERN HEMISPHERE; SURVEY-VESSEL; DISTRIBUTION.

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Kemper, C., Coughran, D., Warenke, R., Pirzl, R., Watson, M., Gales, R. and Gibbs, S. 2008. Southern right whale (*Eubalaena australis*) mortalities and human interactions in Australia, 1950-2006. *J. Cetacean Res. Manage.* 10(1):1-8.

A total of 44 records of southern right whale mortalities and non-fatal anthropogenic interactions have been documented in Australia by museums, wildlife agencies and researchers since 1950. Sixteen of the events involved whales that apparently survived. Events were recorded in all months except January and 65% occurred in the period July to October. Mortalities were more numerous in the western half of the continent where southern right whales are more frequently observed. Events were classified according to their outcome and nature: carcasses (with no evidence of human interaction) $n=25$, fatal entanglements $n=1$, non-fatal entanglements $n=12$, fatal vessel collisions $n=2$, non-fatal vessel collisions $n=3$, non-fatal shooting $n=1$. No live strandings were recorded. The number of both mortalities and non-fatal anthropogenic incidents has increased 4-fold since the mid 1970s. More calves than 'non-calf' whales were present in the carcass category, whereas the opposite was the case for events involving human interaction. Lines, nets and buoys used in fishing crustaceans (rock-lobster, crab) were associated with several entanglements ($n=5$). A longline entanglement of a 14m female resulted in a chronic injury, debilitation and death. As a proportion of the total records for each region, there were fewer vessel collisions of right whales in Australia (11%) than in South Africa (16%) or the North Atlantic (35%). KEYWORDS: SOUTHERN RIGHT WHALE; NORTH ATLANTIC RIGHT WHALE; AUSTRALASIA; STRANDINGS; INCIDENTAL CATCHES; VESSEL COLLISIONS; SOUTHERN HEMISPHERE.

Gilpatrick, J.W. and Perryman, W.L. 2008. Geographic variation in external morphology of North Pacific and Southern Hemisphere blue whales (*Balaenoptera musculus*). *J. Cetacean Res. Manage.* 10(1):9-22.

Geographic variations in size and proportions of blue whales (*Balaenoptera musculus*) were investigated using length data acquired from whaling records and aerial photogrammetric surveys. Results showed that blue whales found in the eastern Pacific off Central and North America are significantly shorter (by approximately 2m) than blue whales found at higher latitudes in the North Pacific. Results support the occurrence of a morphologically distinct eastern North Pacific (ENP) blue whale population which migrates in spring/summer from warm waters off Central America and Mexico to temperate feeding grounds along the west coast of North America. Southern Hemisphere blue whales sampled with vertical aerial photogrammetry off northern Peru and the Galapagos Islands were similar in size to the ENP blue whales. However, the population affinity of these southern blue whales remains uncertain. No length data were available for blue whales formerly captured off southern Japan and Korea. Nonetheless, a history of diminishing fishery catches and a lack of any recent sightings suggests that these whales were members of a geographic population that is now severely depleted or extinct. Based on comparisons of total length, length of rostrum and length of tail region, ENP blue whales were found to be morphologically similar to the 'pygmy' blue whale (*B.m. breviceauda*) described from the Kerguelen Island region of the southern Indian Ocean. 'Antarctic' blue whales (*B.m. intermedia*) from the Southern Ocean were found to be statistically significantly larger than their conspecifics at high latitudes in the North Pacific. These results support the hypotheses that blue whales that migrate from warm seas to cold feeding grounds in high latitudes are larger than those whose distributions are limited to low and mid-latitudes. Differences in morphology may reflect selective pressure on populations to adapt physiologically to energy demands associated with different migration, environmental and ecological regimes. As some of the results come from populations located far apart in different oceans, questions remain concerning the continuity of populations within and among ocean basins. Consequently, research using fishery data and approaches such as photogrammetry, telemetry, acoustics and molecular genetic analysis should be continued to better understand the worldwide blue whale population structure. KEYWORDS: BLUE WHALE; DISTRIBUTION; MORPHOMETRICS; PHOTOGRAMMETRY; PHOTOGRAPHY; SOUTHERN HEMISPHERE; WHALING-HISTORICAL; PHOTO-ID; SURVEY-AERIAL; MIGRATION; PACIFIC OCEAN; SOUTHERN OCEAN.

Boisseau, O., Gillespie, D., Leaper, R. and Moscrop, A. 2008. Blue (*Balaenoptera musculus*) and fin (*B. physalus*) whale vocalisations measured from northern latitudes of the Atlantic Ocean. *J. Cetacean Res. Manage.* 10(1):23-30.

Vocalisations were recorded in the vicinity of sighted blue whales (*Balaenoptera musculus*) and fin whales (*B. physalus*) in the North Atlantic between Iceland and Greenland in August 2004 from a hydrophone towed behind a research vessel and from free floating sonobuoys. The structures of recorded calls were broadly similar to those reported from other areas, but lacked the stereotypical patterning of those signals thought to represent reproductive displays. Counts of non-patterned blue whale calls indicated low vocalisation rates, with a mean of 0.62 phrases per whale per hour (0.12 A-B and 0.49 arch phrases per whale per hour). However, vocalisations were highly clustered in time, with 80% of blue whale calls ascribed to the focal animals arriving within a single 80 second period. It is not clear what behavioural, geographical or seasonal trends may influence the vocalisation rate of large baleen whales, and thus direct comparisons between areas are difficult. However, it is hoped the results presented will be of use in interpreting remote recordings of blue whales made from the North Atlantic. Hydrophones were also monitored continuously over 7,757km of trackline using an automated detection algorithm developed for North Atlantic right whales (*Eubalaena glacialis*). However, no North Atlantic right whales were seen or heard during the study period. KEYWORDS: BLUE WHALE; FIN WHALE; NORTH ATLANTIC RIGHT WHALE; ACOUSTICS; VOCALISATION; SURVEY-ACOUSTIC; NORTHERN HEMISPHERE; ATLANTIC OCEAN.

Flach, L., Flach, P.A. and Chiarello, A.G. 2008. Density, abundance and distribution of the guiana dolphin (*Sotalia guianensis* van Benéden, 1864) in Sepitiba Bay, southeast Brazil. *J. Cetacean Res. Manage.* 10(1):31-36.

Line transect surveys were conducted from August 2002 to July 2003 to examine the abundance and distribution of the guiana dolphin (*Sotalia guianensis*) in Sepitiba Bay-Southeast Brazil. A boat-based platform and 50 pre-determined line transects were used to assess the population on two main stratum-specific environments of the bay (entrance and interior). A total of 3,140km of transects were surveyed at 12-15km hr⁻¹ and good sea conditions (Beaufort 0-2), resulting in 157 sightings of dolphin groups and 129 sightings after truncation of all sightings beyond 400m. From the 129 sightings the DISTANCE program generated a population density of 2.79 dolphins km⁻² and calculated a population of 1,269 individuals (CI=739-2,196) for the bay. Sighting frequency ($n=126$ or 80.3%) was higher at the entrance of the bay compared with the interior ($n=31$ or 19.7%), although, the density and abundance were similar for the entrance (2.91 dolphins km⁻² and 596 dolphins) and interior (2.69

dolphins km⁻² and 672 dolphins). Results reveal an important population of guiana dolphin at Sepetiba Bay, the largest thus far studied off the South American coast, stressing the importance of the area for the conservation of this species. The study also indicated that line-transect sampling carried out from small boats in large bays can produce statistically robust estimates and therefore could be recommended for population monitoring in other areas of the Brazilian coast with similar characteristics. KEYWORDS: CETACEANS; DISTANCE SAMPLING; SOUTH AMERICA; GUIANA DOLPHIN SURVEY-VESSEL; ABUNDANCE ESTIMATE; DISTRIBUTION; STATISTICS.

Smith, B.D. and Mya, T.T. 2008. A note on the species occurrence, distributional ecology and fisheries interactions of cetaceans in the Mergui (Myeik) Archipelago, Myanmar. *J. Cetacean Res. Manage.* 10(1):37-44.

A vessel-based line-transect survey for cetaceans conducted during 23 February-6 March 2005 of the nearshore waters (to a depth of 40-60m) of the Mergui (Myeik) Archipelago of southern Myanmar searched along 955km of trackline resulting in 30 cetacean sightings. These included Indo-Pacific bottlenose dolphins *Tursiops aduncus* ($n=15$), Indo-Pacific humpback dolphins *Sousa chinensis* ($n=3$), spinner dolphins *Stenella longirostris* ($n=4$); the largest of these was mixed with pantropical spotted dolphins *Stenella attenuata*, Irrawaddy dolphins *Orcaella brevirostris* ($n=1$), finless porpoises *Neophocaena phocaenoides* ($n=1$), Bryde's whales *Balaenoptera edeni/brydei* (identification tentative; $n=1$), one unidentified baleen whale (probably also a Bryde's whale) and four unidentified delphinid groups. Irrawaddy dolphins and finless porpoises were found in shallow, brackish waters, Indo-Pacific humpback dolphins also in shallow waters but those less affected by freshwater inputs and Bryde's whales and Indo-Pacific bottlenose, spinner and spotted dolphins in deeper and clearer waters. In total 2,565 gill netters/long liners (95% CI=1,228-3,903), 1,301 squid jiggers (95% CI=611-1,992) and 532 stern trawlers (95% CI=154-910) were estimated to be operating in the study area. Concentrations of gill netters/long liners were particularly high in shallow nearshore waters and at least 150 were operating in the bay where the only sightings of Irrawaddy dolphins and finless porpoises were made. There is a need to better assess nearshore cetacean populations, investigate whether or not incidental and intentional catches are sustainable and incorporate a cetacean element into an initiative to establish a marine protected area network in the Mergui Archipelago. KEYWORDS: SURVEY-VESSEL; HABITAT; FISHERIES; GILLNETS; ASIA; INCIDENTAL CATCHES; DIRECT CAPTURE; TRAWLS; CONSERVATION; DISTRIBUTION; NORTHERN HEMISPHERE; INDO-PACIFIC BOTTLENOSE DOLPHIN; INDO-PACIFIC HUMPBAC DOLPHIN; SPINNER DOLPHIN; PANTROPICAL SPOTTED DOLPHIN; IRRAWADDY DOLPHIN; FINLESS PORPOISE; BRYDE'S WHALE, DWARF SPERM WHALE.

Smith, B.D., Ahmed, B., Mowgli, R.M. and Strindberg, S. 2008. Species occurrence and distributional ecology of nearshore cetaceans in the Bay of Bengal, Bangladesh, with abundance estimates for Irrawaddy dolphins *Orcaella brevirostris* and finless porpoise *Neophocaena phocaenoides*. *J. Cetacean Res. Manage.* 10(1):45-58.

A vessel-based line-transect survey conducted during February 2004 along 1,018km of systematic trackline in the nearshore waters of Bangladesh resulted in 111 'on-effort' cetacean sightings including: Irrawaddy dolphins, *Orcaella brevirostris* ($n=75$, mean group size=2.2); finless porpoises, *Neophocaena phocaenoides* ($n=11$, mean group size=2.6); Indo-Pacific humpback dolphins, *Sousa chinensis* (*chinensis*-form; $n=6$, mean group size=16.2); Indo-Pacific bottlenose dolphins, *Tursiops aduncus* ($n=3$, mean group size=36.1); pantropical spotted dolphins, *Stenella attenuata* ($n=1$, best, high and low group size estimates=800, 1,100 and 600, respectively); Bryde's whales, *Balaenoptera edeni/brydei* (large-form; $n=1$, three individuals); and unidentified small cetaceans ($n=14$). Cetacean distribution was closely tied to environmental gradients, with Irrawaddy dolphins and finless porpoises occurring most often in nearshore, turbid, low-salinity waters, Indo-Pacific humpback dolphins in slightly deeper waters where the colour turned from brown to green and Indo-Pacific bottlenose dolphins and Bryde's whales in deep, clear, high-salinity waters of the Swatch-of-No-Ground (SoNG), a 900+m-deep submarine canyon that extends to within about 40km of the Sundarbans mangrove forest. A Generalised Additive Model of environmental and presence-absence data indicated that Irrawaddy dolphin distribution was conditionally dependent ($p<0.05$) on low salinity and shallow depth, which explained 36% of the variance. A distance analysis of Irrawaddy dolphin and finless porpoise sightings resulted in abundance estimates of 5,383 (CV=39.5) and 1,382 (CV=54.8%), respectively. The positive conservation implications of these abundance estimates were tempered by observations of potentially unsustainable bycatch in gillnet fisheries targeting elasmobranchs and scarring on bottlenose dolphins consistent with trawl fishery interactions. The nearshore waters of Bangladesh support a taxonomically diverse and relatively abundant cetacean fauna, which can probably be explained by the wide variety of environmental gradients (river-sea and shallow-deep) available within a relatively small area and the enormous biological production driven by extreme fluvial and oceanographic processes. Priority recommendations for future research include: (1) evaluating bycatch levels and the types of fishing gears responsible for incidental kills; (2) investigating the spatial and temporal dynamics of high-density cetacean hotspots; (3) resolving the species and population identities of baleen whales and delphinids occurring in the SoNG; and (4) assessing the abundance, movement patterns and fishery interactions of Indo-Pacific bottlenose dolphins. KEYWORDS: ABUNDANCE ESTIMATE; CONSERVATION; DISTRIBUTION; GILLNETS; HABITAT; INDIAN OCEAN; TRAWLS; SURVEY-VESSEL; NORTHERN HEMISPHERE; INCIDENTAL CATCHES; FISHERIES; STATISTICS; IRRAWADDY DOLPHIN; FINLESS PORPOISE; INDO-PACIFIC HUMPBAC DOLPHIN; INDO-PACIFIC BOTTLENOSE DOLPHIN; PANTROPICAL SPOTTED DOLPHIN; SPINNER DOLPHIN; BRYDE'S WHALE, DWARF SPERM WHALE.

Johnston, D.W., Robbins, J., Chapla, M.E., Mattila, D.K. and Andrews, K.R. 2008. Diversity, habitat associations and stock structure of odontocete cetaceans in the waters of American Samoa, 2003-06. *J. Cetacean Res. Manage.* 10(1):59-66.

Little is known about the species composition, distribution, abundance or stock structure of odontocetes in the central and western tropical Pacific Ocean, including those inhabiting the US Exclusive Economic Zone (EEZ) waters of American Samoa. While some information on species presence in this region has been gleaned from anecdotal sightings and whaling and stranding records, odontocete diversity in the waters of American Samoa has never been formally investigated. This lack of information precludes efforts to determine the sustainability of cetacean populations within US EEZ waters. This paper reports on the first dedicated surveys to document the presence and distribution of odontocete cetaceans in the waters of American Samoa. A series of small-boat photo-identification and biopsy surveys for cetaceans were conducted in the nearshore waters of Tutuila during 2003-06. In addition, ship-based visual surveys were conducted in the waters surrounding the Manu'a Islands, Rose Atoll and Swains Island in summer 2006. A total of 58 groups of odontocete cetaceans were encountered during both small-boat and ship-based surveys: spinner dolphins (*Stenella longirostris*, $n=34$), rough-toothed dolphins (*Steno bredanensis*, $n=10$), sperm whales (*Physeter macrocephalus*, $n=3$), false killer whales (*Pseudorca crassidens*, $n=5$), bottlenose dolphins (*Tursiops truncatus*, $n=1$), dwarf sperm whales (*Kogia sima*, $n=1$), short-finned pilot whales (*Globicephala macrorhynchus*, $n=1$), and three groups of unidentified odontocetes. Photographs were analysed for quality and individuals with distinctive markings were selected for entry into a photo-identification catalogue.

The resultant catalogue included 46 spinner dolphins, 41 rough-toothed dolphins, 2 bottlenose dolphins, 5 false killer whales, 4 pilot whales, 1 dwarf sperm whale and 4 sperm whales. Thirteen spinner dolphins and 14 rough-toothed dolphins were sighted in multiple years. To investigate stock structure, spinner dolphin genetic data were used to compare mitochondrial control region genetic diversity and allele frequencies between American Samoa and the Hawaiian Islands. American Samoa had a higher genetic diversity, and populations at the two locations were genetically distinct ($F_{ST} = 0.21$). The high diversity at American Samoa indicates that spinner dolphins at this location are not reproductively isolated, but the data do not rule out the possibility that these dolphins may be demographically isolated on ecological timescales. KEYWORDS: PACIFIC OCEAN; ODONTOCETES; SURVEY-VESSEL; BIOPSY SAMPLING; PHOTO-ID; MOVEMENTS; GENETICS; SPINNER DOLPHIN; ROUGH-TOOTHED DOLPHIN; SPERM WHALE; FALSE KILLER WHALE; BOTTLENOSE DOLPHIN; DWARF SPERM WHALE; SHORT-FINNED PILOT WHALE.

Ohishi, K., Fujise, Y. and Maruyama, T. 2008. *Brucella* spp. in the western North Pacific and Antarctic cetaceans: a review. *J. Cetacean Res. Manage.* 10(1):67-72.

Brucella spp. has been reported in a variety of marine mammals worldwide. Serological and pathological studies were conducted on *Brucella* spp. in the western North Pacific using samples from three whale species collected during 2000 under the second phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPNI). Serum samples from 40 common minke whales (*Balaenoptera acutorostrata*), 43 Bryde's whales (*B. edeni*) and 4 sperm whales (*Physeter macrocephalus*) were assessed with agglutination testing designed for *B. abortus* detection. *Brucella*-specific serum antibodies were detected in 38% of common minke whale samples. A lower prevalence (9%) of the antibody was observed for the Bryde's whale samples, whereas no specific antibody against *Brucella* was observed for the four sperm whales. Serum samples from 104 Antarctic minke whales (*B. bonaerensis*) collected under the Japanese Whale Research Program under Special Permit in the Antarctic (JARPA) were analysed, and no *Brucella*-specific antibodies were detected. Granular lesions with caseation and mineralisation were found in 35% (13 males and one female) of 40 minke whale gonads. Similar lesions were also observed in the gonads of one male and one female Bryde's whale. These gonad lesions were not found in 440 Antarctic minke whales and five sperm whales, despite the thorough examination conducted for reproduction studies. Histopathological studies showed that the lesions consisted of epithelioid cells, multinucleated giant cells and had an infiltration of lymphocytes. DNA fragments were amplified by PCR using specific primers from ten of 22 abnormal testis tissues collected from common minke whales. The DNA sequences had IS711 transposable elements downstream of bp26, characteristic of marine strains of *Brucella* spp. The gene structure of *omp2*, and specific PCR products for seal strains, showed similarity to Atlantic seal strains rather than Atlantic whale strains. This showed that classification based on marine mammal host species, *B. cetacea* and *B. pinipedia* is not appropriate. Considering the zoonotic nature of the genus *Brucella*, the crews and researchers who have had frequent contact with whales were serologically examined and were found to have no health issues associated with this agent. No *Brucella*-specific antibody was detected in the sera from 51 persons examined in 2001, nor from 103 examined issues in 2003. KEYWORDS: DISEASE; *BRUCELLA*; COMMON MINKE WHALE; ANTARCTIC MINKE WHALE; BRYDE'S WHALE; SPERM WHALE; REPRODUCTION; GENETICS; IMMUNOLOGY; BIOMARKERS; JARPA; JARPNI; PACIFIC OCEAN; ANTARCTIC OCEAN; SCIENTIFIC PERMITS; SURVEY-VESSEL.

Acevedo, R., Oviedo, L., Silva, N. and Bermúdez-Villapol, L. 2008. A note on the spatial and temporal distribution of humpback whales (*Megaptera novaeangliae*) off Venezuela, southeastern Caribbean. *J. Cetacean Res. Manage.* 10(1):73-80.

This paper presents information on the spatial and temporal distribution of humpback whales in Venezuelan waters. Using a relational database containing information from the museums of Venezuela, published and unpublished records were incorporated into a Geographical Information System (MapInfo Professional 7.0). A total of 53 records were gathered, of which sightings made up 72%, followed by acoustic sampling (9%) intentional capture (6%), stranding (6%) and unknown records (8%). Humpback whales were mainly sighted over the continental shelf of the northeastern region in shallow waters of 0-100m in depth. The date on which each record was made supports the seasonal occurrence of North Atlantic humpback whales off the Venezuelan coast. Opportunistic sightings and stranding records from the austral winter months do not give conclusive proof that Southern Hemisphere humpback whales are present during this time, but lead to the hypothesis that whales migrate from Brazil. Systematic research effort (especially photo-identification) is recommended in order to better understand humpback whale movements, distribution and identity. KEYWORDS: HUMPBACK WHALE; ATLANTIC OCEAN; SOUTH AMERICA; DISTRIBUTION; WHALING-HISTORICAL; NORTHERN HEMISPHERE; CARIBBEAN SEA; MOVEMENTS.

Brownell, R.L., Jr., Nowacek, D.P. and Ralls, K. 2008. Hunting cetaceans with sounds: a worldwide review. *J. Cetacean Res. Manage.* 10(1):81-88.

Cetaceans are sensitive to a variety of anthropogenic sounds because they normally use sound to navigate, communicate and capture prey. This paper reviews some fisheries that have taken advantage of this sensitivity by using sound to help capture numerous species of dolphins and whales. Fishermen in many parts of the world have independently developed methods that use sounds to drive (herd) various species of small cetaceans so that they can be killed and used for food, culled (i.e. to offset competition for fish), help capture fish (e.g. in the Eastern Tropical Pacific) or be taken into captivity. It is well documented that drive fisheries for small cetaceans have occurred for at least 650 years in Japan and Europe. With respect to large whales, the use of sound became widespread after World War II, with the advent of an early form of sonar (ASDIC) which was used for hunting both baleen and sperm whales. Baleen whales displayed a strong avoidance reaction to ASDIC by swimming rapidly away from the sound while remaining near the surface of the water. In contrast, sperm whales made longer dives in response to ASDIC. During the 20th Century, fishermen using these two acoustical methods killed millions of cetaceans (including those caught in the Eastern Tropical Pacific tuna fisheries), both small and large. The effectiveness of acoustic capture methods shows that a wide range of cetacean species have strong avoidance reactions to a variety of anthropogenic sounds. Research to better document the characteristics of these sounds, including those used in existing drive fisheries and those produced by ASDIC devices, would improve understanding of the types of anthropogenic sounds that could contribute to mass-stranding events and should be minimised in protected habitats for cetaceans. KEYWORDS: SMALL CETACEANS; SONAR; STRESS; HEARING; DIRECT CAPTURE; LIVE-CAPTURE; WHALING-HISTORICAL; WHALING-MODERN; WHALING-SMALL-TYPE; ACOUSTICS; SPERM WHALE; STRIPED DOLPHIN; SHORT-FINNED PILOT WHALE; FALSE KILLER WHALE; RISSO'S DOLPHIN; PANTROPICAL DOLPHIN; PYGMY KILLER WHALE; MELON-HEADED WHALE; KILLER WHALE; FRASER'S DOLPHIN; HARBOUR PORPOISE; LONG-FINNED PILOT WHALE; ATLANTIC

WHITE-SIDED DOLPHIN; NORTHERN BOTTLENOSE WHALE; PACIFIC WHITE-SIDED DOLPHIN; GRAY WHALE; BLUE WHALE; HUMPBACK WHALE.

Weller, D.W., Bradford, A.L., Kato, H., Bando, T., Otani, S., Burdin, A.M. and Brownell Jr, R.L. 2008. Photographic match of a western gray whale between Sakhalin Island, Russia and Honshu, Japan: first link between the feeding ground and a migratory corridor. *J. Cetacean Res. Manage.* 10(1):89-91.

Between 2005 and 2007, four female western gray whales were accidentally entrapped and died in Japanese set nets while migrating along the Pacific coast of Honshu, Japan. Photographs of these animals were compared to a photo-identification catalogue of western gray whales from their feeding ground off Sakhalin Island, Russia, to look for matches of individuals between the two areas. Although useable quality photographs were available for only one of the four whales from Japan, a confirmed match was made to a whale photographed off Sakhalin Island. This match represents the first link between the feeding ground and a migratory corridor and highlights the importance of multinational research collaboration in the formation of range-wide conservation measures to protect this critically endangered population. KEYWORDS: GRAY WHALE; PHOTO-ID; ENTRAPMENT; BYCATCH; CONSERVATION; NORTHERN HEMISPHERE; INCIDENTAL CATCHES; FEEDING GROUNDS; MIGRATION; PACIFIC OCEAN.

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LeDuc, R.G., Martien, K.K., Morin, P.A., Hedrick, N., Robertson, K.M., Taylor, B.L., Mugue, N.S., Borodin, R.G., Zelenina, D.A., Litovka, D. and George, J.C. 2008. Mitochondrial genetic variation in bowhead whales in the western Arctic. *J. Cetacean Res. Manage.* 10(2):93-98.

Bowhead whales in the Western Arctic are managed as a single stock by the International Whaling Commission (IWC). In response to recent concerns about the potential existence of multiple stocks in the region, we examined genetic variation in the mitochondrial control region among various spatial, temporal and age-related strata. Sequences from 382 samples were used in the comparisons. No significant differences were detected in spatial comparisons or in temporal comparisons along Alaska's North Slope. However the χ^2 analysis showed evidence of genetic heterogeneity between some of the age cohorts, specifically between animals born prior to 1918 (n=8) and those born after 1979 (n=34) (p=0.030), between those born 1918-1949 (n=13) and those born after 1979 (p=0.050), and between the two aforementioned older cohorts and those born after 1979 (p=0.009). There was also a significant Fst difference between autumn (n=13) and spring (n=11) whales from St. Lawrence Island (p=0.049). The age data were insufficient to determine if this seasonal difference was due in part to the difference between age cohorts. KEYWORDS: BOWHEAD WHALE; GENETICS; WHALING; ARCTIC; NORTHERN HEMISPHERE.

Koski, W.R., George, J.C. and Zeh, J.E. 2008. A calf index for monitoring reproductive success in the Bering-Chukchi-Beaufort Seas bowhead whale (*Balaena mysticetus*) population. *J. Cetacean Res. Manage.* 10(2):99-106.

The percentage of calves in a whale population can provide information on whether a population is increasing, stable or decreasing and is an input to population models. In this paper a method for estimating the percentage of calves in the Bering-Chukchi-Beaufort Seas (B-C-B) bowhead whale population in any given year by obtaining information on the percentage of calves passing Point Barrow, Alaska, during the last three weeks of the spring migration is presented. The method incorporates information on the timing of the migration with the percentage of calves detected during calf index surveys conducted during weekly periods from 14 May to early June. Historic data provide the different proportions of the migration during the weekly periods during low, medium and high calf years. The index is adjusted to allow for calves passing before 14 May and calves that are born after their mothers pass Point Barrow. The calf index was calculated for eight years using data from aerial photographic surveys near Point Barrow from 1985 to 2004 and the mean percentage of calves in the sampled years was 6.1%. Power analyses indicate that nine years of calf index data are required following a decline to detect a 60% reduction in the calf index. Additional calf index surveys prior to a decline would increase the power to detect a decline. This method can provide a robust estimate of the percentage of calves in the population each year with a modest aerial survey or photographic effort at Point Barrow. The data would be valuable in evaluating whether calving rates are within the range tested for the purpose of reviewing the B-C-B bowhead whale Strike Limit Algorithm. KEYWORDS: ARCTIC; BEAUFORT SEA; CHUKCHI SEA; BOWHEAD WHALE; PHOTOGRAMMETRY; POPULATION PARAMETERS; CALVES; REPRODUCTION; SURVEY-AERIAL; NORTHERN HEMISPHERE; BIRTH RATE.

O'Hara, T.M., Hanns, C., Woshner, V.M., Zeh, J., Bratton, G. and Taylor, R. 2008. Essential and non-essential elements in the bowhead whale: epidermis-based predictions of blubber, kidney, liver and muscle tissue concentrations. *J. Cetacean Res. Manage.* 10(2):107-18.

Assessment of element concentrations in wildlife must address both nutritional and toxicological considerations. The liver, epidermis, muscle and kidney of the bowhead whale are rich in some essential and non-essential elements. Blubber tends to have lower concentrations of these elements. Various cetaceans have been evaluated for these elements using a variety of sample sources (live and dead stranded whales, bycaught animals, remote and capture-release biopsy techniques, hunter killed whales etc). One constant shared by these approaches is the sampling of epidermis and adjacent dermis (blubber). In this study, the ability of elemental concentrations in bowhead whale epidermal samples to predict the corresponding elemental concentrations in blubber, kidney, liver and muscle is investigated. Epidermal concentrations had no predictive value for copper (Cu), manganese (Mn), lead (Pb), selenium (Se) or zinc (Zn) in any of the other tissues evaluated, except that the epidermal measurement provided an upper bound for blubber concentration of Cu, Mn, Se and Zn. Epidermal concentrations of the four other elements considered were predictive for some other tissues. Arsenic (As) concentrations could be predicted in kidney, liver and muscle but not blubber, although the preponderance of samples with concentrations below the minimum level reported (MLR, also known as 'detection limit') and the small sample sizes that resulted from their omission suggest that these data should be interpreted with caution. Epidermal concentrations of cadmium (Cd) were strongly predictive for blubber and weakly predictive for muscle concentrations. Epidermal concentrations of mercury (Hg) were weakly predictive of blubber, liver and muscle concentrations. Epidermal concentrations of magnesium (Mg) were strongly predictive in blubber, kidney and liver but only weakly predictive in muscle. Thus epidermal biopsy cannot predict elemental concentrations in four key tissues in bowhead whales in most cases. Cobalt (Co) and molybdenum (Mo) were not detected in any epidermal samples. This inability of

epidermal element concentrations to reflect concentrations in internal tissues is likely true for other mysticetes and perhaps for cetaceans in general. At a minimum, before using epidermal biopsies to predict internal tissue concentrations of elements, researchers must establish that a sound scientific basis exists for doing so. Such proof must be specific to the elements, species and tissues in question as well as based upon statistically adequate sample sizes. KEYWORDS: BOWHEAD WHALE; EPIDEMIOLOGY; HEAVY METALS; NUTRITION; POLLUTANTS; ELEMENTS; EPIDERMIS; TISSUES; STATISTICS.

Heide-Jørgensen, M.P., Borchers, D.L., Witting, L., Laidre, K.L., Simon, M.J., Rosing-Asvid, A. and Pike, D.G. 2008. Estimates of large whale abundance in West Greenland waters from an aerial survey in 2005. *J. Cetacean Res. Manage.* 10(2):119-30.

An aerial line transect and cue counting survey of large whales in West Greenland was conducted in August and September 2005. The survey covered the area between Cape Farewell and Disko Island on the West Greenland coast out to the 200m depth contour. The surveyed area covered 163,574km² and a total of 246 sightings of 9 cetacean species were obtained. Abundance estimates were developed for humpback whales, *Megaptera novaeangliae* (21 sightings), fin whales, *Balaenoptera physalus* (78 sightings) and common minke whales, *B. acutorostrata* (42 sightings). The mean group size of humpback whales was 3.30 but groups as large as 95 animals were seen off effort. The mean group size of fin whales was 2.96 with groups as large as 50 seen. Common minke whale group size was 1.1 with only one sighting of a group of two whales. Humpback whales were found both in offshore and coastal areas of West Greenland with the exception of Store Hellefiske Bank and the Cape Farewell offshore area. The line transect abundance estimate of humpback whales was 1,218 (CV=0.56), uncorrected for submerged whales (availability bias) and whales that were available to be seen but were missed by the observers (perception bias). Fin whales were observed in all areas of the survey and the uncorrected line transect estimate was 1,660 (CV=0.38). When corrected for perception bias the estimates increase to 3,234 fin whales (CV=0.44). Common minke whales were found in almost equal densities in all strata except for the Cape Farewell offshore area, where none were seen. The cue-counting abundance estimate of common minke whales was 4,856 (CV=0.49) for West Greenland using a cue rate of 46.3 cues per hour (CV=10.6). If the estimate is corrected for perception bias the common minke whale abundance is estimated to be 10,792 whales (CV=0.59). Low coverage was attained in the northern area of West Greenland and this should cause an especially large negative bias for the estimates of fin whale and humpback whale abundance because this area is believed to have particularly large densities of these whales. KEYWORDS: FIN WHALE; COMMON MINKE WHALE; HUMPBACK WHALE; SURVEY-AERIAL; SURVEY-VESSEL; NORTHERN HEMISPHERE; ABUNDANCE ESTIMATE; CUE COUNTING; DISTRIBUTION; g(0); SCHOOL SIZE.

Pace, D.S., Miragliuolo, A. and Mussi, B. 2008. Behaviour of a social unit of sperm whales (*Physeter macrocephalus*) entangled in a driftnet off Capo Palinuro (Southern Tyrrhenian Sea, Italy). *J. Cetacean Res. Manage.* 10(2):131-36.

Driftnet fishing is notorious for being the major source of fatal entanglement of cetaceans and for its devastating impact on some pelagic species of the Mediterranean fauna. Of all the large cetaceans, the sperm whale (*Physeter macrocephalus*) is most affected by this fishing technique. On 9 August 2004, a group of five sperm whales, two adult females and three juvenile individuals, was found trapped in a driftnet 40 miles southwest off Capo Palinuro (Italy). Their tails were totally immobilised by the net and one animal was completely entangled. All the animals showed numerous lesions on their bodies. The group was freed by the Italian Coast Guard scuba-diving team during a two-day rescue operation. This exceptional case of sperm whale disentanglement was a unique opportunity to study the group's acoustic and general behaviour during a particularly stressful event. Out of a total video/acoustic recording of 110 minutes, 91 were examined. During the rescue procedures, the whales' behaviour was described as open mouthed, sideways roll, agitation of fluke and pectoral fins, head rubbing, fluke contact (with head, flippers and back by the liberated animals) and defecation. As expected, the entangled individuals produced different patterns of clicks, identified as 'usual clicks', 'codas' and 'creaks'. Each pattern was associated with specific behaviour. Despite international and national regulation banning fishing with driftnets in the Mediterranean Sea, driftnets continue to be used illegally in this sperm whale habitat, posing a constant threat to the species' survival in the region. KEYWORDS: INCIDENTAL CATCHES; SPERM WHALE; DRIFTNET; MEDITERRANEAN SEA; BEHAVIOUR; NORTHERN HEMISPHERE.

Waring, G.T., Nøttestad, L., Olsen, E., Skov, H. and Vikingsson, G. 2008. Distribution and density estimates of cetaceans along the mid-Atlantic ridge during summer 2004. *J. Cetacean Res. Manage.* 10(2):137-46.

During 4 June-2 July 2004, the Norwegian R/V G.O. Sars conducted a multi-disciplinary survey along the mid-Atlantic Ridge (MAR) from the Reykjanes Ridge to north of the Azores. This provided the first systematic survey information on MAR cetacean populations. Using naked eye or 7×50 hand-held binoculars, observers searched in a 140° arc centred along the ships' heading. Eleven cetacean species and 10 other taxonomic groups were identified along 2,321km of transect effort. The sei whale (*Balaenoptera borealis*) and sperm whale (*Physeter macrocephalus*) were the most commonly sighted species (53 and 48 sightings, respectively). There were 12 sightings of the fin whale (*B. physalus*). There were 26, 13 and 12 sightings, respectively of the common dolphin (*Delphinus delphis*), pilot whale (*Globicephala* sp.) and striped dolphin (*Stenella coeruleoalba*). Density estimates of species ranged from 0.018 to 0.238 animals km⁻². The precision of the estimates (CV) was low, ranging from 40% to 61%. Species distribution varied north to south; the highest aggregations of baleen whales were sighted at the Charlie Gibbs Fracture Zone (CGFZ). Sperm whales were also observed at the CGFZ as well as north of this area. Pilot whales and Atlantic white-sided dolphins (*Lagenorhynchus acutus*) were sighted mainly in the cold (5-16°C) and less saline (34.8-36.7 ‰) water masses along the Reykjanes Ridge. Conversely, common dolphins and striped dolphins were most commonly sighted south of the CGFZ in areas with warmer (12-22°C) and more saline (34.8-36.7 ‰) surface water temperatures. KEYWORDS: ATLANTIC OCEAN; NORTHERN HEMISPHERE; DISTRIBUTION; SURVEY-VESSEL; ABUNDANCE ESTIMATE; SPERM WHALE; SEI WHALE; COMMON DOLPHIN; FIN WHALE; PILOT WHALE; STRIPED DOLPHIN; ATLANTIC WHITE-SIDED DOLPHIN.

Koschinski, S., Diederichs, A. and Amundin, M. 2008. Click train patterns of free-ranging harbour porpoises acquired using T-PODs may be useful as indicators of their behaviour. *J. Cetacean Res. Manage.* 10(2):147-56.

Harbour porpoise signals consist of directional, high frequency stereotypic clicks which can be logged using T-PODs. Variation in interclick intervals (ICIs) can be used to distinguish different acoustic behaviours. So far, studies on ICI variation are mostly descriptive and the behavioural context in which certain click train patterns are emitted is poorly understood. In this study, the behaviour of free-ranging porpoises

was quantified by using typical ICI patterns known from the literature. These were recorded using two T-PODs deployed at a wind farm site (Nysted, Denmark) between 14 June and 12 July 2005 and during the entanglement of a porpoise calf in a gillnet (Clayoquot Sound Canada). It was possible to distinguish between feeding, approach behaviour and communication and known ICI patterns associated with these behaviours were used to categorise acoustic data. During feeding typical click trains start with long ICIs (30-70ms) and end with ICIs down to about 2ms. In a transition phase ICIs rapidly decrease. Click trains attributed to feeding were found in the wind farm data at a rate of 6.3d-1 (n=174) with a patchy distribution. We found 20 to 74s long click train sequences with ICIs decreasing from a median of 72ms (range 34 to 143ms) to 5ms at a rate of 1.6day-1 (n=45). This was interpreted as approach behaviour, in which the animal was acoustically 'locked on' to a reflective structure. Communication signals are built up of click trains with very short ICIs (<7ms). During the entanglement of a porpoise calf, three different call types were determined at a rate of 8.9min-1 (n=89). One call with variable duration (100 to 890ms) and relatively stable ICIs as low as 3.6ms resembled 'distress calls' described by Amundin (1991b). Another call type with durations from 780 to 830ms and ICIs ranging from 3.0 to 10 ms and thus different with respect to ICI curve progression was found only three times. These had a U-shaped ICI curve, similar to an 'alarm' or 'fright' call described by Busnel and Dziedzic (1966). A third and previously unreported call is characterised by a long call duration (up to 1,270ms) and sometimes oscillating ICIs with an initial decrease from about 9ms to around 7ms and an increase towards the end. The data presented suggest that the T-POD is a promising tool for behavioural studies. It is possible to recognise certain acoustic behavioural categories described in the literature, but it is important to look at the temporal context with other vocalisations in T-POD data, such as ICIs of preceding click trains. KEYWORDS: COMMUNICATION; ECHOLOCATION; FEEDING, FOOD/PREY; BIOSONAR; HARBOUR PORPOISE; ACOUSTICS; NORTHERN HEMISPHERE.

Balmer, B.C., Wells, R.S., Nowacek, S.M., Nowacek, D.P., Schwacke, L.H., McLellan, W.A., Scharf, F.S., Rowles, T.K., Hansen, L.J., Spradlin, T.R. and Pabst, D.A. 2008. Seasonal abundance and distribution patterns of common bottlenose dolphins (*Tursiops truncatus*) near St. Joseph Bay, Florida, USA. *J. Cetacean Res. Manage.* 10(2):157-68.

Three unusual mortalities events involving bottlenose dolphins (*Tursiops truncatus* Montagu 1821) occurred along Florida's northern Gulf of Mexico coast between 1999 and 2006. The causes of these events, in which over 300 bottlenose dolphins are known to have died, are still under investigation. The impact of these mortality events cannot be fully evaluated, because little prior information on bottlenose dolphin abundance and distribution patterns exist in this region. Thus, the goals of this study were to estimate seasonal abundance, develop site-fidelity indices, and describe distribution patterns of bottlenose dolphins in St. Joseph Bay, Gulf County, Florida, USA. This study site was chosen because it was impacted by all three unusual mortality events and was the geographic focus of the 2004 event. Mark-recapture photo-identification surveys were conducted across multiple seasons from February 2005 through July 2007. Site-fidelity indices were calculated for each identifiable dolphin based upon all photo-ID efforts undertaken in the area. Distribution patterns were investigated by short-term (12-94 days) radio-tracking of tagged individuals across seasons (April-July, n=9; July-October, n=15). Mark-recapture closed and robust abundance estimates, as well as site-fidelity indices suggest that St. Joseph Bay supports a resident community of 78-152 bottlenose dolphins. During spring and autumn, this region experiences an influx of dolphins, as demonstrated by closed and robust abundance estimates of 313-410 and 237-340, respectively. These results are supported by the distribution patterns of radio-tagged individuals. Individuals tagged in summer tended to stay within or near St. Joseph Bay, whereas two individuals tagged in spring ranged more than 40km from the study site. This study provides the first detailed examination of bottlenose dolphin abundance and distribution patterns for this region of the northern Gulf coast of Florida. These results suggest that unusual mortality events probably had, and will in the future have, seasonally variable effects on bottlenose dolphins in St. Joseph Bay. Future mortality events that occur during the summer and winter in St. Joseph Bay may predominantly affect resident individuals, while those that occur during the spring and autumn will probably affect both residents and seasonal visitors. KEYWORDS: BOTTLENOSE DOLPHIN; ABUNDANCE ESTIMATE; MARK-RECAPTURE; SITE- FIDELITY; PHOTO-ID; RADIO-TAGGING; NORTH AMERICA.

Larese, J.P. and Chivers, S.J. 2008. Age estimates for female eastern and whitebelly spinner dolphins (*Stenella longirostris*) incidentally killed in the eastern tropical Pacific tuna purse-seine fishery from 1973-82. *J. Cetacean Res. Manage.* 10(2):169-78.

Age was estimated from teeth for 1,267 female eastern spinner dolphins (*Stenella longirostris orientalis*) and 1,071 female whitebelly spinner dolphins (*S.l. longirostris*) incidentally killed in the eastern tropical Pacific yellowfin tuna purse-seine fishery between 1973 and 1982. The final age assigned to each specimen was the mean of two readers' age estimates made independently and without knowledge of the corresponding biological data for each specimen. The oldest eastern spinner dolphin was estimated to be 24.5 years and the oldest whitebelly spinner dolphin was 26 years. Age bias plots revealed nonlinear systematic bias between readers while a measure of overall precision, coefficient of variation (CV), indicated equivalent difficulty in estimating age for each population. The age frequency distributions generated in this study document the age structure of dolphins sampled from the observed incidental kill, which will facilitate further assessments of the impact of the fishery on these dolphins. KEYWORDS: SPINNER DOLPHIN; PACIFIC OCEAN; PURSE-SEINES; INCIDENTAL CATCHES; AGE DETERMINATION; AGE DISTRIBUTION.

Avila, I.C., García, C. and Bastidas, J.C. 2008. A note on the use of dolphins as bait in the artisanal fisheries of Bahía Solano, Chocó, Colombia. *J. Cetacean Res. Manage.* 10(2):179-82.

Dolphin hunting for fishing bait in Bahía Solano, Chocó, Colombia, was evaluated during eight months, between July 2005 and April 2006. Interviews were conducted with 122 fishermen (18.2% of the registered fishermen in the zone), who cover at most 890km² when fishing (approximately 2.3% of the Pacific Territorial Sea of Colombia), and data obtained from landings at a fishing company. Only fishermen using longlines (37.3%) confirmed using dolphins as bait. It was not possible to obtain additional information about date, specific location or dolphin species, but the most probable captured species were common bottlenose dolphin and pantropical spotted dolphin. Nine dolphins were killed during the study period (1.1 dolphins/month) and extrapolating these numbers to all fishermen using longlines in the region (250), 24 dolphins might have been taken during the study period (3 dolphins/month). Fish species caught using dolphin bait include Pacific bearded brotula groupers and smooth-hound. KEYWORDS: PANTROPICAL SPOTTED DOLPHIN; BOTTLENOSE DOLPHIN; PACIFIC OCEAN; SOUTH AMERICA; DIRECT CAPTURE; FISHERIES; PURSE-SEINES; GILLNETS; TRAWLS.

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Punt, A.E. 2008. A note on the modelling of MSY-related parameters when population dynamics are stochastic. *J. Cetacean Res. Manage.* 10(3):183-90.

A method is outlined for calculating the values for the parameters which determine MSYR and MSYL in the types of population dynamics models on which *Implementation Simulation Trials* and *Evaluation Trials* are based in the face of environmental variability in fecundity (birth rate) and survival. The method is illustrated using a minke whale-like biology in which MSYR is defined in terms of harvesting of the mature female component of the population. Results are shown for various levels of environmental variation in survival and fecundity. KEYWORDS: MANAGEMENT PROCEDURES; MSYR; SIMULATION; MODELLING; BIRTH RATE; COMMON MINKE WHALE.

Aldrin, M., Huseby, R.B. and Schweder, T. 2008. A note on tuning the *Catch Limit Algorithm* for commercial baleen whaling. *J. Cetacean Res. Manage.* 10(3):191-94.

The *Catch Limit Algorithm* for commercial baleen whaling developed by the International Whaling Commission converges slowly to a steady depletion (proportion of carrying capacity), and consequently 300 years of management is proposed as horizon for tuning and computer simulation. Long-term depletion is rather insensitive to the parameter currently used for tuning, and an alternative control parameter is suggested for this purpose. KEYWORDS: WHALING-REVISED CATCHES; MANAGEMENT PROCEDURE.

Rugh, D.J., Koski, W.R., George, J.C. and Zeh, J. 2008. Interyear re-identification of bowhead whales during their spring migration past Barrow, Alaska, 1984-1994. *J. Cetacean Res. Manage.* 10(3):195-200.

As a part of a review of bowhead whale (*Balaena mysticetus*) stocks, a study was conducted to evaluate how much mixing occurs in the whales' spring migration, a period which immediately follows the mating season. This study has used aerial photography of bowhead whales during their spring migration near Point Barrow, which has resulted in 5,800 images, primarily from 1984 through 1994. These photographs included 40 different whales seen in at least two years, and of these, two were seen in three different years, making for a pair-wise sample size of 42 matches between years. Differences between dates of initial sightings and subsequent sightings (i.e. resightings) ranged from -31 to +23 days comparing month and day only, irrespective of year. These resightings were well dispersed across most of the bowhead spring migration; 98% of the photographs were taken across 45 days from 19 April through 2 June. Models for predicting resighting date from initial sighting date, whale length, presence of a calf, year of initial sighting and year of subsequent sightings were considered, and the best model was chosen using Akaike's Information Criterion (AIC). The best model included most predictors but did not include initial sighting date. Thus, all of the available evidence indicates that individual mature bowheads do not have a consistent migration timing past Barrow; instead, in subsequent years they may appear on almost any date within the normal migratory period. This wide mixing and near-random distribution of resighting dates throughout the spring migration is indicative of a single stock of whales that have a somewhat plastic schedule. KEYWORDS: BOWHEAD WHALE; ARCTIC; NORTH AMERICA; DISTRIBUTION; MIGRATION; PHOTO-ID.

Lowry, L.F., Frost, K.J., Zerbini, A., DeMaster, D. and Reeves, R.R. 2008. Trend in aerial counts of beluga or white whales (*Delphinapterus leucas*) in Bristol Bay, Alaska, 1993-2005. *J. Cetacean Res. Manage.* 10(3):201-08.

Thirty-eight aerial surveys of beluga or white whales (*Delphinapterus leucas*) were conducted in Bristol Bay, Alaska, during six different years between 1993 and 2005. Belugas were sighted mainly close to shore in the upper parts of Nushagak and Kvichak bays, as well as along the coast between these bays and in the lower parts of major rivers. Data from 28 complete counts made in good or excellent survey conditions were analysed for trend. Counts ranged from 264 to 1,067. The estimated rate of increase over the 12-year period was 4.8%/year (95% CI = 2.1%-7.5%). Such a rate of increase suggests that either the population was below the environmental carrying capacity in the early 1990s or, alternatively, that factors that had been limiting population increase were alleviated after that time. A review of possible changes in human-caused mortality, predation and prey availability did not reveal a single likely cause of the increase. Among the factors that could have played a role are recovery from research kills in the 1960s, a modest decline in subsistence removals and a delayed response to increases in Pacific salmon (*Oncorhynchus* spp.) abundance in the 1980s. The positive growth rate for this population shows that in recent years there has been no substantial negative impact of human or natural factors, acting either alone or in combination, and there is no need for changes to the current management regime. KEYWORDS: BELUGA WHALE; WHITE WHALE; INDEX OF ABUNDANCE; MONITORING; SURVEY-AERIAL; TRENDS.

Afsal, V.V., Yousuf, K.S.S.M., Anoop, B., Annop, A.K., Kannan, P., Rajagopalan, M. and Vivekanandan, E. 2008. A note on cetacean distribution in the Indian EEZ and contiguous seas during 2003-07. *J. Cetacean Res. Manage.* 10(3):209-16.

Relatively little is known about the distribution of cetaceans in Indian seas due to lack of systematic surveys. For collecting data on species distribution, 35 opportunistic surveys were conducted onboard FORV Sagar Sampada between October 2003 and February 2007 in the Indian EEZ and contiguous seas. In 5,254 hours of sighting effort, a total of 473 cetacean records were made with 5,865 individuals. The occurrence of 10 species from three cetacean families was confirmed. The Indo-Pacific bottlenose dolphin was the most frequently sighted species, whereas the spinner dolphin was dominant in terms of abundance. Long-beaked common dolphins, Indo-Pacific hump-backed dolphin and sperm whales were also recorded at frequent intervals. Cetaceans were found to have a wide geographical distribution in the Indian EEZ and contiguous seas. High abundance and species richness were recorded in the Southeastern Arabian Sea and southern Sri Lankan waters. From the information collected during the present study, the platform of opportunity has proved to be a useful means for cetacean survey. KEYWORDS: SURVEY-VESSEL; INDIAN EEZ; DISTRIBUTION; BLUE WHALE; SPERM WHALE; FALSE KILLER WHALE; SHORT-FINNED PILOT WHALE; RISSO'S DOLPHIN; STRIPED DOLPHIN; SPINNER DOLPHIN; LONG-BEAKED COMMON DOLPHIN; INDO-PACIFIC BOTTLENOSE DOLPHIN; INDO-PACIFIC HUMP-BACKED DOLPHIN.

Palka, D., Rossman, M., VanAtten, A. and Orphanides, C. 2008. Effect of pingers on harbor porpoise (*Phocoena phocoena*) bycatch in the US northeast gillnet fishery. *J. Cetacean Res. Manage.* 10(3):217-26.

Harbour porpoise (*Phocoena phocoena*) bycatch in the US Northeast gillnet fishery is managed under the Harbour Porpoise Take Reduction Plan (HPTRP), which was implemented on 1 January 1999. The HPTRP divides this fishery into management areas that are either completely closed to all gillnets or closed only to gillnets that do not use pingers. Questions about pingers that have arisen include: (1) would pingers be as effective in an operational fishery as in controlled scientific experiments; (2) would the fishery comply with these regulations; and (3) would harbour porpoises

habituate to pingers? To investigate these questions, data from over 25,000 gillnet hauls observed by the Northeast Fisheries Observer Program after the implementation of the HPTRP, 1999-2007, were examined. In a 1994 controlled scientific experiment conducted in part of this fishery that used 15cm mesh gillnets, the bycatch rate in pingered nets was 92% less than that in nets without pingers. In contrast, in the operational fishery, the bycatch reduction in pingered nets was 50-70%, depending on the time, area and mesh size. In particular, there was no observed bycatch in pingered nets that used the same mesh size as used in the experiment. Thus, it seems that the apparent decrease in pinger effectiveness in the operational fishery was partially due to the type of gillnet used and lack of compliance. Pinger usage started out high in 1999 (the first year required), dropped substantially during 2003-05 and perhaps due to outreach activities increased beginning in 2006. During years of high pinger usage, 87% of the tested pingers were functional, while only 36% of the tested pingers were functional during years of low pinger usage. In general, as expected, observed bycatch rates in hauls without pingers were greater than bycatch rates in hauls with the required number of pingers. Unexpectedly, bycatch rates of observed hauls with an incomplete set of pingers were higher than in observed hauls without pingers. Confounding factors that could partially explain this apparently contrary result are discussed. There was no evidence for temporal trends in the bycatch rates, suggesting that harbour porpoises had not habituated to the pingers. In conclusion, in the US Northeast gillnet fishery, harbour porpoises do not appear to have habituated to pingers, and pingers appear to have reduced the bycatch rate, particularly when the required number of pingers were used and in nets using mesh sizes of 15cm or less. KEYWORDS: NOISE; GILLNETS; INCIDENTAL CATCHES; CONSERVATION; CATCH PER UNIT EFFORT; MONITORING; ATLANTIC OCEAN; NORTH AMERICA; SHORT-TERM CHANGE; MANAGEMENT REGULATIONS; SAMPLING TECHNIQUES.

Berrow, S., Cosgrove, R., Leeney, R.H., O'Brien, J., McGrath, D., Dalgard, J. and Le Gall, Y. 2008. Effect of acoustic deterrents on the behaviour of common dolphins (*Delphinus delphis*). *J. Cetacean Res. Manage.* 10(3):227-34.

Not all delphinids are similarly affected by acoustic deterrent devices (pingers). At-sea trials were carried out to assess a range of acoustic signals and deterrents on the behaviour of common dolphins. In initial tests two acoustic deterrent devices, which previously produced an evasive response by bottlenose dolphins, failed to elicit any similar behaviour in common dolphins. A new signal output device, which permitted a range of signals to be tested at various source levels and characteristics was subsequently developed but again no significant effects on the behaviour of common dolphins were observed. Two commercially available acoustic deterrents, which had deterred common dolphins in previous studies, produced an occasional mild evasive response. Significant modification of the signal type or source level may be more effective, but our results suggest that pingers, at their current state of development, may not provide a consistently effective deterrent signal for common dolphins. KEYWORDS: ACOUSTICS; INCIDENTAL CATCHES; CONSERVATION; MANAGEMENT PROCEDURE; FISHERIES; GILLNETS; COMMON DOLPHIN; BOTTLENOSE DOLPHIN; NORTHERN HEMISPHERE.

Trippel, E.A., Holy, N.L. and Shepherd, T.D. 2008. Barium sulphate modified fishing gear as a mitigative measure for cetacean incidental mortalities. *J. Cetacean Res. Manage.* 10(3):235-46.

Incidental mortality from entanglements in fishing gear is threatening cetacean populations worldwide. In eastern Canadian waters, entanglement deaths of the critically endangered transboundary North Atlantic right whale (*Eubalaena glacialis*) are a key conservation concern and incidental mortalities of harbour porpoise (*Phocoena phocoena*) in gillnets are a major source of mortality. Since the 1990s, a number of mitigation techniques to reduce mortalities in both species have been tested and the use of some in the US commercial fishery have been legislated. Despite this, the North Atlantic right whale population remains in a precarious state and entanglement deaths of harbour porpoise have been increasing in recent years. Further, mitigation devices, such as acoustic alarms, carry with them concerns about habituation, noise pollution, maintenance requirements and cost. The modifying of the physical characteristics of commercial fishing gear has shown some promise at reducing entanglement mortalities in initial testing while avoiding many of the drawbacks of other mitigation methods. In this study the current state of development and effectiveness of mitigation techniques through the addition of barium sulphate to fishing gear rope and twine were investigated. The development of a neutrally buoyant groundline, through the addition of barium sulphate, was undertaken in order to reduce the probability of large whale entanglements in lobster pot gear. The resulting product maintained a much lower profile in the water column relative to traditional polypropylene groundline, however, it was found unsuitable for hard-bottom areas as it was susceptible to chaffing and breaking. In order to reduce mortalities once large whales are entangled, a weak rope was developed again with the addition of barium sulphate. The breaking strength of this product was found to be 1,065lb which meets the US legislated limits (1,100lb), as opposed to traditional polypropylene rope which had a breaking strength of over 2,400lb. To meet the challenge of harbour porpoise entanglements, a gillnet twine was developed to have an increased acoustic profile and a more stiff form through the addition of barium sulphate. In field testing trials, the barium sulphate modified gillnets reduced harbour porpoise bycatch and had minimal effects on targeted groundfishes. Although they are in an early state of development, barium sulphate modified fishing gear shows promise at reducing entanglement deaths of cetaceans. KEYWORDS: GILLNETS; INCIDENTAL CATCHES; CONSERVATION; NORTH ATLANTIC RIGHT WHALE; HARBOUR PORPOISE; FISH; ATLANTIC OCEAN; NORTH AMERICA; SUSTAINABILITY; NORTHERN HEMISPHERE; ECHOLLOCATION; FISHERIES.

Reeves, R.R., Smith, T.D. and Josephson, E.A. 2008. Observations of western gray whales by ship-based whalers in the 19th century. *J. Cetacean Res. Manage.* 10(3):247-56.

Animals belonging to the small, endangered population of western gray whales (*Echrichtius robustus*) are observed today primarily during the summer open-water season in feeding areas off the northeastern coast of Sakhalin Island, Russia. The migration route(s) and wintering area(s) used by this population are largely unknown. Gray whales once had a fairly extensive distribution in the Sea of Okhotsk but little detailed information has been published on when and where they occurred. Open-boat, ship-based whalers from the United States and a few other countries conducted an intensive hunt for bowhead whales (*Balaena mysticetus*) and North Pacific right whales (*Eubalaena japonica*) in the Sea of Okhotsk from the 1840s to 1870s. According to entries in voyage logbooks, the American whalers regularly encountered (and sometimes hunted) gray whales in the far northeastern corner of the Okhotsk Sea (Shelikhov Bay, Gizhiginskaya Bay and Penzhinskaya Gulf) between early May-late August. They also observed gray whales in summer along the northern coast of the sea (especially Tauskaya Bay), around the Shantar Islands, in Sakhalin Bay, off Cape Elizabeth at the northern tip of Sakhalin Island and along the west coast of the Kamchatka peninsula. No evidence was found in the logbooks studied of gray whales (and indeed of whaling effort) off northeastern Sakhalin Island where most observations of gray whales occur in the present day. KEYWORDS: GRAY WHALE; WHALING-HISTORICAL; SEA OF OKHOTSK; NORTHERN HEMISPHERE; BOWHEAD WHALE; NORTH PACIFIC RIGHT WHALE.

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Williams, R. and O'Hara, P. 2010. Modelling ship strike risk to fin, humpback and killer whales in British Columbia, Canada. *J. Cetacean Res. Manage.* 11(1):1-8.

Many cetacean species are susceptible to mortality or serious injury from vessel collisions. Spatially explicit assessments of risk per whale can help identify potential problem areas to guide appropriate mitigation measures. Canada's Pacific waters host high cetacean densities and intense maritime traffic, and the issue of vessel collisions has taken on a high priority in British Columbia (BC) recently due to several major industrial development applications. Spatially-explicit statistical modelling and Geographic Information System (GIS) visualisation techniques identified areas of overlap between shipping activity and waters used by humpback, fin and killer whales. Areas of highest risk were far removed from areas with highest concentrations of people, suggesting that many beach-cast carcasses could go undetected. With few exceptions, high-risk areas were found in geographic bottlenecks, such as narrow straits and passageways. Port expansion and a proposed pipeline for carrying oil from Alberta to BC's north coast (with associated oil tanker traffic) would increase ship strike risk for all three species. The risk assessments illustrate where ship strikes are most likely to occur, but cannot estimate how many strikes occur. Propeller wounds on live killer whales are common in the region, and fatal collisions have been reported in BC for all three species. Procedures were used to estimate potential mortality limits in accordance with a wide range of quantitative management objectives from jurisdictions around the world. While the extent of under-reporting of ship strikes has not been evaluated, the few known cases of collisions involving fin whales suggest that mortality due to ship strike for this species may already be approaching or even exceeding mortality limits under the most risk-averse management objectives. It is hoped that risk maps may inform environmental impact assessments of marine traffic because it will be easier to plan new shipping lanes so that they avoid high-density areas for whales than it will be to move the lanes after they become entrenched. KEYWORDS: SHIP STRIKE; CONSERVATION; SPATIAL MODELLING; REGULATIONS; ABUNDANCE ESTIMATE; MANAGEMENT OBJECTIVES; RISK ASSESSMENT; NORTHERN HEMISPHERE; FIN WHALE; HUMPBAC WHALE; KILLER WHALE.

Givens, G.H., Hoeting, J.A. and Beri, L. 2010. Factors that influence aerial line transect detection of Bering-Chukchi-Beaufort Seas bowhead whales. *J. Cetacean Res. Manage.* 11(1):9-16.

This paper presents a rich, complex dataset including 25 years of aerial line transect surveys for bowhead whales in the Bering, Chukchi and Beaufort Seas, for which a distance detection function was estimated. The analysis was limited to the autumn migratory period and to the portions of the Beaufort and Chukchi Seas occupied by bowhead whales during this period. The primary purpose of the work was to improve the understanding of what factors significantly affect detection. Comprehensive model selection efforts based on the AIC identified useful predictors. Results showed that Beaufort Sea state, ocean depth, inter-sighting waiting distance and year were among the factors affecting detections. For example, increased depth and long wait distances between sightings were both associated with narrower effective strip widths. Some of the results can be interpreted as evidence for a relationship between detection probabilities and whale behaviour. The complexity of the overall dataset required substantial data organisation and offered many alternative analysis approaches, but the results were fairly consistent across such choices. Notwithstanding successful estimation of the detection function, the data present substantial challenges to standard abundance estimation using line transect methods. KEYWORDS: JCRM 11(1); ARCTIC; NORTHERN HEMISPHERE; BOWHEAD WHALE; BERING SEA; CHUKCHI SEA; BEAUFORT SEA; SURVEY-AERIAL; MODELLING.

Sadykova, D. and Schweder, T. 2010. Migration ranks for bowhead whales (*Balaena mysticetus*) at Barrow in spring. *J. Cetacean Res. Manage.* 11(1):17-22.

In a series of aerial photographic surveys of bowhead whales migrating past Barrow in Alaska in the spring, 40 individuals were captured in more than one year. To study individual-specific persistency in migratory pattern, the relative ranks of the captures of these whales among all captures that year were analysed. Controlling for body length and the presence of calves, the correlation of relative ranks in individuals captured multiple times was found not to be significantly different from zero (p -value=0.78). KEYWORDS: BOWHEAD WHALE; MARK-RECAPTURE; MIGRATION; MODELLING; PHOTO-ID; SURVEY - AERIAL; BERING SEA; BEAUFORT SEA; CHUKCHI SEA; NORTHERN HEMISPHERE.

da Silva, C.Q. and Tiburcio, J.D. 2008. Empirical Bayes estimation of the size of a closed population using photo-identification data. *J. Cetacean Res. Manage.* 11(1):23-30.

Photo-ID data are broadly used for estimating animal abundance using capture-recapture models. Animals that do not possess either natural or acquired marks sufficient to allow re-identification are called unmarked, and when a substantial part of the population is composed of such individuals, the classical models described in the literature do not apply. In this paper an Empirical Bayes capture-recapture analysis for dealing with the estimation of the capture probabilities and the estimation of abundance N for populations that include unmarked individuals is presented. Using a Gibbs sampling approach, Monte Carlo estimates for the posterior distribution of N were obtained. The Empirical Bayes approach was found to improve precision in the estimation of N , compared to the results obtained using other Bayesian methods. Additionally, when the population included a very large number of unmarked individuals, inferences for N obtained using the Empirical Bayes approach were definitely superior to those obtained using any of the vague beta priors tested. The methodology was applied to bowhead whale data for the 1985 and 1986 photo-ID surveys. KEYWORDS: BOWHEAD WHALE; ABUNDANCE ESTIMATE; PHOTO-ID; EMPIRICAL BAYES; MODELLING; BERING SEA; CHUKCHI SEA; BEAUFORT SEA.

Laran, S., Joiris, C., Gannier, A. and Kenney, R.D. 2010. Seasonal estimates of densities and predation rates of cetaceans in the Ligurian Sea, northwestern Mediterranean Sea: an initial examination. *J. Cetacean Res. Manage.* 11(1):31-40.

The Ligurian Sea is one of the most attractive areas for cetaceans in the Mediterranean Sea, and is now included in a Marine Protected Area, the Pelagos Sanctuary. Despite a lower species diversity than in other parts of the world, because of their abundance, cetaceans are thought to represent significant consumers in this ecosystem. Surveys were conducted within the Pelagos Sanctuary from 2001 to 2004. Densities of five species: striped dolphin (*Stenella coeruleoalba*); fin whale (*Balaenoptera physalus*); sperm whale (*Physeter macrocephalus*); long-finned pilot whale (*Globicephala melas*); and Risso's dolphin (*Grampus griseus*), were estimated and converted to biomass. Total biomass density of cetaceans in the Ligurian Sea was estimated as 93kg km⁻² (CV=28%) in winter (October to March) and 509kg km⁻² (CV=16%) in summer (April to September). Daily predation rates by cetaceans were estimated as 2.9kg km⁻² d⁻¹ in winter, increasing to 10.4kg km⁻² d⁻¹ in summer, corresponding to a total annual ingestion of 2.4t km⁻² y⁻¹. The annual primary production required for cetaceans was estimated to be 12.6gC m⁻² y⁻¹, corresponding to 6-15% of the net primary production known for this area. Estimated cetacean predation on fish was similar to reported fisheries landings, nevertheless, management of artisanal fisheries and accurate quantification of the resources they exploit will be necessary for the responsible management of fisheries in this Mediterranean

Marine Protected Area. KEYWORDS: INDEX OF ABUNDANCE; NUTRITION; FOOD/PREY; SANCTUARIES; FEEDING GROUNDS; SURVEY- VESSEL; SURVEY - ACOUSTIC; STRIPED DOLPHIN; FIN WHALE; SPERM WHALE; LONG-FINNED PILOT WHALE; RISSO'S DOLPHIN; MEDITERRANEAN SEA; NORTHERN HEMISPHERE.

Poncelet, E., Barbraud, C. and Guinet, C. 2010. Population dynamics of killer whales (*Orcinus orca*) in the Crozet Archipelago, southern Indian Ocean: a mark-recapture study from 1977 to 2002. *J. Cetacean Res. Manage.* 11(1):41-48.

Population size and annual survival probabilities for the killer whales (*Orcinus orca*) inhabiting the inshore waters of Possession Island, Crozet Archipelago, southern Indian Ocean, were estimated through mark-recapture modelling. Capture histories were generated from a set of photographs taken under a photo-identification protocol and a set of photographs taken opportunistically, between 1964 and 2002. Photographs were selected according to their intrinsic quality and the degree of natural marking of individuals. Under those conditions, only well-marked individuals were considered as 'marked' from a capture-recapture perspective. The purpose of this double selection was to minimise identification errors and reduce the heterogeneity of capture probabilities. Abundance estimates were derived from the Mth sequential model for closed populations and adjusted for the proportion of well-marked individuals in the study population and for the number of photo-identified individuals. Under this framework, estimates of 98 (95% CI 70-156) individuals in 1988-89, and 37 (95% CI 32-62) individuals in 1998-2000 are proposed. After a weighted model averaging, the Cormack-Jolly-Seber models with the strongest support from the data produced low survival probability estimates, decreasing from 0.935 (95% CI 0.817-0.979) to 0.895 (95% CI 0.746-0.961) for males, and from 0.942 (95% CI 0.844-0.980) to 0.901 (95% CI 0.742-0.966) for females over the period 1977-2002. A Jolly-Seber model was used as a 'second opinion' model. It confirmed the worrying status of the population with a constant survival probability estimated at 0.89 (95% CI 0.84-0.93) and a constant rate of increase (applying to the well-marked fraction of the population) estimated at 0.94 (95% CI 0.90-0.99) for the period 1987-2000. This rate of increase is consistent with the abundance estimates presented here. Possible violations of the underlying model assumptions were investigated and it was concluded that the abundance estimates for the period 1988-89 and the CJS survival estimates should be the most reliable results. It is feared that the killer whales around Possession Island are in sharp decline, as may be true for the whole Crozet Archipelago. The effect of low prey stocks and lethal interactions with fisheries as the most likely causes of this decline are discussed. KEYWORDS: KILLER WHALE; INDIAN OCEAN; PHOTO-ID; MARK-RECAPTURE; ABUNDANCE; SURVIVAL; FISHERIES.

Braulik, G.T., Ranjbar, S., Owfi, F., Aminrad, T., Dakhteh, S.M.H., Kamrani, E. and Mohsenizadeh, F. 2010. Marine mammal records from Iran. *J. Cetacean Res. Manage.* 11(1):49-64.

Iran has 1,700km of coastline that borders the Persian Gulf and the Arabian Sea in the northwest Indian Ocean. Apart from a handful of records, almost nothing is known about which marine mammal species occur in Iranian waters. This review was conducted to fill this information gap. A total of 127 marine mammal records of 14 species were compiled from Iranian coastal waters. Ninety-nine were from the Persian Gulf, 26 from the Gulf of Oman and 2 were of unknown location. Records of finless porpoise (*Neophocaena phocaenoides*) (25), Indo-Pacific humpback dolphin (*Sousa chinensis*) (24) and Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) (22) were by far the most numerous, a probable reflection of their inshore distribution and local abundance. Other species recorded were long-beaked common dolphin (*Delphinus capensis tropicalis*), rough-toothed dolphin (*Steno bredanensis*), striped dolphin (*Stenella coeruleoalba*), spinner dolphin (*Stenella longirostris*), Risso's dolphin (*Grampus griseus*), false killer whale (*Pseudorca crassidens*), sperm whale (*Physeter macrocephalus*) and dugong (*Dugong dugon*). Records of 26 mysticetes were compiled, 10 of which were tentatively identified as Bryde's whales (*Balaenoptera edeni*), 1 possible fin whale (*Balaenoptera physalus*), 3 humpback whales (*Megaptera novaeangliae*) and the remainder were not identified to species. The largest threat to small cetaceans in Iran is likely to be incidental capture in fishing gear. Nine finless porpoises were recorded as bycatch and this and other coastal species may be declining due to unsustainable mortality rates. Some of the world's busiest shipping lanes pass through Iranian waters and ship strikes are likely to be the largest threat to mysticetes in the area. KEYWORDS: DISTRIBUTION; NORTHERN HEMISPHERE; INDIAN OCEAN; IRAN; SIRENIA; STRANDINGS; CONSERVATION; PERSIAN GULF; FINLESS PORPOISE; INDO-PACIFIC HUMPBAC DOLPHIN; LONG-BEAKED COMMON DOLPHIN; ROUGH-TOOTHED DOLPHIN; STRIPED DOLPHIN ; SPINNER DOLPHIN ; RISSO'S DOLPHIN; FALSE KILLER WHALE; SPERM WHALE; BRYDE'S WHALES; FIN WHALE; HUMPBAC WHALE.

Minton, G., Cerchio, S., Collins, T., Ersts, P., Findlay, K.P., Pomilla, C., Bennet, D., Meyer, M.A., Razafindrakoto, Y., Kotze, P.G.H., Oosthuizen, W.H., Leslie, M., Andrianarivelo, N., Baldwin, R., Ponnampalam, L. and Rosenbaum, H. 2010. Comparison of humpback whale tail fluke catalogues from the Sultanate of Oman with Madagascar and the East Africa Mainland. *J. Cetacean Res. Manage.* 11(1):65-68.

The photo-identification catalogue of humpback whale tail flukes from Oman was compared with those from Antongil Bay, Madagascar and study sites in South Africa and Mozambique collectively termed the 'East African Mainland'. No matches were found, supporting other lines of evidence that the humpback whales studied off the coast of Oman form part of a discrete Arabian Sea population, which adheres to a Northern Hemisphere breeding cycle, and has little or no ongoing exchange with the nearest neighbouring populations in the southern Indian Ocean. While the sample size from Oman is small, and low levels of ongoing exchange might not be detected in this type of catalogue comparison, the study nonetheless emphasises the need to pursue research and conservation efforts in the known and suspected range of the Endangered Arabian Sea humpback whale population. KEYWORDS: HUMPBAC WHALE; SOUTHERN HEMISPHERE; INDIAN OCEAN; ARABIAN SEA; PHOTO-ID.

O'Brien, J.M., Berrow, S.D., Ryan, C., McGrath, D., O'Connor, I., Pesante, G., Burrows, G., Massett, N., Klötzer, V. and Whooley, P. 2010. A note on long-distance matches of bottlenose dolphins (*Tursiops truncatus*) around the Irish coast using photo-identification. *J. Cetacean Res. Manage.* 11(1):69-74.

Images of 120 individual bottlenose dolphins from around the Irish coast were obtained from three photo-identification catalogues. Twenty three individuals were subsequently re-sighted, which is a re-sighting rate of 19%. The distance between re-sightings ranged from 130 to 650km and the duration from 26 to 760 days. Images were also compared to a catalogue of resident dolphins from the Shannon Estuary candidate Special Area of Conservation and from Wales but no matches were found. This short study provides strong evidence that bottlenose dolphins in Irish coastal waters are regularly undertaking large movements around the entire Irish coast and must be considered highly mobile and transient. These results have important implications for the conservation and management of this species. KEYWORDS: NORTHERN HEMISPHERE; BOTTLENOSE DOLPHIN; PHOTO-ID; MONITORING; DISTRIBUTION; CONSERVATION; MANAGEMENT PROCEDURE.

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Heide-Jørgensen, M.P., Witting, L., Laidre, K.L., Hansen, R.G. and Rasmussen, M.H. 2010. Fully corrected estimates of minke whale abundance in West Greenland in 2007. *J. Cetacean Res. Manage.* 11(2):75-82.

A visual aerial line transect survey for common minke whales (*Balaenoptera acutorostrata*) was conducted off West Greenland in August and September 2007. A total of 8,670km of survey effort covered 11 strata in sea states <5 with a total stratum area of 213,807km². The 27 sightings of common minke whales were all within a strip width of 300m and the average time from first detection to when the sighting passed abeam was 1.7 sec. Due to the uniform and narrow distribution of the detections, strip census methods were used to analyse the survey. Two methods were deployed to correct the strip census estimates for whales missed by the observers and whales that were submerged during the passage of the plane. Method 1 included all detections of common minke whales (n=27) and correction for an instantaneous availability that included submergence of whales. Using data from sea states <3 (n=22) the 'at surface' abundance of common minke whales was 1,866 (CV=0.30) whales. A correction for whales missed by the observers with a simple mark-recapture estimator resulted in a corrected abundance of 1,904 (CV=0.30) whales. Adjusting for the availability bias resulted in a fully corrected estimate of 16,609 (95% CI 7,172-38,461) common minke whales. Method 2 used only detections of common minke whales that were observed to break the surface (n=19). Applying this method to effort data at sea state <3 n=14 resulted in an 'at surface' abundance of 1,174 (CV=0.39) whales. A correction for whales missed by the observers increased the abundance to 1,198 (0.39) whales. Adjusting for the availability bias resulted in a fully corrected estimate of 22,952 (95% CI 7,815-67,403) common minke whales. KEYWORDS: COMMON MINKE WHALE; ABUNDANCE ESTIMATE; AERIAL SURVEY; SATELLITE TAGGING; WEST GREENLAND.

Heide-Jørgensen, M.P., Laidre, K., Simon, M., Burt, M.L., Borchers, D.L. and Rasmussen, M.H. 2010. Abundance of fin whales in West Greenland in 2007. *J. Cetacean Res. Manage.* 11(2):83-88.

An aerial line transect survey of fin whales (*Balaenoptera physalus*) conducted off West Greenland in 2007 was used to estimate the current abundance of fin whales on the summer feeding ground. A total 24 sightings of fin whale groups were collected during 8,632km of survey effort in sea states <5. Based on conventional distance sampling techniques an abundance of 4,359 whales (95% CI 1,879-10,114) was estimated. The survey was conducted as a double platform survey and mark recapture distance sampling techniques were used to correct for perception bias which resulted in an estimate of 4,468 whales (95% CI 1,343-14,871). Both estimates are negatively biased because no corrections were applied for whales that were submerged during the passage of the survey plane. The abundance estimate furthermore only represents the coastal areas of West Greenland. The sightings at the westernmost border of the strata suggest that the entire Baffin Bay-Davis Strait summer abundance of fin whales could be considerably larger. Based on comparison with previous surveys in West Greenland in 1987/88 and 2005 it appears that the fin whale abundance in West Greenland has increased. KEYWORDS: FIN WHALE; ABUNDANCE ESTIMATE; SURVEY-AERIAL; WEST GREENLAND; NORTHERN HEMISPHERE.

Koski, W.R., Zeh, J., Mocklin, J., Davis, A.R., Rugh, D.J., George, J.C. and Suydam, R. 2010. Abundance of Bering-Chukchi-Beaufort bowhead whales (*Balaena mysticetus*) in 2004 estimated from photo-identification data. *J. Cetacean Res. Manage.* 11(2):89-100.

Ice-based surveys near Point Barrow, Alaska, have been used to obtain most estimates of abundance for the Bering-Chukchi-Beaufort (B-C-B) stock of bowhead whales, but global warming has raised concerns that ice-based surveys may not be practical in the future. Aerial photographic surveys provide an alternative method for obtaining abundance estimates and may replace ice-based surveys. Aerial photographic surveys were conducted near Point Barrow during the spring migrations of bowhead whales in 2003 and 2004 and, in 2005, in the northern Bering Sea in spring and near Barrow in fall. The 2003 survey was the most complete photographic survey of the population conducted to date. These surveys provided photo-identification data for use in capture-recapture analyses. A screening procedure was used to define which whales captured in 2003, 2004 and/or 2005 were marked and could be reidentified if photographed on another occasion. An estimate of the number of marked whales was obtained using a closed population model for capture-recapture data. Several models were investigated, including models that accounted for heterogeneity in capture probabilities, but a simple model with no covariates produced the most precise estimate. To account for unmarked whales, the estimate of marked whales was divided by an estimate of the proportion of the bowhead population that was marked based on the 1989-2004 spring photographic surveys near Point Barrow. Abundance of the B-C-B bowhead population in 2004 (excluding calves) was estimated to be 12,631 with CV 0.2442, 95% bootstrap percentile confidence interval (7,900; 19,700) and 5% lower limit 8,400. These results were compared with results that used approximate variance expressions for the estimates of the number of marked whales, the proportion of the population that was marked and population abundance instead of using the bootstrap. The estimates of abundance in 2004 computed for comparison included one based on a modified Petersen estimate of the number of marked whales that omitted the 2005 data as well as the estimate of 12,631 described above. The comparison estimates also included estimates of abundance in 1985 computed from 1984-87 photographic survey data using the same methods. All the abundance estimates computed from photographic data were consistent with expectations based on independent abundance and trend estimates from the ice-based surveys conducted from 1978 to 2001. KEYWORDS: ABUNDANCE ESTIMATE; MARK-RECAPTURE; SURVEY-AERIAL; PHOTO-ID; BOWHEAD WHALE; ARCTIC; BEAUFORT SEA.

Archer, F.I., Martien, K.K., Taylor, B.L., LeDuc, R.G., Ripley, B.J., Givens, G.H. and George, J.C. 2010. A simulation-based approach to evaluating population structure in non-equilibrium populations. *J. Cetacean Res. Manage.* 11(2):101-14.

The standard null model of panmixia used to test for population subdivision is based on a set of assumptions that can be violated given recent events likely to result in non-equilibrium genetic composition coupled with the complex life histories of many species. Bowhead whales (*Balaena mysticetus*) represent such a species. Bowhead whales also have a well-documented history of severe commercial harvest in the recent past which would be expected to leave a population out of genetic equilibrium. They also have a very long life span, overlapping generations, and age and sex-structured migrations. In addition, samples come from whales killed in a hunt known to be non-random with respect to size at different whaling villages. Sampling of such a population could lead to erroneous conclusions regarding population structure, which could have real consequences for aboriginal whaling. To better interpret the results of standard population genetic analyses, an individual-based model of bowhead whale population dynamics and genetics was created using the R package rmetasim. The model re-created as closely as possible all aspects of the demography, genetics, and whaling history of bowhead whales. Simulated datasets were generated by sampling from the simulated population in a way that matched the age, sex and geographic distribution of empirically collected samples. The empirical bowhead datasets were compared to null distributions generated from the simulated datasets for a variety of genetic analyses. The analysis indicates that the empirical genetic data sampled from the Bering Chukchi-Beaufort (BCB) stock of bowhead whales are more consistent with the model of a population with the same whaling history and demographic composition as BCB whales, than they are with a single, randomly-mating population in genetic equilibrium under a standard Wright-Fisher model. Additionally, it was demonstrated that by failing to account for the unique features of the population dynamics of the species, standard tests of genetic differentiation based on panmixia may produce misleading results. The approach outlined will likely

prove useful for evaluating population structure in other species likely to be out of equilibrium. KEYWORDS: WHALING-ABORIGINAL; WHALING-HISTORICAL; ARCTIC; MANAGEMENT; MODELLING; AGE DISTRIBUTION; GENETICS; BOWHEAD WHALE; BERING SEA; CHUKCHI SEA; BEAUFORT SEA; NORTHERN HEMISPHERE.

Beekmans, B.W.P.M., Forcada, J., Murphy, E.J., De Baar, H.J.W., Bathmann, U.V. and Fleming, A.H. 2010. Generalised additive models to investigate environmental drivers of Antarctic minke whale (*Balaenoptera bonaerensis*) spatula density in austral summer. *J. Cetacean Res. Manage.* 11(2):115-30.

There is a need to characterise the physical environment associated with Antarctic minke whale density in order to understand long-term changes in minke whale distribution and density in open waters of the Southern Ocean during austral summer months. To investigate environmental drivers of Antarctic minke whale density, generalised additive models (GAMs) were developed, based on line transect data collected for the International Decade of Cetacean Research (IDCR) and Southern Ocean Whale Ecosystem Research (SOWER) programmes. The GAMs were fitted independently by survey year. Explained deviances ranged from 14.9% to 35.1%. Most models included covariates related to transition zones, such as distances to the continental shelf break and sea ice edge, both of which showed a predominantly negative relationship with whale density. This study suggests high variability in the relationships between Antarctic minke whale density and the environment. None of the selected covariates had a consistent qualitative relationship with density at either the circumantarctic or the regional scale. This in part may be explained by the changing ice-related boundaries of the surveys between years and hence differences in survey region. Another possible reason is that in absence of better data, most of the covariates considered were derived from remote sensing data. More localised surveys with comparable survey area conducted across the Southern Ocean, where whale sightings data are collected simultaneously with *in situ* non-biotic and prey data, are likely to provide a better assessment of the environmental determinants of whale density. KEYWORDS: ANTARCTIC MINKE WHALE; SOUTHERN OCEAN; DISTRIBUTION; ICE; MODELLING; SOWER.

Carrillo, M. and Ritter, F. 2010. Increasing numbers of ship strikes in the Canary Islands: proposals for immediate action to reduce risk of vessel-whale collisions. *J. Cetacean Res. Manage.* 11(2):131-38.

The Canary Islands, known for their extraordinarily high cetacean species diversity, have witnessed a rapid expansion in fast and high speed ferry traffic during the past few years. At the same time, ship strikes have been increasingly reported. 556 cetacean carcasses, found ashore, or reported, in the Canary Islands between 1991 and 2007, were examined. 59 strandings (10.6%) were found to involve vessel-whale collisions, the great majority of strandings (58%) occurred on Tenerife. Species most affected were sperm whales (*Physeter macrocephalus*, N=24, 41%), pygmy sperm whales (*Kogia breviceps*, N=10, 17%), Cuvier's beaked whales (*Ziphius cavirostris*, N=7, 12%), short-finned pilot whales (*Globicephala macrorhynchus*, N=6, 10%) and at least three baleen whale species (N=9, 15%). Twenty six animals (44%, N=42) were either calves or juveniles, and one was a newborn. The temporal distribution of strandings indicates that lethal strikes have increased in recent years. Most ship strikes, assumingly by large and fast moving vessels, probably resulted in the death of the animals, as indicated by severe injuries such as huge slashes, cuts, broken vertebrae or animals separated into halves. Given these numbers and the widely accepted fact that only a portion of ship strikes will be recorded due to under-reporting and carcasses drifting away or sinking, ship strikes appear to be a major threat to cetaceans in the Canary Islands, especially to sperm whales. Moreover, the issue is a matter of human safety, as crew and passengers are at risk of being harmed, too. In this situation, a number of measures to mitigate the risk of ship strikes are recommended as a matter of high priority. These include the placement of dedicated look-outs on fast moving vessels, the shift of ferry transects where feasible, a speed limitation for local high-risk areas where cetacean abundance is notably high, the introduction of an obligatory reporting system of vessel-whale collisions and the conduction of detailed studies dealing with this pressing issue. KEYWORDS: CETACEANS; SHIP STRIKES; CANARY ISLANDS; NORTHERN HEMISPHERE; MEDITERRANEAN SEA; FAST FERRY TRAFFIC; MITIGATION; SPERM WHALE; PYGMY SPERM WHALE; CUVIER'S BEAKED WHALE; SHORT-FINNED PILOT WHALE.

Ritter, F. 2010. Quantification of ferry traffic in the Canary Islands (Spain) and its implications for collisions with cetaceans. *J. Cetacean Res. Manage.* 11(2):139-46.

The Canary Islands, known for their high cetacean species diversity, have witnessed a rapid expansion of fast ferry traffic during the past few years. At the same time, ship strikes have been repeatedly documented. In this paper an overview of the inter-island ferry traffic in the archipelago is given. Ferry types in use: normal; fast; and high speed vessels, are described, and the transects on which they operate are identified. To quantify the extent of the inter-island ferry traffic, three parameters were determined: (1) the actual transects from the different ports on the islands; (2) the number of travels made per week on each transect; and (3) the length of each transect. Resulting numbers indicate that normal ferries travel approx. 66,000km, fast ferries travel approx. 570,000km and high speed ferries travel approx. 845,000km between islands each year. Fast and high speed ferry traffic is concentrated in the western islands. Areas of high risk for ship strikes within the archipelago are identified by comparing the location of transects with known areas of high cetacean abundance. It is argued that the Canary Islands are a hot spot for vessel-whale collisions and that a policy to counteract this situation is urgently needed. KEYWORDS: CETACEANS; SHIP STRIKES; FERRY TRAFFIC; FAST FERRIES; CANARY ISLANDS; EUROPE; SPERM WHALE; WHALEWATCHING.

Schaffar, A., Garrigue, C. and Constantine, R. 2010. Exposure of humpback whales to unregulated whalewatching activities in their main reproductive area in New Caledonia. *J. Cetacean Res. Manage.* 11(2):147-52.

Whale- and dolphin-watching activities are demonstrating a strong growth worldwide, raising concern of their potential impacts on cetacean populations and emphasising the need for management. Humpback whales recently have become the focus of an important tourism industry in the South Pacific, particularly in New Caledonia, where operators focus on a small population of humpback whales on their main breeding ground. Despite considerable growth since it began in 1995, the industry remains unregulated. Between 2005 and 2007, a study was conducted to assess the impact of whalewatching activities on the behaviour of humpback whales in New Caledonia. All data were collected from a land-based research station using a theodolite. Results show that 54% of all humpback whale groups sighted were exposed to whalewatching boats. Each group was watched simultaneously by an average of 2.5 boats. More than three boats were present within 300m of a group of whales 30 % of the time. The length of time a group of whales was observed in the presence of boats each day was on average of one hour and 52 minutes but exceeded two hours 37% of the time. On average, each boat spent 52 minutes with the same group of whales. The closest point of approach was less than 100m for 86% of groups with a calf and 55% of non-calf groups. These results indicate that humpback whales are exposed to whalewatching boats in New Caledonia at a level exceeding the limits commonly recommended by management measures worldwide. Such exposure could be particularly problematic for mother calf pairs, more vulnerable to threats. The strong site fidelity of individuals on this breeding ground raises concern of potential cumulative impacts. Management measures should be implemented to regulate whalewatching activities and ensure the conservation of this small, endangered population of humpback whales. KEYWORDS: WHALEWATCHING; MANAGEMENT; CONSERVATION; HUMPBACK WHALE; PACIFIC OCEAN; SOUTHERN HEMISPHERE.

Speakman, T.R., Lane, S.M., Schwacke, L.H., Fair, P.A. and Zolman, E.S. 2010. Mark-recapture estimates of seasonal abundance and survivorship for bottlenose dolphins (*Tursiops truncatus*) near Charleston, South Carolina, USA. *J. Cetacean Res. Manage.* 11(2):153-62.

The stock structure of western North Atlantic bottlenose dolphins (*Tursiops truncatus*) is complex, with seasonally migratory stocks often overlapping with year-round resident stocks. High rates of exchange between northern-most sites have been documented but movement and seasonal fluctuation in abundance among sites along the southern portion of the US Atlantic coast is not well understood. To better understand seasonal abundance, a three-year mark-recapture study of bottlenose dolphins in coastal and estuarine waters near Charleston, South Carolina, USA was conducted. A robust design was employed in order to minimise bias and more precisely determine seasonal estimates of abundance and concurrently examine temporary immigration/emigration and survivorship. Systematic boat-based surveys were carried out (n=192) from January 2004 to December 2006. The entire study area was surveyed one week per month; an additional survey was conducted in the months in which seasonal abundance was estimated: January (winter), April (spring), July (summer) and October (autumn). Standard photo-identification techniques were used to accumulate sightings of 521 distinctively marked dolphins, 65% of which were sighted more than once. Pollock's robust design was applied using MARK and adjusted the ensuing abundance estimates for the seasonal proportion of unmarked dolphins (ranging from 0.27 to 0.40) in the population. Estimates ranged from 364 (95% CI=305-442) in January 2004 to 910 (95% CI=819-1018) in October 2006. Summer abundance estimates were consistently greater than those from winter months, although estimates varied considerably among years. The same model was used to calculate an annual survival rate estimate of 0.951 (95% CI=0.882-1.00) for marked individuals within the population. A high degree of transience, demonstrated by seasonal influxes of singlesighted individuals, made it difficult to differentiate between mortality and permanent emigration. The results support the occurrence of three distinct dolphin groups found in Charleston waters: year-round residents; seasonal residents; and transients. Reporting abundance and survivorship estimates together is useful in explaining and validating results for populations in which transient individuals occur. These results provide important information for stock and viability assessment of coastal bottlenose dolphins in the western North Atlantic. KEYWORDS: BOTTLENOSE DOLPHIN; PHOTO-IDENTIFICATION; SURVIVORSHIP; ABUNDANCE ESTIMATE; MARK-RECAPTURE; NORTH AMERICA; NORTHERN HEMISPHERE.

Danil, K., Chivers, S.J., Henshaw, M.D., Thieleking, J.L., Daniels, R. and St Leger, J.A. 2010. Cetacean strandings in San Diego County, California, USA: 1851-2008. *J. Cetacean Res. Manage.* 11(2):163-84.

There were 717 cetacean strandings recorded in San Diego County, California, USA between 1851 and 2008. These strandings comprised 18 odontocete and 6 mysticete species. Common dolphins (both the short-beaked (*Delphinus delphis*) and long-beaked common dolphin (*D. capensis*)) were the most commonly stranded cetacean species (43.2%), followed by bottlenose dolphins (*Tursiops truncatus*) (16.5%), gray whales (*Eschrichtius robustus*) (11.0%), and Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) (7.0%). A higher number of strandings was observed in the La Jolla and Coronado/Imperial Beach areas, which likely reflects the influence of coastal protrusions in those regions. Strandings of bottlenose dolphin neonates suggests their calving season extends from May to September. Strandings of common dolphin species peaked in the early- to mid- 1970s and in the late-1990s to 2008, coincident with cool oceanographic regimes. In addition, extralimital strandings of harbour porpoises and temporal changes in stranding rates of Dall's porpoises (*Phocoenoides dalli*) and short-finned pilot whales (*Globicephala macrorhynchus*) may have been associated with changes in oceanographic conditions. Evidence of human interaction in strandings included entanglements, boat strikes, shootings, and harpooning. Overall, the stranding record largely reflected the species composition of the Southern California Bight and provided confirmation for presence of cryptic species not previously recorded by aerial and ship surveys. KEYWORDS: STRANDINGS; NORTHERN HEMISPHERE; PACIFIC OCEAN; CLIMATE CHANGE; DISTRIBUTION; SEASONALITY; COMMON DOLPHIN; LONG-BEAKED COMMON DOLPHIN; BOTTLENOSE DOLPHIN; DALL'S PORPOISE; SHORT-FINNED PILOT WHALE; GRAY WHALE; PACIFIC WHITE-SIDED DOLPHIN.

Higdon, J.W. 2010. Commercial and subsistence harvest of bowhead whales (*Balaena mysticetus*) in eastern Canada and West Greenland. *J. Cetacean Res. Manage.* 11(2):185-216.

Commercial harvesting of bowhead whales (*Balaena mysticetus*) from the eastern Canada-West Greenland population started with Basque whalers in the Strait of Belle Isle ca. 1530 AD. Subsistence harvests have an even longer history, and the first culture to be active bowhead whalers was the Thule, which replaced the Dorset culture in the central and eastern Arctic ca 1200 AD. Previous harvest compilations have been incomplete, and back-calculated population models have thus been negatively biased. In recent decades this population has shown significant recovery and is the subject of Inuit subsistence harvests in both Canada and West Greenland. A revised historic abundance estimate is needed to examine the level of recovery; this requires *inter alia* a revised and updated catch series. Here I summarise available information from multiple anthropological, archaeological, historic and recent sources, and estimate commercial and subsistence harvests in eastern Canada and West Greenland. From 1530-1915, commercial whalers took an estimated 55,916-67,53 (median 61,537) bowhead whales (varying assumptions on the intensity of the Basque harvest), which is known to be incomplete. Inuit harvests before commercial whaling began (1200-1529 AD) were estimated at 11,435 whales, based on the abundance of whale bone at winter houses excavated by archaeologists. After 1500 AD, Inuit whaling declined, and the total estimated harvest between 1530 AD and the end of commercial whaling was 8,406 whales. Inuit whaling declined again after commercial whalers overharvested the population and only 65 whales are known to have been harvested (or struck and lost) from 1918-2009. The Inuit harvest statistics are based on scattered data and a number of assumptions, with some evidence that at least parts of the series are underestimated. Even if harvests were higher, they would have probably not been large enough to cause population declines. The long tradition of Inuit bowhead whaling was negatively impacted by commercial harvests. Combining all harvests from 1530-2009 AD results in a total estimated kill of some 70,000 whales (not including struck and lost whales and known gaps for some nations and eras), with most (88%) taken by commercial whalers. Data quality varies considerably by nation and era, and was assigned to a 3-point scale for reliability, with over half the harvest considered to be the least reliable. This is the most comprehensive summary and estimate of bowhead harvests for this region, but is still known to be incomplete and is based on a number of assumptions and disparate data sources. KEYWORDS: STATISTICS; WHALING-ABORIGINAL; WHALING-HISTORICAL; WHALING-REVISED CATCHES; ARCTIC OCEAN; ATLANTIC OCEAN; MODELLING.

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Gillespie, D., Leaper, R., Gordon, J. and MacLeod, K. 2010. An integrated data collection system for line transect surveys. *J. Cetacean Res. Manage.* 11(3):217-28.

A computer based system for the collection of line transect survey data is described. The primary goals of the system were to measure (rather than estimate) distances and angles wherever possible, to provide accurate time-stamps for surfacing events as an aid to duplicate identification and to facilitate accurate data collection by using computers to automate data collection wherever possible. Distance and angle measurements were made using established photogrammetric techniques. Collection of photogrammetric data from video was automated and included a system of data buffering so that several seconds of data prior to each observer sighting could be captured. An additional goal of the system was to eliminate the need for post-cruise data entry and validation through the use of on-board data validation software. The system was successfully used during the 2005 SCANS-II and the 2007 CODA surveys. KEYWORDS: SURVEY-VESSEL; PHOTOGRAMMETRY.

Leaper, R., Burt, L., Gillespie, D. and MacLeod, K. 2010. Comparisons of measured and estimated distances and angles from sighting surveys. *J. Cetacean Res. Manage.* 11(3):229-38.

Photogrammetric systems using video cameras were used to measure radial distances to sightings during the SCANS-II, CODA and SOWER surveys. These surveys included sightings of a variety of species from harbour porpoise, at distances of a few hundred metres, to large baleen whales at distances greater than 10km. A total of 910 initial sightings with estimated distances from reticles and measured distances from video, using 7×50 (636) or $25 \times$ 'Big Eye' (274) binoculars, were compared. Bearings to sightings were also measured from still images. The CVRMSE in distances varied between 0.19 and 0.33 for reticle binoculars. Comparisons of measured distances to simultaneous sightings by other observers using naked eye gave a CVRMSE of 0.39 for naked eye estimates. There was a consistent, non-linear pattern in all data sets, of over-estimating close distances to sightings of surfacing cetaceans and under-estimating those further away. However, this pattern was not evident from the distance experiments on SOWER to fixed targets which also had a much lower variance (CVRMSE = 0.13). Bearing data from SCANS-II and CODA showed around 5% of estimates had gross errors greater than 20° that were attributed to mistakes. For the remaining values, RMS errors were in the range 5.7° – 7.2° for SCANS-II and CODA and 4.9° for SOWER. Both distance and angle errors will make a substantial contribution to the variance of abundance estimates and simulated data showed that the observed non-linear nature of distance errors may cause considerable bias even when linear regressions might suggest little bias. There still remain technological challenges in operating complex electronic systems at sea to measure distances and bearings, but investment in these methods should be a cost effective way of reducing bias and improving precision of cetacean abundance estimates. KEYWORDS: SURVEY-VESSEL; PHOTOGRAMMETRY.

Koski, W.R., Abgrall, P. and Yazvenko, S.B. 2010. An inventory and evaluation of unmanned aerial systems for offshore surveys of marine mammals. *J. Cetacean Res. Manage.* 11(3):239-48.

A literature review, internet searches and communications with personnel working with unmanned aerial systems (UAS) were used to identify the capabilities of UAS throughout the world. We assessed their ability to replace manned aerial surveys for marine mammals, sea turtles and seabirds and to monitor, in real time, sea ice and other physical features that might influence marine mammal distribution. The vast majority of the systems identified were either too expensive or their capabilities did not meet minimum standards necessary to perform the tasks required of them in real time. Eight systems were identified that might be able to perform some of the desired tasks. Several other systems had similar capabilities but had not been tested or would require upgrades. Installation of high-definition (HD) video and better stabilisation systems would improve UAS performance. It is recommended that development of HD video with real-time data transmission and improved stabilisation systems for UAS be pursued and that side-by-side comparisons of a few of the best systems be conducted. KEYWORDS: INDEX OF ABUNDANCE; MONITORING; NOISE; SHORT-TERM CHANGE; SURVEY-AERIAL; VIDEO; UNMANNED-AERIAL SYSTEM.

Kleppe, T.S., Skaug, H.J. and Okamura, H. 2010. Asymptotic bias of the hazard probability model under model mis-specification. *J. Cetacean Res. Manage.* 11(3):249-52.

We compare the sensitivity of the estimated effective strip half-width with respect to choice of hazard probability function (Q). This is done by fitting the model under an erroneous assumption about the parametric form of Q, and comparing the estimated and true effective strip half-width. An 'infinite sample size' setting is employed, where fitting the model by maximum likelihood amounts to minimising the Kullback Leibler distance between the assumed and true models. The experiment is carried out in a situation that is relevant to minke whale sighting surveys both in the Antarctic and in the northeastern Atlantic. It is found that the hazard probability model is fairly robust with respect to the choice of parametric class for Q. The largest observed bias in the resulting effective strip half-width is less than 10%, while for most situations there is almost no bias. KEYWORDS: ABUNDANCE ESTIMATE; $g(0)$; SURVEY-VESSEL.

Schwarz, L.K., Gerrodette, T. and Archer, F.I. 2010. Comparison of closing and passing mode from a line-transect survey of delphinids in the eastern Tropical Pacific Ocean. *J. Cetacean Res. Manage.* 11(3):253-66.

Line-transect ship surveys are the primary method used to estimate abundance of pelagic cetaceans. However, survey methods are often modified from traditional methods because observers must approach cetacean groups to identify species and estimate group size. Returning to the trackline after approaching a school dramatically reduces the amount of effective survey time, so ships often resume survey effort at the sighting but parallel to the original trackline (closing mode). Survey effort is no longer independent of group locations, and it is unclear how such methodological modifications affect overall abundance estimates. This research presents the results of a study designed to determine the effects of closing mode methods on abundance estimation for cetacean species in the eastern tropical Pacific. Species identification and group size estimation in closing mode are compared with results using survey techniques where the ship does not approach or slow down to investigate a sighting (passing mode). Both empirical data and simulations were used to compare group encounter rates in the two modes and to better understand the mechanisms that might lead to an encounter rate bias in closing mode. As seen in similar studies, observers are able to identify to the species level less frequently in passing mode (81% vs 57% of sightings), and point estimates of delphinid group size were 58% lower in passing mode than closing mode at distances between 1.0 and 5.5km from the trackline. In addition, uncertainty in

group size both within and between observers was higher in passing mode. Closing mode delphinid group encounter rates were generally 20–25% lower than passing mode delphinid group encounter rates. Simulations showed the empirically lower encounter rates in closing mode are due to a loss in detection probability caused by the stop-start nature of the survey method. The closing mode encounter rate bias is greater when groups are in fewer and/or tighter clusters and when overall group density is higher. Methodological adjustments and analytical solutions to improve group size estimation and species identification in passing mode and reduce closing mode encounter rate bias are analytically complex and would also result in the loss of important additional life history data. Nevertheless, such avenues should be explored further. KEYWORDS: SURVEY-VESSEL; SAMPLING STRATEGY; MODELLING; PACIFIC OCEAN; ABUNDANCE ESTIMATE; $g(0)$; SCHOOL SIZE.

Garrison, L.P., Martinez, A. and Maze-Foley, K. 2010. Habitat and abundance of cetaceans in Atlantic Ocean continental slope waters off the eastern USA. *J. Cetacean Res. Manage.* 11(3):267-78.

This study quantifies the abundance and spatial distribution of the cetacean community occupying continental shelf edge and inner continental slope waters along the US southeast Atlantic coast. A shipboard visual line-transect survey was conducted between June and August of 2004 that included effort in waters >50m deep encompassing the shelf break and inner continental slope off the US east coast between 28°N and 38°N latitude. The abundance of nine cetacean taxa was estimated using line-transect distance analysis and an independent observer approach to correct for visibility bias. Canonical correspondence analysis was used to examine the spatial distribution of the cetaceans encountered during the survey as a function of surface temperature, surface salinity, surface fluorescence, bottom depth, and bottom slope. The abundance estimates for most species were much higher than those from a study of the area conducted in 1998. This is primarily due to increased coverage of the shelf-break region and correction for visibility bias. The multivariate analysis indicated four distinct groups of cetaceans that partitioned habitat as a function of salinity, depth, and a latitudinal gradient. These groups were associated with specific water masses and hydrographic features including mid-Atlantic shelf waters (Group I), the shelf break (Group II), mid-Atlantic slope waters (Group III), and south Atlantic slope water (Group IV). Areas where water masses converge such as the continental shelf break along the mid-Atlantic and near Cape Hatteras, North Carolina are therefore areas of both high diversity and density of cetaceans. KEYWORDS: CETACEAN HABITAT; LINE-TRANSECT SURVEY; MULTIVARIATE ANALYSIS.

Lauriano, G., Panigada, S., Canneri, R. and Zeichen, M.M. 2010. Abundance estimate of striped dolphins (*Stenella coerulealba*) in the Pelagos sanctuary (NW Mediterranean) by means of line transect surveys. *J. Cetacean Res. Manage.* 11(3):279-84.

To assess cetacean densities in the Pelagos Sanctuary for Mediterranean Marine Mammals, a Marine Protected Area (MPA) specifically designated to protect cetaceans, a survey was carried out in the Ligurian-Provençal Basin (NW Mediterranean) in August 2008. An area of 58,000 km² was surveyed in eight days with equally spaced zigzag transects, covering 1,255 km in favourable conditions. Tracklines were designed using Distance 5.0 to allow for homogeneous coverage probability over the selected area. Fifty three sightings of four cetacean species were made: striped dolphins ($n = 37$), fin whales ($n = 12$), sperm whales ($n = 3$) and Cuvier's beaked whales ($n = 1$). Estimates of abundance were obtained using Distance 5.0. The estimated dolphin abundance was 13,232 (CV = 35.55; 95% CI = 6,640–26,368), with a density of 0.23 individuals km⁻¹ (CV = 35.55; 95% CI = 0.11–0.45). No fin whale abundance estimate was possible due to the small sample size. The point estimate of the 2008 striped dolphin abundance estimate was almost half of that of a survey conducted in 1992 by Forcada and colleagues (1995) in the same area with comparable effort, platform and methodology (25,614; CV = 25.3; 95% CI = 15,377–42,658); nevertheless, the difference was not statistically significant. These results strongly support the need for further systematic monitoring in the Sanctuary and in the surrounding areas, in order to assess striped dolphin abundance, spatial and temporal trends. KEYWORDS: ABUNDANCE ESTIMATE; SURVEY-VESSEL; CONSERVATION; EUROPE; STRIPED DOLPHIN.

Montero-Cordero, A. and Lobo, J. 2010. Effect of tourist vessels on the behaviour of the pantropical spotted dolphin, *Stenella attenuata*, in Drake Bay and Caño Island, Costa Rica. *J. Cetacean Res. Manage.* 11(3):285-92.

Despite the exponential increase in whalewatching activities in Costa Rica, little is known about its biological impact on resident coastal populations of dolphins in the country. Globally, this activity has brought economic benefits to the communities where it is practiced and in some cases, has played an important role in conservation of these mammals. However, when intensively practiced, this activity may significantly affect the animals, since its success depends on following cetaceans for extended periods of time. This study was conducted during the 2004–2005 and 2005–2006 dry seasons, to examine the biological factors associated with this activity in two areas where it is intensively practiced: Drake Bay and Caño Island. Three strip transects were followed within a high (vessel) traffic area. The pantropical spotted dolphin was studied through instant sampling, every two minutes. Sighting density of dolphins accompanied by tourist boats was greater within 3km of the island compared to the average density in the whole study area. Dolphins reacted negatively to those boats that did not follow at least one of the rules of boat handling in the current existing national regulation for whalewatching guidelines. Furthermore, a logistic regression analysis showed that feeding and resting are less likely to occur in the presence of tourist boats. These two behaviours are extremely important and mishandled boats could cause the spotted dolphin to leave this area if these flaws continue. Due to the lack of economic resources and staff from state institutions in Costa Rica, the reinforcement of the Whalewatching Executive Decree 32495 (2005) may be more efficient with 'bottom up' control, where community representatives control their own resources in conjunction with government oversight. KEYWORDS: WHALEWATCHING; MANAGEMENT; SPOTTED DOLPHIN; BEHAVIOUR; TOURISM; REGULATION.

Frost, K.J. and Suydam, R.S. 2010. Subsistence harvest of beluga whales, *Delphinapterus leucas*, in northern and western Alaska, 1987–2006. *J. Cetacean Res. Manage.* 11(3):293-300.

Four stocks of beluga or white whales (*Delphinapterus leucas*) are hunted by Alaska Natives in northern and western Alaska. These are the Beaufort Sea, eastern Chukchi Sea, eastern Bering Sea and Bristol Bay stocks. Since 1987, the Alaska Beluga Whale Committee has monitored the subsistence harvests of belugas from these stocks. During this 20 year period, the total landed harvest for the four stocks combined (adjusted for years with missing data) ranged from 208 in 1995 to 494 in 1988, with a 20 year average of 323 per year. For individual stocks the average annual landed harvests for 1987–2006 were: Beaufort Sea – 41; Chukchi Sea – 62; eastern Bering Sea – 191; and Bristol Bay – 20. There was no significant longterm trend ($p > 0.05$) in the rate of harvesting for any stock from 1987–2006. Average landed harvests relative to estimated stock size were: 0.1% for the Beaufort Sea (0.4% including belugas harvested from the Beaufort Sea stock by Canadian hunters); 1.7% for the eastern Chukchi

Sea; 1.1% for the eastern Bering Sea; and 1.1% for Bristol Bay. The success of beluga harvest monitoring in Alaska is due to the cooperation of beluga hunters from more than 40 small coastal communities who report their harvests to the Alaska Beluga Whale Committee (ABWC). Through the ABWC, beluga hunters have been able to formalise their role in managing their subsistence resources. KEYWORDS: BELUGA WHALE; WHITE WHALE; WHALING - ABORIGINAL; MANAGEMENT; ARCTIC.

Minton, G., Collins, T., Findlay, K. and Baldwin, R. 2010. Cetacean distribution in the coastal waters of the Sultanate of Oman. *J. Cetacean Res. Manage.* 11(3):301-14.

Small boat surveys were conducted between 2000 and 2003 in three main regions of Oman's coastal waters: Muscat, the Gulf of Masirah and Dhofar. Survey data were analysed to calculate relative abundances of the seven most frequently encountered species in these areas. These include (in order of frequency) bottlenose dolphins (*Tursiops* sp.), long-beaked common dolphins (*Delphinus capensis*), humpback whales (*Megaptera novaeangliae*), spinner dolphins (*Stenella longirostris*), Indo-Pacific humpback dolphins (*Sousa chinensis*), Bryde's whales (*Balaenoptera* sp.) and Risso's dolphins (*Grampus griseus*). Other species observed include false killer whales (*Pseudorca crassidens*), blue whales (*Balaenoptera musculus*), rough-toothed dolphins (*Steno bredanensis*) and unidentified beaked whales. Encounter rates per distance searched were plotted by 0.1 x 0.1 degree grid cell, giving an indication of relative abundances and key areas of habitat used by each of the seven most frequently encountered species. These plots demonstrate that the nearshore areas of the Gulf of Masirah, as well as the coastal waters of Dhofar, are areas of concentration for the Arabian Sea's recently designated Endangered subpopulation of humpback whales, as well as Indo-Pacific humpback dolphins, which are considered Near Threatened on the IUCN Red List of Threatened Species. The results presented here provide valuable baseline data for future research and help to inform conservation management efforts that are required to address the highly vulnerable status of the humpback whale and Indo-Pacific humpback dolphin populations in question. KEYWORDS: ARABIAN SEA; GULF OF OMAN; DISTRIBUTION; HABITAT; BRYDE'S WHALE; BLUE WHALE; HUMPBACK WHALE; SPERM WHALE; BOTTLENOSE DOLPHIN; COMMON DOLPHIN; SPINNER DOLPHIN; RISSO'S DOLPHIN; INDO-PACIFIC HUMPBACK DOLPHIN; ROUGH-TOOTHED DOLPHIN.

Van Waerebeek, K., Leaper, R., Baker, A.N., Papastavrou, V. and Thiele, D. 2010. Odontocetes of the Southern Ocean Sanctuary. *J. Cetacean Res. Manage.* 11(3):315-46.

Twenty-eight odontocete species were identified as occupying sub-Antarctic and Antarctic habitat covered by the 1994 IWC-established Southern Ocean Sanctuary. Toothed whales evidently play an important part in the Antarctic polar ecosystem. Twenty-two species are autochthonous in showing a regular, apparently year-round, presence in the Sanctuary: *Physeter macrocephalus*, *Kogia breviceps*, *Orcinus orca*, *Globicephala melas edwardii*, *Pseudorca crassidens*, *Lagenorhynchus cruciger*, *Lagenorhynchus obscurus*, *Lissodelphis peronii*, *Cephalorhynchus commersonii*, *Cephalorhynchus hectori*, *Tursiops truncatus*, *Delphinus delphis*, *Phocoena dioptrica*, *Hyperoodon planifrons*, *Berardius arnuxii*, *Ziphius cavirostris*, *Tasmacetus shepherdi*, *Mesoplodon layardii*, *Mesoplodon traversii*, *Mesoplodon grayi*, *Mesoplodon bowdoini* and *Mesoplodon hectori*. Six species are considered vagrants into the Sanctuary: *Kogia sima*, *Grampus griseus*, *Steno bredanensis*, *Mesoplodon peruvianus*, *Mesoplodon densirostris* and *Mesoplodon mirus*. However, vagrant status of these three mesoplodonts is only provisionally assigned, considering that improved knowledge of diagnostic features of beaked whales should, as in recent years, continue to facilitate at-sea identification. Two species are considered as having a 'contiguous' range (records less than 2° north of Sanctuary boundaries): *Mesoplodon ginkgodens* (at 39°S) and *Mesoplodon mirus* (at 38°24'S). The habitual southern range of at least four odontocetes extends significantly farther poleward than expected. *G. melas edwardii* is regularly encountered south of the Antarctic Polar Front, much like *M. grayi* which is known to reach the Ross Sea ice edge (ca. 67°S). *Z. cavirostris* and *L. obscurus* cross the Polar Front occasionally. The distribution of *M. peruvianus* and *M. traversii* and their relation to SST are unclear. Their southernmost records, 42°31'S and 44°17'S respectively, may either be extralimital or, more likely, reflect ordinary austral range. Temporally non-aligned distribution patterns of *Hyperoodon planifrons* in Antarctic and South African waters may suggest stock segregation. KEYWORDS: ANTARCTIC; DISTRIBUTION; MOVEMENT; SANCTUARY; SOUTHERN HEMISPHERE; SOUTHERN OCEAN SANCTUARY; SURVEY-VESSEL; ODONTOCETES; BEAKED WHALES; ANTARCTIC; HABITAT.

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Heide-Jørgensen, M.P., Laidre, K., Hansen, R.G., Burt, M.L., Simon, M., Borchers, D.L., Hanssen, J., Harding, K., Rasmussen, M.H., Dietz, R. and Teilmann, J. 2012. Rate of increase and current abundance of humpback whales in West Greenland. *J. Cetacean Res. Manage.* 12(1):1-14.

Aerial line transect surveys of the density of humpback whales (*Megaptera novaeangliae*) conducted off West Greenland eight times between 1984 and 2007 were used to estimate the rate of increase on the summer feeding ground. Only surveys in 1993, 2005 and 2007 had enough sightings to construct independent density estimates, whereas the surveys in 1984–85 and 1987–89 had to be merged and treated as two surveys. The annual rate of increase was 9.4% yr⁻¹ (SE = 0.01) between 1984 and 2007. This rate of increase is higher than the increase estimated at the breeding grounds in the West Indies, but is of the same magnitude as the observed rate of increase at other feeding grounds in the North Atlantic. A matrix model based on observed life history parameters revealed that the theoretical growth rate of a humpback whale population ranged between 1 and 11%. This confirms that the observed growth in West Greenland is within the plausible values. The survey in 2007 was used to make a fully corrected abundance estimate including corrections for whales that were submerged during the passage of the survey plane. The line transect estimate for 2007 was 1,020 (CV = 0.35). When the estimate was corrected for perception bias with mark-recapture distance sampling (MRDS) methods, the abundance increased to 1,505 (0.49). A correction for availability bias was developed based on time-depth-recorder information on the time spent at the surface (0–4m). However, used directly this correction leads to a positively-biased abundance estimate and instead a correction was developed for the non-instantaneous visual sighting process in an aircraft. The resulting estimate for 2007 was 3,272 (CV = 0.50) for the MRDS analysis. An alternative strip census estimate deploying a strip width of 300m resulted in 995 (0.33) whales. Correction for perception bias resulted in 991 (0.35) whales and corrected for the same availability bias as for the MRDS method resulted in a fully corrected estimate of 2,154 (0.36) humpback whales in West Greenland in 2007. KEYWORDS: HUMPBACK WHALE; ABUNDANCE ESTIMATE; SURVEY-AERIAL; SATELLITE TAGGING; WEST GREENLAND; MARK-RECAPTURE; DISTANCE SAMPLING.

Punt, A.E. and Wade, P.R. 2012. Population status of the eastern North Pacific stock of gray whales in 2009. *J. Cetacean Res. Manage* 12(1):15-28.

An age- and sex-structured population dynamics model is fitted using Bayesian methods to data on the catches and abundance estimates for the Eastern North Pacific (ENP) stock of gray whales. The prior distributions used for these analyses incorporate revised estimates of abundance for ENP gray whales and account explicitly for the drop in abundance caused by the 1999–2000 mortality event. A series of analyses are conducted to evaluate the sensitivity of the results to different assumptions. The model fits the available data adequately, but, as in previous assessments, the measures of uncertainty associated with the survey-based abundance estimates are found to be negatively biased. The data support the inclusion of the 1999–2000 mortality event in the model, and accounting for this event leads to greater uncertainty regarding the current status of the resource. The baseline analysis estimates the ENP gray whale population to be above the maximum sustainable yield level (MSYL) with high probability (0.884). The posterior mean for the ratio of 2009 (1+) abundance to MSYL is 1.29 (with a posterior median of 1.37 and a 90% probability interval of 0.68–1.51). These results are consistent across all the model runs conducted. The baseline model also estimates the 2009 ENP gray whale population size (posterior mean of 20,366) to be at 85% of its carrying capacity (posterior mean of 25,808), and this is also consistent across all the model runs. The baseline model estimate of the maximum rate of increase, λ_{max} , is 1.062 which, while high, is nevertheless within the range of estimates obtained for other baleen whales. KEYWORDS: ASSESSMENT; GRAY WHALES; WHALING-ABORIGINAL.

Salgado Kent, C., Jenner, C., Jenner, M., Bouchet, P. and Rexstad, E. 2012. Southern Hemisphere Breeding Stock 'D' humpback whale population estimates from North West Cape, Western Australia. *J. Cetacean Res. Manage* 12(1):29-38.

Estimates of the abundance of Breeding Stock D humpback whales (*Megaptera novaeangliae*) are key to the conservation and management of what is thought to be one of the largest populations of the species. Five years (2000, 2001, 2006, 2007 and 2008) of aerial surveys carried out over an eight-year period at North West Cape (Western Australia) using line transect methodology allowed trends in whale numbers to be investigated, and provided a base for comparison with estimates made approximately 400km south at Shark Bay (Western Australia). A total of 3,127 whale detections were made during 74 surveys of the 7,043km² study area west of NWC. Pod abundance for each flight was computed using a Horvitz-Thompson like estimator and converted to an absolute measure of abundance after corrections were made for estimated mean cluster size, unsurveyed time, swimming speed and animal availability. Resulting estimates from the migration model of best fit with the most credible assumptions were 7,276 (CI = 4,993–10,167) for 2000, 12,280 (CI = 6,830–49,434) for 2001, 18,692 (CI = 12,980–24,477) for 2006, 20,044 (CI = 13,815–31,646) for 2007, and 26,100 (CI = 20,152–33,272) for 2008. Based on these data, the trend model with the greatest r^2 was exponential with an annual increase rate of 13% (CI = 5.6%–18.1%). While this value is above the species' estimated maximum plausible growth rate of 11.8%, it is reasonably close to previous reports of between 10–12%. The coefficient of variation, however, was too large for a reliable trend estimate. Perception bias was also not accounted for in these calculations. Based on a crude appraisal which yielded an estimated $p(0)$ of 0.783 (from independent observer effort, CV = 0.973), the 2008 humpback population size may be as large as 33,300. In conclusion, the work here provides evidence of an increasing Breeding Stock D population, but further surveys are necessary to confirm whether the population is indeed increasing at its maximum rate. KEYWORDS: HUMPBACK WHALE; AUSTRALASIA; ABUNDANCE ESTIMATE; SURVEY-AERIAL; MIGRATION; MODELLING; TRENDS.

Ferguson, M.C. 2012. Quantifying spatial characteristics of the Bowhead Whale Aerial Survey Project (BWASP) survey design. *J. Cetacean Res. Manage* 12(1):39-44.

The Bowhead Whale Aerial Survey Project (BWASP) has been conducted annually since 19769 in the Alaskan Beaufort Sea to monitor the distribution and relative abundance of the Bering-Chukchi-Beaufort (BCB) stock of bowhead whales (*Balaena mysticetus*) during their autumn migration. BWASP was created to specifically address broad-scale research and management questions related to bowhead whale ecology, with particular interest in the potential effects of oil and natural gas exploration, development and production activities on the BCB bowhead whales. With elevated concerns about climate change, increasing oil and gas activities and the forecasted increase in vessel traffic, it is expected that interest in the BWASP dataset will also increase in order to evaluate effects of these anthropogenic activities on BCB bowhead whales and indigenous whaling. The following analysis quantified the spatial characteristics of the BWASP survey design and provided guidelines for the types of investigations that the BWASP data can potentially address. Sampling lags (transect spacing) in the BWASP survey design of approximately 20km along the east/west axis of the study area limit the spatial scale of phenomena that can be detected using data from a single BWASP survey. Therefore, BWASP data are relatively uninformative for studying variability in distribution or relative abundance along the east/west axis over short time scales (one survey) and within small areas measuring less than approximately 20km. In addition, computer simulations showed spatial heterogeneity in the long-term survey coverage probability (the probability that a given location will be included in a survey having an assumed effective search width under the BWASP survey design). Pooled transects created from simulated surveys resulted in a repeating diamond pattern in which coverage probability was low. Analyses incorporating data from many BWASP surveys should account for this spatial heterogeneity, via either the survey coverage probabilities or quantification of survey effort; otherwise estimates of variables such as relative density, density, or habitat use may be biased. The BWASP surveys have increased understanding of the broad-scale patterns of bowhead distribution, relative abundance and behaviour. The utility of this dataset in informing other questions will depend upon the scale of the ecological phenomena under investigation and the analytical scales used to address the questions. KEYWORDS: BOWHEAD WHALE; ARCTIC; SURVEY-AERIAL; MODELLING; DISTRIBUTION; BEAUFORT SEA; LINE TRANSECT; NORTHERN HEMISPHERE.

Palacios, D.M., Ferreira, J.C., Gerrodette, T., García, C., Soler, G.A., Avila, I.C., Bessudo, S., Hernandez, E., Trujillo, F., Florez-Gonzalez, L. and Kerr, I. 2012. Cetacean distribution and relative abundance in Colombia's Pacific EEZ from survey cruises and platforms of opportunity. *J. Cetacean Res. Manage* 12(1):45-60.

Cetacean sighting data collected under various programmes in Colombian Pacific waters were collated with the goal of assessing the distribution and abundance patterns of all species occurring in the exclusive economic zone (EEZ). Distribution maps are presented for 19 species and one genus based on 603 sightings collected between 1986 and 2008. Ordered by sighting frequency, these species were: humpback whale (*Megaptera novaeangliae*); striped dolphin (*Stenella coeruleoalba*); common bottlenose

dolphin (*Tursiops truncatus*); pantropical spotted dolphin (*Stenella attenuata*); common dolphin (*Delphinus delphis*); Risso's dolphin (*Grampus griseus*); sperm whale (*Physeter macrocephalus*); rough-toothed dolphin (*Steno bredanensis*); short-finned pilot whale (*Globicephala macrorhynchus*); mesoplodont whales (*Mesoplodon* spp.); Cuvier's beaked whale (*Ziphius cavirostris*); melon-headed whale (*Peponocephala electra*); false killer whale (*Pseudorca crassidens*); killer whale (*Orcinus orca*); spinner dolphin (*Stenella longirostris*); dwarf sperm whale (*Kogia sima*); Bryde's whale (*Balaenoptera edeni*); pygmy killer whale (*Feresa attenuata*); minke whale (*Balaenoptera acutorostrata*) and fin whale (*Balaenoptera physalus*). Concentrations of sightings were observed in three geographic areas: (1) the continental shelf (depths <200m) and the contiguous continental slope (200–2,000m); (2) over the Malpelo Ridge, an offshore bathymetric feature and (3) the northeast corner of the EEZ between Golfo de Cupica and the border with Panamá, although we do not rule out that these patterns could be an artefact of non-random effort. In inshore waters, the most frequently seen species were pantropical spotted dolphin, common bottlenose dolphin and humpback whale. For several of the data sets we provide encounter rates as indices of relative abundance, but urge caution in their interpretation because of methodological limitations and because several factors that affect sightability could not be accounted for in these estimates. Our results provide useful information for ongoing regional research and conservation initiatives aimed at determining occurrence, population status and connectivity within adjacent EEZs in the eastern tropical Pacific. Suggested research priorities include conducting dedicated surveys designed for estimating abundance and monitoring trends throughout the EEZ and focused studies in areas of special interest like the continental shelf, the Malpelo Ridge and the vicinity of Cupica and Cabo Marzo. More research is also needed in terms of quantifying the sources and impact of anthropogenic mortality on population size. Studies characterising genetic diversity and stock discreteness in coastal species (pantropical spotted dolphin and common bottlenose dolphin) would help inform local management strategies. KEYWORDS: SOUTH AMERICA; EASTERN TROPICAL PACIFIC OCEAN; SURVEY-VESSEL; INCIDENTAL SIGHTINGS; ABUNDANCE ESTIMATE; INDEX OF ABUNDANCE; DISTRIBUTION; HABITAT; BREEDING GROUNDS.

Olson, P.A., Ensor, P. and Kuningas, S. 2012. Observations of killer whales off East Antarctica, 82°-95°E, in 2009. *J. Cetacean Res. Manage* 12(1):61-64.

Observations of killer whales (*Orcinus orca*) during a survey off East Antarctica, 82°-95°E revealed previously undescribed variations in pigmentation and group associations. During the survey 24 killer whale groups were sighted south of 60°S and classified, when possible, to Types A, B, or C based on their external morphology. Sufficient observation was available for nine groups to be classified: 2 groups of Type A; 1 mixed group of Type A and Type B; 3 groups of Type C; and 3 groups with eyepatch pigmentation intermediate in size between Types B and C. These whales may represent an intergrade between Types B and C or a previously unrecognised form. One of the 'intermediate' groups was observed feeding in a multi-species aggregation with other cetaceans in deep water. Clearly distinguishable Type A and Type B whales were observed feeding together in a mixed aggregation, the first time that this has been documented. KEYWORDS: KILLER WHALE; ANTARCTIC; COLOURATION; TAXONOMY.

Silva, M.A., Steiner, L., Cascao, I., Cruz, M.J., Preto, R., Cole, T., Hamilton, P.K. and Baumgartner, M. 2012. Winter sighting of a known western North Atlantic right whale in the Azores. *J. Cetacean Res. Manage* 12(1):65-69.

A right whale (*Eubalaena glacialis*) from the western North Atlantic population, sighted in the Azores, was subsequently found to have moved back to the northwest Atlantic. The whale was sighted in the Azores on 5 January 2009 travelling in a west-south westerly direction at a constant speed. A photographic match was found to an adult female in the North Atlantic Right Whale Catalogue. The whale's previous last sighting, on 24 September 2008 in the Bay of Fundy, Canada, implies movement to the Azores of at least 3,320km in 101 days. It was subsequently resighted in the Bay of Fundy on 2 September 2009, 237 days after being seen in the Azores. This appears to be the only documented evidence of a western North Atlantic right whale outside its normal range in winter, and provides additional evidence of the potential for interbreeding between western North Atlantic right whales and the remnant eastern population. KEYWORDS: NORTH ATLANTIC RIGHT WHALE; ATLANTIC OCEAN; EUROPE; MOVEMENTS; DISTRIBUTION; STOCK IDENTITY; MANAGEMENT; NORTHERN HEMISPHERE.

Félix, F., Caballero, S. and Olavarría, C. 2012. Genetic diversity and population structure of humpback whales (*Megaptera novaeangliae*) from Ecuador based on mitochondrial DNA analyses. *J. Cetacean Res. Manage* 12(1):71-77.

Information on the genetic characterisation of humpback whales (*Megaptera novaeangliae*) wintering off Ecuador (Breeding Stock G) is presented. Mitochondrial DNA was extracted and sequenced from 230 skin samples collected between 2002 and 2008 to establish the genetic diversity of this population. From 182 usable samples, 41 different haplotypes were found, eight of which were new and unique. Haplotype diversity ($h \pm SD$) was estimated to be 0.922 ± 0.012 and the nucleotide diversity ($\pi \pm SD$) 0.019 ± 0.009 . A comparison with other areas within the Southeast Pacific (Colombia and Magellan Strait) and the Antarctic Peninsula suggested panmixia within Breeding Stock G, even though significant differentiation was found with Magellan Strait ($p < 0.0001$ in both F_{ST} and Φ_{ST}). An additional analysis with the exact test of population differentiation showed significant differences in haplotype frequencies between breeding areas in Ecuador and southern Colombia ($p < 0.01$), suggesting some level of stratification at breeding grounds as supported by photo-identification studies. The Ecuadorian dataset included haplotypes reported in all three Southern Hemisphere ocean basins indicating recent gene flow within the Southern Hemisphere. The population showed a male-biased sex ratio in adult animals of 2.16:1. Further research and a larger number of samples from breeding areas in the north (Panama and Costa Rica) are required to appropriately assess the extent of structure in this population. KEYWORDS: HUMPBACK WHALE; GENETICS; BREEDING GROUNDS; SOUTH AMERICA; BREEDING STOCK G.

Gendron, D. and Ugalde de la Cruz, A. 2012. A new classification method to simplify blue whale photo-identification technique. *J. Cetacean Res. Manage* 12(1):79-84.

Individual identification of blue whales is based on unique pigmentation patterns. Historically photo-identification has been based on the pigmentation patterns observed on a large portion of the animal's flanks. The new classification method presented here is based primarily on seven dorsal fin shapes and secondarily on five pigmentation patterns selected from a minor portion of the flank adjacent to the dorsal fin. This classification is then applied to a blue whale catalogue that comprises 621 individuals photo-identified in the waters adjacent to the Baja California Peninsula in Mexico. The classification system adequately divides the number of individuals per dorsal fin category and pigmentation patterns. It has been useful not only for reducing time and for

matching photographs more efficiently but also has facilitated the finding of intra-catalogue photographic recaptures or photo-recaptures and has enhanced the efficiency of the field work. This new classification method should be considered by other blue whale researchers and for future inter-catalogue comparisons. KEYWORDS: TECHNIQUE; PHOTO-ID; BLUE WHALE.

Hardy, T., Williams, R., Caslake, R. and Tregenza, N. 2012. An investigation of acoustic deterrent devices to reduce cetaceans bycatch in an inshore set net fishery. *J. Cetacean Res. Manage* 12(1):85-90.

In Europe, problems with the use of pingers on larger fishing vessels have raised the question as to whether pingers would be practical on smaller vessels, which are a large proportion of the European static net fishing fleet. In this study, four netting vessels less than 10m long used AQUAmark pingers on part of their nets off the southwest coast of Britain over a 12 month period. Boat skippers recorded ease of use. Acoustic click detectors were deployed on test and control nets to assess the response of cetaceans to the pingers. No significant practical problems, apart from premature failure of pingers, were encountered. During the study, only one harbour porpoise was bycaught, in an unpingered net. In 650 days of acoustic data from pingered and non-pingered nets, matched by location, date and boat, there was a highly significant reduction in the number of porpoise clicks recorded at nets with pingers to 48% of the number predicted from the number recorded at control nets (range 35–51%). To assess habituation, single, modified pingers that were active for alternate seven hour periods were moored below a click detector at two sites, one of which has strong tides and high levels of associated ambient noise. This study showed a stronger pinger effect at the quiet site and a much reduced effect at the noisy site. There was evidence of a period of exclusion of porpoises following pinger use that could exceed seven hours, and no evidence of habituation. Results suggest that pingers are practical on small vessels, that they reduce harbour porpoise activity around nets and are therefore likely to reduce bycatch. Easier means of detecting pinger failure are needed. Pingers should be considered as a bycatch mitigation method in small vessel fisheries using bottom set nets. KEYWORDS: BYCATCH; EUROPE; HARBOUR PORPOISE; COMMON DOLPHIN; ACOUSTICS; GILLNET FISHERY.

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Holt, S. 2012. Negotiating the Indian Ocean Sanctuary. *J. Cetacean Res. Manage* 12(2):145-50.

This paper provides an overview of the establishment of the International Whaling Commission's Indian Ocean Sanctuary in 1979. The International Convention for the Regulation of Whaling enables the IWC to designate sanctuaries as well as open and closed areas for whaling. The author reflects upon the background to the issue of whale sanctuaries within the IWC and the particular role of the Seychelles Government in the development of the proposal for a sanctuary in the Indian Ocean. He notes the political, scientific and practical factors surrounding the acceptance of the proposal by the IWC and briefly discusses subsequent events. KEYWORDS: MANAGEMENT; SANCTUARIES; INDIAN OCEAN.

Adulyanukosol, K., Thaongsukdee, S. and Kittiwattanawong, K. 2012. Cetaceans and mass strandings in Thai waters. *J. Cetacean Res. Manage* 12(2):151-58.

A total of 25 species of cetaceans have been recorded in Thai waters from stranding and sighting records. A summary of these, together with details of five mass strandings on the Andaman Sea coast of Thailand, are reported here. The first mass stranding, of nine spinner dolphins (*Stenella longirostris*) was at Talibong Island, Trang Province, in January 1999; six carcasses were examined and three were lost. The second record comprised five spotted dolphins (*Stenella attenuata*) stranded at Ban Ko Kho Khao, Phang-nga, in February 1999; two dolphins were released alive. The third stranding was of eight spotted dolphins at Mai Phai Island, Phang-nga, in March 2006; five animals died and three were released alive. The fourth mass stranding was of 30 false killer whales (*Pseudorca crassidens*) at Racha Yai Island, Phuket, in June 2008; 29 animals were released while one drowned. The fifth record consisted of three rough-toothed dolphins (*Steno bredanensis*) stranded at Nam Bor Bay, Phuket, in July 2008; all three were returned to the open sea. It was difficult to determine the causes of death of the stranded dolphins. However, it was possible that the first two mass strandings were caused by disease. Some strandings were possibly influenced by the landscape of the stranding locations (narrow bay in one case, wide gently sloping beach in another). KEYWORDS: IRRRAWADDY DOLPHIN; INDO-PACIFIC BOTTLENOSE DOLPHIN; FINLESS PORPOISE; FALSE KILLER WHALE; STRIPED DOLPHIN; SPINNER DOLPHIN; PANTROPICAL SPOTTED DOLPHIN; INDO-PACIFIC HUMPBACK DOLPHIN; SPERM WHALE; MASS STRANDING; ANDAMAN SEA; GULF OF THAILAND.

Kumarran, R.P. 2012. Cetaceans and cetacean research in India. *J. Cetacean Res. Manage* 12(2):159-72.

The diversity of cetacean species in Indian waters is high, with 25 species recorded so far. Records of cetaceans from India during the last 200 years have provided insights into their spatiotemporal distribution, behaviour, feeding, reproduction, fishery interaction and pollution. The cetacean fauna is dominated by pantropical species, with a relatively high abundance of spinner dolphins, which is similar to other areas studied within the northern Indian Ocean. Historical records were analysed to propose an inventory of cetaceans. Cetacean diversity was highest in the Gulf of Mannar on the southeast coast of India, which with 14 species recorded from a small area can be considered a 'hot spot' for further research. Fishery interactions, domestic consumption, pollution and lack of quality information to inform management are the main threats for successful survival of cetaceans. The status of information regarding cetaceans in India could be classified based on this study as: six species with adequate data; five species where data is restricted to a few geographic locations; four species for which data collection is being initiated; five species with sparse data; and six species which are difficult to observe. KEYWORDS: AREA-INDIA; ARABIAN SEA; BAY OF BENGAL; HISTORICAL DATA; STRANDING; FISHERY INTERACTION; DOMESTIC CONSUMPTION; POLLUTION; DATA QUALITY; INVENTORY; FALSE KILLER WHALE; INDO-PACIFIC BOTTLENOSE DOLPHIN; INDO-PACIFIC HUMPBACK DOLPHIN; IRRRAWADDY DOLPHIN; KILLER WHALE; LONG-BEAKED COMMON DOLPHIN; MELON-HEADED WHALE; PANTROPICAL SPOTTED DOLPHIN; RISSO'S DOLPHIN; ROUGH-TOOTHED DOLPHIN; SHORT-FINNED PILOT WHALE; SPINNER DOLPHIN; STRIPED DOLPHIN; BLUE WHALE; BRYDE'S WHALE; COMMON MINKE WHALE; FIN WHALE; HUMPBACK WHALE; SEI WHALE; SPERM WHALE; DWARF SPERM WHALE; PYGMY SPERM WHALE; BEAKED WHALE - BLAINVILLE'S; CUVIER'S BEAKED WHALE; FINLESS PORPOISE.

Sathasivam, K. and Natarajan, K.S. 2012. Obtaining distributional information on Indian Ocean cetaceans: suggestions based on and Indian network experience. *J. Cetacean Res. Manage* 12(2):173-75.

The understanding of the occurrence and distribution of cetaceans in the Indian region is largely based on information that has been incidentally obtained from strandings and bycatches. An attempt was made to compile such data systematically. The resultant database has been made widely accessible by hosting it on the internet. To improve the quality of information collected, identification aids were published on the same website. A stranding booklet was also created, mainly for the use of individuals and organisations with limited access to the internet. The 'spare capacity' of individuals and organisations was used to gather information and also to prepare the website and booklets, so that little or no expense was incurred. Recommendations are made regarding the collection of distributional data from the Indian Ocean. KEYWORDS: INDIAN OCEAN; STRANDING; CONSERVATION; MONITORING.

Ilangakoon, A.D. 2012. A review of cetacean research and conservation in Sri Lanka. *J. Cetacean Res. Manage* 12(2):177-83.

Sri Lanka is a developing island nation in the northern Indian Ocean. Travellers and historians have documented whales in the waters around the island as far back as the 14th century but the first scientific records of live cetaceans from vessel-based research observations were documented only in the early 1980s. Sri Lanka's waters have high cetacean species richness with 27 species recorded to date and year-round abundance. Small cetaceans are however increasingly threatened due to the developing fisheries industry, with bycatch being a major cause for concern. Other identified threats include increasing shipping traffic and unregulated marine tourism. Cetaceans are protected by national legislation but implementation of the relevant laws and conservation measures is hampered by resource constraints. The prevailing gaps in knowledge are also due to a lack of resources to carry out dedicated long-term research on cetaceans in a developing country with more immediate human development priorities. Therefore strengthened law enforcement and finding adequate resources for sustained systematic research that can inform management decisions are priorities in Sri Lanka. KEYWORDS: CONSERVATION; INDIAN OCEAN; INCIDENTAL CATCHES; SPERM WHALE; BLUE WHALE; INDO-PACIFIC HUMPBACK DOLPHIN; SPINNER DOLPHIN; COMMON BOTTLENOSE DOLPHIN; RISSO'S DOLPHIN; PANTROPICAL SPOTTED DOLPHIN; FRASER'S DOLPHIN; ROUGH-TOOTHED DOLPHIN; SHORT-FINNED PILOT WHALE; FALSE KILLER WHALE; PYGMY KILLER WHALE; KILLER WHALE; MELON-HEADED WHALE; COMMON DOLPHIN; CUVIER'S BEAKED WHALE; BLAINVILLE'S BEAKED WHALE; GINKGO-TOOTHED BEAKED WHALE; LONGMAN'S BEAKED WHALE; SOUTHERN BOTTLENOSE WHALE; PYGMY SPERM WHALE; DWARF SPERM WHALE; FIN WHALE; COMMON MINKE WHALE; HUMPBACK WHALE; BRYDE'S WHALE.

De Vos, A., Clark, R., Johnson, C., Johnson, G., Kerr, I., Payne, R. and Madsen, P.T. 2012. Cetacean sighting and acoustic detections in the offshore waters of Sri Lanka: March-June 2003. *J. Cetacean Res. Manage* 12(2):185-93.

The Indian Ocean Sanctuary was established in 1979 in an effort to allow exploited stocks of whales to recover from whaling and to facilitate benign research. Further information is required to establish comprehensive management and conservation measures for species within these waters. The current study took place in the offshore waters of Sri Lanka in early 2003. During three research cruises conducted between 29 March and 17 June 2003 the R/V *Odyssey* covered a total track line of 4,480km around the island resulting in 52 confirmed group sightings of 11 species from three cetacean families. As the tracklines were designed to locate sperm whales (*Physeter macrocephalus*) for tissue sampling, they accounted for the greatest number of sightings. Only two species of balaenopterids, the blue whale (*Balaenoptera musculus*) and the Bryde's whale (*Balaenoptera edeni*), were recorded with the blue whale being the most frequently sighted species. Spinner dolphins (*Stenella longirostris*) were the most dominant species in terms of numbers. Some small odontocetes such as the common bottlenose dolphin (*Tursiops truncatus*), striped dolphin (*Stenella coeruleoalba*) and Fraser's dolphin (*Lagenodelphis hosei*) were observed in mixed-species groups, while one group of melon-headed whales (*Peponocephala electra*) was seen associating with a group of sperm whales. Risso's dolphins (*Grampus griseus*) were frequently sighted throughout the research cruise, with one unusual record of a large mating group. Many sightings were made in the vicinity of the numerous submarine canyons around Sri Lanka's coastline highlighting their potential role in enhancing productivity in the offshore waters. It is concluded that Sri Lankan offshore waters hold a rich, but little surveyed cetacean fauna that warrants further studies and implementation of conservation measures to protect these populations. KEYWORDS: INDIAN OCEAN; BLUE WHALE; SPERM WHALE; FALSE KILLER WHALE; PANTROPICAL SPOTTED DOLPHIN; SPINNER DOLPHIN; BRYDE'S WHALE; BOTTLENOSE DOLPHIN; STRIPED DOLPHIN; FRASER'S DOLPHIN; RISSO'S DOLPHIN; MELON-HEADED WHALE; MONITORING; SURVEY-COMBINED; CONSERVATION; INCIDENTAL CATCHES.

Ilangakoon, A.D. and Sathasivam, K. 2012. The need for taxonomic investigations on Northern Indian Ocean blue whales (*Balaenoptera musculus*): implications of year-round occurrence off Sri Lanka and India. *J. Cetacean Res. Manage* 12(2):195-202.

The blue whale (*Balaenoptera musculus*) is one of the most common cetaceans in the waters around Sri Lanka and in a worldwide context one of the highest low-latitude sighting rates for this species has been recorded in these waters. As genetic analyses, acoustic studies and even long-term sighting surveys for blue whales in these waters are limited, the taxonomic status and population affinities of these animals are not definitively known at present. Sighting records of this species were examined from the waters around Sri Lanka and stranding records from the coasts of both Sri Lanka and India in terms of seasonality of occurrence and it was found that the species is clearly present in these waters throughout the year. This, together with secondary data on certain morphological characteristics and behavioural anomalies, indicates that these waters are ecologically important to blue whales in the Northern Indian Ocean and questions are raised regarding the subspecific identity and population affinities of the animals in the region. It is not clear if they belong to either of the two subspecies currently recognised for the Southern Ocean and Indian Ocean region: their apparently non-migratory nature is akin to the pygmy blue whale *B.m. breviceauda*, while some morphological and behavioural characteristics are indicative of Antarctic blue whales of the subspecies *B.m. intermedia*. This raises the possibility of an entirely different or intermediate subspecies and the need to re-examine *B.m. indica* as a third subspecies in the Northern Indian Ocean. As clarifying their taxonomic status is important in the context of conservation and

management, multi-disciplinary studies are urgently needed. KEYWORDS: BLUE WHALE; NORTHERN INDIAN OCEAN; TAXONOMY; SUB-SPECIES; NORTHERN HEMISPHERE.

Anderson, R.C., Branch, T.A., Alagiyawadu, A., Baldwin, R. and Marsac, F. 2012. Seasonal distribution, movements and taxonomic status of blue whales (*Balaenoptera musculus*) in the northern Indian Ocean. *J. Cetacean Res. Manage* 12(2):203-18.

There is a distinct population of blue whales, *Balaenoptera musculus*, in the northern Indian Ocean. The taxonomic status of these animals has long been uncertain, with debate over whether this population represents a distinct subspecies, and if so which name should apply. They have most frequently been assigned to *B. musculus brevicauda*, but are currently considered to be *B. m. indica*. The movements of these blue whales within the northern Indian Ocean are poorly understood. This paper reviews catches ($n = 1,288$), sightings ($n = 448$, with a minimum of 783 animals), strandings ($n = 64$) and acoustic detections ($n = 6$ locations); uses ocean colour data to estimate seasonality of primary productivity in different areas of the northern Indian Ocean; and develops a migration hypothesis. It is suggested that most of these whales feed in the Arabian Sea off the coasts of Somalia and the Arabian peninsula during the period of intense upwelling associated with the southwest monsoon (from about May to October). At the same time some blue whales also feed in the area of upwelling off the southwest coast of India and west coast of Sri Lanka. When the southwest monsoon dies down in about October–November these upwellings cease. The blue whales then disperse more widely to eke out the leaner months of the northeast monsoon (during about December to March) in other localised areas with seasonally high productivity. These include the east coast of Sri Lanka, the waters west of the Maldives, the vicinity of the Indus Canyon (at least historically), and some parts of the southern Indian Ocean. The data are consistent with the hypothesis that at least some of the blue whales that feed off the east coast of Sri Lanka in the northeast monsoon also feed in the Arabian Sea during the southwest monsoon. These whales appear to migrate eastwards past the north of Maldives and south of Sri Lanka in about December–January, returning westwards in about April–May. KEYWORDS: BLUE WHALE; INDIAN OCEAN; STRANDINGS; SANCTUARIES; INCIDENTAL SIGHTINGS; MIGRATION.

Anderson, R.C., Sattar, S.A. and Adam, M.S. 2012. Cetaceans in the Maldives: a review. *J. Cetacean Res. Manage* 12(2):219-25.

The cetaceans of the Maldives were poorly known until relatively recently, but have received increased attention over the past decade. Twentythree species of cetacean have now been recorded. A number of sightings surveys, and one acoustic survey, have been completed. The species most frequently seen is the spinner dolphin (*Stenella longirostris*). A national system for reporting cetacean strandings has been in place since 2000, although some earlier strandings were also reported; approximately 160 strandings of 16 species have been recorded to date. The species most commonly reported stranding is the sperm whale (*Physeter macrocephalus*). Ambergris has been exported from the Maldives since ancient times; recent export statistics are reviewed. All cetaceans are protected by law within Maldivian waters. More significantly, most forms of net-fishing, including gill-netting and purse-seining are banned in the Maldives to protect the traditional pole and line tuna fishery. Cetacean-watching is becoming increasingly popular, with spinner dolphins being the main attraction, although other species are also sought after on specialist trips. KEYWORDS: INDIAN OCEAN; SANCTUARIES; WHALING - HISTORICAL; INCIDENTAL SIGHTINGS; SURVEY-VESSEL; STRANDINGS; WHALEWATCHING.

Clark, R.A., Johnson, C.M., Johnson, G., Payne, R., Kerr, I., Anderson, R.C., Sattar, S.A., Godard, C.A.J. and Madsen, P.T. 2012. Cetacean sightings and acoustic detections in the offshore waters of the Maldives during the northeast monsoon seasons of 2003 and 2004. *J. Cetacean Res. Manage* 12(2):227-34.

Despite its central position in the Indian Ocean Sanctuary, little is known about the offshore cetacean fauna of the Maldives. Here we report survey results gathered by the R/V *Odyssey* in the Maldives during the 2003 and 2004 northeast monsoon seasons, and provide data on cetaceans from visual and acoustic observations. The survey was conducted over a period of 72 days and covered 10,915 track line kilometres. The main aim of the survey was to collect biopsy samples from sperm whales (*Physeter macrocephalus*) as part of a global survey of ocean pollutants. Totals of 157 sightings and 1,461 acoustic detections of 16 identified cetacean species were recorded. Risso's dolphin (*Grampus griseus*), pantropical spotted dolphin (*Stenella attenuata*), spinner dolphin (*Stenella longirostris*) and sperm whale were the most commonly sighted species. Sperm whales and pantropical spotted dolphins were particularly abundant in the southern Maldives. The cetacean acoustic detection rate was 2.5 times higher than in the eastern Indian Ocean and Western tropical Pacific, while the non-physeterid sighting rate was 1.7 times higher than the Eastern tropical Pacific and 6.7 times higher than the eastern Indian Ocean based on other research conducted by the R/V *Odyssey* using the same methodology. It is concluded that the Maldives has a diverse and seemingly abundant cetacean community. KEYWORDS: INDIAN OCEAN; SANCTUARIES; SURVEY-ACOUSTIC; SIGHTINGS; SPERM WHALE; MALDIVES.

Gore, M.A., Kiani, M.S., Ahmad, E., Hussain, B., Ormond, R.F., Siddiqui, J., Waqas, U. and Culloch, R. 2012. Occurrence of whales and dolphins in Pakistan with reference to fishers' knowledge and impacts. *J. Cetacean Res. Manage* 12(2):235-47.

This paper reports the findings of a project (Cetacean Conservation Pakistan) launched in 2004 with a view to: (a) undertaking quantitative surveys to determine the variety and abundance of species present; (b) working with local fisher communities to collate local knowledge and promote public awareness; and (c) promoting a marine cetacean conservation strategy and measures. Boat-based surveys for live animals and shore surveys for beachcast specimens have confirmed the presence of twelve species of whale and dolphin. Among these bottlenose dolphins (*Tursiops* sp.) occur both inshore along the coasts of Sindh and Balochistan, and offshore in parts of Balochistan; these two populations possibly representing different sub-species. Indo-Pacific humpback dolphins (*Sousa chinensis*) are common inshore around the mouth of the Indus Delta and in large sheltered bays in Balochistan, where finless porpoise (*Neophocaena phocaenoides*) also occur. Spinner dolphins (*Stenella longirostris*) were observed in very large schools (up to 2,000) around the shelf edge in eastern Balochistan, as were Risso's dolphins (*Grampus griseus*) in smaller numbers. Common dolphins (*Delphinus capensis*) were recorded even further offshore. There were two sightings of humpback whales (*Megaptera novaeangliae*), and one of a killer whale (*Orcinus orca*). Bryde's whales (*Balaenoptera edeni*), sperm whales (*Physeter macrocephalus*) and Cuvier's beaked whales (*Ziphius cavirostris*) were recorded only during beach surveys, while skeletal remains in institutions also supported the occurrence of blue whales (*Balaenoptera*

musculus). Work with local fisher communities supported this picture of species distribution and provided information on threats to local cetaceans. These are principally occasional entanglement in fishing gear and opportunistic exploitation for use as food, as bait, as medicine or for other purposes. The project incorporated policy development and the preparation of a marine cetacean biodiversity action plan that included the listing of species in provincial conservation legislation, the designation of a marine protected area in Balochistan, the establishment of a national whale and dolphin conservation society, and trials of whale and dolphin watching as a means of raising public awareness and providing alternative economic value. KEYWORDS: ABUNDANCE ESTIMATE; ARABIAN SEA; KILLER WHALE; BRYDE'S WHALE; SPERM WHALE; CUVIER'S BEAKED WHALE; BLUE WHALE; BOTTLENOSE DOLPHIN; CETACEANS; CONSERVATION; FINLESS PORPOISE; FISHERIES INTERACTION; HABITAT; RISSO'S DOLPHIN; COMMON DOLPHIN; INDO-PACIFIC HUMPBACK DOLPHIN; HUMPBACK WHALE; INCIDENTAL CATCHES; INDIAN OCEAN; SPINNER DOLPHIN; SURVEY-SHORE-BASED; SURVEY-VESSEL.

Amir, O.A., Berggren, P. and Jiddawi, N.S. 2012. Recent records of marine mammals in Tanzanian waters. *J. Cetacean Res. Manage* 12(2):249-53.

Marine mammal species diversity off Zanzibar and Tanzania, East Africa, has been recorded by the Marine Mammal Education and Research Group at the Institute of Marine Sciences, Zanzibar, Tanzania since 1998. The data presented in this report reflect the efforts of 10 years collection of information from marine mammals stranded and incidentally caught in Tanzanian waters. Additional information from dedicated surveys of cetaceans (whales and dolphins) and incidental sightings reported by the general public are also provided. From 1992 through 2008 a total of 235 specimens of 13 cetacean species and the dugong were recorded. 214 (90.7%) records referred to specimens from bycatch in drift and bottom-set gillnets and 22 (9.3%) referred to specimens from strandings. Based on incidental catch and sightings records, Indo-Pacific bottlenose, spinner and Indo-Pacific humpback dolphins, observed year-round, and humpback whales, observed seasonally during July to November, were the most common species in Tanzanian coastal waters. KEYWORDS: STRANDINGS; BYCATCH; INDO-PACIFIC BOTTLENOSE DOLPHIN; INDO-PACIFIC HUMPBACK DOLPHIN; SPINNER DOLPHIN; HUMPBACK WHALE; SPERM WHALE; DUGONG; ZANZIBAR; TANZANIA.

Dulau-Drouot, V., Fayon, J., Mouysset, L. and Boucaud, V. 2012. Occurrence and residency patterns of humpback whales off Reunion Island during 2004-10. *J. Cetacean Res. Manage* 12(2):255-63.

Dedicated humpback whale surveys were conducted around Réunion Island during 2004-10. Boat-based surveys were conducted from June to October, in the main objective of collecting photo-identification data. For 2004-10, a total of 501 survey trips, representing 1,530 hours of onsearching effort, and 724 humpback whale sightings were achieved. Although effort had a significant influence on the number of sightings, sighting rate was shown to increase significantly from 2007 onwards, with a peak in 2008. Seasonal variations were observed, with significantly higher numbers of sightings occurring in July–September. Larger number of whales, together with increased survey effort, led to larger datasets collected in 2008-10, allowing further investigation of residency pattern. Within-year recaptures from fluke photographs showed that a relatively large proportion (30%) of the identified whales was recaptured on more than one day around the island. Maximum recapture interval reached 64 days, with a mean ranging 22–29 days for 2008–10. Mean residency, estimated from expected lagged identification rate, was 25 days. Mothers with a calf were shown to reside around the island for longer period of time than other individuals. A seasonal pattern of residency was demonstrated, with single capture individuals occurring early in the season, mainly as singleton or pairs, while individuals showing higher recapture interval were present around the island from August to October. Between-year recaptures were reported for 2009-10, with five individuals re-sighted on consecutive years. The fluke catalogue for Réunion includes 312 distinct individuals identified during 2004–10 surveys, together with 21 additional whales captured opportunistically since 2001. The increasing trend in the number of whales, the high residency time observed for 2008–10 and the recent occurrence of inter-annual recaptures suggest that Réunion Island has become an important migratory site for humpback whales within the south-western Indian Ocean (Breeding Stock C). The species might expand its spatial range by occupying new breeding sites (or re-occupying old ones) within the south-western Indian ocean, as a result of population growth. KEYWORDS: HUMPBACK WHALE; INDIAN OCEAN; BREEDING GROUND; RESIDENCY PATTERN; PHOTO-ID; SURVEY-VESSEL.

Plön, S., Albrecht, K.H., Cliff, G. and Froneman, P.W. 2012. Organ weights of three dolphin species (*Sousa chinensis*, *Tursiops aduncus* and *Delphinus capensis*) from South Africa: implications for ecological adaptation? *J. Cetacean Res. Manage* 12(2):265-76.

Data from bycaught, but otherwise presumed healthy individuals can contribute important biological data on species of cetaceans that are otherwise lacking. This study utilises data collected from systematic necropsies performed between October 1970 and May 2010 on 142 Indo-Pacific humpback dolphins (*Sousa chinensis*), 607 Indo-Pacific bottlenose dolphins (*Tursiops aduncus*), and 640 long-beaked common dolphins (*Delphinus capensis*) incidentally caught and drowned in the shark nets off KwaZulu-Natal, South Africa. The aim of this analysis was to: (1) determine average absolute and relative organ weights for the three taxa as baseline values for later pathological examinations; and (2) examine potential correlations with the physiology and ecology in the three genera. Body length-weight relationships were described for the three species, indicating that *S. chinensis* is more robust than *T. aduncus*, with *D. capensis* being the smallest species out of the three taxa. Organ weights, as a percentage of total body weight were examined for the three delphinids. Organs examined included heart, lungs and trachea, liver, kidneys, spleen, and testes. Relative heart, liver and kidney weights were significantly larger in the small-bodied, fast-swimming *D. capensis*, than in the slower, more coastal *S. chinensis* and *T. aduncus*, possibly reflecting differences in activity patterns between the three species. Relative lung and trachea weights were not significantly different in the three species. Combined testes weight, as a percentage of total body weight, in combination with information on group size and sexual dimorphism suggested a monogamous or extreme polygynous (harem) mating system in *S. chinensis*, frequent copulations in *T. aduncus*, and sperm competition in *D. capensis*. The results of the present study suggest that the relative sizes of the major organs in the three genera are a reflection of the differing life histories and ecologies of the species examined. KEYWORDS: INCIDENTAL CATCHES; AFRICA; INDO-PACIFIC HUMPBACK DOLPHIN; INDO-PACIFIC BOTTLENOSE DOLPHIN; LONG-BEAKED COMMON DOLPHIN.

Eyre, E.J. and Frizell, J. 2012. A note on observations of cetaceans in the Indian Ocean Sanctuary, Australia to Israel, April 1995. *J. Cetacean Res. Manage* 12(2):277-85.

A forty-day voyage from Hobart (Australia) to Haifa (Israel) included a visual and acoustic census for cetaceans in the Indian Ocean Sanctuary. One hundred and sixty-three sightings were made, 156 occurring within the Sanctuary. Twelve species were identified. Sperm whales (*Physeter macrocephalus*) were encountered most frequently (51% of identified encounters), whilst spinner dolphins (*Stenella longirostris*) were numerically dominant. Other species identified included bottlenose dolphins (*Tursiops* spp.), short-beaked common dolphin (*Delphinus delphis*), pan-tropical spotted dolphin (*Stenella attenuata*), rough-toothed dolphin (*Steno bredanensis*), Risso's dolphin (*Grampus griseus*), killer whale (*Orcinus orca*), short-finned pilot whale (*Globicephala macrorhynchus*), false killer whale (*Pseudorca crassidens*), Bryde's whale (*Balaenoptera edeni*) and Cuvier's beaked whale (*Ziphius cavirostris*). The most sightings occurred WNW of the Seychelles, east of Somalia, and in the Gulf of Aden and Red Sea. Half of the sperm whale sightings were to the east of Ras Hafun (Somalia), and included adults, subadults and at least one calf. Thirteen hours were spent listening for cetaceans using a towed array whilst the ship was underway. Cetaceans were detected at 78% of the listening stations, with a possible four species recorded (sperm whale, spinner dolphin, pilot whale, bottlenose dolphin). The survey shows the value of platforms of opportunity for studying the pelagic communities of cetaceans in the Indian Ocean Sanctuary. It highlights the need for further research in the northwestern sector where anthropogenic threats are varied and increasing. KEYWORDS: INDIAN OCEAN; SPERM WHALE; SPINNER DOLPHIN; PAN-TROPICAL SPOTTED DOLPHIN; BOTTLENOSE DOLPHIN; ROUGH-TOOTHED DOLPHIN; BRYDE'S WHALE; RISSO'S DOLPHIN; COMMON DOLPHIN; PILOT WHALE; KILLER WHALE; CUVIER'S BEAKED WHALE; FALSE KILLER WHALE; SURVEY-ACOUSTIC; SURVEY-VESSEL.

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Laake, J.L., Punt, A.E., Hobbs, R., Ferguson, M., Rugh, D. and Breiwick, J. 2012. Gray whale southbound migration surveys 1967-2006: an integrated re-analysis. *J. Cetacean Res. Manage* 12(3):287-306.

Between 1967 and 2007, 23 seasons of shore-based counts of the Eastern North Pacific (ENP) stock of gray whales (*Eschrichtius robustus*) were conducted throughout all or most of the southbound migration near Carmel, California. Population estimates have been derived from these surveys using a variety of techniques that were adapted as the data collection protocol evolved. The subsequent time series of estimates was used to evaluate trend and population status, resulting in the conclusion that the population was no longer endangered and had achieved its optimum sustainable population (OSP) level. We re-evaluated the data from all of the surveys using a common estimation procedure and an improved method for treatment of error in pod size and detection probability estimation. The newly derived abundance estimates between 1967 and 1987 were generally larger (-2.5% to 21%) than previous abundance estimates. However, the opposite was the case for survey years 1992 to 2006, with estimates declining from -4.9% to -29%. This pattern is largely explained by the differences in the correction for pod size bias, which occurred because the pod sizes in the calibration data over-represented pods of two or more whales and underrepresented single whales relative to the estimated true pod size distribution. KEYWORDS: ABUNDANCE ESTIMATE; GRAY WHALES; WHALING - ABORIGINAL.

Burt, M.L., Borchers, D.L. and Ensor, P. 2012. Trackline detection probability of Antarctic minke whales: analyses of the BT mode experiments conducted on the IWC-SOWER cruises 2005/06-2007/08. *J. Cetacean Res. Manage* 12(3):307-16.

IWC sightings surveys to obtain abundance estimates of cetaceans have taken place in the Antarctic since 1978/79. In order to interpret the minke whale abundance from these surveys and trial different search protocols for future cruises, Buckland-Turnock (BT) search mode experiments were conducted during the IWC-SOWER 2005/06, 2006/07 and 2007/08 cruises. BT search mode is a particular configuration of a double-observer survey and two configurations of BT mode were implemented on the SOWER cruises; BT-NSP mode and BT-option 2. Normal standard passing (NSP) mode is a standard search mode for SOWER vessels and in BT-NSP mode, the observer located on the barrel became the primary and searched as usual in NSP mode with 7×50 binoculars; the observers on the upper bridge became the tracker and used big eye binoculars mounted on the upper bridge. Thus, the probability of detection for the observer in the barrel can be estimated which can help inform interpretations of abundance estimates of SOWER data. For BT-NSP mode, the estimates of detection probability on the trackline for the observer in the barrel ranged between 0.35 (CV = 0.57) to 0.69 (CV = 0.23) for the different years and combinations of data and models. In BT-option 2, the observer on the barrel (searching with 7×50 binoculars) acted as tracker and the observer on the independent observer (IO) platform acted as the primary (searching with naked eye). For this configuration, the estimates of primary detection probability on the trackline were 0.25 (CV = 0.59) and 0.28 (CV = 0.50) for two different models. KEYWORDS: SOUTHERN HEMISPHERE; SURVEY-VESSEL; SOWER; MINKE WHALE; g(0); MARK-RECAPTURE.

Hansen, R.G., Heide-Jørgensen, M.P. and Laidre, K.L. 2012. Recent abundance of bowhead whales in Isabella Bay, Canada. *J. Cetacean Res. Manage* 12(3):317-19.

An aerial survey of the late-summer distribution of bowhead whales, *Balaena mysticetus*, in Isabella Bay, Nunavut, Canada, was conducted on 19 September 2009. A total of 28 sightings were obtained during 155km of survey effort and >90% of the sightings were detected by both platforms. Corrections were made for whales that were submerged during the passage of the survey plane, resulting in an abundance estimate of 1,105 bowhead whales (95% CI: 532-2,294). No cow-calf pairs were observed confirming earlier observations that east Baffin Island is primarily visited by subadult and adult whales. KEYWORDS: Electronic; BOWHEAD WHALE; ABUNDANCE ESTIMATE; SURVEY-AERIAL; BAFFIN BAY; ISABELLA BAY.

Franklin, W., Franklin, T., Brooks, L., Gibbs, N., Childerhouse, S., Smith, F., Burns, D., Paton, D., Garrigue, C., Constantine, R., Poole, M.M., Hauser, N., Donoghue, M., Russell, K., Mattila, D.K., Robbins, J., Oosterman, A., Leaper, R., Harrison, P., Baker, S. and Clapham, P. 2012. Antarctic waters (Area V) near the Balleny Islands are a summer feeding area for some Eastern Australian (E(i) breeding group) humpback whales (*Megaptera novaeangliae*). *J. Cetacean Res. Manage* 12(2):321-27.

Discovery mark tagging provided the first evidence of linkages between eastern Australian and Oceania Humpback whale breeding grounds and the Antarctic Area V feeding areas. Early investigation of movements of humpback whales in the Western Pacific led to the view that the Balleny Islands and the Ross Sea were the summer destinations for humpback whales from eastern Australia and the Oceania breeding grounds. Recent photo-identification (ID) studies provided further evidence of low

levels of migratory interchange and complex linkages within Oceania and between eastern Australia and Oceania. We report here the migratory movement of three humpback whales (*Megaptera novaeangliae*) between Eastern Australia (E(i) breeding stock) and the Area V Antarctic feeding area in the vicinity of the Balleny Islands. Using photo-ID techniques, comparisons between a Balleny Island fluke catalogue (n = 11 individuals) and existing fluke catalogues from eastern Australia (n = 3,120 individuals) and Oceania (n = 725 individuals), yielded three matches to Hervey Bay, Byron Bay and Ballina in eastern Australia and no matches to Oceania. The eastern Australia catalogue (n = 3,120) was made up of Hervey Bay (n = 1,556), Byron Bay, (n = 916) and Ballina (n = 648). The Oceania catalogue (n = 725) is made up of Tonga (n = 282); New Caledonia (n = 160); French Polynesia (n = 159); New Zealand (n = 41); Cook Islands (n = 36); American Samoa (n = 31); Vanuatu, Niue, Samoa and Fiji (n = 11) and Norfolk Island (n = 5). Only three previous individual photo-ID matches have been reported between eastern Australia Breeding Stock E(i) and Antarctic Area V feeding areas in the vicinity of the Balleny Islands and the Ross Sea. Only one genotype match has been reported between Antarctic Area V feeding areas and Oceania breeding grounds. An analysis of the frequencies of whales seen and not seen in the Balleny Islands, Oceania and eastern Australia, relative to the expected frequencies, based on the estimated population sizes and the sizes of the catalogues, supports the hypothesis that Antarctic Area V waters, in the vicinity of the Balleny islands, is a summer feeding area for some eastern Australian humpback whales. KEYWORDS: HUMPBACK WHALES; FEEDING GROUNDS; POPULATION STRUCTURE; HUMPBACK WHALE; PHOTO-ID; MIGRATION; SITE FIDELITY; EASTERN AUSTRALIA; OCEANIA; ANTARCTIC; BREEDING GROUNDS; FEEDING AREAS; SURVEY-VESSEL; SOUTHERN HEMISPHERE; PACIFIC OCEAN.

Heide-Jørgensen, M.P., Garde, E., Nielsen, N.H., Andersen, O.N. and Hansen, S.H. 2012. A note on biological data from the hunt of bowhead whales in West Greenland 2009-2011. *J. Cetacean Res. Manage* 12(3):329-33.

One male and six female bowhead whales were taken for subsistence in Disko Bay, West Greenland, in April-May 2009-2011. All of these whales were sexually mature with body lengths exceeding 14m. One female was pregnant with a 3.87m foetus and three others presumably had small fetuses that were not detected in the field. Another female that showed no signs of recent pregnancy had a minimum of 7-8 corpora albicantia but no mature follicles. One 14.10m male with a 42kg testis was classified as sexually mature. Estimated ages of the whales were between 37 and 50 yrs. The observations on growth and reproduction were consistent with data on bowhead whales in Alaska. Four of the whales had recently been feeding as their stomachs contained calanoid copepods, especially *Calanus hyperboreus*. KEYWORDS: BOWHEAD WHALE; FOOD/PREY; COPEPODS; REPRODUCTION; AGE DISTRIBUTION; SEX RATIO.

Gunnlaugsson, T. 2012. Relatedness between samples quantified and an optimal criterion for match detection approximated. *J. Cetacean Res. Manage* 12(3):335-40.

Data on relatedness of individuals between or within samples can be used to address population parameters in much the same way as conventional mark-recapture data and has some advantages, but also opens up new research areas. In such studies not only decisions on the sample size have to be made but also the number of genetic markers to be worked up, or even developed, and during analysis the criteria for accepting a match chosen. The likelihood of detecting a true match must be assessed and weighed against the likelihood of including a false positive. To aid with this, formulae are presented here for the probability of the number of relatives alive over periods of time and a process to approach the optimal criterion for match detection. To apply the process programs were developed that are made available, and an example is given. KEYWORDS: ABUNDANCE ESTIMATE; MARK-RECAPTURE; SEX RATIO; BIOPSY SAMPLING; DNA FINGERPRINTING; MODELLING; AGE AT FIRST PARTURITION; SURVIVORSHIP; RECRUITMENT AGE.

Pampoulie, C., Olafsdottir, G., Hauksdottir, S., Skirinsdottir, S., Olafsson, K., Magnusdottir, S., Chosson, V., Halldorson, S.D., Olafsdottir, D., Gunnlaugsson, T., Danielsdottir, A.K. and Vikingsson, G.A. 2012. A note on a mother-foetus pair and alleged father match in the Atlantic fin whale (*Balaenoptera physalus*) off Iceland. *J. Cetacean Res. Manage* 12(2):341-43.

The North Atlantic fin whale (*Balaenoptera physalus*) undertakes long-distance annual migration between high-latitude summer feeding locations and low-latitude winter mating locations, like most of the baleen whales. By statistically comparing genotype profiles of mother-foetus pairs (n = 23) to that of the potential alleged father (n = 139) captured at the same feeding location in Iceland, we found a matching pairing of a mother-foetus captured in 2009 and a father captured in 2010. To our knowledge, the present study is the first one to detect a mother-foetus pair matching with an alleged father, caught at exactly the same feeding area one year later. KEYWORDS: FIN WHALE; ATLANTIC OCEAN; GENETICS; MIGRATION; FEEDING GROUNDS; PATERNITY.

Shirakihara, M. and Shirakihara, K. 2012. Bycatch of the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) in gillnet fisheries off Amakusa-Shimoshima Island, Japan. *J. Cetacean Res. Manage* 12(3):345-51.

A year-round resident population of the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) inhabits the waters off Amakusa-Shimoshima Island (32°25'N, 130°05'E), in Japan. The effect of bycatch in gillnet fisheries on the Amakusa population was examined. Population size in 2007 and 2008 was estimated at 230 individuals (CV = 2.5%) and 216 individuals (CV = 2.1%), respectively, based on a mark-recapture technique. The magnitude of bycatch was evaluated by analysing interview surveys (263 gillnetters) during these two years. Minimum numbers of dolphin bycatch were 12 individuals in 2007 and 14 individuals in 2008. Most of the dolphins, which were captured by bottom-set gillnets, were considered to be Indo-Pacific bottlenose dolphins for the following reasons: (1) two individuals were identified based on DNA analysis; (2) only *Tursiops* sp. and finless porpoises were found in the sighting survey by ferry boats, and fishermen can distinguish between the two; and (3) the seasonal and spatial distribution of bycatch corresponded well to habitat use patterns of the Amakusa population. If the US potential biological removal (PBR) approach is used it estimates two individuals per year, which is much lower than the minimum bycatch numbers of 12-14 individuals per year (5.2-6.5% of abundance estimates). Reducing bycatch mortality caused by bottom-set gillnets is essential for the effective conservation of Indo-Pacific bottlenose dolphins in Amakusa, Japan. KEYWORDS: GILLNETS; INCIDENTAL CATCHES; INDO-PACIFIC BOTTLENOSE DOLPHIN; ASIA; ABUNDANCE ESTIMATE; MARK-RECAPTURE.

Galletti Vernazzani, B., Carlson, C.A., Cabrera, E. and Brownell, J.R. 2012. Chilean blue whales off Isla Grande de Chiloe, 2004-2012: distribution, site-fidelity and behaviour. *J. Cetacean Res. Manage* 12(3):353-60.

A collaborative research program (the Alfaguara Project) has collected information on Chilean blue whales (*Balaenoptera musculus*) off Isla Grande de Chiloe, in southern Chile, through eight aerial and 85 marine surveys. A total of 363 individual blue whales was photo-identified from 2004 to 2010. Approximately 20% of all catalogued individuals were resighted within the same season and 31% were resighted between years. Recaptures of photo identified individuals from other areas to the north and south of the main study area support the hypothesis that the feeding ground off southern Chile is extensive and dynamic. The high overall annual return and sighting rates highlight the waters off northwestern Isla de Chiloe and northern Los Lagos as the most important aggregation areas currently known for this species in Chile and one of the largest in the Southern Hemisphere. Observations on feeding and social behaviour also were recorded. These results provide important information on the conservation status of Chilean blue whales and highlight the necessity that long-term photographic identification research and line-transect surveys to monitor health conditions and population trends be continued off northwestern Isla de Chiloe. The high frequency of large vessels in the mouth of the Chacao Channel (along the north side of Chiloe) and the high number of blue whales in the area raises the possibility of vessel collisions. Therefore, it is necessary to develop and implement a conservation plan for these whales to address this and other potential threats. KEYWORDS: DISTRIBUTION; INDEX OF ABUNDANCE; PHOTO-ID; SITE FIDELITY; FEEDING; SOCIAL; BLUE WHALE; PACIFIC OCEAN; SOUTH AMERICA.

Tellechea, J.S. and Norbis, W. 2012. A note on recordings of Southern right whales (*Eubalaena australis*) off the coast of Uruguay. *J. Cetacean Res. Manage* 12(3):361-64.

Passive acoustic detection has the potential to provide data regarding the location of right whales. Right whales are not known to produce songs; nonetheless, the call repertoire of *Eubalaena australis*, the southern right whale, has been exhaustively and quantitatively analysed. This paper describes sound production by southern right whales in the coast of Uruguay (35°S) in the South Atlantic Ocean. No previous study of southern right whale sounds in Uruguayan waters exists. The calls recorded were: Up call, a low tonal call with a frequency of 50Hz to 200Hz; High call, which has the most energy in a range of 200-500Hz, and Pulsive call, a complex mixture made up of amplitude modulated noise and tones, 50-200Hz. This is the first acoustic study of *E. australis* in this region and focusses on the occurrence of calls previously identified by Clark to obtain more information about the acoustic behaviour of this cetacean in Uruguayan coastal waters. Future efforts will be made to obtain more recordings in different locations along the coast of Uruguay, where annual sightings occur. Such information is essential for examining global differences between vocalisations of southern right whales. KEYWORDS: SOUTHERN RIGHT WHALE; URUGUAY; SOUND; BIOACOUSTICS.

Robinson, K.P., O'Brien, J.M., Berrow, S.D., Cheney, B., Costa, M., Eisfeld, S.M., Haberlin, D., Mandelberg, L., O'Donovan, M., Oudejans, M.G., Ryan, C., Stevick, P.T., Thompson, P.M. and Whooley, P. 2012. Discrete or not so discrete: long distance movements by coastal bottlenose dolphins in UK and Irish waters. *J. Cetacean Res. Manage* 12(3):365-71.

The potential for long distance movements in common bottlenose dolphins (*Tursiops truncatus*) from six UK and Irish study sites was examined using photographs of natural markings. Here we provide the first evidence for long-term re-sightings between the Moray Firth, Inner Hebrides and across international borders to the Republic of Ireland as determined for eight individuals over a ten year period from 2001 to 2010. Minimum dispersal distances of up to 1,277km were resolved providing a new distance record for the species in European waters. Although none of the sightings were made within protected areas, several were made in waters used by animals from a Special Area of Conservation (SAC) revealing some evidence for connectivity between areas previously regarded as discrete. Our findings highlight the need to mitigate broader-scale anthropogenic impacts affecting these dolphins across multiple sites throughout their coastal range. Accordingly, we underline the importance of developing wider conservation measures for this species in UK and Irish waters, but particularly in prospective corridor areas potentially linking designated SACs in the Moray Firth, Cardigan Bay and Shannon Estuary. KEYWORDS: COMMON BOTTLENOSE DOLPHIN; MOVEMENTS; PHOTO-ID; MONITORING; MANAGEMENT PROCEDURE; CONSERVATION.

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Brodie, P., Ramirez, K. and Haulena, M. 2013. Growth and maturity of beluga (*Delphinapterus leucas*) in Cumberland Sound, Canada, compared to those raised in captivity: evidence for GLG/2. *J. Cetacean Res. Manage* 13(1):1-18.

The beluga (*Delphinapterus leucas*) is one of the few cetaceans to adapt, year-round, to an Arctic environment, one of the most challenging marine habitats, incorporating shallow estuaries, high turbidity, shifting pack-ice and extreme tidal ranges. Adaptation is attributed in part, to year-round herd integrity and synchrony, occupying a sequence of restricted seasonal habitats and calving sites, which are reflected in tooth laminae. Field research, 1966-1969, led to the conclusion that females are sexually mature at 5.75 years and males at 8.75 years, gestation is 15–16 months, reproductive cycle 3 years, with a lifespan of 30–35 years. Newborn and the first four year-classes are recognisable by length, body colour and morphology. The two-year nursing period results in rapid growth, coincident with a training period to acquire social, feeding, and crucial under-ice navigational skills. Belugas in Cumberland Sound had been reduced through exploitation, thus it is unlikely that present numbers are food limited, reflecting maximum rate of increase. We examine growth indices for captive belugas, either captured as calves, or first and second generations born in captivity, to compare known-age animals. Onset of sexual maturity in males and females is similar to findings for Cumberland Sound, which was based on two growth layer groups per year in the teeth, or GLG/2. We analyse studies where previous oral doses of tetracycline, as well as bomb radiocarbon 14C from 1958 were used to argue for single annual GLGs or GLG/1. Dedicated field studies, using appropriate dosage of intramuscular tetracycline, provide evidence for GLG/2. The 14C study appears to have been compromised by preparation technique and burdens sampled in the 1990s may have been of maternal origin, transferred during foetal growth and nursing, or from recent fallout to 1980. Fundamental to the issue of growth-at-age: arguments for GLG/1 are based on back-calculation from adults of unknown age, while GLG/2 is based on projection from newborn to known-age young and adults. Direct observations and cross-referenced parameters do not substantiate GLG/1, which requires halving the growth rate, thus doubling the age of sexual and physical maturity as well as lifespan, resulting in a 40% reduction of the intrinsic rate of natural increase, substantially lower than the present rate of recovery observed. KEYWORDS: AGE DETERMINATION; BELUGA; BOMB RADIOCARBON 14C; CAPTIVE; DENTINAL GLGS; GROWTH; MANAGEMENT; NARWHAL; REPRODUCTION; AGE AT SEXUAL MATURITY; TETRACYCLINE.

Bassos-Hull, K., Perrtree, R.M., Shepard, C.C., Schilling, S., Barleycorn, A.A., Allen, J.B., Balmer, B.C., Pine, W.E. and Wells, R.S. 2013. Long-term site fidelity and seasonal abundance estimates of common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida and responses to natural perturbations. *J. Cetacean Res. Manage* 13(1):19-30.

Information characterising site fidelity and abundance for common bottlenose dolphins (*Tursiops truncatus*) along the southwest coast of Florida is important for defining stock structure for management purposes. Long-term site fidelity and ranging patterns of bottlenose dolphins in Charlotte Harbor and Pine Island Sound, Florida were investigated using photo-ID data collected during 566 boat-based surveys from 1982 through 2007. Seasonal abundance estimates were generated from seven multi-week field seasons during 2001 through 2006, before and after a major hurricane and red tide event occurred in the area. In total, 1,154 distinctive dolphins were identified up to 34 times each with 84% of individuals resighted on more than one day. Multiple year residency rates were high with 81% of dolphins sighted in at least two years and 30% over ten or more years. Seventy-six percent of individuals with sightings on two or more days were observed in both summer and winter. Of 249 dolphins sighted on ten or more days in the study area, 83% were never observed outside the study area, indicating strong site-fidelity. Two years after a devastating Category 4 hurricane in 2004 and following two years of *Karenia brevis* harmful algal blooms, 94% of dolphins were observed in the same region within the study area and abundance estimates remained stable. Documenting range and site fidelity patterns of individuals over long periods of time is helpful for characterizing population structure and for examining changes attributable to environmental factors and perturbations such as hurricanes, harmful algal blooms and climate change. KEYWORDS: COMMON BOTTLENOSE DOLPHIN; PHOTO-ID; SITE FIDELITY; ABUNDANCE ESTIMATE; MARK-RECAPTURE; CLIMATE CHANGE; NORTH AMERICA; NORTHERN HEMISPHERE.

Martien, K.K., Gregovich, D.P. and Punt, A.E. 2013. Defining the appropriate 'Unit-To-Conserve' under the International Whaling Commission's Revised Management Procedure. *J. Cetacean Res. Manage* 13(1):31-38.

Identifying the appropriate 'Unit to Conserve' (UTC) is critical to the success of any management scheme. While the need to define the UTC appropriate to the IWC's *Catch Limit Algorithm (CLA)* has long been recognised by its Scientific Committee, little progress has been made on this issue. The *CLA* was rigorously tested prior to its adoption. However, most of those original performance trials focused on single-population scenarios or two-population scenarios with no ongoing dispersal. None of the trials considered the performance of the *CLA* across a range of dispersal rates. In this study, the performance of the *CLA* under a variety of population structure scenarios is examined. This is the first study to investigate the levels of connectivity (i.e. dispersal rate) for which populations require separate management to meet the conservation goals of the *CLA*. All the trials consisted of two populations that were managed as a single stock for 100 years. Both historical and modern hunts were spatially-biased so that population 1 was the primary target of hunting. Parameters that varied among trials were the relative carrying capacities (*K*) of the populations, the dispersal rate between them, maximum sustainable yield rate (*MSYR₁₊*), and the precision in simulated abundance estimates. All of these parameters had strong effects on the conservation performance of the *CLA*. Trials with a low *MSYR₁₊* (1%) generally ended with the abundance of population 1 below 0.54*K*, regardless of the dispersal rate or relative carrying capacities of the two populations. The same was true of trials in which the carrying capacity of population 1 represented only 10% of the total landscape carrying capacity and the CV of the abundance estimates was low, even when dispersal between populations was high ($5 \times 10^{-3}\text{yr}^{-1}$) and *MSYR₁₊* was 4%. The results suggest that the appropriate UTCs under the RMP are likely to exchange dispersers at high enough rates that they will be difficult to delineate using existing methods. These results also highlight the value of spatially-diffuse hunting patterns that avoid potential overhunting of unrecognised stocks. KEYWORDS: CONSERVATION; UNIT-TO-CONSERVE; MANAGEMENT PROCEDURE; SUSTAINABILITY; STOCK IDENTITY.

Bertulli, C.G., Rasmussen, M.H. and Tetley, M.J. 2013. Photo-identification rate and wide-scale movement of common minke whales (*Balaenoptera acutorostrata*) in the coastal waters of Faxaflói and Skjálfandi Bays, Iceland. *J. Cetacean Res. Manage* 13(1):39-45.

Information on movement and site fidelity is important for conservation and management. Photo-ID of common minke whales (*Balaenoptera acutorostrata*) was conducted from whalewatching vessels within the coastal waters of Faxaflói (a bay on the southwest coast of Iceland) and Skjálfandi (a bay on the northeast coast) between 2007-10 and 2001-10 respectively, to examine fidelity to the sampling locations and movement between them. Images of 292 individual minke whales were obtained in Faxaflói and 61 in Skjálfandi, with an overall 'annual re-capture proportion' of 23.3% in the former and 16.4% in the latter. Most (about 80%) of the resighted animals in each bay were re-sighted in one year only. The total number of identified whales has increased in both Faxaflói and Skjálfandi Bays since 2007 and 2001 respectively, suggesting the existence of an open population in both bays. One match was found between the two bays, eight years apart; the distance was approximately 600km between southwest and northeast Iceland. This study shows the value of photo-ID studies from platforms of opportunity such as whalewatching vessels. More data are required from broader geographic areas before firm conclusions can be drawn about movements and site fidelity within Icelandic waters. KEYWORDS: MINKE WHALE; PHOTO-ID; SITE FIDELITY; MOVEMENTS; NORTH ATLANTIC; NORTHERN HEMISPHERE; SURVEY-VESSEL; DISTRIBUTION.

Vermeulen, E. 2013. Abundance estimates of southern right whales (*Eubalaena australis*) in Bahía San Antonio, Patagonia, Argentina. *J. Cetacean Res. Manage* 13(1):47-51.

The abundance of southern right whales (*Eubalaena australis*) was estimated by the means of aerial line-transect surveys for the area of Bahía San Antonio, a bay located in the north-western region of the San Matías Gulf (40°50'S 64°50'W), Rio Negro, Patagonia Argentina. In total, seven aerial surveys were conducted in the first week of August and September 2009, September, October and November 2010, and August, September 2011. Survey effort equalled a total flight time of 12.4h, during which 200 whales were counted in 119 whale groups. Half of the encounters were solitary animals and 17% were mating groups. Corrected abundance estimates showed the highest amount of whales present in the bay during the month of September, with 85 ± 71 , 207 ± 08 and 117 ± 55 animals in 2009, 2010 and 2011 respectively. In adjacent months, less than half the amount of whales seemed to be present. The correction factor $g(0)$ availability resulted 0.392 ± 0.456 . Perception bias was not accounted for. These aerial surveys resulted in the first estimates of southern right whale abundance in this north Patagonian bay and indicated a rather abrupt peak during the month of September. This being the peak month for right whale presence is consistent with data from other regions in the Southwest Atlantic, but data obtained in the other months remained scarce and thus results should be interpreted carefully. The complete absence of whales in the area during November 2010 and August 2011 raises further questions on the predictability of the whale's presence in the area. Overall, more consistent aerial surveys should be conducted to accurately determine the annual and interannual evolution of southern right whale abundance in the study area. KEYWORDS: SOUTHERN RIGHT WHALES; ABUNDANCE ESTIMATE; SURVEY- AERIAL; SOUTHERN HEMISPHERE; SOUTH AMERICA; BREEDING GROUNDS; FEEDING GROUNDS; SITE FIDELITY; DISTRIBUTION.

Silberg, J.N., Acebes, J.M.V., Burdin, A.M., Mamaev, E.G., Dolan, K.C., Layusa, C.A. and Aca, E.Q. 2013. New insight into migration patterns of western North Pacific humpback whales between the Babuyan Islands, Philippines and the Commander Islands, Russia. *J. Cetacean Res. Manage* 13(1):53-57.

The population structure of humpback whales (*Megaptera novaeangliae*) in the North Pacific has received significant attention in recent years through the collaborative Structure of Populations, Levels of Abundance, and Status of Humpback whales in the North Pacific (SPLASH) study. However, the analysis of humpback whales in the western North Pacific Asian population was limited in the SPLASH study, due to small sample size. Much of the Asian population summers off Kamchatka, Russia and spends the winters in breeding grounds in Okinawa and Ogasawara, Japan and the Babuyan Islands in the northern Philippines. Prior studies grouped the Commander Islands feeding ground in Russia, with the eastern Aleutian Islands as part of the central humpback whale stock. This paper uses additional years of photo-ID data from both the Philippines (160 whales from 2000-12) and the Commander Islands (531 whales from 2008-10) to establish a previously unreported migratory connection by matching four animals between the two sites. The new migratory linkage found in the present study suggests that a small portion of humpback whales hypothesised to be migrating to a 'missing' breeding ground in the central North Pacific are actually migrating to the Philippines. However, additional studies on a wider geographical scale are required. KEYWORDS: HUMPBACK WHALE; ASIA; PACIFIC OCEAN; MOVEMENTS; BREEDING GROUNDS; FEEDING GROUNDS; MIGRATION; DISTRIBUTION; CONSERVATION; SURVEY-VESSEL; PHOTO-ID.

Ivashchenko, Y.V., Clapham, P.J. and Brownell Jr, R.L. 2013. Soviet catches of whale in the North Pacific: revised totals. *J. Cetacean Res. Manage* 13(1):59-72.

The USSR conducted a global campaign of illegal whaling beginning in 1948. Catch records for Soviet pelagic operations in the Southern Hemisphere (and the northern Indian Ocean) have been largely corrected, but major gaps have remained for the North Pacific. Here, using newly discovered whaling industry reports, corrected figures for Soviet catches in this ocean are provided. During the period 1948-79, a minimum of 190,183 whales were killed by the USSR in the North Pacific (195,783 if one includes an estimate for sperm whales taken in years for which there are no true data); of these, only 169,638 were reported to the IWC, a difference of 20,568 whales (26,168 including the sperm whale estimate). Figures were falsified for 8 of 12 hunted species, with some catches over-reported to camouflage takes of illegal species. Revised catch totals (caught vs. reported) are as follows: blue whale – 1,621 vs. 858; fin whale – 14,167 vs. 15,445; humpback whale – 7,334 vs. 4,680; sperm whale – 153,686 vs. 132,505; sei whale – 7,698 vs. 11,363; North Pacific right whale – 681 vs. 11; bowhead whale – 145 vs. 0; gray whale – 172 vs. 24. Bryde's, minke, killer and Baird's beaked whale catches were reported correctly. Of all the hunted species, sperm and North Pacific right whales were the most heavily impacted. Major falsifications for sperm whales involved figures for both total catch and sex ratio. KEYWORDS: WHALING-MODERN; ILLEGAL WHALING; REVISED CATCHES; NORTH PACIFIC; NORTHERN HEMISPHERE; HUMPBACK WHALE; GRAY WHALE; BOWHEAD WHALE; SPERM WHALE; RIGHT WHALE; BLUE WHALE; FIN WHALE; SEI WHALE; BRYDE'S WHALE.

Lammers, M.O., Pack, A.A., Lyman, E.G. and Espiritu, L. 2013. Trends in collisions between vessels and North Pacific humpback whales (*Megaptera novaeangliae*) in Hawaiian waters (1975-2011). *J. Cetacean Res. Manage* 13(1):73-80.

Injury from collisions with vessels is a growing threat worldwide for many species of whales. Thirty seven years of historical records were examined for evidence of vessel collisions with humpback whales in the main Hawaiian Islands. Between 1975 and 2011, 68 collisions between vessels and whales were reported including 59 witnessed collisions and 9 observed whale injuries that were consistent with a recent vessel collision. No collisions were immediately lethal. The waters between Maui, Molokai, Lanai and Kahoolawe, which are known to have one of the highest concentrations of humpback whales in the Hawaiian Islands, had the highest incidence of collisions. Over 63% of the collisions involved calves and sub-adults, suggesting a greater susceptibility towards collisions among younger animals. The rate of collisions increased significantly over the final twelve breeding seasons of the study and was greater than predicted by the estimated annual increase in the whale population, suggesting that the rising number of reported collisions cannot be explained solely by the annual increase in whale abundance. Although the total number of registered vessels and shipping traffic in Hawaii remained relatively constant between 2000 and 2010, there was a significant increase in the number of vessels between 7.9m and 19.8m in length. Vessels within this size range were also the most commonly involved in collisions during the study period, accounting for approximately two thirds of recorded incidents. It is concluded that from 1975-2011, there was a significant increase in reports of non-lethal collisions between vessels and humpback whales, especially calves and sub-adults, in the main Hawaiian Islands that likely reflects a combination of factors including the recovery of the population of North Pacific humpback whales, increases in traffic of particular vessel types, and increased reporting practices by operators of vessels. KEYWORDS: HUMPBACK WHALE; SHIP STRIKES; STATISTICS; TRENDS; PACIFIC OCEAN; NORTHERN HEMISPHERE.

Brandon, J.R. and Punt, A.E. 2013. Testing the Gray Whale Strike Limit Algorithm (SLA): allowing environmental variability to influence population dynamics. *J. Cetacean Res. Manage* 13(1):81-88.

The performance of the *Gray Whale SLA* is evaluated based on an operating model conditioned on available information for the eastern North Pacific stock of gray whales including: survey estimates of 1+ abundance; calf counts; strandings data; and the extent of sea-ice in the feeding grounds in the Bering Sea in the early season. Multiple scenarios are considered in the analyses to explore the impact of different sources of environmental variation, including scenarios in which future environmental forcing and episodic events are driven by the relationships between reproductive success and survival to sea ice. A variety of sources of uncertainty are considered, including parameter uncertainty, the uncertainty about the relationship between the extent of sea-ice and population dynamics, and observation error. The impact of these sources of uncertainty on the performance of the *Gray Whale SLA* is small. For all scenarios considered in the simulations, application of the *SLA* results in the stock being at or near carrying capacity at the end of a 92 year projection period for which sea-ice cover forecasts are available, while still satisfying the needs of aboriginal whalers. KEYWORDS: BIRTH RATE; CLIMATE CHANGE; ICE; MANAGEMENT PROCEDURE; MODELLING; MORTALITY RATE; WHALING-ABORIGINAL; GRAY WHALE.

Sumich, J.L., Blokhin, S.A. and Tiupleyev, P.A. 2013. Revised estimates of foetal and post-natal growth in young gray whales (*Eschrichtius robustus*). *J. Cetacean Res. Manage* 13(2):89-96.

Patterns of gray whale growth in body length and weight with age are evaluated using published values of foetal and post-natal body dimensions at reported ages, supplemented with previously unpublished measured lengths of 88 mid-gestation fetuses, 82 first-summer calves and 30 second-summer whales taken in the summer/autumn Chukotkan native subsistence fishery. Gompertz growth models are fitted to foetal and post-natal lengths at age, predicting mean lengths at birth in mid-January of 4.7m, 7.9m at weaning and 8.7m at one year. The late foetal diapause in growth of length is not supported by the available data. Two equations were derived for estimating body weights from the linear body dimensions of length and maximum girth. For biomass estimates, two equations based on length alone and on both girth and length are derived. A multiple least squares regression equation fit to 14 measurements of the same whale over 14 months of captive rehabilitation predicts mean body weights at birth of 1,100–1,200kg, 5,100–5,200kg at six months (weaning), and 6,700–6,800kg at one year of age. KEYWORDS: AGE DETERMINATION; BREEDING GROUNDS; CAPTIVITY; GRAY WHALE; GROWTH; MODELLING; MORPHOMETRICS; PACIFIC OCEAN; PHOTOGRAMMETRY; REPRODUCTION; STRANDINGS; WHALING - ABORIGINAL.

D’Intino, A.M., Darling, J.D., Urbán R., J. and Frasier, T.R. 2013. Lack of nuclear differentiation suggests reproductive connectivity between ‘southern feeding group’ and the larger population of eastern North Pacific gray whales, despite previous detection of mitochondrial differences. *J. Cetacean Res. Manage* 13(2):97-104.

During winter, eastern North Pacific gray whales migrate south to calving grounds in the lagoons of Baja California, and in spring they migrate north to their summer feeding grounds in the Chukchi and Beaufort Seas. Although the majority of the population makes this migration, a small subset of the population known as the ‘southern feeding group’ ends their northward migration early, spending summers feeding in waters ranging from northern California to southern Alaska. Previous analyses based on photo-ID and mtDNA data indicate that this seasonal sub-structuring results from maternally-directed site fidelity to different feeding grounds, and that this site fidelity and feeding ground preference is passed from mothers to their offspring. It is currently assumed, but not known, that the individuals of the southern feeding group mate with the rest of the population, and therefore that the eastern North Pacific gray whale represents one interbreeding population. Testing this assumption and understanding how these whales are related to the rest of the population, is key to making appropriate management decisions, which are particularly relevant given the recent increase in potential removals, or threats in the area such as the proposed resumption of aboriginal whaling, and increased oil pipeline development and subsequent vessel traffic. This paper analyses 15 nuclear microsatellite loci in 59 individuals from the southern feeding group and 40 individuals from the calving lagoons (representative of the larger population) to test the hypothesis that the eastern North Pacific gray whale represents one interbreeding population. No indication of population sub-structuring was found based on these nuclear loci, suggesting that all sampled whales do indeed represent one interbreeding population. Combined, these data from mitochondrial and nuclear markers therefore suggest one interbreeding population that is seasonally subdivided based on maternally-directed site fidelity to different feeding areas. KEYWORDS: EASTERN NORTH PACIFIC; GRAY WHALE; REPRODUCTION; WHALING-ABORIGINAL; FEEDING GROUNDS; GENETICS; SITE FIDELITY; SEGREGATION.

Coughran, D.K., Gales, N.J. and Smith, H.C. 2013. A note on the spike in recorded mortality of humpback whales (*Megaptera novaeangliae*) in Western Australia. *J. Cetacean Res. Manage* 13(2):105-08.

An unprecedented number of humpback whales ($n = 46$) from Breeding Stock D (BSD) were found dead or dying on Western Australian beaches in 2009. This compares to an average of less than four stranded humpback whales in each year in the period between 1989 and 2008. The recorded number of humpback whales on beaches in the year preceding this peak (2008, $n = 13$) and the two years following the peak (2010, $n = 16$; 2011, $n = 17$) were also above the long term average. In 2012 ($n = 7$), the numbers of stranded whales was closer to the longer term average. The majority of stranded individuals were either calves (44%) or juveniles/sub-adults (49%), with only 7% classified as adults. Most whales appeared emaciated. There were insufficient data to determine cause of death. Three possible hypotheses to explain this spike in mortality are proposed: (1) the increase in mortality of BSD was an artefact of increased detection and reporting; (2) the increase was temporary and transitory; and (3) the spike in mortality represents the start of an increasing trend in mortality as the population approaches carrying capacity. We suggest that hypothesis two is the most plausible but on-going monitoring will be required to test this. KEYWORDS: HUMPBAC WHALE; MONITORING; SOUTHERN HEMISPHERE; STRANDING; TRENDS.

Rankin, R., Maldini, D. and Kaufman, G. 2013. Bayesian estimate of Australian humpback whale calving interval under sparse resighting rates: 1987-2009. *J. Cetacean Res. Manage* 13(2):109-21.

This study estimates a calving interval for humpback whales from a long-term photo-ID catalogue of 2,973 8 individuals resighted in Hervey Bay, East Australia. The study proposes a modification of two existing methods to deal with partial identification of sex and age-classes of whales from visual surveys. One method truncates the data to only those individuals who are known to be breeding females (based on the presence of a calf) while discarding 11 all resighting events prior to the first observed breeding event. The second method utilizes the multi-stage mark 12 recapture (MSMR) framework and multi-event extension to include all resighted individuals and their entire 13 encounter history. We assess the performance of either method and detail the careful conditioning required in either 14 case (subtly different from most other mark-recapture methods) in order to handle ambiguity of sex and age-15 classes. Both truncation and the multi-event methods led to similar estimates of calving intervals: 2.98 years (95% 16 Credibility Interval: 2.27-3.51) and 2.78 years (95%CI: 2.23-3.68) respectively. More importantly, estimates were 17 more sensitive to the exact specification of resighting probabilities among age and sex classes than to the type of 18 conditioning. However, the multi-event framework resulted in more precise estimates of other important life-history 19 parameters such as apparent survival, and included a wider constituency of age and sex classes. KEYWORDS: HUMPBAC WHALE; MODELLING; REPRODUCTION; BIRTH RATE; PHOTO-ID; AUSTRALASIA; MARK-RECAPTURE.

Hakamada, T., Matsuoka, K., Nishiwaki, S. and Kitakado, T. 2013. Abundance estimates and trends for Antarctic minke whales (*Balaenoptera bonaerensis*) in Antarctic Areas IV and V for the period 1989/90-2004/05. *J. Cetacean Res. Manage* 13(2):123-51.

The Japanese Whale Research Programme under Special Permit in the Antarctic (JARPA) conducted sighting surveys during the 1989/90 to 2004/05 austral summer seasons (mainly in January and February), alternating between IWC management Areas IV (70°E-130°E) and V (130°E-170°W), both south of 60°S each (split-year). These data are analysed to obtain abundance estimates for Antarctic minke whales (*Balaenoptera bonaerensis*) in these Areas. The estimates are calculated by standard line transect analysis methods using the program DISTANCE under the assumption that $g(0)=1$. Annual rates of increase in abundance are estimated using log-linear models. The analyses take several recommendations from the 2006 JARPA Review Meeting into consideration. Those addressed here aim to: (a) improve the point estimates of abundance and their precision; and (b) evaluate (through sensitivity tests) the effect of different factors associated with the JARPA survey on the estimates of abundance and trend. GLM models are used to adjust for different strata being surveyed at different times of year over the duration of JARPA, with model selection being based on AICc. Abundance estimates for Area IV range from 16,562 (CV = 0.542) in 1997/98 to 44,945 (CV = 0.338) in 1999/00, while those for Area V range from 74,144 (CV = 0.329) in 2004/05 to 151,828 (CV = 0.322) in 2002/03. Estimates of the annual rates of increase in abundance are 1.8% with a 95% CI of [-2.5%, 6.0%] for Area IV and 1.9% with a 95% CI of [-3.0%, 6.9%] for Area V. Estimates of these trends are robust to the effects of changes in survey timing, the shapes of the shoulders of detection functions, portions of survey tracklines following the ice edge, parts of the Areas in which no survey took place and poor coverage within some strata. Adjustments to allow for the $g(0)$ being less than 1 are made by the application of a regression model, developed from the results of the Okamura-Kitakado (OK) method estimate of minke whale abundance from the IDCR-SOWER surveys, which provides estimates of $g(0)$ from the statistics of the minke whale school size distribution in a stratum. With this adjustment, abundance estimates increase by an average of 32,333 (106%) for Area IV and 89,245 (86%) for Area V, while the estimates of annual rates of increase and their 95% CIs change slightly to 2.6% [-1.5%, 6.9%] for Area IV and 1.6% [-3.4%, 6.7%] for Area V. KEYWORDS: ANTARCTIC; ANTARCTIC MINKE WHALE; JARPA; SIGHTING SURVEY; SURVEY-VESSEL; ABUNDANCE ESTIMATE; TRENDS.

Murase, H., Temoai, J., Kirata, T., Finkaso, S., Yasunaga, G. and Pastene, L.A. 2013. A note on cetaceans off Kiribati and Tuvalu from a research cruise in October 2010. *J. Cetacean Res. Manage* 13(2):153-58.

This paper summarises the results of a sighting survey conducted around the Gilbert Islands (Kiribati) and Tuvalu Islands (Tuvalu) in the central Pacific Ocean between 3 and 17 October 2010. This was the first systematic collection of cetacean sighting data in this region. The main objective of the survey was to investigate the occurrence and distribution of cetaceans around Kiribati and Tuvalu. In addition biopsy samples were obtained to investigate the species identity of Bryde's-whale-like baleen whales through genetic analyses and to assess feeding ecology of cetaceans in the survey area through the examination of fatty acids. The survey was carried out using a sighting survey vessel, which covered a total of 1,012 n.miles ($\approx 1,875$ km). A total of 24 schools (640 individuals) of cetaceans was sighted: three schools (five individuals) of Bryde's-whale-like baleen whales, one school (nine individuals) of sperm whales (*Physeter macrocephalus*), one school (six individuals) of killer whales (*Orcinus orca*), one school (14 individuals) of short finned pilot whales (*Globicephala macrorhynchus*), one school (two individuals) of false killer whales (*Pseudorca crassidens*), eight schools (483 individuals) of spinner dolphins (*Stenella longirostris*), and one school (70 individuals) of striped dolphins (*Stenella coeruleoalba*). Mitochondrial DNA (mtDNA) analyses based on the biopsy samples identified two of the Bryde's-whale-like whales sighted, as of the putative species *Balaenoptera brydei*. Compositions of fatty acids of Bryde's and killer whales are presented. The survey provided new information on the distribution and fatty-acid composition of cetaceans around Kiribati and Tuvalu. KEYWORDS: DISTRIBUTION; FEEDING ECOLOGY; TAXONOMY; TROPICAL PACIFIC.

Stevick, P.T., Allen, J.M., Engel, M.H., Félix, F., Haase, B. and Neves, M.C. 2013. Inter-oceanic movement of an adult female humpback whale between Pacific and Atlantic breeding grounds off South America. *J. Cetacean Res. Manage* 13(2):159-62.

We report the first documented movement of an individual humpback whale between the eastern South Pacific stock off Ecuador and the western South Atlantic stock off Brazil. This constitutes the first record of a humpback whale in both the Atlantic and Pacific breeding grounds off South America, and one of a small number of inter-oceanic movements documented to date. It is possible that, even at quite low levels, this movement of individuals between breeding grounds contributes to the current high level of mtDNA diversity in these once-depleted Southern Hemisphere populations. When first sighted, the whale was accompanied by a young calf, and is therefore identified as an adult female. This movement to a different and distant breeding ground is the first reported by a reproductively mature female, and shows that extreme long-distance travellers among humpback whales are not restricted to young males. KEYWORDS: HUMPBACK WHALE; BREEDING GROUND; SOUTH AMERICA; MOVEMENTS; PHOTO-ID.

Iriarte, V. and Marmontel, M. 2013. Insights on the use of dolphins (boto, *Inia geoffrensis* and tucuxi, *Sotalia fluviatilis*) for bait in the piracatinga (*Calophrys macropterus*) fishery in the western Brazilian Amazon. *J. Cetacean Res. Manage* 13(2):163-73.

In the Amazon Basin, the use of the pink dolphin or boto (*Inia geoffrensis*) for bait in the piracatinga (*Calophrys macropterus*) fishery was first detected in the year 2000. Since then, this artisanal fishery has become more prevalent as it requires only a few hours of work per night and provides immediate cash earnings. It is thus an attractive addition to (or replacement for) traditional fishing. Previous reports have noted the use of botos as bait, but stated that the most common bait used are caimans (*Melanosuchus niger*, *Caiman crocodilus*). Estimates of the number of dolphins killed based on fish landings have been proposed and an apparent decrease in sighting/survival of an artificially-marked boto population was observed. Although stocks/population estimates, trends and actual numbers of hunted dolphins are unknown, the conservation impacts of this activity are of concern. Between October 2010 and November 2011, research was conducted within an area with serious conflicts between dolphins and fishermen as well as intense fishing for piracatinga, i.e. in the lower Japurá River, on the border with the Mamirauá and Amanã Sustainable Development Reserves, where both boto and tucuxi (*Sotalia fluviatilis*) are used for bait. One-hundred and fifty-seven monitoring surveys were carried out in eight key communities, confirming 114 piracatinga fishing events through direct monitoring and incognito surveys of fishing gear (gaiolas). Empirical evidence of the activity in gaiolas comprised pieces of bait, carcass remains, piracatinga provoked vomits and dolphin fished carcasses. Of those, 31.2% ($n = 35$) involved cetacean bait

(91.4% *I. geoffrensis*, 8.58% *S. fluviatilis*), 68.7% ($n = 77$) caiman bait (96% *M. niger*, 4% *C. crocodilus*), and two fishing events used both types. These percentages may be higher/lower in other areas within and outside the Reserves. Given the increasing trend of the piracatinga fishery, the authors believe that precautionary measures for the conservation of Amazonian dolphins are urgently needed. Development of practical short-term solutions (e.g. offal-baited fish traps) and multispecies management together with law enforcement, incentives and educational programmes could allow the future transition of riverine communities from the piracatinga fishery to sustainable, higher income activities. KEYWORDS: BOTO; TUCUXI; DIRECT CAPTURE; FISHERIES; CONSERVATION; MANAGEMENT; SUSTAINABILITY; REGULATIONS.

Ryan, C., Graig, D., López-Suárez, P., Vazquez Perez, J., O'Connor, I. and Berrow, S.D. 2013. Breeding habit of poorly studied humpback whales (*Megaptera novaeangliae*) in Boa Vista, Cape Verde. *J. Cetacean Res. Manage* 13(2):175-80.

The waters surrounding Cape Verde comprise one of two known breeding grounds for humpback whales in the North Atlantic. The population remains very small and has apparently failed to recover since the cessation of whaling there. During the breeding seasons of 2011 and 2012, sighting surveys were carried out for humpback whales off Boa Vista, the easternmost island of the Cape Verde Island archipelago. The distribution and relative abundance of humpback whales and mother-calf pairs was investigated by plotting effort-corrected sightings using a 2km² grid-square. The study area, a 206km² region from the coastline up to 8km offshore, covered the western half of Boa Vista where whales have previously been regularly recorded. Following 1,954km of search effort, 117 sightings of humpback whales were made. An encounter rate of 0.11 whales per km was recorded for both years. It is hoped that these data may assist in implementing conservation measures to protect humpback whales and the habitat of Baía Sal Rei, which appears to be the single most important bay for winter breeding, calving and nursing humpback whales in the eastern North Atlantic. KEYWORDS: CONSERVATION; MONITORING; SURVEY VESSEL; DISTRIBUTION; BREEDING GROUND; NORTH ATLANTIC; HUMBACK WHALE; PHOTO-ID; INDEX OF ABUNDANCE.

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Kitakado, T., Lockyer, C. and Punt, A.E. 2014. A statistical model for quantifying age-reading errors and its application to the Antarctic minke whales. *J. Cetacean Res. Manage* 13(3):181-90.

A statistical method for quantifying age-reading error, i.e. the extent of bias and inter-reader variability among readers, is introduced. The method assumes the availability of an independent control reader who produces reference ages for ageing structures which are also read by the subject readers. This reader is assumed to provide unbiased age estimates. Linear structures in bias and variance are incorporated in a conditional probability matrix representing the stochastic nature of age-determination for each reader. A joint likelihood function for the parameters related to ageing bias, variance and nuisance parameters is defined based on observed ageing outcomes from both the control and subject readers. The method is applied to data for Antarctic minke whales taken during Japanese commercial (1971/72-1985/86) and scientific (1986/87-2004/05) whaling. 250 earplugs selected according to a predetermined protocol were used in the analyses to estimate the inter-reader variation for four Japanese readers. One of the authors acted the control reader. The Japanese readers and the control reader differed in terms of both the expected age given the true age, and variance in age-estimates. The expected age and random uncertainty in age-estimates differed among the Japanese readers, although the two readers in charge of age-reading for samples taken during Japanese scientific whaling (JARPA I and JARPA II) provided quite similar ageing outcomes. These results contribute to analyses using catch-at-age data for this species. It should also be noted that the model and approach in this paper can be applied to populations other than the Antarctic minke whales, if a control reader is available, even retrospectively. KEYWORDS: ANTARCTIC; MINKE WHALE; AGE-READING ERROR; EARPLUGS.

Félix, F. and Haase, B. 2014. A note on the northernmost record of the Antarctic minke whale (*Balaenoptera bonaerensis*) in the eastern Pacific. *J. Cetacean Res. Manage* 13(3):191-94.

In this study the first record of the Antarctic minke whale (*Balaenoptera bonaerensis*) in Ecuador (2°7.35'S, 80°45.7'W) is presented. It was a single stranding of a calf of 3.43m in length. The species was identified based on morphological characteristics such as the number and colour of baleen plates, the number and extension of ventral grooves, lack of white flipper patch and the waved greyish light colouration pattern on the flanks, among others. Although only a handful of records exist of this species in the Eastern Pacific, it confirms that the breeding area of this species at least reaches the equator in this region. KEYWORDS: MINKE WHALE; DISTRIBUTION; SOUTH AMERICA; BREEDING GROUNDS; PACIFIC OCEAN; SOUTHERN HEMISPHERE.

Koh, H.S., Jo, J.E., Ahn, N.H., Lee, J.H., Kim, K.S. and Jin, C.W. 2014. Preliminary study on genetic differences between two species of finless porpoises, genus *Neophocaena*, with lack of genetic divergence between two subspecies of the narrow-ridged finless porpoise, *N. asiaorientalis*: cytochrome *b* sequence analysis. *J. Cetacean Res. Manage* 13(3):195-200.

Using samples from bycaught finless porpoises, cytochrome *b* sequences were analysed and phylogenetic trees were constructed. The aims were to: (1) determine genetic divergences within the genus *Neophocaena*; (2) examine interspecific divergences between *N. asiaorientalis* and *N. phocaenoides*; and (3) examine intraspecific divergence between *N. a. asiaorientalis* and *N. a. sunameri*. For this purpose, complete cytochrome *b* sequences for 12 *N. a. sunameri* specimens, collected from fishery markets at Pohang in southeastern Korea, were obtained, and these sequences were compared to the corresponding partial (402bp) and complete (1,140bp) sequences of *Neophocaena*, obtained from GenBank. From a maximum likelihood tree with the partial sequences of the two *Neophocaena* species, two clades were detected, corresponding to the two species, with average genetic distance of 1.64%, four fixed site differences (1.00%), and a *Gst* value of 0.64, although we did not examine the specimens from Southeast Asia and contiguous South China Sea. Furthermore, from the complete sequences, we recognised a lack of genetic divergence between the two subspecies of *N. asiaorientalis*, with a *Gst* value of 0.06 and two pairs of identical sequences between them, indicating that our results do not support current subspecies classification. Thus, we newly found that our cytochrome *b* sequencing results are useful for the examination of interspecific and intraspecific divergences in *Neophocaena*, although further genetic analyses with additional specimens of *Neophocaena* across its distributional range are necessary to confirm the findings in this study. KEYWORDS: GENETICS; TAXONOMY; BYCATCH; SEA OF JAPAN; ARABIAN SEA; INDIAN SEA; EAST CHINA SEA; NORTHERN HEMISPHERE; FINLESS PORPOISE.

Pitchford, J.L., Serafin, B.J.S., Shannon, D., Coleman, A.T. and Solangi, M. 2014. An analysis of historical bottlenose dolphin (*Tursiops truncatus*) strandings in the Mississippi Sound, USA using classification and regression trees (CART). *J. Cetacean Res. Manage.* 13(3):201-10.

Trends in bottlenose dolphin (*Tursiops truncatus*) strandings can be used to examine several factors associated with mortality and life history and are essential for detecting unusual mortality events (UMEs). This study characterised stranding trends in the Mississippi Sound (MS) region of the northern Gulf of Mexico (GoM) from 1996–2009 using kernel density estimation (KDE) and classification and regression tree (CART) analysis. An annual mean of 26.1 strandings ($n=14$), $SD=13.7$, 95% CI [18.2, 34.0] and a peak in strandings during spring (March–May) were evident from our analyses. Neonates stranded almost exclusively in spring indicating that this is the dominant breeding and calving season in this area. Spatial distributions revealed that the majority of dolphins stranded along central and western portions of the MS Sound near Gulfport, MS and on Ship Island during the spring and summer months, but were more often found in the eastern MS Sound during winter and autumn. Our CART analyses indicated that 1996, which contained a declared UME, was anomalous from other years as the number of adult, sub-adult and juvenile strandings was relatively high during the autumn and winter. Further, our analyses showed that the location of those strandings on Ship Island in autumn and winter was unique from all other years in the historical record. These results represent historical conditions that can be used as a baseline for future studies of the effects of environmental disturbances, including UMEs, in MS. This research also demonstrates the versatility and usefulness of CART for describing historical trends, detecting departures from the norm and explaining UMEs within the framework of a single analysis. This approach represents an objective assessment tool that could be used to assist governmental agencies with determining the onset of a UME and could help support or refute the cause of these events. KEYWORDS: COMMON BOTTLENOSE DOLPHIN; STRANDINGS; GULF OF MEXICO; NORTHERN HEMISPHERE; STATISTICS; DISTRIBUTION.

Benmessaoud, R., Cherif, M. and Bejaoui, N. 2014. Baseline data on abundance, site fidelity and association patterns of common bottlenose dolphins (*Tursiops truncatus*) off the northeastern Tunisian coast (Mediterranean Sea). *J. Cetacean Res. Manage.* 13(3):211-20.

The common bottlenose dolphin has been studied intensively in numerous locations around the world but very little is known about this species along the South Mediterranean Basin. In this study, the temporal distribution of dolphins, group dynamics, site fidelity and association patterns of common bottlenose dolphins along the northeastern coastal waters of Tunisia was assessed through mark-recapture photo-identification techniques. Prior to this study, no research has focused on bottlenose dolphins within these waters, despite the potential for human impacts on this species. A total of 718h of boat-based observations, spanning 284 days, were spent at sea between August 2008 and July 2010. During this period, 253h were spent in direct observation of 317 groups of common bottlenose dolphins. Bottlenose dolphins were observed in all seasons, although seasonality was evident, with more encounters during the summer. Photo-identification studies show that 43 individuals used the northeastern coast of Tunisia on a regular basis, while others were present less often. Based on a social structure analysis it was possible to discriminate different communities related with the spatial distribution of the sightings (Zembra island, Hammamet, Kelibia and Galite island). KEYWORDS: BOTTLENOSE DOLPHIN, SURVEY-VESSEL; ABUNDANCE ESTIMATE; PHOTO-ID; SCHOOL SIZE; SITE FIDELITY; MEDITERRANEAN SEA; NORTHERN HEMISPHERE; STATISTICS.

Towers, J.R., McMillan, C.J., Malleson, M., Hilderling, J., Ford, J.K.B. and Ellis, G.M. 2014. Seasonal movements and ecological markers as evidence for migration of common minke whales photp-identified in the eastern North Pacific. *J. Cetacean Res. Manage.* 13(3):221-29.

In the eastern North Pacific Ocean, common minke whales (*Balaenoptera acutorostrata*) are widespread but encountered relatively infrequently. It is generally believed that they make annual migrations between higher latitudes in the summer and lower latitudes in the winter; however, in some temperate coastal regions where common minke whales have been sighted year-round they have been referred to as resident. To determine movement patterns of common minke whales found in coastal waters of British Columbia and Washington we examined photo-identification data that were collected opportunistically from 2005–12. These data were from four non-overlapping areas between 48°N and 53°N. Despite year-round search efforts, common minke whales were only encountered between April and October. Most of the 44 unique individuals identified in 405 encounters displayed fidelity to areas both within and among years. Five of these whales made relatively large-scale intra-annual movements between areas on six occasions. They were documented to move up to 424km in a northerly direction in spring and up to 398km in a southerly direction in autumn. The seasonal patterns of these movements provide new insights into the foraging ranges and migrations of the individuals. Ecological markers provide evidence that the common minke whales photographed undertake annual long distance migrations. Scars believed to be from cookiecutter shark (*Isistius brasiliensis*) bites were observed on 43 individuals and the majority of whales documented with good quality images each year had acquired new scars since the previous year. Furthermore, the commensal barnacle *Xenobalanus globicipitis* was observed on three individuals. Since these sharks and barnacles are from relatively warm waters, it can be inferred that they interacted with the common minke whales at lower latitudes. These findings may have important implications for the definition and management of common minke whale stocks and/or populations in the eastern North Pacific. KEYWORDS: MOVEMENTS; MIGRATION; PHOTO-ID; NORTH PACIFIC; ECOLOGICAL MARKERS; FEEDING GROUNDS; SITE FIDELITY; COMMON MINKE WHALE; NORTHERN HEMISPHERE.

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Hamilton, L.J. and Lindsay, K. 2014. Beaked whale strandings on the coast of Australia in comparison to other cetaceans. *J. Cetacean Res. Manage* 14: 1-14.

Beaked whale (Ziphiidae) strandings on the coast of Australia are examined in comparison to five other odontocete (toothed whale) species and two mysticetes (baleen whales) representative of non-Ziphiids found stranded in Australian waters. Ninety percent of reported beaked whale strandings involve a single animal. Seven beaked whale stranding events of three or more individuals have been recorded from 1871 to 2010, with a maximum in any event of 6. The five non-Ziphiid odontocetes had maximum numbers in a stranding of 13, 51, 65, 200, and 250, and a combined total of 66 events with 10+ in a stranding. The mysticetes had almost exclusively single strandings. Similar trends for the Ziphiids and other cetaceans are generally observed worldwide, although larger numbers of Ziphiids have stranded elsewhere. Continental scale geographical stranding patterns are similar for the Ziphiids, the five non-Ziphiid odontocetes, and the two mysticetes, although not for the same reasons. Reported strandings predominantly occurred around the southern half of Australia south of 20°S. On average around three times as many beaked whale stranding events per month occurred for the period January to April than for July to December. The monthly trend for beaked whale strandings follows the seasonal cycle of sea temperatures, indicating a relation to oceanic phenomena, rather than to the often invoked effect of increased observer effort in months with warmer air temperatures. Some single and dual beaked whale strandings which include a female may be related to use of shallow sheltered waters for calving and subsequent resting. KEYWORDS: BEAKED WHALE; STRANDINGS; AUSTRALASIA.

Morita, J.G. and George, J.C. 2014. Age classification of bowhead whales using recursive partitioning. *J. Cetacean Res. Manage* 14: 15-22.

An algorithm was derived for using morphometric data to classify bowhead whales into three age brackets: over 90 years ('very old'); 60–90 years ('old'); and under 60 ('younger'). Recursive partitioning was applied to a subset of the data from post mortem examinations. This subset consisted of whales with higher quality data scores and with either estimated ages or characteristics of very old animals such as: near-maximum body length and baleen length; heavy scarring; and ancient weapons embedded in them. Statistical analysis suggested that for males, body length and peduncle girth provide the most useful information for this age classification. For females, anterior flipper length and body length were the key variables for classifying age. If anterior flipper length is not available for females, then body length, baleen length and peduncle girth may be used to classify age. KEYWORDS: CLASSIFICATION TREES; MORPHOMETRIC GROWTH; BOWHEAD WHALE; POPULATION PARAMETERS; NORTHERN HEMISPHERE; ARCTIC; WHALING - ABORIGINAL; AGE DETERMINATION.

Read, A.J., Barco, S., Bell, J., Borchers, D.L., Burt, M.L., Cummings, E.W., Dunn, J., Fougères, E.M., Hazen, L.J., Williams Hodge, L.E., Laura, A.M., McAlarney, R.J., Nilsson, P., Pabst, D.A., Paxton, C.G.M., Schneider, S.Z., Urian, K.W., Waples, D.M. and McLellan, W.A. 2014. Occurrence, distribution and abundance of cetaceans in Onslow Bay, North Carolina, USA. *J. Cetacean Res. Manage* 14: 23-36.

In this paper the occurrence, distribution and abundance of cetaceans in offshore waters of Onslow Bay, North Carolina, USA is described. Between June 2007 and June 2010 monthly aerial and shipboard line-transect surveys were conducted along ten 74km transects placed perpendicular to the shelf break. In total 42,676km of aerial trackline (218 sightings) and 5,209km of vessel trackline (100 sightings) were observed. Seven species of cetaceans were observed, but the fauna was dominated strongly by common bottlenose and Atlantic spotted dolphins. Both species were present year-round in the study area. Using photo-identification techniques, five bottlenose dolphins and one spotted dolphin were resighted during the three-year period. In general, the abundance of cetaceans in Onslow Bay was low and too few sightings were made to estimate monthly abundances for species other than bottlenose and spotted dolphins. Maximum monthly abundances of bottlenose and spotted dolphins were 4,100 (95% CI: 1,300–9,400) in May 2010 and 6,000 (95% CI: 2,500–17,400) in March 2009, respectively. Bottlenose dolphins were found throughout the study area, although they were encountered most frequently just off the shelf break. In contrast, spotted dolphins exhibited a strong preference for waters over the continental shelf and were not encountered beyond the shelf break. KEYWORDS: ABUNDANCE ESTIMATE; MONITORING; SURVEY-COMBINED; TRENDS; PHOTO-ID; ATLANTIC OCEAN; NORTHERN HEMISPHERE; ATLANTIC SPOTTED DOLPHIN; MODELLING; BOTTLENOSE DOLPHIN; COMMON DOLPHIN; RISSO'S DOLPHIN; ROUGH-TOOTHED DOLPHIN; FIN WHALE; SPERM WHALE; SHORT FINNED PILOT WHALE.

Bouveroux, T., Tyson, R.B. and Nowacek, D.P. 2014. Abundance and site fidelity of bottlenose dolphins in coastal waters near Panama City, Florida. *J. Cetacean Res. Manage* 14: 37-42.

Dolphin watching and swim-with programmes are popular tourist attractions in Panama City, Florida, USA. Despite this, little is known about the population of dolphins that utilise this area, specifically St. Andrew Bay. To learn more about this population, photo-identification mark-recapture surveys were conducted between March 2004 and July 2007. The main objectives were to estimate the abundance of bottlenose dolphins inhabiting this region during this time period and to examine their patterns of site fidelity. Robust design population models were used to calculate seasonal abundance estimates, which ranged from 89 (CI 95% = 71–161) to 183 (CI 95% = 169–208) dolphins, even though 263 distinctive dolphins were identified during the study. Only 7% of dolphins (n = 18) observed were seen regularly in the study region. In addition, only 12% of dolphins (n = 30) observed had high site fidelity for the study region, while 58% (n = 153) were considered to be transient to the area. This study provides baseline information regarding dolphin abundance and site fidelity in and around St. Andrew Bay that may be used for the conservation and management of this dolphin population. KEYWORDS: BOTTLENOSE DOLPHIN; ABUNDANCE; PHOTO-ID; SITE FIDELITY; GULF OF MEXICO; MARK-RECAPTURE; NORTHERN HEMISPHERE; NORTH AMERICA.

Randage, S.M., Alling, A., Currier, K. and Heywood, E. 2014. Review of the Sri Lanka blue whale (*Balaenoptera musculus*) with observations on its distribution in the shipping lane. *J. Cetacean Res. Manage* 14: 43-49.

A population of blue whales is resident off the southern coast of Sri Lanka and has been observed year-round by the crew of a whalewatching vessel, Raja & the Whales, a few miles south of Mirissa Harbour. Over the course of three years (1 December 2009 to 30 November 2012), a total of 485 blue whale sightings were reported with an average of 4.56 individuals observed per sighting. This number does not represent the total number of individuals seen because repeat sightings were highly probable. Calves were observed during the northeast monsoon. Sightings were confined to an area of about 200 n.miles that is bisected by a heavily trafficked shipping lane. Much of this area is characterised by submarine canyons and sloping bathymetry, which contributes to monsoonal seasons of high productivity and upwelling suitable for feeding whales. While the numbers of injuries and fatalities due to ship strikes are not known, four dead blue whales were observed along the southern coast over the course of five months (1 January to 31 May 2014). It is of great urgency to understand the identity and size of this population, reduce ship strikes and address all issues threatening this population in order to arrive at possible mitigation

measures for its protection. KEYWORDS: BLUE WHALE; SRI LANKA; NORTHERN INDIAN OCEAN; SHIP STRIKES; BYCATCH; CONSERVATION; WHALEWATCHING; NORTHERN HEMISPHERE; SURVEY-VESSEL; ASIA; SOUTHERN HEMISPHERE.

Boye, T.K., Simon, M. and Witting, L. 2014. How may an annual removal of humpback whales from Godthaabsfjord, West Greenland, affect the within-fjord sighting rate? *J. Cetacean Res. Manage* 14: 51-56.

Photo-identifications of humpback whales in the Godthaabsfjord area were collected from 2007 to 2012 and divided into individuals and number of sightings per individual. Monte Carlo simulations were performed on the sighting distributions of individual humpback whales to investigate the potential impact that local removals (e.g. ship strikes, subsistence hunt) could have on the sighting rate of humpback whales in Godthaabsfjord. Half of the sightings were based on the same six individuals during the six year period. Sighting rate was likely to drop regardless of when (spring, summer or autumn) an individual was removed due to the large degree of site fidelity of several humpback whales in Godthaabsfjord. Removals could affect the whalewatching industry in Godthaabsfjord where humpback whales constitute a key species. The least impact may be achieved by conducting the hunt outside the fjord system or minimising summer or autumn hunts within the fjord, as spring removals tend to have the least effect on summer sighting rates. KEYWORDS: HUMPBACK WHALE; WHALING-ABORIGINAL; WHALEWATCHING; SIGHTING RATE; SITE FIDELITY; WEST GREENLAND.

Baines, M.E. and Reichelt, M. 2014. Upwellings, canyons and whales: an important winter habitat for balaenopterid whales off Mauritania, northwest Africa. *J. Cetacean Res. Manage* 14: 57-67.

The aim of this study was to identify critical habitats for baleen whales in the Mauritanian upwelling zone using data collected from a platform of opportunity: a 60 day geophysical survey approximately 100km southwest of Cap Blanc, Mauritania in winter (2012/13). The bathymetry of the 5,500km² study area was complex, including parts of the Cap Timiris Canyon system. Large whales, including sei and blue whales, accounted for 70% of the 238 cetacean sightings. Species identification was often problematic, especially in the case of balaenopterid whales, so data for all whales of this genus were pooled for the estimation of abundance and distribution. Spatial modelling was applied to estimate abundance and to plot a predicted density map of balaenopterid whales. Depth and the chlorophyll-a concentration when at its peak (in the previous September) were significant predictors of whale density. Point abundance in the study area was estimated at 272 whales (95% CI 265-279) and density was highest in the depth range 500-2,250m near to the canyon system (6.18 whales/100km², 95% CI 6.03-6.51). Steep seabed topography created by canyons running off the shelf edge, together with the strong upwelling system, probably create optimal habitats for the euphausiid prey of sei and blue whales. Sei whales were observed skim-feeding at dawn or dusk on seven occasions; in one sighting an aggregation of 18 skim-feeding sei whales were observed. The high density of these baleen whale species in such a highly productive area and direct observation of feeding behaviour in sei whales, provides evidence of feeding during the winter breeding season, when they have previously been presumed to feed less. This study demonstrates the potential value of collecting further data on seismic survey vessels and would improve understanding of cetacean ecology in remote and under-explored regions. KEYWORDS: HABITAT; OCEANOGRAPHY; FEEDING GROUNDS; MODELLING; ATLANTIC OCEAN; ABUNDANCE ESTIMATE; SEISMIC SURVEY; SEI WHALE; BLUE WHALE.

Greenman, J.T. and McFee, W.E. 2014. A characterisation of common bottlenose dolphin (*Tursiops truncatus*) interactions with the commercial shrimp trawl fishery of South Carolina, USA. *J. Cetacean Res. Manage* 14: 69-79.

In the United States, interactions between the shrimp trawl fishery and bottlenose dolphins are known to exist; however, the level of mortality is largely unknown, and has not been studied in South Carolina, USA. The current study attempted to determine if interactions between bottlenose dolphins and the South Carolina commercial shrimp trawl fishery pose a significant threat to dolphin populations and if fishery related mortality is underreported. Onboard observations were made during a 25 day (August–December 2010) field study. No dolphin takes occurred during the observational period. These observations focused on direct physical interactions with the gear and depredation behaviours. Additionally, a subsample of the shrimp fishery in South Carolina was asked to participate in a mailed survey. The survey included questions related to gear, dolphin observations, and the status of the shrimp fishery. This paper also examines historical dolphin stranding data from the NOAA/CCEHBR MMIS database for signs of shrimp fishery interactions. A three-tiered flow diagram was developed to characterise each stranding case according to the likelihood that mortality resulted from trawler interaction. Field results point to significant dolphin presence around commercial trawlers ($x^2 = 23.406$, $p < 0.001$). Survey results showed 12 unreported incidents of shrimp trawl fishery mortality of dolphins. Finally, stranding records revealed several more cases with signs of possible trawler interaction. The current US National Marine Fisheries Service (NOAA) designation of the fishery as a Category II fishery is correct. Increased observer coverage and improved communication with the fishery on the importance of reporting takes is warranted. KEYWORDS: COMMON BOTTLENOSE DOLPHIN; FISHERIES; INCIDENTAL CATCHES; TRAWLS; STRANDINGS; CONSERVATION; MANAGEMENT PROCEDURE.

Punt, A. 2014. A summary history of the application of statistical catch-at-age analysis (SCAA) to Antarctic minke whales. *J. Cetacean Res. Manage* 14: 81-92.

Various forms of SCAA methods have been applied to data for Antarctic minke whales since this method was first presented to the Scientific Committee of the International Whaling Commission by Punt and Polacheck (2005). A brief overview is provided of the historical use of methods which use catch-at-age data to draw inferences regarding trends in abundance for Antarctic minke whales. The original version of the SCAA and how this method has been modified over time to more adequately mimic the available data on length, conditional age-at-length and indices of abundance from IDCR/SOWER and JARPA/JARPAII is described. The paper also lists the specifications for the reference case analyses in each paper presented to the Scientific Committee. The focus is on methodology, with only limited comment on the results from each subsequent analysis. KEYWORDS: CATCH-AT-AGE; ANTARCTIC MINKE WHALE; POPULATION MODEL; SOUTHERN HEMISPHERE.

Punt, A., Hakamada, T., Bando, T. and Kitakado, T. 2014. Assessment of Antarctic minke whales using statistical catch-at-age analysis (SCAA). *J. Cetacean Res. Manage* 14: 93-116.

Statistical catch-at-age analysis (SCAA) is applied to data for Antarctic minke whales. The SCAA model is spatially-structured, can model multiple stocks of minke whales, and can utilise several data types for parameter estimation. The application to Antarctic minke whales considers two stocks (I and P) in five areas which cover Antarctic Areas III–E to VI–W. The parameters of the model (annual deviations about the stock-recruitment relationship, changes over time in carrying capacity, density-dependence parameters related to productivity and carrying capacity, and the parameters which determine growth by stock, age-specific natural mortality by stock, and vulnerability by area and 'fleet') are estimated by fitting the model to data on catches, catch-at-length, conditional age-at-length, and estimates of absolute and relative abundance. A reference case analysis is selected, and sensitivity explored using retrospective analyses and by varying the assumptions on which the reference case analysis is based. The reference case analysis is able to mimic all of the data sources adequately. Most of the analyses (reference and sensitivity) indicates that Antarctic minke whales in the assessed area increased from 1930 until the mid-1970s and have declined thereafter, with the extent of the decline greater for minke whales in Antarctic Areas III–E to V–W than for those

further east. Natural mortality is consistently estimated to be higher for younger and older individuals than for individuals of intermediate age. Estimates of MSYR1+ (the exploitation rate on animals 1 and older at which sustainable yield is maximised) are presented, but are unreliable owing to the lack of contrast. KEYWORDS: CATCH-AT-AGE, ANTARCTIC MINKE WHALE, POPULATION MODEL; SOUTHERN HEMISPHERE; SURVEY-VESSEL; MODELLING; MSY RATE; ANTARCTIC; MORTALITY RATE; SCIENTIFIC PERMITS.

Hampton, J.O., Mawson, P.R., Coughran, D.K. and Vitali, S.D. 2014. Validation of the use of firearms for euthanasing stranded cetaceans. *J. Cetacean Res. Manage* 14: 117-23.

Efforts to euthanise stranded cetaceans remain highly variable in their outcomes, with few field tested operational procedures available. This study sought to validate the efficacy of using modern firearms technology to euthanise small (<6m length) stranded cetaceans. Post-mortem evidence was gathered from the standardised shooting of cetacean cadavers (n = 10), representing six species, using .30 caliber (7.62mm) firearms and blunt solid copper-alloy non-deforming projectiles, in southwestern Australia. The six species studied were Risso's dolphin, common dolphin, bottlenosed dolphin, pygmy sperm whale, Cuvier's beaked whale, and humpback whale. Post-mortem data revealed that 100% of bullet wound tracts fully penetrated the skulls of shot animals, with associated indirect skull fracturing, secondary bone missiles and brain parenchyma laceration. The results suggest that appropriate firearms technology is fully capable of inducing instantaneous fatal pathology to the central nervous system of these species. In comparison to alternative methods for the euthanasia of stranded cetaceans, the use of firearms is associated with superior animal welfare outcomes, public safety levels and accessibility. This paper provides a template for the safe, humane and repeatable use of this technique to euthanise <6m length stranded cetaceans. KEYWORDS: AUSTRALASIA; STRANDINGS; STRESS; EUTHANASIA.

Van der Zee, J.P. and Punt, A.E. 2014. Evaluating critical dispersal rates for whale management under the IWCs Revised Management Procedure: an application for North Atlantic common minke whales. *J. Cetacean Res. Manage* 14: 125-32.

A key consideration for any Revised Management Procedure (RMP) and Aboriginal Whaling Management Procedure (AMWP) Implementation is the choice of stock structure hypotheses, and the weighting of alternative stock structure hypotheses using available data. The RMP/AMWP-lite framework is applied to the North Atlantic common minke whales for three stock structure hypotheses and two RMP 'variants'. The stock structure hypotheses differ in terms of how many stocks are found in the North Atlantic and how they mix on the feeding grounds. Focusing on the eastern North Atlantic, simulations are undertaken to assess when management performance for two RMP variants is inadequate and how much effective dispersal between adjacent stocks is needed so that the performance of these variants becomes adequate. KEYWORDS: WHALING; MANAGEMENT; NORTH ATLANTIC; MINKE WHALES.

Franklin, W., Franklin, T., Gibbs, N., Childerhouse, S., Garrigue, C., Constantine, R., Brooks, L., Burns, D., Paton, D., Poole, M., Hauser, N., Donoghue, M., Russell, K., Mattila, D.K., Robbins, J., Anderson, M., Olavarria, C., Jackson, J., Noad, M., Harrison, P., Baverstock, P., Leaper, R., Baker, S. and Clapham, P. 2014. Photo-identification confirms that humpback whales (*Megaptera novaeangliae*) from eastern Australia migrate past New Zealand but indicates low levels of interchange with breeding grounds of Oceania. *J. Cetacean Res. Manage* 14: 133-40.

Recent photo-identification and genetic studies have identified at least five discrete breeding populations in Australia and Oceania: western Australia (D), eastern Australia (E (i)), New Caledonia (E (ii)), Tonga (E (iii)), French Polynesia and the Cook Islands (F). Also evident are low levels of intermingling among breeding populations consistent with the degree of genetic differentiation. Photo-identification has confirmed linkages between Area V feeding areas and eastern Australia breeding grounds and one genotype match has been reported between Area V feeding areas and Oceania breeding grounds. Recent abundance estimates show strong increases in the eastern Australian population, and some recovery in the New Caledonia and Tonga populations, but with little evidence of recovery at other known Oceania breeding grounds or New Zealand. Studies to date have provided no conclusive evidence of the migratory destination of humpback whales passing through New Zealand waters en route between Antarctic feeding areas and tropical breeding grounds. Photo-identification comparisons were undertaken between humpback whale fluke catalogues from eastern Australia (EA, 1315), Oceania east (OE, 513), Oceania west (OW, 166) and New Zealand (NZ, 13). Five matches were found between OE/OW, four matches between OW/EA and three matches between NZ/EA. The data are used to investigate and discuss the migratory destination and breeding ground migratory interchange of humpback whales travelling through New Zealand waters. The data confirm that humpback whales with site fidelity to eastern Australia migrate past New Zealand including through the Cook Strait and Foveaux Strait. KEYWORDS: HUMPBACK WHALE; PHOTO-ID; OCEANIA; BREEDING GROUNDS; HUMPBACK WHALES; PHOTO-ID; MIGRATION; SITE FIDELITY; EASTERN AUSTRALIA; NEW ZEALAND; OCEANIA; ANTARCTIC WATERS; BREEDING GROUNDS; FEEDING AREAS

Schmitt, N.T., Double, M.C., Baker, S., Gales, N., Childerhouse, S., Polanowski, A.M., Steel, D., Albertson, R., Olavarria, C., Garrigue, C., Poole, M., Hauser, N., Constantine, R., Paton, D., Jenner, C.S., Jarman, S.N. and Peakall, R. 2014. Mixed-stock analysis of humpback whales (*Megaptera novaeangliae*) on Antarctic feeding grounds. *J. Cetacean Res. Manage* 14: 141-57.

In understanding the impact of commercial whaling, it is important to estimate the mixing of low latitude breeding populations on Antarctic feeding grounds, particularly the endangered humpback whale populations of Oceania. This paper estimates the degree of genetic differentiation among the putative populations of Oceania (New Caledonia, Tonga, the Cook Islands and French Polynesia) and Australia (western Australia and eastern Australia) using ten microsatellite loci and mtDNA, assesses the power of the data for a mixed-stock analysis, determines ways to improve statistical power for future studies and estimates the population composition of Antarctic samples collected in 2010 south of New Zealand and eastern Australia. A large proportion of individuals could not be assigned to a population of origin (> 52%) using a posterior probability threshold of > 0.90. The mixed-stock analysis simulations however, produced accurate results with humpback whales reapportioned to their population of origin above the 90% threshold for western Australia, New Caledonia and Oceania grouped using a combined mtDNA and microsatellite dataset. Removing the Cook Islands, considered a transient region for humpback whales, from the simulation analysis increased the ability to reapportion Tonga from 86% to 89% and French Polynesia from 89% to 92%. Breeding ground sample size was found to be a factor influencing the accuracy of population reapportionment whereas increasing the mixture or feeding ground sample size improved the precision of results. The mixed-stock analysis of our Antarctic samples revealed substantial contributions from both eastern Australia (53.2%, 6.8% SE) and New Caledonia (43.7%, 5.5% SE) [with Oceania contributing 46.8% (5.9% SE)] but not western Australia. Despite the need for more samples to improve estimates of population allocation, our study strengthens the emerging genetic and non-genetic evidence that Antarctic waters south of New Zealand and eastern Australia are used by humpback whales from both eastern Australia and the more vulnerable breeding population of New Caledonia, representing Oceania. KEYWORDS: HUMPBACK WHALE; CONSERVATION; FEEDING GROUNDS; GENETICS; MIGRATION; SOUTHERN OCEAN; ANTARCTIC.

Matthews, J. 2014. Method for estimating sperm whale abundance from an acoustic strip transect survey with a two-element towed hydrophone. *J. Cetacean Res. Manage* 14: 159-70.

A method for estimating sperm whale abundance in an acoustic line-transect survey with a two-element hydrophone is described. The analysis starts from the point where a set of click trains have been identified by an analyst. Using likelihood methods, a description is given of the estimation from each click train of (i) whale positions from the bearing patterns of click trains, (ii) most likely numbers of whales in aggregations and (iii) a radial detection function based on the times of detected clicks and the estimated position. The method uses the complete set of allowable arrangements of these click trains into different numbers of whales. The number of arrangements is potentially very large yet can be computed because many click train combinations are not permissible, e.g. overlapping click trains cannot be from the same whale. It is suggested that the method could work well over perpendicular distances where the detection function is near-certain i.e. a strip transect survey. The method is applied to survey data from the western Mediterranean. Simulations based on the estimated radial detection function support a strip width of 5km. Some shortcomings and areas for further development are discussed. KEYWORDS: ABUNDANCE ESTIMATE; SURVEY-ACOUSTIC; ACOUSTICS.

Hamilton, L.J. and Lindsay, K. 2014. The relation of coastal geomorphology to larger mass strandings of odontocetes around Australia. *J. Cetacean Res. Manage* 14: 171-84.

Sites of larger live mass strandings (10 to 250 individuals) for five selected odontocete (toothed whale) species around Australia are examined to see if they have any characteristics or properties which might be related to the strandings. Bays are the significant coastal unit in the 66 events reported over a 100 year period; only three events were not within bays but on open sandy coastlines. Species, species adult size and bay size do not appear to be factors in these larger stranding events. The reason for the association of bays with larger mass strandings is not obvious. Many of the bays have simple planform and uncomplicated bathymetry. However, they share some properties previously associated with strandings that are a consequence of the processes of bay formation. Coastal locations other than particular types of bays do not necessarily have all of these properties, potentially explaining why these bays dominate the Australian mass stranding record. A chain of geomorphological, physical, and biological factors can be constructed to explain the role of the bays in mass strandings. Regardless of this possible explanation, there is an observed correlation of particular site properties with larger live mass strandings about Australia which might be expected to have predictive power in indicating potential mass stranding sites. This is particularly apparent when key properties of stranding sites are defined and compared in terms of simple quantitative thresholds. The sites of herd strandings around New Zealand generally exhibit the expected properties. KEYWORDS: AUSTRALASIA; AUSTRALIA; STRANDINGS; ODONTOCETE; PACIFIC OCEAN; SOUTHERN HEMISPHERE; TRENDS.

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Heide-Jørgensen, M.P. and Laidre, K.L. 2015. Surfacing time, availability bias, and abundance of humpback whales in West Greenland. *J. Cetacean Res. Manage*. 15: 1-8.

Visual aerial surveys of large whales are negatively biased unless correction factors are developed for correcting for the availability of whales at the surface. One method for developing a correction factor for this bias is by instrumenting whales with recorders that measure the amount of time the whales spent at the surface. A total of 31 satellite-linked time-depth recorders of three different types were deployed on humpback whales (*Megaptera novaeangliae*) in West Greenland in May and July 2009-2010. Over the period whales were tracked, the SLTDRs recorded the fraction of a 6-hour period that the whales spent at or above 2 m depth. This depth is considered to be the maximum depth humpback whales are reliably detected on visual aerial surveys in West Greenland. Eighteen transmitters provided both data on the surface time and the drift of pressure transducer. The average surface time for these whales over the entire tracking period and during the two 6-hr periods with daylight was 28.3% (cv=0.06). Six whales that met data filtering criteria had reduced drift of the depth transmitter and their average surface time was 33.5% (cv=0.10). Previous analyses of visual aerial survey data have shown that the amount of time whales are available to be seen by observers is not an instantaneous process. Therefore the surface time needs to be corrected for a positive bias of about 10% when developing a correction factor for availability bias which increases the availability to 36.8% (cv=0.10). The most recent survey of humpback whales in West Greenland was conducted in 2007 and corrections with this availability factor provides fully corrected abundance estimates of 4,090 (cv=0.50) for mark-recapture distance sampling analysis and 2,704 (cv=0.34) for a strip census abundance estimate. These estimates are about 25% larger than previous estimates from the same survey. KEYWORDS: SATELLITE TAGGING; SURVEY-AERIAL; ABUNDANCE ESTIMATE; HUMPBACK WHALE; NORTHERN HEMISPHERE.

Best, B.D., Fox, C.H., Williams, R., Halpin, P.N. and Paquet, P.C. 2015. Updated marine mammal distribution and abundance estimates in British Columbia. *J. Cetacean Res. Manage* 15: 9-26.

Information relating to the distribution and abundance of species is critical for effective conservation and management. For many species, including cetacean species of conservation concern, abundance estimates are lacking, out of date and/or highly uncertain. Systematic, line-transect marine mammal surveys were conducted in British Columbia's (BC) coastal waters over multiple years and seasons (summer 2004, 2005, 2008, and spring/autumn 2007). In total, 10,057km of transects were surveyed in an 83,547km² study area. Abundance estimates were calculated using two different methods: Conventional Distance Sampling (CDS) and Density Surface Modelling (DSM). CDS generates a single density estimate for each stratum, whereas DSM explicitly models spatial variation and offers potential for greater precision by incorporating environmental predictors. Although DSM yields a more relevant product for the purposes of marine spatial planning, CDS has proven to be useful in cases where there are fewer observations available for seasonal and inter-annual comparison, particularly for the scarcely observed elephant seal. The summer abundance estimates (with lower and upper 95% confidence intervals; all DSM method unless otherwise stated), assuming certain trackline detection (underestimates true population size) were: harbour porpoise (*Phocoena phocoena*) 8,091 (4,885-13,401); Dall's porpoise (*Phocoenoides dalli*) 5,303 (4,638-6,064); Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) 22,160 (16,522-29,721); humpback whale (*Megaptera novaeangliae*) 1,092 (993-1,200); fin whale (*Balaenoptera physalus*) 329 (274-395); killer whale (all ecotypes; *Orcinus orca*), 371 (222-621); common minke whale (*B. acutorostrata*) 522 (295-927); harbour seal (total; *Phoca vitulina*) 24,916 (19,666-31,569); Steller sea lion (total; *Eumetopias jubatus*) 4,037 (1,100-14,815); and northern elephant seal (CDS method; *Mirovanga angustirostris*) 65 (35-121). Abundance estimates are provided on a stratum-specific basis with additional estimates provided for Steller sea lions and harbour seals that were 'hauled out' and 'in water'. This analysis updates previous estimates by including additional years of effort, providing greater spatial precision with the DSM method over CDS, novel reporting for spring and autumn seasons (rather than summer alone), and providing new abundance estimates for Steller sea lion and northern elephant seal. In addition to providing a baseline of marine mammal abundance and distribution, against which future changes can be compared, this information offers the opportunity to assess the risks posed to marine mammals by existing and emerging threats, such as fisheries bycatch, ship strikes, and increased oil spill and ocean noise issues associated with increases of container ship and oil tanker traffic in British Columbia's continental shelf waters. KEYWORDS: SURVEY-VESSEL; ABUNDANCE ESTIMATE; DISTRIBUTION; CONSERVATION; BRITISH COLUMBIA; PACIFIC OCEAN; HUMPBACK WHALE; KILLER WHALE; COMMON MINKE WHALE; FIN WHALE; PACIFIC WHITE-SIDED DOLPHIN; STELLER SEA LION; ELEPHANT SEAL; HARBOUR SEAL; HARBOUR PORPOISE; DALL'S PORPOISE; NORTHERN HEMISPHERE.

Bertulli, C.G., Tetley, M.J., Magnúsdóttir, E.E. and Rasmussen, M.H. 2015. Observations of movement and site fidelity of white-beaked dolphins (*Lagenorhynchus albirostris*) in Icelandic coastal waters using photo-identification. *J. Cetacean Res. Manage.* 15: 27-34.

The white-beaked dolphin (*Lagenorhynchus albirostris*) is the most commonly sighted delphinid species in Icelandic coastal waters. However, little is known about the species' abundance, site fidelity and movements throughout its range. Photo-identification studies were conducted from April-October (2002-10) during whalewatching operations in Faxaflói and Skjálfandi bays on the southwest and northeast coasts of Iceland, respectively. Minimum abundance, annual site fidelity and movement between bays were calculated. A total of 154 and 52 individuals were identified in Faxaflói and Skjálfandi bays, respectively. The annual re-sighting rate was 21.4% in Faxaflói bay while only one individual was re-sighted in Skjálfandi bay (1.7%). A total of five dolphins (2.3%) were matched between Faxaflói and Skjálfandi bays with the period between re-sightings ranging from 272 to 821 days (mean 28.16 days, SD = 5.94). Low site fidelity rates observed likely signify a much larger home range than the present study area, into either other coastal or offshore zones, or alternatively may be explained by a large natural population size and/or the opportunistic nature of sampling during this study. Therefore, expansion of the study area is required. The matches between bays suggest that white-beaked dolphins inhabit a largescale coastal range of the Icelandic coast and can be considered highly mobile and transient possibly due to scarce and patchy resources. Alternatively it could be due to a large population size. KEYWORDS: WHITE-BEAKED DOLPHIN; PHOTO-ID; SITE FIDELITY; MOVEMENTS; NORTH ATLANTIC; ICELAND; NORTHERN HEMISPHERE.

Robertson, F.C., Koski, W.R., Brandon, J.R., Thomas, T.A. and Trites, A.W. 2015. Correction factors account for the availability of bowhead whales exposed to seismic operations in the Beaufort Sea. *J. Cetacean Res. Manage.* 15: 35-44.

The accuracy of estimates of cetacean density from line-transect survey data depends in large part on how visible the target species is to the observer. Behavioural data (i.e. surface and dive times) from government- and industry-funded aerial observation programmes (1980-2000) were used to calculate availability correction factors needed to estimate the number of bowhead whales (*Balaena mysticetus*) from aerial survey sighting data. Correction factors were calculated for bowhead whales exposed and not exposed to seismic operations. Travelling non-calf whales were found to be less likely to be available for detection than other whales, and their availability further declined in the presence of seismic operations. Non-calves were also less available to observers during autumn when exposed to seismic operations than when not exposed, regardless of activity (travelling or otherwise). Such differences in availability appear to reflect behavioural responses to the sound of seismic operations that alters the surfacing and diving patterns of bowhead whales. Localised abundance estimated from aerial surveys may range from 3% to as much as 63% higher in areas ensounded by seismic operations if correction factors are applied to account for differences in availability associated with the presence of seismic operations, compared to abundance estimates derived from assessments that only account for changes in availability of undisturbed whales. These results provide the first empirical estimates of availability for bowhead whales exposed to seismic operations and highlight the implications of not correcting for disturbance-related availability in density assessments in the vicinity of seismic operations. KEYWORDS: g(0); SURVEY-AERIAL; NOISE; BEAUFORT SEA; BOWHEAD WHALE; LINE-TRANSECT; BEHAVIOUR; DIVING; MONITORING.

Whitt, A.D., Powell, J.A., Richardson, A.G. and Bosycki, J.R. 2015. Abundance and distribution of marine mammals in nearshore waters off New Jersey, USA. *J. Cetacean Res. Manage.* 15: 45-59.

Marine mammal abundance and distribution in New Jersey's nearshore waters are not well known due to limited dedicated studies. The first year-round systematic surveys were conducted to determine the spatial/temporal distribution and estimate the abundance of marine mammals in this region prior to wind power development. Eight marine mammal species were observed: North Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), minke whale (*Balaenoptera acutorostrata*), fin whale (*Balaenoptera physalus*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), harbour porpoise (*Phocoena phocoena*) and harbour seal (*Phoca vitulina*). Results indicate clear seasonal patterns in distribution and abundance. The fin whale, humpback whale and bottlenose dolphin were sighted during all seasons. The abundance of large whales in the study area was relatively low while the abundance of dolphin and porpoise species was high and largely seasonal. The bottlenose dolphin was the most abundant species; however, abundance was high only during spring and summer. Common dolphins and harbour porpoises were common in the study area during winter and spring. These baseline data will be used to assess potential environmental impacts of the construction and operation of offshore wind power facilities in this region. KEYWORDS: ABUNDANCE ESTIMATE; MODELLING; DISTRIBUTION; CONSERVATION; SURVEY-AERIAL; SURVEY-VESSEL; ATLANTIC OCEAN; HABITAT; NORTH ATLANTIC RIGHT WHALE; HUMPBACK WHALE; MINKE WHALE; FIN WHALE; BOTTLENOSE DOLPHIN; COMMON DOLPHIN; HARBOUR PORPOISE; HARBOUR SEAL.

Durban, J., Weller, D., Lang, A. and Perryman, W. 2015. Estimating gray whale abundance from shore-based counts using a multilevel Bayesian model. *J. Cetacean Res. Manage.* 15: 61-68.

Counts of southbound migrating whales off California form the basis of abundance estimation for the eastern North Pacific stock of gray whales (*Eschrichtius robustus*). Previous assessments (1967-2007) have estimated detection probability (p) from the detection-non detection of pods by two independent observers. However, tracking distinct pods in the field can be difficult for single observers; resulting in biased estimates of pod sizes that needed correcting, and matching observations of the same pod by both observers involved key assumptions. Due to these limitations, a new observation approach has been adopted wherein a paired team of observers work together and use a computerized mapping application to better track and enumerate distinct pods and tally the number of whales passing during watch periods. This approach has produced consistent counts over four recently monitored migrations (2006/7, 2007/8, 2009/10 and 2010/11), with an apparent increase in p compared to the previous method. To evaluate p and estimate abundance in these four years, we compared counts from two independent stations of paired observers operating simultaneously using a hierarchical Bayesian "N-mixture" model to simultaneously estimate p and abundance without the challenge of matching pods between stations. The overall average detectability $p_0 = 0.80$ (95% Highest Posterior Density Intervals [HPDI] = 0.75-0.85), which varied with observation conditions, observer effects and changes in whale abundance during the migration. Abundance changes were described using Bayesian model selection between a parametric model for a Normally distributed common migration trend and a semi-parametric model that estimated the time trends independently for each year; the resultant migration curve was a weighted compromise between models, allowing for key departures from the common trend. The summed estimates of migration abundance ranged from 17,820 (95% HPDI = 16,150-19,920) in 2007/8 to 21,210 (95% HPDI = 19,420-23,230) in 2009/10, consistent with previous estimates and indicative of a stable population. KEYWORDS: ABUNDANCE ESTIMATE; MIGRATION; MODELLING; GRAY WHALE; SURVEY-SHORE BASED; PACIFIC OCEAN; NORTHERN HEMISPHERE.

Fazio, A., Arguelles, M.B. and Bertellotti, M. 2015. Spatial and temporal dynamics of whalewatching in Península Valdés, Patagonia, Argentina. *J. Cetacean Res. Manage.* 15: 69-76.

Península Valdés (Patagonia, Argentina) is considered one of the best places in the world to watch southern right whales (*Eubalaena australis*) due to the large number of animals as well as to their predictability and proximity to the coast. The present study describes the spatial and temporal dynamics of whalewatching, and the different groups of whales that were the focus of this activity in Península Valdés during six reproductive seasons (from 2005 to 2008 and from 2012 to 2013). The aim was to generate useful tools to improve whalewatching

activity in this area. Data were recorded from 1,816 whalewatching trips operated from Puerto Pirámides. Every trip had several stopovers to watch whales, defined as 'sightings'. At the beginning of the season, most sightings occurred near Puerto Pirámides port, while at the end of the season, sightings were further from the port. During the first half of the whale season, trips tended to be coastal and shorter but the groups of whales sighted were more varied, including solitary animals, mating groups and mothers with their recently born calves. In the second half of the season, trips tended to be further from the coast and longer, but the whales sighted were mainly mother-calf pairs, the last group of whales to leave the area. This difference in the characteristics of the sightings as the whale season progressed could be the basis to generate different recreational experience opportunities. Whalewatching has a major impact on the regional economy and whalewatching regulations, if correctly applied, could improve the quality of a conservation plan, considering that both gulfs of Península Valdés (San José and Nuevo) are the main calving areas for this species in the South Atlantic Ocean. KEYWORDS: WHALEWATCHING; REGULATIONS; DISTRIBUTION; BREEDING GROUNDS; SHORT-TERM CHANGE; SOUTHERN RIGHT WHALE; SOUTH AMERICA; SOUTHERN HEMISPHERE.

Konishi, K. and Walløe, L. 2015. Substantial decline in energy storage and stomach fullness in Antarctic minke whales (*Balaenoptera bonaerensis*) during the 1990s. *J. Cetacean Res. Manage* 15: 77-92.

A substantial decline in energy storage in the Antarctic minke whale during the JARPA period (18 years starting from the austral summer 1987/88) was reported by the authors in 2008. The statistical method used in the study was simple multiple linear regression. The results have since been thoroughly discussed by the Scientific Committee of the IWC because of the potential importance of the findings. Some members suggested that the sampling heterogeneity in the JARPA data was so substantial that generalized linear models with interaction terms and random-effects terms should be explored. For the present article, five response variables related to energy storage and the variable "stomach content weight" were systematically analysed using generalized linear models recommended by the review panel at the JARPA II review meeting and by the SC in 2014. For all five energy storage variables, the results show declines in the interval 3% to 9% over the JARPA period, all significantly different from zero at the 5% level, but no later decline. The weight of sieved stomach contents declined by 25% over the same period. The coefficients of the decline and the coefficients for most other independent variables were very similar to values obtained by simple linear regression, but in some cases the standard errors were larger. The results indicate that important changes took place in the Antarctic ecosystem during the 1990s. We argue that the most important cause of the changes must have been the simultaneous increase in other krill feeders, especially humpback whales. KEYWORDS: MINKE WHALES; ENERGY STORAGE; STOMACH FULLNESS; ECOSYSTEM CHANGES; JARPA; INTERSPECIES COMPETITION; ANTARCTIC.

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Gore, M.A., Culloch, R.M., Gray, H.W.I., Hoelzel, R., Lockyer, C., Kiani, M.S., Waqas, U., Hussain, B., Rahim, A., Shah, A. and Ormond, R.F.G. 2017. Assessment of beach-cast cetaceans in Pakistan: implications for conservation and management. *J. Cetacean Res. Manage* 16: 1-7.

Until recently, little was known about the distribution and species occurrence of marine cetaceans in Pakistani waters, an area which needed to be addressed urgently given its inclusion in the Indian Ocean Whale Sanctuary. Boat-based surveys (2005-09) carried out along the coast of Pakistan identified 12 species of cetaceans. Although these surveys can be very useful for providing information on species presence and distribution, estimates of the age and sex of these groups can be more uncertain. Consequently, this present study undertook complementary beach-based surveys over the same period across all accessible regions of the Pakistani coast and created a community reporting scheme for stranded and beach-cast remains of cetaceans. Tissue samples and/or skeletal material were collected over three years from 37 individual specimens, with DNA successfully extracted from 24. Using molecular techniques, a total of seven species were identified and there was an indication that the majority of the samples were from males. An analysis of teeth collected from 12 beach-cast odontocetes showed an age range between neonatal and 17 years. The results of this study corroborate the presence of species observed during the boat-based surveys and identified a further three species. The data also provide additional information on age and sex. A comparison with similar studies suggests that the stranding rate is low in Pakistan. No mass strandings occurred during the seven year monitoring period. The results indicate that beach-based surveys are effective for gathering data on species presence in regions where resources are limited, the terrain is harsh and availability of data is low. Ultimately, the results of this work will help with assessing the conservation status and management requirements of the region's cetaceans, both locally and internationally with respect to the Indian Ocean Whale Sanctuary. KEYWORDS: STRANDINGS; CONSERVATION; INDIAN OCEAN; SURVEY - SHORE-BASED; AGE DETERMINATION; SEX RATIO; GENETICS; INDIAN OCEAN HUMPBACK DOLPHIN; SPINNER DOLPHIN; INDO-PACIFIC FINLESS PORPOISE; BOTTLENOSE DOLPHINS-GENERAL.

Klotz, L., Fernández, R. and Rasmussen, M.H. 2017. Annual and monthly fluctuations in humpback whale (*Megaptera novaeangliae*) presence in Skjálfandi Bay, Iceland, during the feeding season (April-October). *J. Cetacean Res. Manage* 16: 9-16.

Humpback whales are among the most common whale species occurring in Skjálfandi Bay, North Iceland. Since 2001, 309 photographed humpback whales have been identified and catalogued. The percentage of whales re-sighted from year to year has been always less than 27% and only 49 out of 309 identified individuals were sighted in the Bay in two or more years, indicating that the humpback whales occurring in Skjálfandi Bay have various feeding areas. Kernel Density Estimations indicated distribution changes within the bay and throughout the season. In early summer, humpback whale densities were higher in the southern and western part of Skjálfandi Bay, whereas as the season progressed whale concentration increased further north in the direction of the open sea. Generalised Linear Models (GLMs) were used to analyse a 10 year time series of monthly humpback whale Sightings Per Unit of Effort (SPUE; sightings per minute) during the summer season (May-October). Whalewatching boats were used as research platforms. The total effort was 136,503 minutes. 1,401 sightings of humpback whales were recorded. GLMs show significantly higher SPUE in 2006 (0.0132), 2011 (0.0111) and 2012 (0.0246) when compared to the start of the time series. September showed a significantly lower SPUE (0.0024) when compared to the baseline month (May). An independent dataset derived from logbook data provided by commercial whalewatching operations was used to derive the percentage of humpback whale positive surveys (surveys where the species was seen) over a longer time series (1995-2012). These data were analysed using Generalised Additive Models (GAMs) and show an increase on the percentage of positive surveys in the period 2006-09, a slight decrease in 2010 and a new increase in 2011-2012. Annual trends in positive surveys for two additional species of locally abundant cetaceans, the harbour porpoise and the white-beaked dolphin, were explored for comparison purposes. No trend was found for porpoises while the percentage of positive surveys for white-beaked dolphins showed a general decrease after 2002. Fluctuations in SPUE and percentage of positive surveys may be due to varying environmental conditions within the bay, with potential implications for whalewatching operations. Given the scientific value of these conclusions, this study also supports the value of integrating whalewatching vessels as opportunistic platforms for cetacean research. KEYWORDS: HUMPBACK WHALE; PHOTO-ID; SIGHTINGS PER UNIT EFFORT; ICELAND; WHALEWATCHING; WHITE-BEAKED DOLPHIN; HARBOUR PORPOISE.

Cunha, I., Freitas, L., Alves, F., Dinis, A., Ribeiro, C., Nicolau, C., Ferreira, R., Goncalves, J.A. and Formigo, N. 2017. Marine traffic and potential impacts towards cetaceans within the Madeira EEZ. *J. Cetacean Res. Manage* 16: 17-28.

Human population growth has resulted in an increase of marine traffic. This has been associated with wildlife disturbance and the effects are expected to increase with continued traffic expansion. A particularly impacted group is cetaceans, known to play an important role in the sustainability and regulation of marine ecosystems. An assessment of marine traffic can therefore contribute towards wildlife conservation measures, especially when evaluated in the context of important areas for cetaceans. The present study took place in Madeira's Exclusive Economic Zone (EEZ), an area hosting a high diversity of cetacean species as well as island-associated groups. Automatic Identification System (AIS) data were collected from a land station between 2008 and 2011 and marine traffic and cetacean visual data collected during shipboard surveys between 2001 and 2011. Results show that Madeira's offshore traffic (up to 12 n.miles from the shore) corresponds to approximately 12% and 22% of the traffic observed in the Baltic and North Sea, respectively. It is mostly composed of cargo ships navigating over fixed routes and using the area as a passage towards different destinations. Cruise ships intersect the area mainly to reach Funchal's port. The number of recreational boats in the area was found to be underestimated since many of them are not equipped with AIS devices. The level of Madeira inshore traffic is harder to evaluate since it is a small area encompassing a shipping route, yet it may represent 0.8% of the traffic recorded in the Strait of Gibraltar. According to the inshore shipboard survey data, coastal marine traffic is mainly composed of fishing boats (47%), recreational boats (24%), ships (17%), whalewatching boats (10%) and big game fishing boats (2%). Most inshore and offshore vessels were found to be navigating at over 10 knots. An inshore 'higher use corridor' common to both vessels and cetaceans was identified as a potential danger zone. KEYWORDS: ATLANTIC OCEAN; SUSTAINABILITY; SURVEY - VESSEL; DISTRIBUTION; NORTHERN HEMISPHERE; FIN WHALE; SHORT-FINNED PILOT WHALE; BEAKED WHALES; SPERM WHALE; BOTTLENOSE DOLPHIN; ATLANTIC SPOTTED DOLPHIN; COMMON DOLPHIN.

Southall, B.L., Quick, N., Hastie, G., Tyack, P. and Boyd, D. 2017. Mitigation of harm during a novel behavioural response study involving active sonar and wild cetaceans. *J. Cetacean Res. Manage* 16: 29-38.

Some studies of how human activities can affect wild free-ranging animals may be considered to have potential negative outcomes too severe to be ethically studied. This creates a societal dilemma involving choices between continuing risky activities with high uncertainty about their potential effects on wildlife, often with considerable associated precaution or undertaking focused research to reduce uncertainty, but with some risk of harm from either strong response leading to potential stranding or direct physical injury from sound exposure. Recent and ongoing field experiments have measured the conditions in which wild cetaceans respond to military sonar, and provided insight into the nature of responses. Here mitigation measures are reported for one of the first such experiments designed to measure fine-scale behavioural responses to controlled exposures of midfrequency (3–4 kHz) active sonar. The objective was to do so without causing the kinds of physical harm that have been previously observed (e.g. stranding events) and that motivated the study. A critical goal of this experimental study was to identify a response that was safe but that could be used as an indicator of the probability of risk from more extreme or sustained exposure from real military operations. A monitoring and mitigation protocol was developed using a feedback control procedure for real-time mitigation of potential harm. Experimental protocols were modulated relative to indicators of potential risk with the explicit objective of detecting potentially harmful consequences of sound exposure and taking appropriate corrective action. Three categories of mitigation methods were developed and integrated within the experimental protocol incorporating designed, engineered, and operational mitigation measures. Controlled exposure experiments involving free-ranging animals were conducted without any evident harm to the experimental subjects, while successfully eliciting behavioural responses that provided meaningful results to inform management decisions. This approach demonstrates the importance of careful design of protocols in exposure-response experiments, particularly in pioneering studies assessing response where both the potential for harm and level of uncertainty may be high. KEYWORDS: ACOUSTICS; CONSERVATION; BEHAVIOUR; MANAGEMENT PROCEDURE; SHORT-TERM CHANGE; BEAKED WHALES; DELPHINIDS; NORTHERN HEMISPHERE.

Lowry, L.F., Zerbini, A., Frost, K.J., DeMaster, D.P. and Hobbs, R.C. 2017. Development of an abundance estimate for the eastern Bering Sea stock of beluga whales (*Delphinapterus leucas*). *J. Cetacean Res. Manage* 16: 39-47.

The first dedicated aerial surveys for beluga whales in the Norton Sound/Yukon Delta region of Alaska were flown during May, June and September 1992. During May 1992 surveys, all of the survey area was covered with pack ice and only a few belugas were seen. In June 1992, many whales were seen in the region of Pastol Bay and the Yukon River Delta, with a few animals seen in eastern Norton Sound. In September 1992, whales were more dispersed and occurred both off the Yukon Delta and in coastal waters of northern Norton Sound. Based on those results, subsequent surveys were flown in June 1993–95 and 1999–2000. In all years except 1999 when there was extensive sea ice in the area, belugas were common off the Yukon Delta and in southern Norton Sound. In most years they were also seen in central Norton Sound. Density and abundance were estimated from the 2000 survey as it represented the most recent data and had the most complete and systematic coverage of the area. In June 2000, belugas were rare in the northern portion of Norton Sound, so the study area was reduced to central and southern Norton Sound and the Yukon Delta, which was divided into four strata by latitude. The density that was estimated with the model that received most Akaike Information Criterion support was 0.121 belugas km⁻² and the number of belugas at the surface in the study area was estimated to be 3,497 (CV = 0.37). A generally accepted correction factor for availability of 2.0 was applied, resulting in an abundance estimate for the eastern Bering Sea beluga stock in June 2000 of 6,994 (95% confidence interval 3,162–15,472). This estimate is likely to be conservative. There are no previous abundance estimates for this region, so a population trend cannot be determined. The available evidence suggests that the current Alaska Native subsistence harvest from this stock is sustainable. Beluga consumption of prey populations is likely significant in the regional ecosystem and may have a particular impact on some stocks of Pacific salmon. KEYWORDS: WHITE WHALE; ARCTIC; BERING SEA; ABUNDANCE ESTIMATE; SURVEY-AERIAL; WHALING-ABORIGINAL; CONSERVATION; NORTHERN HEMISPHERE.

Sartori, C.M., Paitach, R.L. and Cremer, M.J. 2017. Photo-identification of franciscanas (*Pontoporia blainvillei*) in Babitonga Bay, Santa Catarina State, Brazil. *J. Cetacean Res. Manage* 16: 49-55.

The franciscana (*Pontoporia blainvillei*) is a small cetacean endemic to the South Atlantic distributed in coastal waters from Espírito Santo State in Brazil to Chubut Province in Argentina. Babitonga Bay, on the northern coast of Santa Catarina State, Brazil, is home to the only known franciscana population that resides throughout the year in an estuary. Photo-identification is a technique that serves to identify individuals in their natural environment through photographs of natural or artificial body marks. The objective of this paper was to assess the feasibility of identifying individuals from this population from marks present on the dorsal fin and the body. From February 2011 to August 2013, 172 boat surveys were carried out in Babitonga Bay. Groups of franciscanas were recorded on 576 occasions and on 542 of these (94.09%) were photographed. A total of 6,953 (11.89%) from a total of 58,471 photographs were considered of high enough quality to distinguish the features used to identify individuals. Throughout the sampling period, 23 franciscanas were identified. Most of the animals exhibited nicks on the trailing edge of the dorsal fin (82.6%), a mark of longterm duration. Scratches were recorded on only one animal on a single occasion. The rate of resightings ranged from 5.26% to 78.95%, with 39.13% of the individuals showing a rate higher than 50%. A total of 41.8% of the Babitonga Bay population was identified by the presence of marks on the dorsal fin. The study indicates that photo-

identification can be applied to franciscanas, which may allow the realisation of various future studies. Because of this species threatened status, the use of this technique may become particularly important for monitoring franciscanas in Babitonga Bay and perhaps in other regions. KEYWORDS: PHOTO-ID; BRAZIL; SURVEY-VESSEL; ATLANTIC OCEAN.

Scordino, J.J., Gosho, M., Gearin, P.J., Akmajian, A., Calambokidis, J. and Wright, N. 2017. Individual gray whale use of coastal waters off northwest Washington during the feeding season 1984-2011: Implications for management. *J. Cetacean Res. Manage* 16: 57-69.

Gray whales (*Eschrichtius robustus*) in northwest Washington were studied, with the aims to: (1) increase understanding of gray whale use of the study area; (2) document the annual and seasonal fluctuations in the numbers of whales utilising the area; and (3) assess the fidelity of whales to the study area within and between years. Together these goals establish a baseline of gray whale behaviour during summer and autumn in the region of the Makah Tribe's proposed whale hunt. From 1984 to 2011, a total of 225 unique gray whales were observed, with 49% being observed again in a future year. There was significant variability in observation rates of gray whales by month and year. During the feeding season, the observation rate increased to a peak in August in the north research segment in the Pacific Ocean and to a peak in October in research segments in the Strait of Juan de Fuca and in the southern research segment in the Pacific Ocean. Gray whales were most commonly observed at depths of 5–15m over rocky substrates and often near kelp forests, although the locations where they fed were dynamic by both month and year. Some whales habitually returned to northwest Washington, however the average whale in the study area was observed in only 31.6% (SE = 1.6%) of the possible years in which they could have been observed. Gray whales in the study area had an average minimum tenure (residency time) of 24.8 days out of a possible 183 days of the feeding season. A discovery curve analysis did not reach an asymptote over the 27 years of this study showing that there is no population closure to the research area. Based on these findings, it can be concluded that even though northwest Washington is an important feeding area, most Pacific Coast Feeding Group (PCFG) gray whales do not have strong fidelity to this one region within the IWC defined PCFG range. The findings presented in this paper provide a baseline for evaluating the impact of Makah hunting activities on the behaviour of PCFG whales that utilise the Makah's traditional hunting area once hunting activities resume. KEYWORDS: GRAY WHALE; PACIFIC OCEAN; FEEDING GROUND; MOVEMENTS; SITE FIDELITY; NORTHERN HEMISPHERE; SURVEY-VESSEL.

Stone, C.J., Hall, K., Mendes, S. and Tasker, M.L. 2017. The effects of seismic operations in UK waters: analysis of Marine Mammal Observer data. *J. Cetacean Res. Manage* 16: 71-85.

Sixteen years of information from observers on board seismic survey vessels in UK and adjacent waters have demonstrated the varied responses of marine mammals to seismic surveys. Most species showed some response to firing with 'large arrays' (airgun volume 500 cubic inches or more), but responses were less evident when 'small arrays' (less than 500 cubic inches) were active. Several species/species groups responded proactively to the soft start procedure (where the level of firing is increased gradually) indicating that this can be an effective mitigation measure in reducing the risk of physiological damage. Despite the challenge in assigning ecological significance to the varied observed effects, the analyses in this study confirm that marine mammals are sensitive to noise from seismic surveys and therefore mitigation measures should continue to be applied to all seismic operations and such measures should cover all species. KEYWORDS: SHORT-TERM CHANGE; BEHAVIOUR; NOISE; MONITORING; CONSERVATION; EUROPE; SURVEY - VESSEL.

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Franklin, W., Franklin, T., Cerchio, S., Rosenbaum, H., Jenner, C., Jenner, M., Goncalves, L., Leaper, R., Harrison, P., Brooks, L. and Clapham, P. 2017. Photo-identification comparison of humpback whale (*Megaptera novaeangliae*) flukes from Antarctic Area IV with fluke catalogues from East Africa, Western Australia and Eastern Australia. *J. Cetacean Res. Manage* 17: 1-7.

Early 'Discovery mark' data together with recent photo-identification, acoustic, genetic and satellite-radio tag data revealed linkages between humpback whales migrating from breeding grounds (C) off East Africa and the Area III feeding area, from Western Australian breeding grounds (D) and the Antarctic Area IV feeding area and the East Australian breeding grounds (E1) and Antarctic Area V feeding area. These data also revealed low levels of intermingling between (E1) and (D) humpback whales in the Antarctic Area IV feeding area consistent with these being separate populations. Greenpeace photographed the ventral tail flukes of 30 individual humpback whales in the Antarctic Area IV feeding area (70°E–130°E) from 2 to 9 January 2008, between 62°47'S and 64°14'S latitude and 80°00'E and 112°57'E longitude. Comparisons of the Antarctic Area IV Greenpeace fluke catalogue (n = 30) with existing reconciled fluke catalogues from East Africa (n = 842), Western Australia (n = 1,558) and Eastern Australia (n = 1,964), yielded no photo-identification matches. An analysis of the frequencies of whales seen and not seen in Antarctica, East Africa, Western Australia and Eastern Australia relative to the frequencies expected to have been seen and not seen, based on the estimated population sizes and the sizes of the catalogues, provided evidence that the Antarctic whales photographed are from a different population to the East African and East Australian populations. There was weak evidence supporting the hypothesis that the Antarctic whales are from the Western Australian population but insufficient data were available to determine a clear outcome. A comparison of the Antarctic Area IV Greenpeace catalogue (n = 30) with other existing African, Indian Ocean, Western and Eastern Australian and/or Antarctic catalogues, together with increased sampling across the humpback whale feeding season in Antarctica and along the Western and Eastern Australian coastline during their winter migration, is likely to provide further evidence of the migratory destination of these humpback whales. It will also add to our limited knowledge of the extent of population overlap within the Antarctic Area III, IV and V feeding areas. KEYWORDS: HUMPBACK WHALE; PHOTO-IDENTIFICATION; MIGRATORY MOVEMENTS; ANTARCTIC; AFRICA; AUSTRALASIA; FEEDING AREAS; BREEDING GROUNDS; MANAGEMENT AREAS.

Wetzel, D.I., Reynolds, J.E., III, Mercurio, P., Givens, G.H., Pulster, E.I. and George, J.C. 2017. Age estimation for bowhead whales (*Balaena mysticetus*), using aspartic acid racemization with enhanced hydrolysis and derivatization procedures. *J. Cetacean Res. Manage* 17: 9-14.

Accurate determination of the ages of individual whales is key to developing effective conservation strategies for the bowhead whale (*Balaena mysticetus*). Previous attempts to develop reliable methods of age determination for this species have included using body length and baleen length measurements, baleen carbon cycling analysis, assessments of corpora accumulation, and aspartic acid racemisation (AAR; conversion of L to D enantiomers) measurements. Each of these methods has its limitations. The primary objective of this study was to improve the AAR analysis technique for determining age in bowhead whales in order to obtain consistent, reproducible results for D/L ratios for estimated ages. Using a modified AAR method, lenses from 68 bowhead whales were analysed and ages estimated. A comparison of the results to previous ageing by corpora counting or baleen carbon cycling methods for 11 of the whales showed smaller standard errors for the

AAR analyses. The modified AAR methods applied in this study increase the precision of D/L measurements and provide improved bowhead whale AAR results. KEYWORDS: BOWHEAD WHALE; AGE DETERMINATION.

Ivashchenko, Y.V., Clapham, P.J. and Brownell Jr, R.L. 2017. New date on Soviet catches of blue (*Balaenoptera musculus*) and right whales (*Eubalaena japonica*) in the North Pacific. *J. Cetacean Res. Manage* 17: 15-22.

Details are provided on 17 previously unreported catches of blue whales, and 93 catches of North Pacific right whales, all taken illegally by the former USSR. The blue whale catches were made between mid-July and mid-September 1972 in the eastern North Pacific at distances of from 96 to 626 nautical miles from the US west coast (Oregon and Washington); they highlight the inadequacy of the International Observer Scheme, as implemented in 1972, to report or detect illegal whaling. These previously unknown blue whale catches bring the Soviet total to 1,638 for the period 1948–1972. The 93 right whale catches were made during the period 1951–62 around the Kuril Islands, which brings the known total of takes of this species from 1935–1971 to 775 (including 10 taken for scientific research and officially reported at the time). KEYWORDS: WHALING-MODERN; NORTH PACIFIC; BLUE WHALE; NORTH PACIFIC RIGHT WHALE; KURIL ISLANDS; OBSERVER SCHEME; SOVIET WHALING.

Ivashchenko, Y. and Clapham, P. 2017. Evaluation of the accuracy of reported noon positions from Soviet whaling factory ships. *J. Cetacean Res. Manage*. 17: 23-28.

It has generally been assumed that the noon positions reported to the International Whaling Commission (IWC) by Soviet factory ships were accurate, despite that nation's extensive falsification of catch records. In this paper, Soviet whaling industry reports are used to investigate this issue. Comparison of available track data from the reports with information submitted to the IWC through the BIWS shows that the officially reported data provide a reasonably accurate idea of general whaling effort, with minor discrepancies attributable to differences in precision or to geo-referencing. However, the Soviet report tracks sometimes include unreported excursions for the purpose of illegal whaling, and these were omitted from the data sent to the IWC. KEYWORDS: WHALING-MODERN; USSR; PACIFIC OCEAN; SOUTHERN HEMISPHERE.

Franklin, W., Franklin, T., Andrews-Goff, V., Paton, D.A. and Double, M. 2017. Movement of two humpback whales (*Megaptera novaeangliae*) satellite-radio tagged off Eden, NSW, and matched by photo-identification with the Hervey Bay catalogue. *J. Cetacean Res. Manage* 17: 29-33.

Photo-identification studies of humpback whales off eastern Australia show low levels of movement between eastern Australia and New Caledonia whales. Some eastern Australian humpback whales migrate through the southern waters of New Zealand on route to Antarctic feeding areas. Photoidentification studies have shown that the waters near the Balleny Islands, in Antarctic Area V, are a feeding area for some eastern Australian humpback whales. However, such studies provide no details of the routes taken between New Zealand and Australia and to and from Antarctic feeding areas. Sixteen humpback whales were satellite-linked radio tagged off Eden NSW in 2008. The number and duration of the tag positions reported revealed complete migratory transits from Eden to Antarctic Area V and IV feeding areas. Photographs of the Eden humpback whales were compared to the Hervey Bay photo-identification catalogue and yielded two matches, identified from lateral body marks and dorsal fins. This study provides the first evidence that during the southern migration some humpback whales stopover at Hervey Bay and also migrate past Eden on the NSW coast. The tracks of the two whales from Eden showed that a male sighted in Hervey Bay in the same season moved southeast from Eden towards southern New Zealand. A female with site-fidelity to Hervey Bay in previous seasons, accompanied by a calf when the tag was deployed, moved down and around the coast of Victoria, across Bass Strait and then southwest into the Antarctic Area IV feeding area. Eden may be a migratory hub for humpback whales departing from and approaching the east coast of Australia. This study suggests that eastern Australian humpback whales may exhibit a more diverse range of feeding destinations, after leaving Australian coastal waters, than previously reported. KEYWORDS: HUMPBACK WHALE; PHOTO-IDENTIFICATION; SATELLITE TAGGING; MIGRATORY MOVEMENTS; ANTARCTIC; AFRICA; AUSTRALASIA; FEEDING AREAS; BREEDING GROUNDS.

Punt, A.E. 2017. Review of contemporary cetacean stock assessment models. *J. Cetacean Res. Manage* 17: 35-56.

Model-based methods of analysis are widely used to conduct cetacean stock assessments, and to provide the operating models on which management strategy evaluation is based. This paper reviews recent assessments and management strategy evaluations for cetacean populations, with a view towards establishing 'best practice' guidelines for such analyses. The models on which these analyses are based range from simple exponential trend models that ignore density-dependence to complex multi-stock age-sex- and stage-structured models that form the basis for management strategy evaluation. Most analyses assume that density-dependence is on calf survival (which implicitly includes maturity and pregnancy rate), but it could also impact the survival rate of adults or the age-at-maturity. Cetaceans seldom have more than one calf per female each year, which limits the variation in calf numbers, and places an upper limit on the effects of density-dependent calf survival. The models differ in terms of whether the population projections start when substantial catches first occurred or whether allowance is made for time-varying carrying capacity by starting the model in a more recent year. Most of the models are deterministic, but account needs to be taken of variation in cohort strength for analyses that include age-composition data or for species that are relatively short-lived. A limited number of analyses include process variability using a statespace-like modelling framework. For some stocks, abundance is so low that ideally both demographic and environmental variability should be included in models. The primary source of data for parameter estimation is a time-series of estimates of absolute abundance, although some approaches considered used a variety of data types, including relative abundance indices, mark-recapture data and minimum abundance estimates based on haplotype counts. In general, at least one estimate of absolute abundance is needed for parameter estimation; this is because there is a lack of catch-induced declines in abundance captured by indices of relative abundance that could be used to provide information on absolute abundance. Similarly, information on abundance from age- and length- composition data is limited. Most of the analyses quantify uncertainty using Bayesian methods to allow information on biological parameters, particularly the intrinsic rate of growth and the relative population at which maximum production occurs, to be included in the analyses, along with sensitivity testing. The future for the models on which assessments and management strategy evaluations are based will often involve multi-stock models that include age-, sex- and spatial-structure and are fitted as state-space formulations, although at present such models are often too computationally intensive to be feasible for implementation or there is insufficient information in the data to estimate the parameters representing all the processes, leading to simplifications, with the result that the performance of some of the methods of assessment used for cetacean stocks needs to be better understood, including through simulation testing. KEYWORDS: ASSESSMENT; BAYESIAN; CETACEAN; MANAGEMENT STRATEGY.

Currie, J.J., Stack, S.H. and Kaufman, G.D. 2017. Modelling whale-vessel encounters: the role of speed in mitigating collisions with humpback whales (*Megaptera novaeangliae*). *J. Cetacean Res. Manage* 17: 57-63.

Increasing whale populations and vessel traffic worldwide has led to an increase in reported whale-vessel collisions. This paper reports on factors that affect the rate of whale-vessel collisions in the four-island region of Maui, Hawai'i. More specifically, it aims at quantifying the probability of a whale-vessel collision with varying vessel speeds using encounter distances as a proxy. A change point model was used to

identify a speed threshold of 12.5kts (6.4m/s), which showed a significant change in the relationship between speed and mean sighting distance. A 3.4-fold decrease in close encounters with humpback whales was observed when vessels travelled at speeds of 12.5kts (6.4m/s) or less. Furthermore, results indicate that lone adult whales and calves are the most likely to be involved in a collision. A speed limit of 12.5kts (6.4m/s) is warranted in areas and/or during seasons where a high density of whales occurs. This limit aligns with a reduction in lethal vessel strikes with speed from previous studies which found a significant increase in the likelihood of mortality when vessel speed exceeds 12kts. KEYWORDS: MODELLING; SHIP STRIKES; HUMPBACK WHALE; PACIFIC OCEAN; SURVEY VESSEL; CONSERVATION.

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Balmer, B., McDonald, T., Hornsby, F., Adams, J., Allen, J., Barleycorn, A., Clarke, P., Cush, C., Honaker, A., Mchugh, K., Speakman, T., Wells, R. and Schwacke, L. 2018. Long-term trends in a northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncatus*) population in the wake of the *Deepwater Horizon* oil spill. *J. Cetacean Res. Manage.* 18: 1-9.

Bottlenose dolphins along the northern Gulf of Mexico continue to be impacted by numerous stressors including harmful algal blooms, infectious disease epizootics, and oil exposure following the Deepwater Horizon (DWH) oil spill. Studies to assess the potential impacts of the DWH oil spill on dolphins in the northern Gulf of Mexico were initiated as part of a Natural Resource Damage Assessment and included photographic-identification (photo ID) surveys to determine abundance, density, and site fidelity in St. Joseph Bay, Florida (SJB). Although significant oiling did not occur in SJB, long-term data have been collected in this region to provide insight into population-level trends in abundance/density over time. Thus, SJB dolphins could serve as a reference for comparison to other dolphin populations exposed to DWH oiling. During 2005-2007, the results of photo ID and telemetry surveys determined seasonal fluctuations in abundance and identified two different dolphin populations in SJB: residents sighted across multiple seasons and years (St. Joseph Bay Stock), and visitors that were present during the spring and fall and associated with a 2-3fold increase in abundance (Northern Coastal Stock). The goals for the current study were to compare dolphin abundance, density, and site fidelity, prior to (2005-2007), during (2010), and post-DWH (2011 and 2013) using photo-ID surveys and a spatially explicit robust-design capture-recapture (SERDCR) model. The data collected during and post-DWH paralleled previous research in that a low number of individuals with high site fidelity were sighted across seasons and years (St. Joseph Bay Stock), and abundance/density increased in the fall as a result of an influx of dolphins that were likely members of the Northern Coastal Stock. However, June and August 2010 abundance (347; 193-498, 95% CI and 394; 288-534, 95% CI, respectively), density (dolphins/km²) (2.60; 1.36-3.70, 95% CI and 2.55; 1.89-3.29, 95% CI, respectively), and site fidelity patterns were more similar to previous years' spring and fall data, with high abundance estimates, increased dolphin density in coastal waters, and elevated numbers of individuals with low site fidelity in the SJB region. Factors that could have contributed to this increase in abundance include immigration of dolphins from adjacent estuaries, population growth within the St. Joseph Bay Stock, impacts from DWH oiling, and environmental and/or prey-based cues that influence movements of the Northern Coastal Stock. The results of this study demonstrate the importance of long-term monitoring to assess impacts of current and future stressors on the dolphins in the northern Gulf of Mexico. KEYWORDS: ABUNDANCE ESTIMATE; MARK-RECAPTURE; SURVEY - VESSEL; SITE FIDELITY; PHOTO-ID.

Truchon, M.H., Measures, L., Br  thes, J.C., Albert, E. and Michaud, R. 2018. Influence of anthropogenic activities on marine mammal strandings in the estuary and northwestern Gulf of St. Lawrence, Quebec, Canada, 1994-2008. *J. Cetacean Res. Manage.* 18: 11-21.

Stranding records have long been used to monitor marine mammal mortalities and to help identify threats to populations. In coastal areas, marine mammals face numerous anthropogenic threats such as marine traffic and commercial fishing. The objective of this study was to investigate marine mammal stranding records from the St. Lawrence Estuary (SLE) and the northwestern Gulf of St. Lawrence (NWGSL), Quebec, Canada from 1994 to 2008 for evidence of anthropogenic trauma caused by entanglement in fishing gear, ship collisions and gunshots. Of 1,590 marine mammal stranding records, 12% (n = 192) had evidence of anthropogenic trauma, most incidents being reported during summer when activities such as marine traffic, most commercial fishing and recreational boating, occurred and a greater number of species were present in the area. These incidents were classified into five categories (Incidental catch, Ship collision, Severe injury, Gunshot, Other). There were 1,245 mortalities and observations on carcasses suggested that anthropogenic trauma led to the death of 11% (141/1,245) of marine mammals: 14% (87/627) of cetaceans and 9% (54/618) of seals. Mortality of seals due to anthropogenic trauma was low, involving mainly Gunshot for grey (26% or 8/31) and harbour seals (26% or 8/31). Over the study period, marine mammal incidents with evidence of anthropogenic trauma increased significantly, driven by an increase in Incidental catch for two mysticete species, the common minke whale, 42% (39/92) and humpback whale, 13% (12/92) and Other for harbour porpoise 67% (16/24). Ship collision was the most common anthropogenic trauma for fin whales (22% or 8/36) and SLE beluga5 (22% or 8/36). Severe injury was reported for 22% (2/9) of small cetaceans and 78% (7/9) of seals. Evidence from some harbour porpoise stranding records (categorised as Other) suggests illegal hunting, incidental catch, predation or scavenging by grey seals in a marine protected area. The observed increase in Incidental catch of common minke and humpback whales may be due to: (1) a shift in distribution of these two species into the SLE and NWGSL, possibly related to changes in the ecosystem; (2) changes in fishery practices; and (3) an increase in detection of marine mammal strandings. Anthropogenic trauma affecting marine mammals was documented including some species at risk, such as the harbour porpoise, the St. Lawrence estuary beluga population, blue and North Atlantic right whales, in the St. Lawrence ecosystem including in a marine protected area. This study demonstrates the usefulness of stranding records in helping to monitor human-caused mortality in marine mammal populations. KEYWORDS: STRANDINGS; INCIDENTAL CATCHES; TRENDS; ATLANTIC OCEAN; CONSERVATION.

Brodie, P. and Haulena, M. 2018. Dentinal growth layer counts of captive, known-age, mother and daughter belugas (*Delphinapterus leucas*): confirming two growth layer groups (GLG/2) per year; consequences for recovery and management. *J. Cetacean Res. Manage.* 18: 23-31.

Captive mother and daughter belugas (*Delphinapterus leucas*) of Hudson Bay origin died at the Vancouver Aquarium, in November 2016, aged 29.25 and 21.25 years. Aurora, captured at age three and captive since 1990, gave birth to Qila in 1995. Age and histories being known, the focus of this study was on total number of tooth growth layer groups (GLGs) present; one (GLG/1) or two (GLG/2) per year. Teeth from Aurora indicated two growth layers per year (GLG/2) during pre-capture and captivity. Qila deposited GLG/2 throughout her captive life. Clearly an assumption of GLG/1 over GLG/2 doubles the duration of all life stages, including lifespan and age at attainment of sexual maturity. Arguments for GLG/1 have been based on inferences (e.g. from fallout of bomb radio carbon) from adults of unknown age and history, while those for GLG/2 are based on the projection of direct observations from newborn, known-age young to 21 and 29 year-old adults from captivity. Use of radiocarbon is ingenious but such analyses have not been rigorously tested on marine mammals and the sensitivity to necessary correction factors not addressed. The new information from this study contradicts the GLG/1 hypothesis in that such an assumption would place Aurora's birth at the 1958 peak fallout of bomb radiocarbon (14C) yet she was born 29 years later in 1987, while

the birth of her daughter Qila would pre-date the birth of her mother by 13 years. This paper re-assesses three studies that assigned GLG/1 based ages to older adults using GLG/2 and concludes that their supposed births would also pre-date the realistic births of their own mothers plus as many as two previous generations. Proponents of GLG/1 have overestimated the ages of previous calves-at-capture by 200-800%. Given the growth pattern in teeth of these 21 year and 29 year old female belugas, with increasingly finer dentine GLGs deposited as the pulp tissue diminishes, it is difficult to envisage the GLG/1 tooth structures of those assumed to be 60-80 years; none are as yet available. An holistic analysis using direct observations and cross-referenced parameters does not substantiate GLG/1 which implies a 40% reduction of the intrinsic rate of natural increase; as a consequence, overestimating historical population size as well as recovery target population and the predicted date of recovery in Cumberland Sound. KEYWORDS: AGE DETERMINATION; BELUGA; BOMB RADIO-CARBON 14C; CAPTIVE; DENTINAL GLGS; GROWTH; KNOWN-AGE INDIVIDUALS; MANAGEMENT; MODELLING; NARWHAL; REPRODUCTION; SEXUAL MATURITY; POPULATION DENSITY.

Waples, R.S., Hoelzel, A.R., Gaggiotti, O., Tiedemann, R., Palsbøll, P.J., Cipriano, F., Jackson, J., Bickham, J.W. and Lang, A.R. 2018. Guidelines for genetic data analysis. *J. Cetacean Res. Manage.* 18: 33-80.

The IWC Scientific Committee recently adopted guidelines for quality control of DNA data. Once data have been collected, the next step is to analyse the data and make inferences that are useful for addressing practical problems in conservation and management of cetaceans. This is a complex exercise, as numerous analyses are possible and users have a wide range of choices of software programs for implementing the analyses. This paper reviews the underlying issues, illustrates application of different types of genetic data analysis to two complex management problems (involving common minke whales and humpback whales), and concludes with a number of recommendations for best practices in the analysis of population genetic data. An extensive Appendix provides a detailed review and critique of most types of analyses that are used with population genetic data for cetaceans. KEYWORDS: ABUNDANCE ESTIMATE; BREEDING GROUNDS; CONSERVATION; DNA FINGERPRINTING; FEEDING GROUNDS; GENETICS; HUMPBACK WHALE; MIGRATION; MINKE WHALE; REPRODUCTION; TAXONOMY.

Melnikov, V. and Zdor, E. 2018. Observations of bowhead whales along the Northern Chukotka peninsula 2010-2012 with comparisons to 1994-1996 and 2002-2005. *J. Cetacean Res. Manage.* 18: 81-91.

This paper contains information on the seasonal distribution of bowhead whales (*Balaena mysticetus*) in coastal waters of Chukotka (northeast Russia) in 2010-2012. Data from shore-based observation posts provides spatial and temporal information about whale distribution and migration in the coastal zones, as well as information about their relative numbers. The spring migration was observed only from Uelen, Russia (66°N, 149°W), near the northwestern entrance to the Bering Strait, and extended from the end of May through the first half of June. Some year-to-year differences in numbers and migration dynamics were observed. During summer, bowhead whales were sighted in the waters of the northern coast of Chukotka Peninsula in July and August. In 2010-2012, single whales and small groups of up to 4-8 whales were observed in the area for days making non-directed movements. Our observations in 2010-2012 demonstrated that many bowhead whales visited Chukotka coast in the autumn (September) before sea ice formation. From past observations, it appears that the autumn migration begins 2-3 weeks earlier on the northwestern coast of the Chukotka Peninsula than in the (northern) entry of the Bering Strait. The autumn migration of bowhead whales began with ice formation and ended with the complete freezing of the waters. Ice conditions appear to drive high variability in timing of the bowhead autumn migration. The northeastern Chukotka coast is one of the most important feeding areas for the Bering-Chukchi-Beaufort (BCB) bowhead whale population. KEYWORDS: BOWHEAD WHALE; SHORE-BASED VISUAL OBSERVATIONS; NORTHERN CHUKOTKA PENINSULA; CHUKCHI SEA; BERING STRAIT; MIGRATION.

Houser, D., Moore, K., Sharp, S., Hoppe, J. and Finneran, J. 2018. Cetacean evoked potential audiometry by stranding networks enables more rapid accumulation of hearing information in stranded odontocetes. *J. Cetacean Res. Manage.* 18: 93-101.

Knowing the hearing range and sensitivity of a marine mammal is fundamental to determining its potential for being impacted by ocean noise. Enabling stranding responders to perform hearing tests on stranded odontocetes is the most likely means by which most odontocete species will be tested and by which population-level variability in hearing will be determined. A portable auditory evoked potential (AEP) system was modified for use by stranding response teams and optimised to test odontocete hearing. Stranding responders were trained on the system and deployed it to strandings from 2010-2013. Eighteen partial or complete audiograms from common dolphins ($n = 15$) and Atlantic white-sided dolphins ($n = 3$) were obtained. Both species demonstrated typically delphinid audiograms with upper frequency limits of hearing between 113-160kHz; however, the region of best sensitivity in the Atlantic white-sided dolphin (28-56kHz) was 18-28 dB less sensitive than that of the common dolphin. A single common dolphin presented with severe hearing loss consistent with presbycusis in delphinids, but with undefined etiology. The number of audiograms obtained during the study greatly increases our knowledge about hearing in these species, neither of which are common to managed care facilities. In the case of the common dolphin, the number of animals tested allows a first estimate of population-level variability. Continued use of AEP systems by stranding responders will expedite the collection of audiometric information for previously untested species and permit sufficient sample sizes to determine population-level variability in the hearing of tested species. KEYWORDS: HEARING; NOISE; STRANDINGS; ACOUSTICS.

Lewis, T., Boisseau, O., Danbolt, M., Gillespie, D., Lacey, C., Leaper, R., Matthews, J., McInaghan, R. and Moscrop, A. 2018. Abundance estimates for sperm whales in the Mediterranean Sea from acoustic line-transect surveys. *J. Cetacean Res. Manage.* 18: 103-17.

The Mediterranean sub-population of sperm whales is believed to be isolated and is classified as Endangered on the IUCN Red List. Although there is evidence to suggest the population is declining, there is a lack of abundance data. A series of acoustic line-transect surveys were undertaken between 2004 and 2013. In 2004, 3,946km of acoustic effort was conducted in the southern Western Mediterranean basin, resulting in the detection of 159 sperm whales. While in 2007 and 2013, 10,276km of acoustic effort was conducted in the Eastern Mediterranean basin, resulting in the detection of 24 sperm whales. A pooled detection function gave an effective strip half-width of 9.8km. A correction for availability bias was made for each block based on published simulations using data on sperm whale acoustic behaviour: estimates of $g(0)$ were 0.95-0.96. Estimated abundances were: Southern Western Mediterranean Block 634 animals [374-1,077] (95% log-normal confidence interval); Hellenic Trench Block 41 [17-100]; Central Aegean Sea Block 33 [5-203]; Herodotus Rise Block 5 [1-28] and Southern Adriatic Sea Block 2 [0-12]. Estimates for all other blocks were zero. The density of sperm whales in the surveyed Southern Western Mediterranean Block was over 17 times higher than for the surveyed Eastern Mediterranean (2.12 and 0.12 whales per 1,000km² respectively). These results, combined with an acoustic survey of the northern Ionian Sea in 2003 and aerial surveys in the northern Western Mediterranean basin in 2010-11, covered approximately 57% of the likely sperm whale habitat in the Western Mediterranean and 75% in the Eastern Mediterranean. Approximate total estimates of sperm whale abundance in the Western and Eastern Mediterranean basins based on extrapolation to the unsurveyed areas are 1,678 and 164 whales respectively. This gives an estimate for the whole Mediterranean Sea of 1,842 animals. KEYWORDS: SPERM WHALE; MEDITERRANEAN SEA; ABUNDANCE ESTIMATE; DISTRIBUTION; ACOUSTICS; VOCALISATION; CONSERVATION; SURVEY - ACOUSTIC; SURVEY - VESSEL.

Irving, R.A., O'keefe, S., Warren, P., Koldewey, H.J. and Dawson, T.P. 2018. Confirmation of a new breeding area for humpback whales (*Megaptera novaeangliae*) in the central South Pacific. *J. Cetacean Res. Manage.* 18: 119-25.

Small numbers of humpback whales (*Megaptera novaeangliae*, Borowski 1781) have been visiting Pitcairn Island in the central South Pacific annually since the early 1990s. The whales have been observed between the months of June and November in mixed groups including adult males, mothers with calves and escort whales. More recently, similar small groups have also been observed at neighbouring Henderson Island, 200km ENE of Pitcairn. The sightings of mothers with very young calves, the observations of surface-active behaviours and the witnessing of (unrecorded) singing bouts, strongly suggest that the waters around these two islands are being used as calving and mating habitats during the austral winter and spring. Recent photographs and videos taken during visits to both islands confirm that calves are of a size that would suggest they have been born at either Pitcairn or Henderson Islands. Further work is required to assess how these small breeding whale groups may relate to larger groups further west, centered on Mo'orea and Rurutu in French Polynesia, which constitute part of the Cook Islands-French Polynesia Breeding Stock F. As no identification of individuals has yet been undertaken at the Pitcairn Islands, it is too early to determine whether there is any exchange of individuals with these more established groups. KEYWORDS: SOUTH PACIFIC OCEAN; BREEDING GROUNDS; REPRODUCTION; DISTRIBUTION; MIGRATION; CONSERVATION.

Stevick, P.T., Bouvert, L., Gandilhon, N., Rinaldi, C., Rinaldi, R., Broms, F., Carlson, C., Kennedy, A., Ward, N. and Wenzel, F. 2018. Migratory destinations and timing of humpback whales in the southeastern Caribbean differ from those off the Dominican Republic. *J. Cetacean Res. Manage.* 18: 127-33.

Humpback whales wintering in the entire West Indies chain are widely treated as comprising a single breeding population. However, most areas outside of Silver Bank and Samana Bay, Dominican Republic, are poorly and sporadically studied. Data is presented on the timing and movement patterns of 262 whales from the southeastern Caribbean, extending from Antigua in the north to Trinidad and Tobago in the south. Whales from the area were re-sighted in all of the major North Atlantic feeding grounds. However, of the 43 individuals re-sighted in feeding areas, animals from eastern feeding grounds were significantly over-represented, while those from western feeding areas were under-represented. This is in direct contrast to the pattern previously demonstrated in the Dominican Republic. Supporting this finding, the proportion of whales showing visible scarring on the flukes from non-lethal attack by killer whales was similar to that previously shown for Norway; yet lower than that presented from western feeding areas. The seasonal pattern of distribution in the southeastern Caribbean shows a peak of occurrence about six weeks later than in the Dominican Republic, and there is little overlap in the periods of greatest use. Sightings are uncommon before February. The peak in abundance occurs during March and April, declining during May, with some sightings extending into June. This is consistent with the pattern of sightings from historical whaling records in the southeastern Caribbean. These results suggest that the humpbacks mating and calving in this region are not a representative subset of those that winter in the Dominican Republic. Further studies will be needed to examine the spatial nature of the pattern shown here and define the nature and limits of this group, but these results suggest that some part of this breeding area represents a previously un-described distinct population segment within the North Atlantic. Given this, the widely held idea that there is a single West Indies humpback whale distinct population segment is in need of reconsideration. KEYWORDS: HUMPBACK WHALE; FEEDING GROUNDS; BREEDING GROUNDS; MIGRATION; ATLANTIC OCEAN; PHOTO-ID.

Di-Méglio, N., David, L. and Monestiez, P. 2018. Sperm whale ship strikes in the Pelagos Sanctuary and adjacent waters: assessing and mapping collision risks in summer *J. Cetacean Res. Manage.* 18: 135-47.

Humpback whales wintering in the entire West Indies chain are widely treated as comprising a single breeding population. However, most areas outside of Silver Bank and Samana Bay, Dominican Republic, are poorly and sporadically studied. Data is presented on the timing and movement patterns of 262 whales from the southeastern Caribbean, extending from Antigua in the north to Trinidad and Tobago in the south. Whales from the area were re-sighted in all of the major North Atlantic feeding grounds. However, of the 43 individuals re-sighted in feeding areas, animals from eastern feeding grounds were significantly over-represented, while those from western feeding areas were under-represented. This is in direct contrast to the pattern previously demonstrated in the Dominican Republic. Supporting this finding, the proportion of whales showing visible scarring on the flukes from non-lethal attack by killer whales was similar to that previously shown for Norway; yet lower than that presented from western feeding areas. The seasonal pattern of distribution in the southeastern Caribbean shows a peak of occurrence about six weeks later than in the Dominican Republic, and there is little overlap in the periods of greatest use. Sightings are uncommon before February. The peak in abundance occurs during March and April, declining during May, with some sightings extending into June. This is consistent with the pattern of sightings from historical whaling records in the southeastern Caribbean. These results suggest that the humpbacks mating and calving in this region are not a representative subset of those that winter in the Dominican Republic. Further studies will be needed to examine the spatial nature of the pattern shown here and define the nature and limits of this group, but these results suggest that some part of this breeding area represents a previously un-described distinct population segment within the North Atlantic. Given this, the widely held idea that there is a single West Indies humpback whale distinct population segment is in need of reconsideration. KEYWORDS: HUMPBACK WHALE; FEEDING GROUNDS; BREEDING GROUNDS; MIGRATION; ATLANTIC OCEAN; PHOTO-ID.

ISSUE 19

Augé, A.A., Otley, H., Rendell, N. and Frans, V.F. 2018. Spatial distribution of cetacean strandings in the Falkland Islands to define monitoring opportunities. *J. Cetacean Res. Manage.* 19: 1-7.

The waters around the Falkland Islands are used by many species of cetaceans, including endangered and data deficient species, but little is known about their populations. The Falkland Islands cetacean stranding database was transformed in a geo-spatial database using the available descriptions of the locations as no GPS locations were recorded until 2015. It was then used to analyse the spatial distribution of strandings over a period spanning the 1880s to 2015. A total of 169 stranding events could be given a location and mapped. Twelve stranding hotspots were identified. This paper also reports on the first recorded stranding of false killer-whales (*Pseudorca crassidens*) and Antarctic minke whale (*Balaenoptera bonaerensis*) in the Falkland Islands, increasing the total species recorded to 26. Spatially-explicit cetacean stranding databases can provide important data to monitor cetaceans in the light of environmental changes from climate change or industrial development. In the case of the Falkland Islands (remote and sparsely inhabited), identification of hotspots could be used to design an aerial monitoring programme to increase chances of detecting stranding events, organise a rescue or necropsy team to gain samples. The results in this paper should enhance local capacity to conduct research (sample collection for pollutant analyses, genetic studies, etc.) and monitor impacts of human activities on cetacean populations, including from the historical baseline of average numbers and distribution of strandings provided. KEYWORDS: FALKLAND ISLANDS; CONSERVATION; SOUTH ATLANTIC; DISTRIBUTION; WHALES; DOLPHINS-GENERAL.

Lennert-Cody, C.E., Buckland, S.T., Gerrodette, T., Webb, A., Barlow, J., Fretwell, P.T., Maunder, M.N., Kitakado, T., Moore, J.E., Scott, M.D. and Skaug, H.J. 2018. Review of potential line-transect methodologies for estimating abundance of dolphin stocks in the eastern tropical Pacific. *J. Cetacean Res. Manage.* 19: 9-21.

A twelve-year hiatus in fishery-independent marine mammal surveys in the eastern tropical Pacific Ocean (ETP), combined with a mandate to monitor dolphin stock status under international agreements and the need for reliable stock status information to set dolphin bycatch limits in the tuna purse-seine fishery, has renewed debate about how best to assess and monitor ETP dolphin stock status. The high cost of replicating previous ship-based surveys has intensified this debate. In this review, transect methods for estimating animal abundance from dedicated research surveys are considered, with a focus on both contemporary and potential methods suitable for surveying large areas for dolphin species that can form large, multi-species aggregations. Covered in this review are potential improvements to the previous ship-based survey methodology, other ship-based methods, alternative approaches based on high-resolution imagery and passive acoustics, and combinations of ship-based and alternative approaches. It is concluded that for immediate management needs, ship-based surveys, with some suggested modifications to improve precision, are the only reliable option despite their high cost. However, it is recommended that a top research priority should be development of composite methods. Pilot studies on the use of high-resolution imagery and passive acoustics for development of indices of relative abundance to be used in composite methods should be part of any future ship-based survey efforts. KEYWORDS: ABUNDANCE ESTIMATE; INDEX OF ABUNDANCE; TRENDS; SURVEY-VESSEL; SURVEY-AERIAL; SURVEY-ACOUSTIC; SURVEY-COMBINED.

Accardo, C.M., Ganley, L.C., Brown, M.W., Duley, P.A., George, J.C., Reeves, R.R., Heide-Jørgensen, M.P., Tynan, C.T. and Mayo, C.A. 2018. Sightings of a bowhead whale (*Balaena mysticetus*) in the Gulf of Maine and its interactions with other baleen whales. *J. Cetacean Res. Manage.* 19: 23-30.

Bowhead whales generally migrate into high Arctic waters in the summer months and move to lower latitudes in the wintertime. During the 1800s and early 1900s commercial whaling greatly reduced the numbers of bowhead whales in waters adjacent to the North Atlantic Ocean. In recent decades their numbers have been increasing. Thirteen sightings of a bowhead whale were recorded in four areas of the Gulf of Maine in 2012, 2014, and 2017 between latitudes 44°43'N and 41°36'N, far south of the normal range (54°N) for this species. Photographs obtained during these sightings were compared by experienced photo analysts and, based on scarring patterns, the sightings were confirmed to be of the same individual. The bowhead whale was observed alone, in addition to interacting in a social group and engaged in coordinated feeding with other mysticetes at times. The feeding and social behaviour of the bowhead whale was typical for the species but well south of its normal Arctic waters range and in the absence of conspecifics. KEYWORDS: BOWHEAD WHALE; ATLANTIC OCEAN; FEEDING; PHOTO-ID; GULF OF MAINE.

Clark, C.W., Charif, R.A., Hawthorne, D., Rahaman, A., Givens, G.H., George, J.C. and Muirhead, C.A. 2018. Acoustic data from the spring 2011 bowhead whale census at Point Barrow, Alaska. *J. Cetacean Res. Manage.* 19: 31-42.

Arrays of bottom-mounted passive acoustic recorders were used to continuously record the sounds of bowhead whales migrating past Point Barrow, Alaska for a period of 105 days in April-July 2011, spanning the duration of the visual census. Recorders were deployed in a roughly linear array configuration near the edge of the shorefast ice bordering the open lead. The recorded acoustic data were analysed from 156 sample periods comprising a total of 331 hours coincident with the visual census. Bowhead sounds in the sample periods were found by manual inspection of multi-channel sound spectrograms of the array recordings. Source locations for bowhead sounds that were received on three or more sensors within the array were calculated using a robust localisation algorithm. Very high levels of bowhead acoustic activity were observed in comparison to recording efforts undertaken during past censuses, including high rates of singing and call sequences. A total of 22,426 bowhead sounds yielded 15,647 reliable locations. Of these, 6,944 were within the rectangular aperture zone directly in front of the array and therefore used in the calculation of a new population estimate. This paper summarises one of three critical components of the research program leading to the 2011 estimate of abundance of Givens et al. (2016) and is therefore a cornerstone of the scientific basis for IWC Scientific Committee advice for this whale stock. KEYWORDS: ARCTIC; WHALING-ABORIGINAL; SURVEY-ACOUSTIC; ACOUSTICS; MIGRATION.

Weir, C.R., Taylor, M., Jelbes, P.A.Q. and Stanworth, A. 2018. Cue rates and surfacing characteristics of sei whales (*Balaenoptera borealis*) in the Falkland Islands. *J. Cetacean Res. Manage.* 19: 43-55.

The cue rate (CR: blows per whale per hour), surfacing characteristics and swim speeds of sei whales (*Balaenoptera borealis*) were quantified from focal follows carried out at Berkeley Sound (East Falkland) between January and May 2017 and off the west coast of West Falkland between February and April 2018. In Berkeley Sound, focal follows were conducted from Cape Pembroke lighthouse and from a small boat. In West Falkland all focal follows were conducted from a yacht. Thirty-seven focal follows of sei whale individuals or groups (2-5 individuals) were analysed to produce CRs ranging from 21.99 to 46.73, with a mean of 31.46 (SD = 5.12). There was no significant difference in the CRs observed from shore vs. boat platforms or between the two study areas. Maximum submergence times exceeding 13min were recorded from both individuals and groups. The durations of 51 whale surfacing events had a mean of 6.4s (SD = 1.7). The average swim speed during boat-based sei whale focal follows was 5.7kmh⁻¹. The inter-breath intervals (IBIs) recorded from 13 solitary individuals ranged from 77.2 to 180.1s, with an overall mean of 118.6s (SD = 137.6). A combined approach incorporating IBI parameters and sequence pattern was used to classify 270 IBIs into surface dives (mean = 37.2s), intermediate dives (mean = 113.7s) and true dives (mean = 332.6s). Individuals showed marked variation in dive pattern, with some exhibiting clear cycles of true dives interspersed with surface bouts while others routinely took intermediate-duration dives interspersed by single surfacings. Sei whales in Berkeley Sound exhibited a higher proportion of surface dives than whales in West Falkland, and those surface dives were of lower mean and median IBI. Individual sei whales had surface bouts comprising a mean of 3.8 blows and a mean IBI of 33.4s. These are the first quantifiable data on surfacing-dive patterns and CRs for sei whales in the Falkland Islands and across the wider range of the species. The data have conservation and management relevance, including addressing availability bias for line transect and cue count abundance estimates, incorporation into vessel strike modelling, and understanding foraging behaviour. KEYWORDS: CUE RATES; DIVING; FALKLAND ISLANDS; SOUTH ATLANTIC; SOUTHERN HEMISPHERE; SURVEY - AERIAL; SURVEY - SHORE-BASED; SURVEY - VESSEL; SWIM SPEED.

Hamilton, L.J. 2018. Large mass strandings of selected odontocete species: statistics, locations, and relation to earth processes. *J. Cetacean Res. Manage.* 19: 57-78.

Larger mass strandings of open ocean odontocetes (toothed whales) of 10+ animals are examined with a compilation of 710 worldwide events. Six species form 96% of events (false killer, long-finned pilot, melon-headed, short-finned pilot, sperm and white whales), with beaked, killer, and pygmy killer whales forming 4%. Site type was determined for 630 events - three-quarters (76%) are in bays, 14% in shallow topographically complex areas (estuarine environments, straits, keys, reef and coastal lagoons), 8% on relatively unindented coasts, with ice entrapment (of killer whales) and miscellaneous categories being 2%. For the 76% of events in bays, sites with headland-bay character make up 42%, spit-bays 20% (even though there are only four of them), indented bays 9% and unspecified bay types 5%. Headland-

bays and spit-bays become stranding sites through the properties endowed them by their mechanisms of formation and maintenance, but these mechanisms differ greatly for the two. Breakwaters, groyne series, tides, partial burial, and violent storms also appear as themes. Nearshore slopes are less than 1° for 94 of 105 sites having bathymetry information, with only two reaching or exceeding 3°. Some types of potential stranding sites can be identified by simple quantitative specifications for planform, sediment size, and seabed slope, although strandings will not necessarily occur there. There is an indication that larger strandings are globally correlated with areas of higher oceanic primary productivity near landmasses and oceanic islands, but quantitative studies are needed to clarify any such possible relationship. There is also an indication that larger strandings are associated with plate tectonics, with few events being seen on the steeper swell resistant active western margins of South America and South Island (New Zealand) in particular. In contrast several larger events are recorded for the relatively older passive margins of the south-eastern sides of these two landmasses, putatively because waves and swell have had time to construct stranding sites on them. Similarly, few larger events are seen for steeper shores adjacent to coastal highlands, such as those of South Africa and Brazil. These observations indicate previously unsuspected relations between the phenomenon of odontocete mass strandings and global scale earth and ocean processes, but they are essentially hypotheses in need of more quantitative examination. KEYWORDS: STRANDINGS; TRENDS; BAIRD'S BEAKED WHALE; BLAINVILLE'S BEAKED WHALE; CUVIER'S BEAKED WHALE; FALSE KILLER WHALE; GRAY'S BEAKED WHALE; KILLER WHALE; LONG-FINNED PILOT WHALE; MELON-HEADED WHALE; PYGMY KILLER WHALE; SHORT-FINNED PILOT WHALE; SPERM WHALE; WHITE WHALE.

Powell, J.R., Machernis, A.F., Engleby, L.K., Farmer, N.A. and Spradlin, T.R. 2018. Sixteen years later: an updated evaluation of the impacts of chronic human interactions with bottlenose dolphins (*Tursiops truncatus truncatus*) at Panama City, Florida, USA. *J. Cetacean Res. Manage.* 19: 79-93.

Panama City, Florida is considered a notorious 'hot spot' in the southeastern United States for chronic illegal feeding and harassment of bottlenose dolphins. The nature and extent of these interactions was evaluated by Samuels and Bejder (2004); they concluded that food provisioning was the basis for human interactions with wild dolphins, and that these encounters were likely harmful to dolphins. A follow-up study was conducted in 2014 to reassess the current state of human interactions with wild dolphins. The number of conditioned dolphins (n = 21) tripled compared to the previous study. Both studies found conditioned dolphins engaged in human interaction events during approximately 75% of observable time points when vessels or swimmers were present. In this study, conditioned dolphins spent as much as 81% of their time begging or patrolling and significantly decreased their distance moved while doing so. Nested multinomial regression analysis revealed conditioned dolphins engaged in resting or foraging (i.e. natural) behaviour were extremely likely to switch to begging or patrolling (i.e. interaction) behaviours when vessels or swimmers were present. Numerous high risk situations were observed for both conditioned dolphins and humans during these interactions. The latest development in illegal feeding was documented: bait boats feeding dolphins to lure the animals into interactions with tour vessels and swimmers. Our observations indicate that the problem in Panama City has escalated: dolphins are being actively provisioned, often for long periods of time; the proportion of conditioned dolphins has increased; interacting dolphins and humans are both at increased risk for injury, illness, or death; and conditioned dolphin activity budgets and movement patterns continue to be negatively impacted by human behaviour. We recommend a more aggressive management strategy, such as targeted and sustained enforcement of existing regulations as well as additional restrictions that prohibit close approaches and in-water interactions for Panama City in order to curtail continued harassment of dolphins and reduce the risk of injury for both humans and dolphins. KEYWORDS: BEHAVIOUR; BOTTLENOSE DOLPHIN; CONSERVATION; WHALE WATCHING.

Burnham, R. and Duffus, D. 2018. Patterns of predator-prey dynamics between gray whales (*Eschrichtius robustus*) and mysid species in Clayoquot Sound. *J. Cetacean Res. Manage.* 19: 95-103.

The patterns of foraging intensity of gray whales (*Eschrichtius robustus*) over a 17-year period (1997-2013) in Clayoquot Sound, Vancouver Island are examined. In this area, epibenthic mysid species are gray whales' primary prey. The analysis indicates a top-down modification on habitat quality by this apex predator. Intense foraging in one or two summer seasons contributes to reduced prey resources available in the following summer. Years of heavy predation pressure were followed by at least one year of reduced foraging, probably allowing a reprieve in which the mysids could repopulate. Over the time span several patterns were noted including: boom-bust cycles; extended periods of reduced foraging; an overall declining trend of foraging whales using Clayoquot Sound, followed by a significant prey recovery in 2010. Life history patterns of mysids are discussed in the context of their ability to recover from predation, and how this recovery during a reprieve may buffer the intensity of foraging from the previous year. The continuing ability of mysids to recover from repeated and persistent removal will determine the use of Clayoquot Sound as a gray whale foraging area in the future. KEYWORDS: PREDATION; FOOD/PREY; FEEDING GROUNDS; PACIFIC OCEAN; SURVEY-VESSEL; TRENDS; NORTHERN HEMISPHERE.

Adamczak, S.K., Kemper, C. and Tomo, I. 2018. Strandings of dolphins in the Adelaide Dolphin Sanctuary, South Australia. *J. Cetacean Res. Manage.* 19: 105-11.

The Adelaide Dolphin Sanctuary was gazetted in 2005 to protect a resident population of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) that lives in a heavily impacted urban environment. This study assesses the numbers and types of strandings before and after the creation of the sanctuary. Monitoring took place during 1987-2013, when 57 events were reported and 53 carcasses were examined by post-mortem. Events were assigned to a circumstance of death that combined post-mortem results and/or anecdotal information. The majority of records were Indo-Pacific bottlenose dolphins (n = 47, 82%) but a few common dolphins (*Delphinus delphis*, n = 7, 12%) were also documented. Many (n = 19/46, 41%) of the Indo-Pacific bottlenose dolphins were 1 year old or less. Strandings averaged 2.19 per annum for all dolphin species and 1.80 for Indo-Pacific bottlenose dolphins. When pre- (n = 20) and post-sanctuary (n = 27) data were compared for Indo-Pacific bottlenose dolphins, anthropogenic events decreased from 30% (n = 6/20) to 7% (n = 2/27) and no intentional (illegal) killings or entanglements were recorded after 2004. Unintentional anthropogenic mortalities were primarily boat collisions (n = 4 out of 5 cases). Disease was the most frequently recorded circumstance of death (n = 21) and although the number of cases increased after 2004, this may have been due to improved pathology investigations. Live strandings were rare during the study (n = 2). Despite a significant increase in overall dolphin mortalities pre- and post-sanctuary, the number of human-induced mortality events decreased significantly. Continued monitoring and post-mortems of carcasses is recommended for managing dolphins in the sanctuary. KEYWORDS: AUSTRALASIA; INDO-PACIFIC BOTTLENOSE DOLPHIN; SANCTUARIES; REGULATIONS; CONSERVATION.

ISSUE 20

Oviedo Correa, L., Fernández, M., Pachero-Polanco, J.D. and Herra-Miranda, D. 2019. Spatial analysis on the occurrence of inshore and offshore bottlenose dolphins (*Tursiops truncatus*) in Osa Peninsula waters and Golfo Dulce, Costa Rica. *J. Cetacean Res. Manage.* 20: 1-11.

The aim of this assessment is to advance our understanding in the spatial ecology of the resident inshore and offshore population of bottlenose dolphins in Golfo Dulce (GD) and Osa Peninsula Waters (OPW). Our approach used niche-based models (Phillips et al., 2006, Thorne et

al., 2012, Friedlaender et al., 2011), which provided details of how dolphins use coastal and oceanic habitats, describing the factors that influence their distribution in the study area and identifying the critical habitats to be considered for management and conservation. Our analyses indicate several important aspects of the distribution of these two ecotypes of bottlenose dolphins. As expected in the study area, these two ecological races occur in close proximity, but differ in the structural factors of the habitat they occupy. The inshore population uses areas close to the mouths of the rivers as critical foraging habitats, being influenced by tidal cycles and seasonal changes in water temperature and salinity. The offshore population in oceanic habitats must rely on prey species found in rare but profitable patches, therefore pelagic dolphins in the open ocean would often need to travel long distances searching for these patches. Distribution models illustrating the difference in habitat use presented in this assessment are key to effective management of the marine mammals' diversity in Costa Rica. KEYWORDS: COMMON BOTTLENOSE DOLPHIN; PACIFIC OCEAN; HABITAT; MODELLING; DISTRIBUTION; FEEDING GROUNDS.

Anderson, R.C. and Alagiyawadu, A. 2019. Observations of cetaceans off southern Sri Lanka, April 2007-2013. *J. Cetacean Res. Manage.* 20: 13-25.

Cetaceans were observed off the South coast of Sri Lanka in the month of April, every year over a seven-year period, 2007-13. During 48 days at sea a total of 290 cetacean sightings were recorded. Blue whales were abundant, accounting for 61% (n = 177) of all sightings. This concentration of blue whales was predicted and discovered based on a migration hypothesis and there was evidence of the expected net westward movement in April. Nevertheless, most blue whales seen were not obviously on passage and many appeared to be feeding. Mothers with calves and likely reproductive behaviour (breaching and rushing) were also observed. There were five sightings of Bryde's-type whales (*B. brydei/edeni*); four were identified as *B. brydei*, one was identified as *B. edeni*. Sperm whales were sighted 16 times within a narrow band centred just outside the 1,000m isobath. Modal group size was 10-12; based on size most individuals appeared to be mature females or immatures. Spinner dolphin (n = 35 sightings) was the most abundant species, accounting for 67% of all cetaceans seen by number of individuals. They were frequently associated with tuna and seabirds. Risso's dolphin was only seen once, despite being reported as common around Sri Lanka in the early 1980s. They were taken in large numbers by local fisheries, which may have reduced local abundance. Other species recorded were: dwarf sperm whale (n = 3 sightings); shortfinned pilot whale (n = 3); common bottlenose dolphin (n = 9); Indo-Pacific bottlenose dolphin (n = 3); pantropical spotted dolphin (n = 4); and striped dolphin (n = 4). Since the discovery of blue whales off southern Sri Lanka, commercial whale watching centred on the fishing port of Mirissa has developed rapidly, bringing new revenue to the region but also the potential for disturbance to the whales. KEYWORDS: BLUE WHALE; BRYDE'S WHALE; COMMON BOTTLENOSE DOLPHIN; DWARF SPERM WHALE; INCIDENTAL CATCHES; INDIAN OCEAN; INDO-PACIFIC BOTTLENOSE DOLPHIN; MIGRATION; PAN-TROPICAL SPOTTED DOLPHIN; RISSO'S DOLPHIN; SANCTUARIES; SCHOOL SIZE; SHORT-FINNED PILOT WHALE; STRIPED DOLPHIN; WHALE WATCHING.

Andrews, R.D., Baird, R.W., Calambokidis, J., Goertz, C.E.C., Gulland, F.M.D., Heide-Jørgensen, M.P., Hooker, S.K., Johnson, M., Mate, B., Mitani, Y., Nowacek, D.P., Owen, K., Quakenbush, L.T., Raverty, S., Robbins, J., Schorr, G.S., Shpak, O.V., Townsend Jr, F.I., Uhart, M., Wells, R.S. and Zerbini, A.N. 2019. Best practice guidelines for cetacean tagging. *J. Cetacean Res. Manage.* 20: 27-66.

Animal-borne electronic instruments (tags) are valuable tools for collecting information on cetacean physiology, behaviour and ecology, and for enhancing conservation and management policies for cetacean populations. Tags allow researchers to track the movement patterns, habitat use and other aspects of the behaviour of animals that are otherwise difficult to observe. They can even be used to monitor the physiology of a tagged animal within its changing environment. Such tags are ideal for identifying and predicting responses to anthropogenic threats, thus facilitating the development of robust mitigation measures. With the increasing need for data best provided by tagging and the increasing availability of tags, such research is becoming more common. Tagging can, however, pose risks to the health and welfare of cetaceans and to personnel involved in tagging operations. Here we provide 'best practice' recommendations for cetacean tag design, deployment and follow-up assessment of tagged individuals, compiled by biologists and veterinarians with significant experience in cetacean tagging. This paper is intended to serve as a resource to assist tag users, veterinarians, ethics committees and regulatory agency staff in the implementation of high standards of practice, and to promote the training of specialists in this area. Standardised terminology for describing tag design and illustrations of tag types and attachment sites are provided, along with protocols for tag testing and deployment (both remote and through capture-release), including training of operators. The recommendations emphasise the importance of ensuring that tagging is ethically and scientifically justified for a particular project and that tagging only be used to address bona fide research or conservation questions that are best addressed with tagging, as supported by an exploration of alternative methods. Recommendations are provided for minimising effects on individual animals (e.g. through careful selection of the individual, tag design and implant sterilisation) and for improving knowledge of tagging effects on cetaceans through increased post-tagging monitoring. KEYWORDS: BIO-LOGGING; RADIO-TAGGING; SATELLITE TAGGING; TELEMETRY.

Fiedler, P.C. and Lennert-Cody, C.E. 2019. Seasonal and interannual variations in the distributions of tuna-associated dolphins in the eastern tropical Pacific Ocean. *J. Cetacean Res. Manage.* 20: 67-79.

Seasonal and interannual (El Niño-La Niña) variations in dolphin distributions in the eastern tropical Pacific Ocean have not been quantified, in spite of an extensive research vessel database. Fisheries observer data from the yellowfin tuna purse-seine fishery, collected year-round from 1986 through 2015, were used to construct a binned spatiotemporal dataset of the presence/absence of spotted, spinner and common dolphin schools by month and 1° area. Distribution patterns were predicted from generalised additive logistic regression models applied to the binned data, with dynamic predictors of surface temperature and salinity, thermocline depth and a stratification index. The dolphin taxa, especially common dolphins, show some niche separation in relation to these variables. Predicted distributions for each taxon showed seasonal and interannual differences. Spotted and spinner dolphins responded to changes in the position and size of the eastern Pacific warm pool and avoided the equatorial cold tongue in September-October and during La Niña. Common dolphins responded to seasonal and interannual changes in the Costa Rica Dome, the cold tongue, and the coastal upwelling habitat along Baja California, Peru and Ecuador. These predicted temporal variations are consistent with changes in preferred habitat driven by environmental variability. KEYWORDS: DISTRIBUTION; EL NIÑO; MODELLING; OCEANOGRAPHY; PACIFIC OCEAN.

Punt, A.E. 2019. A note regarding conditioning simulation trials for data-poor management strategy evaluations. *J. Cetacean Res. Manage.* 20: 81-92.

Management Strategy Evaluation is a key tool used by the Scientific Committee of the International Whaling Commission to identify appropriate management strategies for commercial and aboriginal subsistence whaling. In several cases, Bayesian approaches have been used to condition the operating models and the assumed priors may substantially impact the conclusions regarding appropriate management strategies in data-poor situations. Three approaches for defining a prior on the 'scaling' parameter (on 'initial depletion', 'current depletion', and 'carrying capacity') are compared in terms of the proportion of draws from the prior that are rejected during the construction of the post-model-pre-data distribution and hence the resulting implied distribution for initial and current depletion. Overall, placing a prior on initial

depletion leads to the fewest rejected draws but the implied distribution for current depletion depends on the catch history. In contrast, placing a prior on carrying capacity leads to less optimistic distributions for initial and current depletion and perhaps to unreasonably optimistic distributions for MSY. The issue of the appropriate distribution for the 'scaling' parameter in population models should be an explicit component of Management Strategy Evaluation and Bayesian assessments in data-poor situations in general. KEYWORDS: BAYESIAN METHODS; MANAGEMENT STRATEGY EVALUATION; WHALING.

Pavanato, H.J., Gomez-Salazar, C., Trujillo, F., Lima, D., Paschoalini, M., Ristau, N. and Marmontel, M. 2019. Density, abundance and group size of river dolphins (*Inia geoffrensis* and *Sotalia fluviatilis*) in Central Amazonia, Brazil. *J. Cetacean Res. Manage.* 20: 93-100.

A boat-based survey was conducted in the Tefé river and lake (Brazil) in December 2013, during the transitional water period. A combination of strip-width transects parallel to the river, lake-margins and confluences, and cross-channel line transects in the lake, were used to cover a total distance of 670 linear kilometres of the dolphins' habitat. A total of 383 groups of Amazon river dolphin and 124 groups of tucuxi were observed. Group size, density and abundance estimates were obtained per species and habitat (tributary, lake-margin and confluence). Group sizes ranged from one to six individuals for the Amazon river dolphin and from one to eight individuals for the tucuxi. The abundance of river dolphins was higher for the Amazon river dolphin (911, CV = 0.15) than the tucuxi (511, CV = 0.26). Higher densities were found in the lake-margin and tributary for the Amazon river dolphin and in the confluences for the tucuxi. Lake-margins, confluences and tributaries are therefore proposed as critical habitats for the conservation of river dolphins in central Amazonia. The Tefé lake is identified as an area of concern due to a high number of human stressors such as boat traffic, fishing and habitat degradation. KEYWORDS: ABUNDANCE ESTIMATES; HABITAT; SURVEY-VESSEL; MONITORING; SOUTHERN HEMISPHERE; SOUTH AMERICA.

Howe, M., Lammers, M.O. and Baird, R.W. 2019. Participatory science and directed survey methods: a case study with odontocetes in the Maui Nui region of the Hawaiian Islands. *J. Cetacean Res. Manage.* 20: 101-09.

Given the difficulties and costs often associated with surveying cetaceans, enlisting members of the public to collect data offers a promising alternative approach. Comparison of cetacean 'participatory science' (also known as 'citizen science') data with data collected during traditional scientific studies helps reveal the strengths and weaknesses of a participatory science approach. With a large number of vessel operators on the water throughout the year, including dolphin-oriented tour boats, the Hawaiian Islands offer an ideal study site to employ such a dual-method comparison. The study aimed to enhance understanding of nearshore dolphin distributions relative to bathymetry. Operators of tour and fishing vessels within the shallow Maui Nui basin of the Hawaiian Islands were recruited to report delphinid sightings. Researchers conducted standard dolphin surveys within the same region. The participatory science approach was successful in generating a large sample size of sightings from five different species. Findings here demonstrate the potential value of participatory science and of using a multimethod approach to infer odontocete distribution trends relative to bathymetry in areas where both methods are feasible. Important refinements for future projects are highlighted. KEYWORDS: CONSERVATION; DISTRIBUTION; INCIDENTAL SIGHTINGS; SURVEY-VESSEL; WHALE WATCHING.

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REPORT SECTION

Reijnders, P.J.H., Donovan, G.P., Aguilar, A. and Bjørge, A. 1999. Report of the Workshop on Chemical Pollution and Cetaceans, March 1995, Bergen, Norway. *J. Cetacean Res. Manage.* (special issue) 1:1-42.

KEYWORDS: REVIEW; POLLUTION

Clausen, B. 1999. Practical guidelines for postmortem examination and tissue sampling of cetaceans for ecotoxicological purposes. *J. Cetacean Res. Manage.* (special issue) 1:43-5.

KEYWORDS: CETACEANS - GENERAL; POLLUTION; TOXICOLOGY

Aguilar, A., Bjørge, A., Donovan, G. and Reijnders, P. 1999. Proposal to the IWC on Furthering the Recommendations of the Pollution Workshop. *J. Cetacean Res. Manage.* (special issue) 1:47-53. [Also printed in: *Rep.int.Whal.Comm* 48:425-28].

KEYWORDS: POLLUTION; RESEARCH PROPOSAL

International Whaling Commission. 1999. Planning Workshop to Develop a Research Programme to Investigate Pollutant Cause-Effect Relationships in Cetaceans - 'POLLUTION 2000+'. *J. Cetacean Res. Manage.* (special issue) 1:55-82.

KEYWORDS: POLLUTION; RESEARCH PROPOSAL

Reijnders, P.J.H., Rowles, T., Donovan, G.P., O'Hara, T., Bjørge, A., Larsen, F. and Kock, K.-H. 1999. Planning Workshop to Develop a Programme to investigate Pollutant Cause-effect relationships in Cetaceans: 'POLLUTION 2000+'. Annex C. POLLUTION 2000+: after Barcelona. *J. Cetacean Res. Manage.* (special issue) 1:77-83.

KEYWORDS: POLLUTION; RESEARCH PROPOSAL

PAPERS

Aguilar, A., Borrell, A. and Pastor, T. 1999. Biological factors affecting variability of persistent pollutant levels in cetaceans. *J. Cetacean Res. Manage.* (special issue) 1:83-116

The main biological factors responsible for the variability of pollutant concentrations in cetaceans are reviewed. Diet is significant because many pollutants are concentrated through food webs. This explains most interspecific differences in pollutant levels and it may also contribute to variation among populations of the same species or even among different components of the same population when diet is subject to age-related or sex-related variations. The effect of body size is complex. Excretion rate and activity of detoxifying enzymes decrease as body weight increases, processes which would lead to higher pollutant concentrations in large animals. In contrast, a high metabolic rate, which is inversely correlated to body size, is associated with high pollutant concentrations. These opposing effects usually result in higher residue levels in smaller individuals. Body composition affects the contribution of each body compartment to the overall pollutant load. Therefore, the body load of lipophilic pollutants will strongly depend on the relative mass of blubber, a variable that shows a threefold variation among cetacean species, or, in seasonal feeders, among individuals. Nutritive condition also affects the dynamics of lipophilic pollutants. Lipid mobilisation results in an increase in residue levels, but this variation is not as large as a purely concentrative model would suggest because of enhancement of detoxification processes following a rise in tissue pollutant concentrations. Disease affects pollutant levels in different ways: impoverishing nutritive condition; altering normal physiological functions; and depressing reproduction therefore reducing reproductive transfer in females. The combined result of these processes is usually an increase in pollutant levels in diseased individuals. The concentration of lipophilic pollutants normally increases with age in males because input exceeds the ability of the organism to excrete pollutants. Variable proportions of the pollutant load are transferred to offspring during gestation and lactation, for which reason tissue concentrations in females decrease or stabilise, thus producing lower residue levels than in males. However, because not all compounds are transferred at the same rate, their relative abundance varies with age and sex. Intensity of reproductive transfer is also associated with the reproductive traits of the species, particularly the length of lactation. With the exception of size, concentrations of heavy metals increase with age in both sexes but by contrast with lipophilic pollutants, concentrations in females are similar or higher than in males. The significance of these factors of variation should be taken into account when designing sampling methodology, comparing sample groups, or evaluating toxicological impact. KEYWORDS: BIOACCUMULATION; BIOMAGNIFICATION; BOTTLENOSE DOLPHIN; BOWHEAD WHALE; CETACEANS - GENERAL; FIN WHALE; HARBOUR PORPOISE; HEAVY METALS; MINKE WHALE; POLLUTION; POLLUTION-ORGANOCHLORINES; REPRODUCTION; RIGHT WHALE; SPERM WHALE; SPOTTED DOLPHIN;

Peakall, D.B. 1999. Biomarkers as pollution indicators with special reference to cetaceans. *J. Cetacean Res. Manage.* (special issue) 1:117-24

The limited information available on biomarkers in cetaceans and pinnipeds is reviewed. The main problems with their application to cetaceans are the difficulties in obtaining suitable tissue material and in carrying out experimental work to relate pollutant levels and effects. A white whale population from the Gulf of St Lawrence has been found to have a high incidence of tumours and the presence of adducts was related to exposure to benzo(a)pyrene (PAH), a well-known carcinogen. Some research has been carried out on induction of Mixed Function Oxidases (MFOs) (mainly cytochrome P450 system) in cetaceans, but the results are not yet conclusive. Studies on other groups of animals suggest that MFOs may be valuable biomarkers, particularly if techniques to measure them in biopsy skin samples are further developed. The goal should be that wild cetaceans are physiologically normal, biomarkers can be used to identify populations whose physiological functions are outside normal limits because of excessive exposure to pollutants. Since no pristine environments currently exist, measurements of biomarkers along gradients of pollutant exposure are needed to establish normality in cetaceans. KEYWORDS: BERGEN; BIOMARKERS; DALL'S PORPOISE; DNA ADDUCTS; FIN WHALE; HAZARD ASSESSMENT; IMMUNOSUPPRESSION; MINKE WHALE; PHYSIOLOGY; PILOT WHALE - SHORT-FINNED; PINNIPED; POLLUTION; POLLUTION-HAHS; POLLUTION-ORGANOCHLORINES; POLLUTION-PESTICIDES; STRIPED DOLPHIN; WHITE WHALE

Bowles, D. 1999. An overview of the concentrations and effects of heavy metals in cetacean species. *J. Cetacean Res. Manage.* (special issue) 1:125-48

Data are presented on the biomagnification rates, accumulation and concentrations of metals in cetacean species. Concentrations of metals predominantly occur in the soft tissues, although zinc and lead concentrate in the skin and bones. Rates of uptake are dependent upon metal availability, the species' dietary preference and chemical reactions between contaminants. Differences in concentrations occur according to the sex and age of the animal, with certain metals displaying age-related trends. Mercury is the only metal which shows both biomagnification at all levels of the food chain and a positive correlation with age at all stages during a cetacean's life. Differences in concentrations occur between baleen species and toothed cetaceans. Levels tend to be lower in baleen whales, primarily due to a shorter food chain (resulting in lower bioconcentration factors) and as the principal prey species are taken from lower parts of the food chain. A number of storage and detoxifying mechanisms have been recorded in many species that may alter the effects of high metal concentrations. Data on the effects of metal toxicity in cetacean species are sparse, but tolerance limits have been proposed for mercury and cadmium. These are compared with high concentrations recorded in certain species and possible effects extrapolated. Effects of toxicity may alter depending on the species, age and sex of the animal, but indications of toxic effects have been reported. Finally, the possibility of determining regional hot-spots, where background pollution levels are high, from concentrations of mercury reported in cetacean species, are examined. KEYWORDS: BIOACCUMULATION; BIOMAGNIFICATION; POLLUTION; POLLUTION - HEAVY METALS; REVIEW; TOXICITY

Borrell, A. and Reijnders, P.J.H. 1999. Summary of temporal trends in pollutant levels observed in marine mammals. *J. Cetacean Res. Manage.* (special issue) 1:149-55

The present paper reviews reported time trends in concentrations and relative abundance of pollutants in marine mammals. Available information refers only to pinnipeds and cetaceans, mainly covers the period 1969-1988 and focuses on DDTs, PCBs and mercury. Although data are limited, there are indications that in the Canadian Arctic, mercury levels in marine mammals have increased in recent decades. By contrast, during the late 1970s and the 1980s, concentrations of DDTs and PCBs in marine mammals from highly polluted areas have tended to decrease. While this trend is likely to continue for DDTs in the future, it is foreseen that until at least the first decades of the next century, PCB levels will stabilise as degradation is compensated by new inputs caused by the recycling of the fraction currently present in non-marine compartments. KEYWORDS: CETACEANS - GENERAL; PINNIPED; POLLUTION; POLLUTION-METALS; POLLUTION-ORGANOCHLORINES; POLLUTION-PESTICIDES; REVIEW; TRENDS

Jones, P.D., Hannah, D.J., Buckland, S.J., van Maanen, R., Leathem, S.V., Dawson, S., Slooten, E., van Helden, A. and Donoghue, M. 1999. Polychlorinated dibenzo-p-dioxins, dibenzofurans and polychlorinated biphenyls in New Zealand cetaceans. *J. Cetacean Res. Manage.* (special issue) 1:157-67

Limited information is available on the concentrations of halogenated aromatic hydrocarbons (HAHs) in cetaceans from the Southern Hemisphere. This paper presents data on blubber concentrations of polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) in Hector's dolphins, dusky dolphins, southern right whale dolphins, blue whales, minke whales, Gray's beaked whales, Curvier's beaked whales and pygmy right whales stranded in New Zealand. Both HAH concentrations and toxic equivalents (TEQs) are found to be higher in Hector's dolphins, a species with an inshore distribution, than in other odontocetes, which are more oceanic. Baleen whales, which are oceanic and feed at lower trophic levels, present the lowest levels of pollutants, with PCDD and PCDF concentrations usually below detection limits. The PCB profiles of the various species suggest that they are exposed to different PCB sources. Overall, HAH levels detected are lower than those reported for comparable species in the Northern Hemisphere. The relative abundance of low chlorinated PCB congeners in New Zealand cetaceans, as compared to those from northern waters, suggests that the origin of these compounds is mostly atmospheric deposition. KEYWORDS: BEAKED WHALE-CUVIER'S; BEAKED WHALE-GRAY'S; BLUE WHALE; DUSKY DOLPHIN; HECTOR'S DOLPHIN; MINKE WHALE; POLLUTION; PYGMY RIGHT WHALE; SOUTH PACIFIC; SOUTHERN HEMISPHERE; SOUTHERN RIGHT WHALE DOLPHIN;

Cockcroft, V.G. 1999. Organochlorine levels in cetaceans from South Africa: a review. *J. Cetacean Res. Manage.* (special issue) 1:169-76

Publications on levels of organochlorines in cetaceans from South Africa are reviewed. Organochlorine contamination in cetaceans off South Africa is similar to those in Australian waters, but generally low compared to the Northern Hemisphere. An exception are the coastal dolphins inhabiting the South African east coast waters. In these animals levels are similar to Northern Hemisphere coastal cetaceans. Levels are generally higher in coastal dolphins, compared to dolphins living in deeper waters. It is suggested that these differences are directly related to the levels of industrialisation and cultivation of the surrounding area. Too few samples of either baleen whales or toothed whales are available to investigate the differences in organochlorine levels between these two groups. Similarly, even for species with the highest sample sizes - common and bottlenose dolphins - the data are insufficient to investigate trends in contaminant levels.

KEYWORDS: CETACEANS - GENERAL; INDIAN OCEAN; POLLUTION; POLLUTION-ORGANOCHLORINES; REVIEW; SOUTH ATLANTIC;

Henry, J. and Best, P. 1999. A note on concentrations of heavy metals in cetaceans from Southern Africa. *J. Cetacean Res. Manage.* (special issue) 1:177-94

Concentrations of zinc, copper, cadmium, mercury and lead were measured by atomic absorption spectrophotometry in samples of the brain, kidney, liver and muscle tissue from 178 individuals of 323 different cetacean species (4 right whales - *Eubalaena australis*, 2 pygmy right whales - *Caperea marginata*, 3 minke whales - *Balaenoptera acutorostrata*, 3 Bryde's whales - *B. edeni*, 1 humpback whale - *Megaptera novaeangliae*, 1 sperm whale - *Physeter macrocephalus*, 11 pygmy sperm whale - *Kogia breviceps*, 6 dwarf sperm whales - *K. simus*, 1 southern bottlenose whale - *Hyperoodon planifrons*, 1 Cuvier's beaked whale - *Ziphius cavirostris*, 9 Blainville's beaked whales - *Mesoplodon densirostris*, 5 strap-tooth whales - *M. layardii*, 2 True's beaked whales - *M. mirus*, 3 long-finned pilot whales - *Globicephala melas*, 30 Risso's dolphins - *Grampus griseus*, 12 bottlenose dolphins - *Tursiops truncatus*, 5 striped dolphins - *Stenella coeruleoalba*, 1 pantropical spotted dolphin - *S. attenuata*, 1 hump-backed dolphin - *Sousa chinensis*, 21 dusky dolphins - *Lagenorhynchus obscurus*, 1 hourglass dolphin - *L. cruciger*, 12 Heaviside's dolphins - *Cephalorhynchus heavisidii* and 43 common dolphins - *Delphinus delphis*). All but the hourglass dolphin were strandings or animals taken incidental to fishing operations or under scientific permit in coastal waters of South Africa or Namibia. Highest concentrations of Zn, Cu and Hg were generally found in the liver and of Cd in the kidney. Comparisons of animals pre-and post puberty indicated accumulation of hepatic mercury in the pygmy sperm whale, Risso's dolphin, dusky dolphin and common dolphin. Loss of a metal (zinc) after puberty was only shown in the common dolphin. No individual analyses exceeded proposed (human) tolerance limits for hepatic mercury and hepatic or renal cadmium. KEYWORDS: BEAKED WHALE-BLAINVILLE'S; BEAKED WHALE-CUVIER'S; BEAKED WHALE-TRUE'S; BOTTLENOSE DOLPHIN; BRYDE'S WHALE; COMMON DOLPHIN; DUSKY DOLPHIN; DWARF SPERM WHALE; HEAVISIDE'S DOLPHIN; HOURGLASS DOLPHIN; HUMP-BACKED DOLPHIN; HUMPBACK WHALE; MINKE WHALE; PILOT WHALE - LONG-FINNED; POLLUTION; POLLUTION-METALS; PYGMY RIGHT WHALE; PYGMY SPERM WHALE; RIGHT WHALE; RISSO'S DOLPHIN; SOUTH AFRICA; SOUTHERN BOTTLENOSE WHALE; SPERM WHALE; SPOTTED DOLPHIN; ; STRAP-TOOTHED WHALE; STRIPED DOLPHIN

Borrell, A. and Aguilar, A. 1999. A review of organochlorine and metal pollutants in marine mammals from Central and South America. *J. Cetacean Res. Manage.* (special issue) 1:195-207

Published data on pollutants found in marine mammals from Central and South America are limited. Few species have been studied (18) and sample sizes are usually too small to allow for proper assessment of trends or impacts of pollutants on the populations being studied. The only exceptions to this are the franciscana dolphin from Argentina and the spotted dolphin from the eastern tropical Pacific: the former population studied for organochlorines and the latter for heavy metals. Information on organochlorine levels, mainly on PCBs and DDTs, suggests low levels of exposure when compared to other regions of the world. The ratio DDT/PCB is higher than in other areas, which indicates the predominance of agricultural contamination over that of industrial origin. The generally low DDE/DDT ratio, particularly in southern America, indicates a recent usage of this pesticide in the region. Levels of mercury were moderate overall, although marine mammals from the areas where contamination by this metal is likely to be higher, such as the Amazon river, have not been studied in this regard. In contrast, mean cadmium and zinc concentrations were higher overall than those in the range typical for northern marine mammals, while copper and lead levels were comparatively low, although information on these latter metals is extremely limited. The lack of comprehensive, long-term studies makes a sound evaluation of the impact of pollutants on the marine mammals from the region unfeasible. KEYWORDS: MARINE MAMMALS; POLLUTION; POLLUTION-METALS; POLLUTION-ORGANOCHLORINES; SOUTH ATLANTIC; SOUTH PACIFIC;

Brouwer, A. 1999. Induction of biotransformation enzymes by polyhalogenated aromatic hydrocarbons (PHAHs): potential impact on animal physiology and health. *J. Cetacean Res. Manage.* (special issue) 1:209-1

Biotransformation and its role in the elimination of polyhalogenated aromatic hydrocarbons (PHAHs) has been the subject of many studies from the late seventies onwards. The notion of specific, high affinity interactions of phenolic PHAH metabolites with the plasma transport proteins of thyroid hormone and vitamin A, both in vitro and in vivo, stimulated further research into the possible role of biotransformation in the toxicity of certain PHAHs such as PCBs. Currently, phenolic metabolites of PCBs and related compounds have been identified as major metabolites in blood plasma of e.g. grey seals (*Halichoerus grypus*) and humans with background environmental exposure to these chemicals. The concentrations of the hydroxy-PCBs were in the same range as the most persistent parent congeners, such as PCB 153, 138 and 180. These phenolic metabolites were found to possess a specific range of biological activities, which differed from the parent compounds. Another potential adverse effect associated with persistent induction of biotransformation enzymes, like UDP-glucuronyl transferases (UGTs) by PHAHs, is a long-term enhanced elimination of several important endogenous ligands such as vitamin A and thyroid hormones. Reduced levels of vitamin A and thyroid hormones have been reported in most experimental animal and wildlife species exposed to PHAHs. The recent observation of the accumulation of high levels of phenolic PCB metabolites in blood and brain of late gestational rat foetuses, in parallel with reductions in both vitamin A and thyroid hormone levels, suggests that these metabolites may play an important role in the observed developmental toxicity of PHAHs. KEYWORDS: BIOMARKERS; DISEASE; HAZARD ASSESSMENT; PHYSIOLOGY; POLLUTION; POLLUTION-HAHS; POLLUTION-ORGANOCHLORINES; REPRODUCTION;

Busbee, D., Tizard, I., Stott, J., Ferrick, D. and Ott-Reeves, E. 1999. Environmental pollutants and marine mammal health: the potential impact of hydrocarbons and halogenated hydrocarbons on immune system dysfunction. *J. Cetacean Res. Manage.* (special issue) 1:223-48

This paper provides a detailed review of the immunotoxicological effects of environmental pollutants on the health of marine mammals, particularly in relation to their impact on the immune system and mechanisms of toxicity. Environmental pollutants are increasingly implicated (both directly and indirectly) with the onset of infectious disease and related mortality incidents in marine mammals. The release of chemicals into the marine environment and the subsequent bioaccumulation up the food chain may pose a serious threat to marine mammals inhabiting contaminated areas; this has been documented in various studies of pollutant concentrations in tissue samples and large scale mass mortalities. Data correlating pollutant residues with altered reproductive/developmental states, and immune system dysfunction in particular, are reported for terrestrial mammals and suggest a similar association in marine mammals. Immunology is

emphasised as a tool for assessing marine mammal health using quantitative and qualitative techniques to establish the effects of chemical pollutants. This has become increasingly important in relation to the subsequent dangers that may be posed to humans through any indirect exposure via the food chain. KEYWORDS: DISEASE; IMMUNOSUPPRESSION; POLLUTANTS; POLLUTION; POLLUTION-ORGANOCHLORINES; REVIEW;

Martineau, D., Lair, S., De Guise, S., Lipscomb, T.P. and Béland, P. 1999. Cancer in beluga whales from the St Lawrence Estuary, Quebec, Canada: a potential biomarker of environmental contamination. *J. Cetacean Res. Manage.* (special issue) 1:249-65

A population of approximately 500 white whales (*Delphinapterus leucas*) inhabits a short stretch of the St Lawrence Estuary which drains one of the most industrialised areas of the world. Over a 12-year period (1983-1994), 73 carcasses out of 175 beluga* whales reported stranded on the St Lawrence Estuary shoreline have been examined. Of these 73 carcasses, 14 (19%) were affected by 15 different malignant tumours (cancers), one animal being affected by two different types of cancer. Overall, 23% of necropsied sexually mature animals were affected by cancer. Forty percent of the 35 cancer cases reported worldwide in cetaceans occurred in this population. The estimated annual incidence rate (AIR) of cancer in St Lawrence beluga whales, a minimum figure of 233/100,000 animals, is much higher than that reported for any other population of cetaceans, and is similar to that of man, and of hospitalised cats and cattle. More specifically, the AIR of small intestinal cancers in the studied population, a minimum figure of 83/100,000 animals, is much higher than that observed in man and all animals, except in sheep in certain parts of the world, where an environmental carcinogen is believed to be etiologically involved. *The official IWC common name for *Delphinapterus leucas* is the white whale. However, as the common name used in previous papers relating to this population is the alternative 'beluga whale', this has been retained for this paper. KEYWORDS: BERGEN; BIOMARKERS; DISEASE; PATHOLOGY; POLLUTION; POLLUTION-PAHS; WHITE WHALE

Kennedy, S. 1999. Morbilliviral infections in marine mammals. *J. Cetacean Res. Manage.* (special issue) 1:267-73

Epizootics of infectious disease were unknown in cetaceans prior to 1987. However, since then there have been at least three epizootics in dolphins and two in pinniped species. Many of the clinical, pathological and epidemiological features of these events were similar to those of morbilliviral infections in terrestrial mammals. There has been speculation that contaminants may have predisposed marine mammals to these and this is discussed. Morbilliviruses are highly pathogenic viruses and caused epizootics in terrestrial mammals long before the advent of anthropogenic contaminants. KEYWORDS: BOTTLENOSE DOLPHIN; DISEASE; EPIZOOTIC; HARBOUR PORPOISE; IMMUNOSUPPRESSION; PATHOLOGY; PINNIPED; POLLUTION; POLLUTION-ORGANOCHLORINES; REVIEW; STRIPED DOLPHIN; WHITE WHALE

Special Issue 2: Right Whales: worldwide status

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REPORT SECTION

International Whaling Commission. 2001. Report of the Workshop on the Comprehensive Assessment of Right Whales: A worldwide comparison. *J. Cetacean Res. Manage.* (special issue) 2:1-60.

International Whaling Commission. 2001. Report of the Workshop on Status and Trends of Western North Atlantic Right Whales. *J. Cetacean Res. Manage.* (special issue) 2:61-87.

PAPERS

Burnell, S.R. 2001. Aspects of the reproductive biology, movements and site fidelity of right whales off Australia. *J. Cetacean Res. Manage.* (special issue) 2:89-102

Between 1991 and 1997 right whales were studied on their wintering grounds on the southern coastline of Australia, predominantly at the Head of the Great Australian Bight, where over 350 individuals have been identified. The observed mean inter-calf interval for females was 3.33 ± 0.10 years (\pm SE, $n=57$) at the Head of the Bight and 3.64 ± 0.13 years (\pm SE, $n=117$) in the wider Australian population. When inter-calf intervals of six or more years were excluded, the mean intervals became 3.28 ± 0.09 years (\pm SE, $n=56$) and 3.28 ± 0.06 years (\pm SE, $n=107$), respectively. Inter-calf intervals of two years were recorded following the early death of a neonate on two separate occasions and the implications of these 'shortened' intervals and of calvings that were not observed are discussed. The mean age at which yearlings were observed to be fully weaned was calculated to be 365 ± 8 days (\pm SE, $n=18$) from the estimated birth dates of individual calves and subsequent associations, or lack of them, between the yearlings and their cows the following year. A total of 108 movements greater than 200km in length were made by individual whales. The mean within-year movement was 730 ± 84 km, made over 34 ± 4 days (\pm SE, $n=18$), whilst the mean between-year movement was $1,036 \pm 45$ km (\pm SE, $n=87$), made over a mean interval of 3.3 ± 0.3 years (\pm SE, $n=90$). The number and direction of coastal movements observed suggest that the right whales off southern Australia comprise a single population which may undertake an almost circular, anti-clockwise migration to the south of the Australian continent. A significantly greater proportion of females displayed a level of between-year fidelity to the Head of the Bight aggregation area (92%, $n=61$) than did males (68%, $n=19$) or whales of unknown sex (63%, $n=8$). KEYWORDS: AREA-AUSTRALIA; MOVEMENT; REPRODUCTION; RIGHT WHALE; RWI; SITE-FIDELITY; SOUTHERN HEMISPHERE

Bannister, J. 2001. Status of southern right whales (*Eubalaena australis*) off Australia. *J. Cetacean Res. Manage.* (special issue) 2:103-10

The history of Australian right whaling is briefly reviewed. Most catching took place in the first half of the 19th century, with a peak in the 1830s, involving bay whaling by locals and visiting whaleships in winter and whaling offshore in the summer. In the early 20th century, right whales were regarded as at least very rare, if not extinct. The first published scientific record for Australian waters in the 20th century was a sighting near Albany, Western Australia, in 1955. Increasing sightings close to the coast in winter and spring led to annual aerial surveys off southern Western Australia from 1976. To allow for possible effects of coastwise movements, coverage was extended into South Australian waters from 1993. Evidence from 19th century pelagic catch locations, recent sightings surveys, 1960s Soviet catch data and photographically-identified individuals is beginning to confirm earlier views about likely seasonal movements to and from warm water coastal breeding grounds and colder water feeding grounds. Increase rates of ca 7-13% have been observed since 1983. Some effects of different breeding female cohort strength are now beginning to appear. A minimum population size of ca 700 for the period 1995-97 is suggested for the bulk of the 'Australian' population, i.e. animals approaching the ca 2,000km of coast between Cape Leeuwin, Western Australia and Ceduna, South Australia. KEYWORDS: ABUNDANCE; ABUNDANCE ESTIMATE; AREA-AUSTRALIA; DISTRIBUTION; RIGHT WHALE; RWI; SOUTHERN HEMISPHERE; SURVEY - AERIAL; TRENDS

Patenaude, N.J. and Baker, C.S. 2001. Population status and habitat use of southern right whales in the sub-Antarctic Auckland Islands of New Zealand. *J. Cetacean Res. Manage.* (special issue) 2:111-6

In the winters of 1995, 1996 and 1997, research was conducted in the Auckland Islands to evaluate the status of southern right whales in the New Zealand sub-Antarctic. Whales were present in high concentrations each year (maximum count of 146 whales) in a small area on the northeast side of the main island. Cow-calf pairs averaged 12% (range 9% to 14%) of the total population. Most cow-calf pairs were sighted resting at the surface (60%) or travelling (36%) and showed a strong preference for shallow (<20m depth) nearshore waters. The ratio of females to males, as determined by molecular sexing using biopsy samples, varied from 54% to 39% over the three years but did not differ significantly from 1:1 in any year. Both males and females were found in varying group sizes, with the occurrence of

social/sexual activity predominant (85%) in groups of three or more whales. Most single whales were found resting (59%) and occasionally approached the research vessel (19%). A total of 217 individual whales have been photo-identified over the three years of this study, 24% of which were resighted more than once in a season and approximately 15% of which are resighted in more than one year. The high density of whales in Port Ross during winter months, the presence of cow-calf pairs, including newborns, and the frequency of social and sexual activity indicates that the Auckland Islands are a primary wintering habitat for southern right whales in New Zealand waters. However, the low resighting rates within season and documented movement to nearby Campbell Island (290km) suggest that some whales are not resident in the Auckland Islands throughout the season. The rarity of right whales along the main islands of New Zealand and their apparent increase in numbers in the Auckland Islands suggests a major shift in habitat use from pre-exploitation times or the loss of a component of a historically subdivided stock. KEYWORDS: ABUNDANCE ESTIMATE; AREA NEW ZEALAND; BEHAVIOUR; BREEDING GROUNDS; HABITAT; POPULATIONS-STATUS; REPRODUCTION; RIGHT WHALE; RWI; SEX RATIO; SOUTHERN HEMISPHERE; SUB-ANTARCTIC

Stewart, R. and Todd, B. 2001. A note on observations of southern right whales at Campbell Island, New Zealand. *J. Cetacean Res. Manage.* (special issue) 2:117-20

Southern right whales were observed at Campbell Island, in New Zealand's sub-Antarctic ocean, over four field seasons (1983, 1994, 1995 and 1997). Whales were present in both the winter and autumn of 1994. An average of 7-21 whales were seen each season, with a maximum of 44 whales per day in July 1995. Individual whales were resighted in the area over periods of several days to two months. A change to shorter residence periods occurred between the early 1980s and 1990s. Some interchange occurs between Campbell Island and the Auckland Islands, with a recent decrease in number at the former and an increase at the latter. KEYWORDS: AREA NEW ZEALAND; BEHAVIOUR; CENSUS; PHOTO-ID; RIGHT WHALE; RWI; SOUTHERN HEMISPHERE

Patenaude, N., Todd, B. and Stewart, R. 2001. A note on movements of southern right whales between the sub-Antarctic Auckland and Campbell Islands, New Zealand. *J. Cetacean Res. Manage.* (special issue) 2:121-3

To investigate the interchange of southern right whales between wintering grounds of the New Zealand sub-Antarctic, photographs of 31 individuals from Campbell Island were compared to 244 individuals from the Auckland Islands. Three whales first identified at the Auckland Islands in 1995 or 1996 were found at Campbell Island in 1997. One whale identified at Campbell Island in 1995 was seen later that same winter at the Auckland Islands. This provides the first evidence of both within and between year movements of whales between the two New Zealand sub-Antarctic aggregations, suggesting that they are part of one intermingling population. KEYWORDS: AREA NEW ZEALAND; BREEDING GROUNDS; MOVEMENT; PHOTO-ID; RIGHT WHALE; RWI; SOUTHERN HEMISPHERE; SUB-ANTARCTIC

Cooke, J.G., Rowntree, V. and Payne, R.S. 2001. Estimates of demographic parameters for southern right whales (*Eubalaena australis*) observed off Península Valdés, Argentina. *J. Cetacean Res. Manage.* (special issue) 2:125-32

Photographs of the right whales which occur between June and December in the waters surrounding Peninsula Valdés, Argentina, have been obtained from aerial surveys conducted each year from 1971 to the present. Resightings of previously catalogued individuals enable various demographic parameters to be estimated. From analyses of multiple resightings of females accompanied by calves, estimates of the following demographic parameters were obtained, based on the data collected during 1971-90: mean calving interval 3.35 yr (SE=0.05 yr); mean age at first calving 9.1 yr (SE=0.3 yr); adult female annual mortality rate 0.019 (SE=0.005); annual percentage rate of population increase 6.9% (SE=0.7%); reproductive female population size in 1990: 328 animals (SE=21). No evidence of any trend with time in mean calving interval, mortality rate or rate of population increase was found. KEYWORDS: BIOLOGICAL PARAMETERS; INDIVIDUAL RECOGNITION; PHOTO-ID; RIGHT WHALE; RWI; SOUTH ATLANTIC

Rowntree, V.J., Payne, R. and Schell, D.M. 2001. Changing patterns of habitat use by southern right whales (*Eubalaena australis*) on their nursery ground at Península Valdés, Argentina, and in their long-range movements. *J. Cetacean Res. Manage.* (special issue) 2:133-43

Southern right whales (*Eubalaena australis*) have been studied on their nursery ground at Península Valdés, Argentina, every year since 1970. Since 1990, 1,208 individuals have been identified from photographs taken during annual aerial surveys; 618 whales were seen in two or more years. Patterns of habitat use have changed during the study in ways which suggest that right whales may be capable of substantial behavioral and ecological flexibility. One male and three females from Península Valdés have been sighted on other nursery grounds (Tristan da Cunha and southern Brazil). Three individuals from Península Valdés were sighted on feeding grounds off Shag Rocks and South Georgia. Some right whales from Península Valdés showed carbon and nitrogen isotope ratios very similar to those seen in right whales off South Africa, while others showed distinctive isotope ratios indicating that they fed in a different area. Whales of all ages and both sexes moved frequently between three major regions of concentration on the Peninsula Valdés nursery ground. Subadults and adult females with calves were resighted at higher rates than adult males and females in non-calf years. Changes in the geographic distribution of whales at the Peninsula include: (1) abandonment of a major region of concentration; (2) establishment of a nursery area adjacent to the centre of a growing whalewatching industry; and (3) small-scale shifts in distribution, possibly in response to natural and human disturbances. KEYWORDS: BREEDING GROUNDS; DISTRIBUTION; FEEDING; HABITAT; MIGRATION; MOVEMENT; RIGHT WHALE; RWI; SITE-FIDELITY; SOUTH AMERICA; SOUTH ATLANTIC; SOUTHERN HEMISPHERE; SURVEY - AERIAL

Rivarola, M., Campagna, C. and Tagliorette, A. 2001. Demand-driven commercial whalewatching in Península Valdés (Patagonia): conservation implications for right whales. *J. Cetacean Res. Manage.* (special issue) 2:145-51

One of the largest remaining populations of the southern right whale, *Eubalaena australis*, (ca 1,200 individuals in 1986) breeds along the coast of Península Valdés, in Argentine Patagonia. The area offers excellent opportunities for whalewatching because it is possible, with predictability, to have close-up views of animals of all ages. During 11 years, from 1987 to 1997, more than 337,000 tourists took part in boat excursions to watch right whales. The demand increased during this period over 14 times from 5,214 tourists in 1987 to 73,726 in 1997. From 1991 to 1994, more than 8,000 boat trips were required to satisfy a demand of 125,000 people. Most whalewatching involved pregnant animals or mothers and calves that often attempted to avoid the boats. In 1997, whalewatching generated direct revenues of at

least \$US 1 million in boat fees, and direct plus indirect revenues of over \$US 15 million (not including travel costs to Patagonia). The rapid growth of tourism in relation to whales has undisputed economic and public-awareness benefits but it is also raising concern about potentially detrimental effects on the animals. The lack of a management plan and of estimates of a tourist 'carrying capacity' allows customer demand to be the main driving force behind a commercial activity based on a vulnerable species. KEYWORDS: AREA-SOUTH AMERICA; BEHAVIOUR; BREEDING GROUNDS; CONSERVATION; RIGHT WHALE; RWI; SOUTH ATLANTIC; SOUTHERN HEMISPHERE; SUSTAINABILITY; WHALEWATCHING

de Oliveira Santos, M.C., Siciliano, S., de Souza, S.P. and Altmayer Pizzorno, J.L. 2001. Occurrence of southern right whales (*Eubalaena australis*) along southeastern Brazil. *J. Cetacean Res. Manage.* (special issue) 2:153-6

This paper reports on the occurrence of southern right whales (*Eubalaena australis*) in southeastern Brazilian waters (18°S-25°S), with evidence of their use of the region as an important calving area. Only in recent years have right whale sightings and strandings been reported regularly within the surveyed area. Of 71 distinct sightings reported since 1936, 39 (54.9%) were mother-calf pairs observed close to the shore. Most of these sightings (91.5%) were reported from early July to late October. Eight confirmed strandings of this species were observed within the surveyed area, six of which were between July and October. Stranded calves represented 62.5% of these records. Two calves showed evidence of incidental capture. The increasing number of sightings, and recent reports of stranded calves and one adult female could be indicative of an increase in cetacean research efforts in the region. However, it also suggests use of the southeastern Brazilian coast as an important right whale calving area. KEYWORDS: ABUNDANCE; DISTRIBUTION; INCIDENTAL SIGHTINGS; RIGHT WHALE; RWI; SOUTH ATLANTIC; STRANDINGS

Greig, A.B., Secchi, E.R., Zerbini, A.N. and Dalla Rosa, L. 2001. Stranding events of southern right whales, *Eubalaena australis*, in southern Brazil. *J. Cetacean Res. Manage.* (special issue) 2:157-60

Although international protection has been granted since 1935, southern right whales have only recently shown signs of recovery, possibly due to anthropogenic factors. Off Brazil, illegal hunting of right whales occurred until 1973. This paper reports on surveys conducted along the southern Brazilian coast and the information recovered on right whale strandings for this area from 1977-1995. In the first 10 years of this period only four cases were registered. However, in contrast, 20 cases were counted during the last nine years. These results are discussed in relation to marine traffic and the fisheries in the area that produce risks of collision and entanglement. Further, the possibility of storm surges being a preponderant factor in the mortality in this area is presented. These yearly rates are compared with neighbouring areas that are also inhabited by the right whales. Both possibilities fit the hypothesis that the right whales using the Brazilian coast for breeding may finally be showing signs of recovery. KEYWORDS: AREA-BRAZIL; ATLANTIC OCEAN; RIGHT WHALE; RWI; SOUTH AMERICA; SOUTHERN HEMISPHERE; STRANDINGS; SURVEY - SHORE-BASED

Best, P.B., Brandão, A. and Butterworth, D.S. 2001. Demographic parameters of southern right whales off South Africa. *J. Cetacean Res. Manage.* (special issue) 2:161-9

Aerial counts of right whale cow-calf pairs on the south coast of South Africa between 1971 and 1998 indicate an annual instantaneous population increase rate of 0.068 per year (SE=0.004) over this period. Annual photographic surveys since 1979 have resulted in 901 resightings of 550 individual cows. Observed calving intervals ranged from 2-15 years, with a principal mode at 3 years and secondary modes at 6, 9 and 12 years, but these make no allowance for missed calvings. Using the model of Payne et al. (1990), a maximum calving interval of 5 years produces the best fit to the data giving a mean calving interval of 3.12 years (95% confidence interval: 3.07, 3.17). The same model produces an estimate for adult female survival rate of 0.983 (95% CI: 0.972, 0.994). The Payne et al. (1990) model is extended to incorporate information on the observed ages of first reproduction of grey-blazed calves, which are known to be female. This allows the estimation of age at first parturition (median 7.88 years 95% CI 7.17, 9.29). Updates of estimates and confidence intervals for the other demographic parameters are: adult female survival rate 0.986 (0.976, 0.999); first year survival rate 0.913 (0.601, 0.994) and instantaneous population increase rate 0.071 (0.059, 0.082). These biological parameter estimates are shown to be compatible with the observed increase rate of the population without the need to postulate immigration. KEYWORDS: MATURATION; MODELLING; POPULATION PARAMETERS; REPRODUCTION; RIGHT WHALE; RWI; SOUTH AFRICA; SOUTHERN HEMISPHERE; SURVEY - AERIAL; SURVIVAL; TRENDS

Best, P.B., Peddemors, V.M., Cockcroft, V.G. and Rice, N. 2001. Mortalities of right whales and related anthropogenic factors in South African waters, 1963-1998. *J. Cetacean Res. Manage.* (special issue) 2:171-6

Between 1963 and 1998, 55 mortalities of southern right whales and a further three 'possible right whale' mortalities were recorded on the South African coastline. Of the known right whale mortalities, 31 could be classified as 'calves of the year', 8 as juveniles and 14 as adults. Relatively few (6.5-16.1%) of the calf mortalities could be attributed to anthropogenic factors, compared to juveniles (25-50%) and adults (35.7-57.1%). Apparent causes of death included ship strikes (4 definite, 7 possible) and entanglement (4 definite, 1 possible), with one harpooning incident. Five non-fatal ship strikes and 16 instances of non-fatal entanglement were also recorded. Whilst the gear most commonly involved in non-fatal entanglement was crayfish trap lines, three of the four entanglement fatalities involved longline gear. The incidence of scars attributable to previous entanglement remained constant amongst mature females from 1979-1997, at 3-4%. Recorded mortalities increased over the period 1963-1997 at a rate no different from that of population growth over the same period. The current level of anthropogenic mortality does not seem to be affecting population recovery. KEYWORDS: CAPTURE; FISHERIES; HUMAN IMPACT; MORTALITY; RIGHT WHALE; RWI; SHIP STRIKE; SOUTH AFRICA; SOUTHERN HEMISPHERE; STRANDINGS

Rosenbaum, H.C., Razafindrakoto, Y., Vahoavy, J. and Pomilla, C. 2001. A note on recent sightings of southern right whales (*Eubalaena australis*) along the east coast of Madagascar. *J. Cetacean Res. Manage.* (special issue) 2:177-80

Southern right whales (*Eubalaena australis*) are distributed throughout the Southern Hemisphere, where they seasonally migrate between high latitude feeding grounds and low latitude breeding grounds. While there are detailed records of historical and recent whaling off the southern, southwestern and southeastern African coasts, historical catches in Madagascar's waters are poorly documented. There have also been no recent, documented sightings of southern right whales off the east coast of Madagascar. Here we report two sightings, one of a single individual in Antongil Bay in northeastern Madagascar and the other of a mother and calf pair near Fort Dauphin on the southeastern

coast. DNA obtained from a biopsy sample of the single animal showed it was a male possessing one of the common South Atlantic right whale mitochondrial haplotypes. The available DNA data provide limited suggestive evidence that the individuals documented off Madagascar represent long-distance migrants from the well-documented South African population. However, the possibility that these southern right whales are members of a small or remnant population from the historical whaling grounds of Delagoa Bay, Sofala Bay or the Crozet Island feeding grounds cannot be excluded. Regardless of population assignment for these individuals, it appears that some southern right whales may be using different parts of Madagascar's east coast during the wintering season. KEYWORDS: 54-JAPAN; BREEDING GROUNDS; ELECTRONIC; GENETICS; INDIAN OCEAN; RIGHT WHALE; RWI; SIGHTINGS-GENERAL

Roux, J.-P., Best, P.B. and Stander, P.E. 2001. Sightings of southern right whales (*Eubalaena australis*) in Namibian waters, 1971-1999. *J. Cetacean Res. Manage.* (special issue) 2:181-5

Southern right whales were originally abundant in Namibian waters in winter and spring. They were either eradicated from the region or driven to extremely low numbers more than a century ago. Since 1971, 36 incidental sightings and three aerial surveys confirm the regular presence of the species within its historical calving range, between June and December. Calving has been recorded in four successive years and at least 10 calves were born in the area between 1996 and 1999, confirming the existence of a small established breeding population. This represents a northward extension of the hitherto known modern regular calving range in the South East Atlantic Ocean by more than 1,000km. KEYWORDS: AREA-AFRICA; DISTRIBUTION; INCIDENTAL SIGHTINGS; REPRODUCTION; RIGHT WHALE; RWI; SIGHTINGS-GENERAL; SOUTHERN HEMISPHERE; SURVEY - AERIAL

Reeves, R.R. 2001. Overview of catch history, historic abundance and distribution of right whales in the western North Atlantic and in Cintra Bay, West Africa. *J. Cetacean Res. Manage.* (special issue) 2:187-92

The catch history of right whales (*Eubalaena glacialis*) in the western North Atlantic has been studied in a series of projects. Data from European archives on early Basque whaling, centred in the Strait of Belle Isle, showed that there were at least a few thousand right whales in the northern part of the range in the sixteenth century. Data from shore whaling in the eastern United States supplemented by British customs data indicated that there were still more than a thousand right whales in the southern part of the range (i.e. south from Nova Scotia) in the late seventeenth century. Right whales were depleted throughout the western North Atlantic by the middle of the eighteenth century, but small shore whaling enterprises persisted in some areas and pelagic whalers continued to kill right whales opportunistically. An increase in alongshore whaling occurred at Long Island (New York) beginning in the 1850s and in North and South Carolina, Georgia and northern Florida in the 1870s-1880s. By the start of the twentieth century only a few crews of shore whalers remained active in Long Island and North Carolina, and their whaling efforts were desultory. All evidence points to stock depletion as the primary reason for the demise of organised whaling for right whales in eastern North America. Recent sightings indicate that some right whales travel from the Bay of Fundy and Scotian Shelf far to the north and east, at least occasionally reaching the historic Cape Farewell Ground. Areas known to have been used regularly by right whales in the past (e.g. Gulf of St Lawrence, Delaware Bay) are now visited seasonally by only a few individuals. Recent surveys of Cintra Bay, a historic right whale wintering ground in the eastern North Atlantic, provided no evidence of continued use by right whales. KEYWORDS: ABUNDANCE; ABUNDANCE ESTIMATE; AREA-AFRICA; DISTRIBUTION; NORTH ATLANTIC; RIGHT WHALE; RWI; WHALING - HISTORICAL

Knowlton, A. and Kraus, S. 2001. Mortality and serious injury of northern right whales (*Eubalaena glacialis*) in the western North Atlantic Ocean. *J. Cetacean Res. Manage.* (special issue) 2:193-208

Northern right whales in the western North Atlantic number about 300 animals and have shown little sign of recovery in recent decades. Mortality and serious injury due to human activities, particularly commercial fishing and shipping, are thought to be significant factors limiting their recovery. From 1970-1999, 45 right whale deaths were reliably documented. Sixteen of these fatalities (35.5%) were due to ship collisions, and three (6.7%) were due to entanglement in fishing gear. The remainder were neonates (13; 28.9%) and 'unknown cause' mortalities (13; 28.9%). Criteria for defining serious injuries and mortalities from entanglement or ship strikes were developed and include any animal carrying fishing gear, cuts from entanglement or ship strike deeper than 8cm, swelling or necrosis, evidence of poor health from such interactions, and, in carcasses, evidence of haematoma, haemorrhaging or broken bones. A total of 56 animals fitting the defined criteria were documented from 1970-1999: 31 (55.4%) from entanglement and 25 (44.6%) from ship strikes. Nineteen were fatal (16 ship strikes, 3 entanglements), 10 were possibly fatal (2 ship strikes, 8 entanglements) and 27 were non-fatal (7 ship strikes, 20 entanglements). The breakdown of potentially serious injuries by age and sex reveals no difference in levels between sexes but shows a 3.3:1 higher level of interaction in juveniles and calves versus adults. The data show that ship strikes are more immediately lethal, but entanglements can result in long term deterioration of an animal and may be responsible for higher levels of mortality than previously thought. Considering that some animals become entangled, drown and never return to the surface, even these levels may be underestimated. Between 1986 and 1999, 84 animals were presumed dead based on a lack of resightings for six years. There were 32 confirmed deaths during this time period suggesting that at least as many unreported deaths occurred as carcasses were reported. Definitive actions need to be taken to reduce the level and severity of anthropogenic injuries and deaths. Actions could include continued disentanglement efforts, gear modifications, seasonal closures for fisheries, mandatory ship reporting, ships' routing measures and speed restrictions for commercial shipping. KEYWORDS: ENTANGLEMENT; FISHERIES; HUMAN IMPACT; MORTALITY; NORTH ATLANTIC; NORTHERN HEMISPHERE; RIGHT WHALE; RWI; SHIP STRIKE; STRANDINGS

Kenney, R.D. 2001. Anomalous 1992 spring and summer right whale (*Eubalaena glacialis*) distributions in the Gulf of Maine. *J. Cetacean Res. Manage.* (special issue) 2:209-23

No right whales (*Eubalaena glacialis*) were sighted during aerial surveys in May-July 1992 in the Great South Channel region of the South-western Gulf of Maine. This was the first year that spring surveys failed to detect right whales in this region. During the late spring/early summer season when right whales would normally be expected in the Great South Channel, a few were sighted in the central Gulf of Maine, none were found in their usual late summer/early autumn feeding area near Nova Scotia and a few were seen in Massachusetts Bay. The absence of right whales in the Great South Channel in 1992 can be attributed to a shift in the regional zooplankton community. The usual spring zooplankton of the region is strongly dominated by the calanoid copepod *Calanus finmarchicus*, vertically and horizontally aggregated into dense patches which are the preferred foraging areas of right whales. The 1992 zooplankton was dominated by pteropods, distributed evenly throughout the water column. It is possible, although unlikely, that pteropods are unacceptable prey for right whales. A more likely explanation is that their local densities within the small-scale patches were below the energetic threshold required for

successful right whale feeding. The shift in zooplankton dominance in 1992 is likely related to significantly reduced water temperatures and a delay in the development of the usual hydrographic structure of the region. The 1992 temperature and hydrographic anomalies, in turn, can be attributed principally to an unusually large influx of colder and fresher Scotian Shelf Water, and may have been enhanced by widespread cooling of the Northern Hemisphere caused by sulphuric acid haze in the atmosphere from the June 1991 eruption of Pinatubo volcano in the Philippines. KEYWORDS: CLIMATE CHANGE; DISTRIBUTION; ECOSYSTEM; FEEDING GROUNDS; NORTH ATLANTIC; OCEANOGRAPHY; PATCHES; PREY; RIGHT WHALE; RWI

Mayo, C.A., Letcher, B.H. and Scott, S. 2001. Zooplankton filtering efficiency of the baleen of a North Atlantic right whale, *Eubalaena glacialis*. *J. Cetacean Res. Manage.* (special issue) 2:225-9

In order to define the trophic requirements of the North Atlantic right whale, a series of experiments were designed to examine the food capture characteristics of the species. The food filtering efficiency of the baleen of an immature right whale was tested in a flume using graded samples of zooplankton, primarily calanoid copepods, collected in the path of surface-feeding whales. The filtering capacity decreased with decreasing prey organism size, so that greater than 95% of the available caloric content of the zooplankton samples was captured in size fractions collected on 333µm mesh nets. The experiments demonstrate that the filtering efficiency of the baleen narrowly focuses the right whale's feeding on an energy-rich, yet spatially and temporally variable, portion of the mid-water food resource. KEYWORDS: COPEPODS; DIET; EUPHASIIDS; FEEDING; NORTH ATLANTIC; NUTRITION; PREY; RIGHT WHALE; RWI

Kraus, S., Hamilton, P., Kenney, R., Knowlton, A. and Slay, C. 2001. Reproductive parameters of the North Atlantic right whale. *J. Cetacean Res. Manage.* (special issue) 2:231-6

North Atlantic right whale reproduction was assessed for the period 1980 through 1998. At the end of this period, we estimated there were between 299 and 437 right whales alive, including 70 mature females. Using maximum and minimum population estimates for the entire period, mean values for gross annual reproductive rate were 0.36 and 0.49 respectively, and the mean value for calves per mature female per year was 0.25. There is a significant decreasing trend in calves per mature female per year over the entire study period. The mean age at first calving is 9.53 years. The mean number of cows recruited annually since 1985 is 3.8. Mean annual calving intervals have increased significantly during the study period from 3.67 years (1980-1992) to over 5 years (1993-1998). Although the North Atlantic population is affected by significant anthropogenic mortality, diminishing reproductive rates are probably also responsible for the plight of this species. KEYWORDS: NORTH ATLANTIC; REPRODUCTION; RIGHT WHALE; RWI; TRENDS

Kraus, S.D. and Hatch, J.J. 2001. Mating strategies in the North Atlantic right whale (*Eubalaena glacialis*). *J. Cetacean Res. Manage.* (special issue) 2:237-44

Data from 210 groups of right whales engaged in apparent courtship behaviour were examined. Photo-identification of individual whales, videotapes and underwater recordings were used to analyse the composition and function of these groups. Most groups were composed of one female and several males involved in sexual activity. Underwater recordings made of eight groups indicated that females within the groups emitted calls, probably to attract males. Except to breathe, females remained inverted at the surface, making copulation difficult. Females did not actively select mates, but instead created conditions that incited competition among males. Males used agility, strength, stamina and large callosities to compete for mating opportunities when the female rolled over to breathe. Males also probably competed through sperm competition. Maintaining favourable positions next to a female appeared to provide males with the most opportunities to copulate, and repeated copulations with the same female may have increased the probability of displacing competing male's sperm. KEYWORDS: BEHAVIOUR; COMPETITION; NORTH ATLANTIC; PHOTO-ID; REPRODUCTION; RIGHT WHALE; RWI; SOCIAL; VOCALISATION

Brown, M.W., Brault, S., Hamilton, P.K., Kenney, R.D., Knowlton, A.R., Marx, K., Mayo, C.A., Slay, C.K. and Kraus, S.D. 2001. Sighting heterogeneity of right whales in the western North Atlantic: 1980-1992. *J. Cetacean Res. Manage.* (special issue) 2:245-50

The population of western North Atlantic right whales (*Eubalaena glacialis*) is distributed primarily between Florida, USA and Nova Scotia, Canada, aggregating seasonally in five geographically distinct, high-use areas. To test the effectiveness of monitoring all demographic classes (juveniles, adult males and females) of the population in these five habitat areas, an evaluation was carried out of the identification records of catalogued right whales collected between 1980 and 1992, for which the age, sex and reproductive status (for adult females) were known. The mean annual identification frequency of adult females was significantly lower than that of adult males, juvenile females and juvenile males. Among adult females, reproductively active females were seen significantly more often than expected when lactating (with a calf) than during their pregnancy or resting years. These data suggest that, while research efforts in the five high-use habitat areas have had relatively equal success at monitoring juvenile males and females and adult males, many adult females are segregated at times from the rest of the population. Lower variability in annual identification frequencies of adult females indicates that they may be more site specific in their distribution than males, particularly during the years when they are pregnant or resting from a previous pregnancy. Re-running these analyses using sighting records updated through 2000 will help determine if the trends continue to be documented regardless of changes in survey effort and patterns of habitat use of some animals. KEYWORDS: MONITORING; NORTH ATLANTIC; NORTHERN HEMISPHERE; POPULATION ASSESSMENT; RIGHT WHALE; RWI; SIGHTINGS-GENERAL

Kenney, R.D., Mayo, C.A. and Winn, H. 2001. Migration and foraging strategies at varying spatial scales in western North Atlantic right whales. *J. Cetacean Res. Manage.* (special issue) 2:251-60

Western North Atlantic right whales (*Eubalaena glacialis*) utilise several important foraging habitats off the northeastern United States and eastern Canada, where they feed on dense patches of zooplankton. At a fundamental level, a right whale's optimal strategy should be to locate and exploit the prey patches with the highest net energetic return from foraging. There remain many questions, however, concerning their migration and foraging strategies and the environmental cues and sensory modalities involved in migration and foraging, all of which are likely to vary at different spatial scales. For example, a right whale most likely uses different mechanisms and strategies for location of primary feeding grounds than those used for detection of optimum prey patches within a feeding area. This paper proposes a multi-scaled, hierarchical, conceptual model of right whale migratory and foraging strategies and presents a variety of hypotheses concerning the

mechanisms involved. Right whales may return to the general area of their feeding grounds based on prior experience. The locations of successful foraging in the immediately preceding years are likely to be re-visited, as are habitats to which an animal was exposed while accompanying its mother during its first year of life. It is also possible that the whales utilise large- or medium-scale environmental cues, such as currents, temperature discontinuities, or salinity signals indicating coastal plumes, to locate likely areas of high zooplankton patch density. Whilst on their feeding grounds, right whales tend to be aggregated, but there are usually outliers which may represent occasional excursions in search of other prey patches, though there is currently no evidence to address whether they communicate information about prey to other individuals. Their behaviour whilst actively feeding indicates that they can detect differences in patch density and adjust their behaviour accordingly. A likely sensory mechanism for quantification of patch density and triggering of feeding behaviour would be the vibrissae around the anterior opening of the mouth. KEYWORDS: BEHAVIOUR; DISTRIBUTION; FEEDING GROUNDS; FORAGING; HABITAT; MIGRATION; MOVEMENT; NORTH ATLANTIC; PATCHES; RIGHT WHALE; RWI; SITE-FIDELITY

Scarff, J.E. 2001. Preliminary estimates of whaling-induced mortality in the 19th century North Pacific right whale (*Eubalaena japonicus*) fishery, adjusting for struck-but-lost whales and non-American whaling. *J. Cetacean Res. Manage.* (special issue) 2:261-8

This study develops preliminary estimates of total whaling-induced mortality of northern right whales in the 19th century North Pacific pelagic whale fishery. Best's (1987) study of American whaling returns resulted in estimates of the total American catch of 14,480 and 15,374 northern right whales during the period 1839-1909. The present study offers adjustment factors to estimate the total mortality from these catch data. Quantitative data from 14 pelagic expeditions for northern right whales in the North Pacific from 1838-1860 and additional anecdotal information about struck-but-lost animals is reviewed. On 12 voyages, 327 northern right whales were struck with harpoons, but only 133 landed. Adjusted for the subsequent recovery of struck whales, this implies a ratio of 2.43 whales struck for each whale eventually secured and flensed by whaleships. Data from four voyages show that of 148 northern right whales struck with harpoons, 14 sank before they could be processed. From a sample of five voyages, 80 northern right whales were landed and 31 carcasses sank without being secured. During the height of pelagic whaling in the North Pacific, approximately 10% of the fleet was non-American, primarily French. Adjusting recorded catch estimates for struck-but-lost mortality and non-American whaling yields preliminary estimates of total mortality in this fishery in the range of 26,500-37,000 animals during the period 1839-1909. In the single decade of 1840-49, between 21,000-30,000 northern right whales may have been killed in the North Pacific, Sea of Okhotsk and Bering Sea, representing about 80% of the northern right whales killed in this region during the period 1839-1909. KEYWORDS: ABUNDANCE ESTIMATE; NORTH PACIFIC; NORTHERN HEMISPHERE; RIGHT WHALE; RWI; WHALING - HISTORICAL

Brownell, R.L., Clapham, P.J., Miyashita, T. and Kasuya, T. 2001. Conservation status of North Pacific right whales. *J. Cetacean Res. Manage.* (special issue) 2:269-86

The North Pacific right whale (*Eubalaena japonica*) is among the most endangered of all great whales, having been subject to intensive commercial whaling in the 19th century. All available 20th century records of this species in the North Pacific were reviewed. There has been a total of 1,956 recorded sightings since 1900; of these, 991 came from the western North Pacific, 690 from the eastern North Pacific and 284 had no location specified. Thirteen strandings (all but one from the western North Pacific) were recorded. Known catches for commercial or scientific purposes totalled 738 (327 in the western North Pacific, 411 in the eastern North Pacific). Most of the reported Soviet 'sightings' in the eastern North Pacific were actually catches, as may be the case for Soviet sightings in the Okhotsk Sea. In addition, the impact of known Soviet illegal catches in the Okhotsk Sea may be reflected in an apparent decline in sightings after the 1960s (although this may be partly explained by low observer effort). Overall, the data support the hypothesis that at least two stocks of right whales exist in the North Pacific. Any recovery in the western North Pacific population was compromised by the Soviet catches in the Okhotsk region, although recent sightings suggest that this population is still large enough to sustain reproduction. By contrast, Soviet catches in the now-smaller eastern North Pacific population have probably irreversibly damaged any recovery. The extreme paucity of sightings and virtual absence of reproduction in the eastern North Pacific region suggest that this population may become extinct when its remaining members die in the 21st century. Although the prognosis for this population is poor, a long-term monitoring programme is required to better understand its conservation status and to determine whether it may be affected by human-related problems that would require mitigation. KEYWORDS: CONSERVATION; DISTRIBUTION; NORTH PACIFIC; NORTHERN HEMISPHERE; PACIFIC OCEAN; RIGHT WHALE; RWI; WHALING - HISTORICAL; WHALING - MODERN

LeDuc, R.G., Perryman, W.L., Gilpatrick, J.W.J., Hyde, J., Stinchcomb, C., Carretta, J.V. and Brownell, R.L., Jr. 2001. A note on recent surveys for right whales in the southeastern Bering Sea. *J. Cetacean Res. Manage.* (special issue) 2:287-9

Research vessel and aerial platforms were used between 1997 and 2000 to collect genetic and photographic data from a small population of right whales that summers in the southeastern Bering Sea. Totals of 11 and six unique individuals were identified using photographic and genetic methods, respectively. Single matches between years occurred using both methods, and all genetic samples turned out to be from male whales. Long-term research is needed to estimate the size of this population and to determine what threats the whales may be facing. KEYWORDS: GENETICS; NORTH PACIFIC; PHOTO-ID; RIGHT WHALE; RWI; SURVEY - AERIAL; SURVEY-VESSEL

Hiby, L. and Lovell, P. 2001. A note on an automated system for matching the callosity patterns on aerial photographs of southern right whales. *J. Cetacean Res. Manage.* (special issue) 2:291-5

Photographs showing the callosity patterns of southern right whales (*Eubalaena australis*) are currently compared by eye to identify individuals and monitor their occurrence within certain areas. This paper describes software designed to reduce the number of by eye comparisons required to maintain each of the existing local photo-identification catalogues. The software is used to extract, from each photograph, a viewpoint-independent description of the shape and location of each callosity which generates a parallel catalogue of extracts. This is then compared with the description extracted from each new photograph to generate a list of similarity scores and thus highlight likely matches. The software can also be used to compare the different catalogues of extracts with each other. Using a test set of 67 photographs of 23 whales taken from 1974 to 1986, the software reduced the number of by eye comparisons required to identify all individuals by 93% when compared with a purely random search. KEYWORDS: PHOTO-ID; RIGHT WHALE; RWI; SOUTHERN HEMISPHERE

Burnell, S. and Shanahan, D. 2001. A note on a prototype system for simple computer-assisted matching of individually identified southern right whales, *Eubalaena australis*. *J. Cetacean Res. Manage.* (special issue) 2:297-300

A system using computer assistance in the matching of the callosity patterns of individual southern right whales is described. When provided with a digitised representation of an individual whale's callosity pattern, the prototype system produces a hierarchical output of the most similar patterns in the database with relatively high accuracy. A trial database of binary images of the callosity patterns of 165 individually identified southern right whales was created. A further two replicates each of nine different individual whales within the trial database, were then created by two different operators, producing a test set of 18 images. A software program, utilising a pattern recognition algorithm and incorporating a mouse driven user interface, was developed so that when provided with a binary bitmap of an individual whale from the test set, the program compares it against a trial database of previously saved bitmaps and produces a hierarchical output of the most similar whales, or nearest 'matches'. For 15 of the 18 test images (83%), the system returned the correct whale as the top match out of the 165 in the trial database. For the remaining three test images the correct whale was the second, sixth and sixteenth ranked whale in the trial database containing 165 whales. The program was successful in reducing the number of individuals required for manual comparison to a small percentage of the total catalogue, with a high degree of accuracy, and with a significant associated time saving. It is envisaged that the final matching will continue to be done visually by an experienced operator using the original photographs. Further refinement of the system with the aim of streamlining and simplifying the input process and incorporating partial pattern recognition is intended. KEYWORDS: PHOTO-ID; RIGHT WHALE; RWI; SOUTHERN HEMISPHERE; TECHNIQUES

Moore, M.J., Miller, C.A., Morss, M.S., Arthur, R., Lange, W.A., Prada, K.G., Marx, M.K. and Frey, E.A. 2001. Ultrasonic measurement of blubber thickness in right whales. *J. Cetacean Res. Manage.* (special issue) 2:301-9

The right whale population in the northwestern Atlantic appears to face the risk of extinction: ship and fishing gear trauma are significant mortality factors, but calving rates are also depressed compared to southern right whales. A major factor in calving success in many species is body condition. Knowledge of the dynamics of body condition is also important in studies of juvenile and sub-adult growth and seasonal changes in adults. This paper describes a method to assess body condition in live right whales. To characterise the acoustic properties of the blubber/muscle interface we first studied samples of Atlantic white-sided dolphin and right whale in the laboratory. Tissue heterogeneity was examined grossly and in histological sections. Acoustic echoes were strong from the sub-dermal connective tissue sheath(s). Echo strengths did not appear to vary with lipid content. We then used a 0.5MHz ultrasound transducer on a cantilevered 12m pole to touch the back of surfacing right whales briefly. Multiple laboratory and field measurements on individual animals suggest repeated measures of blubber thickness at a single location are reasonably consistent. Data will be normalised to both sampling position on the body and to length of the animal, estimated by mensuration from stereo video images of the animal during sampling. In this way, using a long-term consistent database of blubber thickness measurements, and catalogued reproductive histories from on-going photographic identification studies, we plan to assess the significance of changing body condition in right whale population dynamics. KEYWORDS: BLUBBER; NORTH ATLANTIC; NUTRITION; REPRODUCTION; RIGHT WHALE; RWI; ULTRASOUND TECHNIQUES

Special Issue 3: Humpback Whales: status in the Southern Hemisphere

edited by J.L. Bannister, N. Gales, K. Findlay, A. Zerbini, G.P. Donovan
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REPORT SECTION

International Whaling Commission. 2011. Report of the Workshop on the Comprehensive Assessment of Southern Hemisphere humpback whales, 4-7 April 2006, Hobart, Tasmania. *J. Cetacean Res. Manage.* (special issue 3):5-50.

PAPERS

Branch, T.A. 2011. Humpback abundance south of 60°S from three complete circumpolar sets of surveys. *J. Cetacean Res. Manage.* (special issue 3):51-70.

Austral summer estimates of abundance are obtained for humpback whales (*Megaptera novaeangliae*) in the Southern Ocean from the IWC's IDCR and SOWER circumpolar programmes. These surveys have encircled the Antarctic three times: 1978/79–1983/84 (CPI), 1985/86–1990/91 (CPII) and 1991/92–2003/04 (CPIII), criss-crossing strata totalling respectively 64.3%, 79.5% and 99.7% of the open-ocean area south of 60°S. Humpback whales were absent from the Ross Sea, but were sighted in all other regions, and in particularly high densities around the Antarctic Peninsula, in Management Area IV and north of the Ross Sea. Abundance estimates are presented for each CP, for Management Areas, and for assumed summer feeding regions of each Breeding Stock. Abundance estimates are negatively biased because some whales on the trackline are missed and because some humpback whales are outside the survey region. Circumpolar estimates with approximate midpoints of 1980/81, 1987/88 and 1997/98 are 7,100 (CV = 0.36), 10,200 (CV = 0.30) and 41,500 (CV = 0.11). When these are adjusted simply for unsurveyed northern areas, the estimated annual rate of increase is 9.6% (95% CI 5.8–13.4%). All Breeding Stocks are estimated to be increasing but increase rates are significantly greater than zero only for those on the eastern and western coasts of Australia. Given the observed rates of increase, the current total Southern Hemisphere abundance is greater than 55,000, which is similar to the summed northern breeding ground estimates (~60,000 from 1999–2008). Some breeding ground abundance estimates are far greater, and others far lower, than the corresponding IDCR/SOWER estimates, in a pattern apparently related to the latitudinal position of the Antarctic Polar Front. KEYWORDS: HUMPBACK WHALE;

ABUNDANCE ESTIMATE; ANTARCTIC; BREEDING GROUNDS; DISTRIBUTION; FEEDING GROUNDS; MONITORING; SOUTHERN HEMISPHERE; SOUTHERN OCEAN; SOWER; SURVEY-VESSEL; TRENDS.

Best, P.B. 2011. A note on the age at sexual maturity of humpback whales. *J. Cetacean Res. Manage. (special issue 3)*:71-74.

The conclusion of researchers in the 1950s that humpback whales reached sexual maturity at about age five was largely influenced by their interpretation of baleen tracings, and to achieve consistency with these tracings the accumulation rate of ear plug laminations (growth layer groups: GLGs) was assumed to be two per year. However, ovulation and natural mortality rates calculated by these researchers under the same assumption produced estimates that are difficult to reconcile with other biological data or with more recent estimates using individual re-sighting data. Such disparities are reduced or disappear when an annual accumulation rate is used, in which case their ear plug data would have indicated a mean age at sexual maturity of 9–11 years. Recent estimates of the age of female humpback whales at first calving using longitudinal studies of photoidentified individuals have produced conflicting results, some (from southeastern Alaska) being compatible with the earlier age-determination studies, others (from the Gulf of Maine) suggesting a much younger age. KEYWORDS: HUMPBAC WHALE; GROWTH; AGE DETERMINATION; AGE AT SEXUAL MATURITY; PHOTO-ID.

Matsuoka, K., Hakamada, T., Kiwada, H., Murase, H. and Nishiwaki, S. 2011. Abundance estimates and trends for humpback whales (*Megaptera novaeangliae*) in Antarctic Areas IV and V based on JARPA sightings data. *J. Cetacean Res. Manage. (special issue 3)*:75-94.

Sighting survey data from the Japanese Whale Research Program under Special Permit in the Antarctic (JARPA) are analysed to obtain abundance estimates for humpback whales (*Megaptera novaeangliae*) south of 60°S. The surveys were conducted during the 1989/90–2004/05 austral summer seasons (mainly in January and February); the survey areas alternated between Area IV (70°E–130°E) and Area V (130°E to 170°W) each year. Primary sighting effort totalled 293,811 n.miles over 6,188 days. Abundance estimates are obtained using standard line transect analysis methods and the program DISTANCE. Estimated densities of humpback whales were highest east of the Kerguelen Plateau (80°E–120°E). Abundance estimates for Area IV range from 2,747 (CV = 0.153) in 1993/94 to 31,134 (CV = 0.123) in 2001/02, while those for Area V range from 602 (CV = 0.343) in 1990/91 to 9,342 (CV = 0.337) in 2004/05. The estimates are similar to those obtained from the International Whaling Commission's IDCR-SOWER surveys, which were conducted in Area IV (in 1978/79, 1988/89 and 1998/99) and in Area V (in 1980/81, 1991/92 and 2001/02–2003/04). Estimated annual rates of increase for Area IV (16.4%; 95% CI = 9.5–23.3%) and Area V (12.1%; 95% CI = 1.7–22.6%) are also similar to those obtained from the IDCR-SOWER surveys. The total abundance in Areas IV and V based on the most recent JARPA surveys (2003/04 and 2004/05 combined) is 37,125 (95% CI = 21,349–64,558); the confidence interval incorporates estimated additional variance. Results of several sensitivity tests are presented that suggest that estimates of abundance and trends are not appreciably affected by factors such as different approaches to deal with survey coverage (which in some cases was poor or included gaps). Changes in the order in which survey strata were covered and potential effects are investigated using a nested GLM approach; a QAIC model selection criterion suggests a preference for not attempting to adjust for such changes. Under various sensitivity approaches, the point estimates of increase rates are not greatly affected for Area IV. Although they drop by typically a half for most approaches for Area V, they nevertheless remain within the confidence limits of the base case estimate of 12.1% per year (95% CI = 1.7–22.6%). The presented results thus suggest that the estimated abundance of humpback whales in Area IV has increased rapidly. Although there is also an increase indicated for Area V, it is neither as rapid nor as precisely estimated. Taking these results together with the similar rates of increase estimated from coastal surveys off western and eastern Australia for Breeding Stocks D and E respectively, and given demographic limitations on the increase rates possible for closed populations of humpback whales, the hypothesis is advanced that whales from Breeding Stock E may have shifted their feeding distribution westward as their numbers have increased, perhaps to take advantage of the higher densities of krill to be found to the west. KEYWORDS: ABUNDANCE ESTIMATE; ANTARCTIC; DISTRIBUTION; HUMPBAC WHALE; SURVEY-VESSEL; JARPA; SURVEY-VESSEL; TRENDS.

Allen, J.M., Carlson, C. and Stevick, P.T. 2011. A description and summary of the Antarctic Humpback Whale Catalogue. *J. Cetacean Res. Manage. (special issue 3)*:95-100.

The Antarctic Humpback Whale Catalogue (AHWC) is an international collaborative project investigating movement patterns of humpback whales in the Southern Ocean and corresponding lower latitude waters. The collection contains records contributed by 261 researchers and opportunistic sources. Photographs come from all of the Antarctic management areas, the feeding grounds in southern Chile and also most of the known or suspected low-latitude breeding areas and span more than two decades. This allows comparisons to be made over all of the major regions used by Southern Hemisphere humpback whales. The fluke, left dorsal fin/flank and right dorsal fin/flank collections represent 3,655, 413 and 407 individual whales respectively. There were 194 individuals resighted in more than one year, and 82 individuals resighted in more than one region. Resightings document movement along the western coast of South America and movement between the Antarctic Peninsula and western coast of South America and Central America. A single individual from Brazil was resighted off South Georgia, representing the first documented link between the Brazilian breeding ground and any feeding area. A second individual from Brazil was resighted off Madagascar, documenting long distance movement of a female between non-adjacent breeding areas. Resightings also include two matches between American Samoa and the Antarctic Peninsula, documenting the first known feeding site for American Samoa and setting a new long distance seasonal migration record. Three matches between Sector V and eastern Australia support earlier evidence provided by Discovery tags. Multiple resightings of individuals in the Antarctic Peninsula during more than one season indicate that humpback whales in this area show some degree of regional feeding area fidelity. The AHWC provides a powerful non-lethal and non-invasive tool for investigating the movements and population structure of the whales utilising the Southern Ocean Sanctuary. Through this methodical, coordinated comparison and maintenance of collections from across the hemisphere, large-scale movement patterns may be examined, both within the Antarctic, and from the Antarctic to breeding grounds at low latitudes. KEYWORDS: HUMPBAC WHALE; SOUTHERN HEMISPHERE; PHOTO-IDENTIFICATION.

Cotté, C. and Guinet, C. 2011. The importance of seasonal ice zone and krill densities in the historical abundance of humpback whale catches in the Southern Ocean. *J. Cetacean Res. Manage. (special issue 3)*:101-06.

Humpback whale populations in the Southern Hemisphere were dramatically reduced by the whaling industry. A comprehensive whaling dataset was used in an analysis of circumpolar abundance of humpback whale catches relative to contemporary densities of its preferred prey, Antarctic krill, and to a major dynamic feature of the marine ecosystem, the summer seasonal ice zone (SSIZ) derived

from southernmost whaling locations. The circumpolar abundance of catches derived only from pelagic data, i.e. about 30% of the total humpback whale catches in the Southern hemisphere, was found to be only marginally related to krill density. However, the total abundance of catches – from pelagic operations and land stations, from high and low latitudes – was found to be more related to SSIZ than to krill density, especially when excluding the highly dynamic west Atlantic region where the circulation probably drives the ecosystem. A large SSIZ is likely to provide a favourable feeding ground for humpback whales, given their high energy requirements and because of its predictability and the prey aggregation processes occurring there. KEYWORDS: HUMPBAC WHALE; SOUTHERN OCEAN; WHALING; CATCH ABUNDANCE; ICE; EUPHAUSIIDS; SOUTHERN HEMISPHERE.

Secchi, E.R., Dalla Rosa, L., Kinas, P.G., Nicolette, R.F., Rufino, A.M.N. and Azevedo, A. 2011. Encounter rates and abundance of humpback whales, *Megaptera novaeangliae*, in the Gerlache and Bransfield Straits, Antarctic Peninsula. *J. Cetacean Res. Manage. (special issue 3)*:107-12.

During the austral summer of 2006, the Projeto Baleias/Brazilian Antarctic Program (PROANTAR) conducted ship surveys for estimating whale encounter rates and abundance in Gerlache and Bransfield Straits, westward of the Antarctic Peninsula (edge between IWC Areas I and II). The encounter rate was higher in the Bransfield Strait (0.32 groups n. mile⁻¹; 95% CI: 0.26–0.39) than in the Gerlache Strait (0.24 groups n. mile⁻¹; 95% CI: 0.13–0.44), though the difference was not statistically evident. An abundance estimate using conventional distance sampling methods was computed only for the Bransfield Strait. The perpendicular distance data was best fitted by the half-normal model without adjustments. Derived abundance for the surveyed area was 865 humpback whales (95% CI = 656–1,141; CV = 14.13). This area represents only a small fraction of the Stock G feeding ground. KEYWORDS: ANTARCTIC; BREEDING GROUNDS; HUMPBAC WHALE; ABUNDANCE; ENCOUNTER RATE; ANTARCTICA; SOUTHERN HEMISPHERE; SURVEY-VESSEL.

Zerbini, A.N., Andriolo, A., Heide-Jørgensen, M.P., Moreira, S.C., Pizzorno, J.L., Maia, Y.G., Bethlem, C., VanBlaricom, G.R. and DeMaster, D.P. 2011. Migration and summer destinations of humpback whales (*Megaptera novaeangliae*) in the western South Atlantic Ocean. *J. Cetacean Res. Manage. (special issue 3)*:113-18.

Southern Hemisphere humpback whales (*Megaptera novaeangliae*) migrate from wintering grounds in tropical latitudes to feeding areas in the Antarctic Ocean. In 2003 and 2005, satellite transmitters were deployed on humpback whales on their wintering grounds off the eastern coast of South America (Breeding Stock A). Seven whales were tracked for a period of 16 to 205 days travelling between 902 and 7,258km. The tracks of these whales provided partial or full information on the migratory schedule, migration routes and location of the feeding ground in the Southern Oceans. Whales departed from the coast of Brazil from late October to late December between 20° and 25°S and gradually moved away from the South American coast as they moved towards high latitudes. They followed a somewhat direct, linear path, with an approximate geographic heading of 170°. Satellite telemetry data indicated that the migratory corridors are restricted to a relatively narrow (~500–800km) strip in the South Atlantic Ocean. Migration speed to the feeding grounds averaged 80.2km/day and lasted from 40–58 days. Four individuals arrived at the feeding ground located to the north of the South Sandwich Islands, where they were tracked up to 102 days. Movements in this area were erratic at a mean travelling speed of 22.3km/day. Satellite telemetry data indicate that the main feeding grounds for the population wintering off eastern South America lie between 22°W and 33°W and in the southern South Atlantic Ocean south of the Antarctic Convergence but north of 60°S. This is only partially consistent with the currently proposed stock boundaries for this population on the feeding grounds. KEYWORDS: HUMPBAC WHALE; MOVEMENTS; MIGRATION; FEEDING GROUNDS; SATELLITE TELEMETRY; SOUTH ATLANTIC OCEAN; SOUTHERN HEMISPHERE.

Leaper, R., Peel, S., Peel, D. and Gales, N. 2011. Exploring the assumptions of multi-stock assessment models for humpback whales (*Megaptera novaeangliae*) in the Southern Hemisphere: using breeding stocks D and E as an example. *J. Cetacean Res. Manage. (special issue 3)*:119-28.

There is potential value in exploring multi-stock models to address situations where humpback stocks are mixing. However, sensitivity to the assumptions underlying these models has yet to be fully explored. Using a simple simulation approach, the assumptions of a population model that allows for mixing of humpback whale (*Megaptera novaeangliae*) stocks D and E on feeding areas has been explored by relaxing the assumptions of the original Johnston and Butterworth model in a number of plausible ways. First the ability of the model to estimate parameters was checked for a situation where simulated data are generated from an underlying model of exactly the same form for which the actual values of these parameters are known (Scenario 1). Then the ability of the model to estimate these parameters when alternative forms and assumptions were used for the underlying model generating the data was investigated. Specifically, stocks were allowed to mix non-uniformly across each feeding area and catch was non-uniformly distributed across each feeding area (Scenario 2). The consequences of density dependence implemented on feeding rather than breeding areas (Scenario 3) were also examined. The original mixing model was robust to alternate mixing and catch allocation scenarios in all but one of the simulations, but when density dependence acted at the level of the feeding rather than the breeding areas, the model produced estimates that were quite different from the underlying population. It is recommended that the inclusion of density dependence on feeding areas in models that allow for mixing of whales on these grounds be investigated further. KEYWORDS: HUMPBAC WHALE; ASSESSMENT; MIXING; CATCH ALLOCATION; DENSITY DEPENDENCE; SIMULATION; MODELLING.

Zerbini, A.N., Ward, E., Engel, M., Andriolo, A. and Kinas, P.G. 2011. A Bayesian assessment of the conservation status of humpback whales (*Megaptera novaeangliae*) in the western South Atlantic Ocean (Breeding Stock A). *J. Cetacean Res. Manage. (special issue 3)*:129-44.

The population of humpback whales (*Megaptera novaeangliae*) wintering off the eastern coast of South America is referred to by the International Whaling Commission as 'Breeding Stock A' (BSA). This population was heavily exploited in 20th century modern commercial whaling operations. After more than 30 years of protection, its present status remains unknown. A deterministic sex and age-aggregated population dynamics model was used to estimate the pre-exploitation population size (K), the maximum net recruitment rate (r_{max}), the maximum depletion level (N_{min}/K), and other quantities of interest of BSA. Input data included modern whaling catch series, absolute estimates of abundance, observed growth rates and indices of relative abundance. A Bayesian statistical method was used to calculate probability distributions for the model parameters. Prior distributions were set on r_{max} – an uninformative (Uniform [0, 0.106]) and an informative (Normal [0.067, 0.042]) – and on the population size in 2005 – N₂₀₀₅ (Uniform [500, 22,000]). A total of 10,000 samples were used to compute the joint posterior distribution of the model parameters using the Sampling-Importance-Resampling algorithm. Sensitivity of model outputs to the priors on r_{max}, a genetic constraint, data inclusion

and catch allocation scenarios was investigated. Medians of the posterior probability distributions of quantities of interest for the base case scenario were: $r_{max} = 0.069$ (95% probability intervals [PI] = 0.013–0.104), $K = 24,558$ (95% PI = 22,791–31,118), $N_{min}/K = 2\%$ (PI = 0.31%–12.5%), $N_{2006}/K = 27.4\%$ (PI = 18.3%–39.5%), $N_{2020}/K = 61.8\%$ (PI = 23.8%–88.6%), and $N_{2040}/K = 97.3\%$ (PI = 31.6%–99.9%). Despite apparent recovery in the past three decades, the western South Atlantic humpback whale population is still low relative to its pre-exploitation size and requires continued conservation efforts. . KEYWORDS: HUMPBACK WHALE; POPULATION ASSESSMENT; BAYESIAN STATISTICS; MODELLING; MANAGEMENT; SOUTH ATLANTIC; ANTARCTIC.

Ward, E., Zerbini, A.N., Kinan, P.G., Engel, M.H. and Andriolo, A. 2011. Estimates of population growth rates of humpback whales (*Megaptera novaeangliae*) in the wintering grounds along the coast of Brazil (Breeding Stock A). *J. Cetacean Res. Manage. (special issue 3)*:145-50.

Humpback whales wintering off the eastern coast of Brazil were heavily exploited by commercial whaling in the Southern Hemisphere. During recent years, clear signs of recovery have been observed, but few estimates of population growth rate exist. In this study, quantitative estimates of rates of population increase are obtained from sighting per unit of effort data (1995–98) using generalised linear models and maximum likelihood estimation. The error distributions considered for the models were Poisson and negative binomial. Predictors of the number of sightings included the year, month and 2-week periods during which the sightings were made. Predictors were treated as factors or numeric variables. For the numeric variables, quadratic dependence was also considered for each predictor to allow for possible non-linear relationships. Using Akaike Information Criterion (AICc) as a model selection criterion, the best model included year and month as continuous predictors. The data indicated strong support for the negative binomial over the Poisson models, but did not support models based on a finer temporal scale than month. Assuming year to be a linear predictor, the best estimate of the growth rate for the population wintering off Brazil was 7.4% per year (95% CI = 0.6–14.5%) during the period 1995–98. This estimate provides additional quantitative evidence that this population has been increasing and is consistent with the observed growth rates of other humpback whale stocks. KEYWORDS: HUMPBACK WHALE; INDEX OF ABUNDANCE; MODELLING; TRENDS; BREEDING GROUNDS; SOUTH ATLANTIC; OCEANIA.

Strindberg, S., Ersts, P.J. and Rosenbaum, H.C. 2011. Line transect distance sampling estimates of humpback whale abundance and distribution on their wintering grounds in the coastal waters of Gabon. *J. Cetacean Res. Manage. (special issue 3)*:151-60.

There have been few recent estimates of abundance for humpback whales (*Megaptera novaeangliae*) in the eastern South Atlantic Ocean. The first distance sampling survey of the coastal waters of Gabon was conducted in 2002. The difficult logistics of covering a large survey region with limited time, effort and refuelling opportunities required a line transect survey design that carefully balanced the theoretical demands of distance sampling with these constraints. Inshore/offshore zigzag transects were conducted to a distance of up to approximately 50 n.miles from the coast of Gabon corresponding to the 1,000m depth contour, from the border with Equatorial Guinea to a point south of Mayumba, near the Congo border representing 1,488 n.miles of survey effort. Seventy-nine different groups of humpback whales were observed throughout the survey area comprising a northern (Equatorial Guinea to Cap Lopez) and southern (Cap Lopez to Gamba) survey stratum. Relatively large numbers of whales were encountered throughout the southern stratum; encounter rates and densities were considerably lower in the northern stratum. The initial abundance estimate from a distance sampling analysis suggests that more than 1,200 humpback whales were present in Gabon's coastal waters during the survey period. This estimate does not account for either availability or perception bias. In addition, this instantaneous snapshot of the number of whales occupying Gabon's coastal waters is likely to correspond to only a portion of the population that uses these waters over time. However, the abundance estimate derived from the aerial survey are consistent with those based on photographic and genetic capture-recapture techniques. A continuing research programme in this area will help refine estimates of humpback whale abundance and using genetic and photographic data also establish the relationships between this and other populations. This is important given the potential overlap of humpback whales in large numbers throughout this region and the current extent and continued expansion of hydrocarbon exploration and extraction activities throughout the Gulf of Guinea. KEYWORDS: ABUNDANCE ESTIMATE; SURVEY-AERIAL; AFRICA; ATLANTIC OCEAN; SAMPLING STRATEGY; G(0); MODELLING; HUMPBACK WHALE.

Findlay, K., Meyer, M., Elwen, S., Kotze, D., Johnson, R., Truter, P., Uamusse, C., Siteo, S., Wilke, C., Kerwath, S., Swanson, S., Staverees, L. and van der Westhuizen, J. 2011. Distribution and abundance of humpback whales, *Megaptera novaeangliae*, off the coast of Mozambique, 2003. *J. Cetacean Res. Manage. (special issue 3)*:163-74.

Humpback whales within the southwestern Indian Ocean undertake annual migrations from summer Antarctic/Southern Ocean feeding grounds to winter breeding grounds in the tropical and sub-tropical coastal waters of Mozambique, Madagascar and the central Mozambique Channel Islands. Little is known of the inter-relationship of humpback whales on each of these wintering grounds, or the inter-relationship of these wintering grounds with the summer Antarctic feeding grounds. A line-transect survey of cetacean species was carried out in Mozambique coastal waters between Cabo Inhaca (26°00'S, 33°05'E) and just north of Mozambique Island (14°26'S, 40°53'E) and between the 20 and 200m isobaths, over the period 26 August to 7 September 2003. The majority (98.1%) of 951.8 n.miles of search effort carried out on this survey was in passing mode due to the high densities of whales encountered. Humpback whales were the only large whales to be identified and the distribution of 691 sightings of an estimated 1,130 individual humpback whales and 132 sightings of an estimated 154 large unidentified whales show distribution throughout the survey region. Two sightings of individual small whales were made in the region of Inhambane. In general, higher than expected sighting densities (based on survey effort) were recorded in the region between Cabo Inhaca and Xai-Xai, and in the region of the Pantaloon and David Shoals to the north east of Quelimane. Lower than expected sighting densities were recorded over the Sofala Banks. No distribution trends could be ascribed to environmental parameters, apart from whales being distributed in waters of higher salinities than expected, possibly due to turbidity associated with low salinity water arising from river input. Groups containing a cow and calf pair were distributed across the entire region surveyed. Analyses of unstratified data result in a total abundance estimate of 6,808 (CV = 0.14) humpback and unidentified whales in the 14,029.5 n.mile² area surveyed. As a result of the differences in width of the coastal shelf area along the coast of Mozambique, the line transect survey data were further analysed in four strata. Pooling of estimates over these four strata results in a total abundance of 6,664 whales (CV = 0.16), with highest densities in the southernmost stratum and the lowest densities in the narrow shelf region across the Sofala Banks. Similar analyses of humpback whales only resulted in abundance estimates of 5,930 (CV = 0.15) (unstratified data) and 5,965 whales (CV = 0.17) (data analysed by four strata). Although not directly comparable due to differing survey platforms, these estimates indicate the population to have increased since previous surveys in the early 1990s. KEYWORDS: ABUNDANCE; AREA-AFRICA; DISTRIBUTION; HUMPBACK WHALE; INDIAN OCEAN.

Ersts, P.J., Kiszka, J., Vély, M. and Rosenbaum, H.C. 2011. Density, group composition, and encounter rates of humpback whales (*Megaptera novaeangliae*) in the eastern Comoros Archipelago (C2). *J. Cetacean Res. Manage. (special issue 3)*:175-82.

The Comoros Archipelago is an assemblage of oceanic islands, banks and offshore reef systems that longitudinally span the northern Mozambique Channel. The greater Comoros Archipelago has been designated by the IWC as Wintering sub-Region C2 for humpback whales and is currently considered data deficient. Since 1997, annual marine mammal surveys of varying length and objective have been carried out in the waters surrounding Mayotte, the eastern most island in the Comoros Archipelago. The humpback whales component of these surveys focused effort in and around the lagoon surrounding Mayotte. While it is expected that humpback whales can found throughout Comoros Archipelago it still remains unknown as to what degree humpback whales utilise specific banks and offshore reef systems within this area. Surveys conducted in 2002 and 2003 included passing mode and closing mode components intended to examine the density, group composition and encounter rates of humpback whales in an offshore reef complex and a bank adjacent to the lagoon surround Mayotte. The densities of humpback whales, out to one nautical mile from the surveyed transects, ranged from 0.027 to 0.618 whales/n.mile² across three study sites. Females with calves were the most frequently encountered group type. Encounter rates ranged from 0.98 to 2.36 groups per hour of search effort. These results, while exploratory in nature, indicate that the eastern region of the Comoros may be an important area for humpback whales during the late austral winter months and that additional, more intensive systematic research is warranted. KEYWORDS: HUMPBAC WHALE; BREEDING GROUNDS; CONSERVATION; SURVEY-VESSEL; SOUTHERN HEMISPHERE.

Minton, G., Collins, T., Findlay, K., Baldwin, R., Ersts, P.J., Rosenbaum, H., Berggren, P. and Baldwin, R.M. 2011. Seasonal distribution, abundance, habitat use and population identity of humpback whales in Oman. *J. Cetacean Res. Manage. (special issue 3)*:183-98.

Previously published data on the occurrence of humpback whales (*Megaptera novaeangliae*) in the Arabian Sea suggests that the region hosts a non-migratory population that adheres to a Northern Hemisphere breeding cycle. In order to investigate the distribution and abundance of this population, twelve small boat surveys were conducted in three main locations off the coast of Oman between February 2000 and November 2004. Humpback whales were observed during surveys in Dhofar and Gulf of Masirah on Oman's Arabian Sea coast, but not during surveys in the Muscat region in the Gulf of Oman. An even ratio of males to females was observed and sampled during surveys in the Gulf of Masirah, which was surveyed in October and November (n = 38), while almost all whales sampled in Dhofar in February/March were male (n = 28). Song was detected frequently in the bay surrounding the Halaniyat Islands (formerly known as the Kuria Muria Bay) in February/March, but observations of mother-calf pairs were sparse, and competitive groups were absent. Feeding was observed in both October/November and February/March, but behavioural and environmental observations indicate that the Gulf of Masirah is primarily an important feeding ground, while the Dhofar region, particularly the Halaniyat Bay, may be a breeding area. However, limited survey effort and a lack of recent observations of mother-calf pairs or competitive groups raises the possibility that the primary mating, calving and nursing areas are yet to be identified. Sixty-four individual whales were identified using photographs of dorsal fins or tail flukes. A high rate of re-sightings between years and between survey areas at different times of the year indicates year-round residence off the coast of Oman. A Chapman's modified Petersen estimator was applied to various data pairings to calculate abundance. All pairings yielded estimates of less than 100 individuals, but sample sizes were small and there were various sources of possible bias. Analysis of scarring on the caudal peduncle region of identified individuals in Oman indicates that between 30 and 40% are likely to have been involved in entanglements with fishing gear. Comparison of the Oman photo-identification catalogue with those from Zanzibar, Antongil Bay (Madagascar) and Mayotte and the Geyser Atoll (Comoros Archipelago), yielded no photographic matches. These data are consistent with the hypothesis of a discrete population. The distribution of fluke pigmentation rankings from the Oman catalogue, which varied significantly from those of Madagascar and Mayotte, provides further evidence for this theory. The evidence presented here provides a strong underpinning for the recent IUCN Red List classification of the Arabian Sea sub-population of humpback whales as Endangered. In light of ongoing coastal development and other threats to this population's habitat and future survival, urgent research and conservation measures are recommended. KEYWORDS: HUMPBAC WHALE; ARABIAN SEA; OMAN; MARK-RECAPTURE; BREEDING GROUNDS; FEEDING GROUNDS; DISTRIBUTION; ENTANGLEMENT; PHOTO-ID; GENETICS; NORTHERN HEMISPHERE.

Brandão, A. and Butterworth, D.S. 2011. Concerning demographic limitations on the population growth rate of west Australian (breeding stock D) humpback whales. *J. Cetacean Res. Manage. (special issue 3)*:199-208.

The upper bound of 0.126 on the maximum demographically possible annual growth rate for humpback whales that has standardly been imposed on recent applications of age-aggregated assessment models for this species in the IWC Scientific Committee, is based on an analysis that assumes steady age structure. It is conceivable that transient age-structure effects could admit greater population growth rates for short periods than suggested by such a bound. This possibility is addressed by developing an age-structured population model in which possible density dependent changes in pregnancy rate, age at first parturition and natural mortality are modelled explicitly, and allowance is made for the possibility of natural mortality increasing at older ages. The model is applied to the case of the west Australian humpback whale population (Breeding Stock D), for which breeding ground surveys over the 1982–1994 period provide a point estimate of 0.10 for the annual population growth rate. Results based upon the breeding population survey estimate of abundance of 10,032 in 1999 suggest that 0.12 is the maximum demographically feasible annual rate of increase for this stock over 1982–1994 if it is a closed population. This result is based on essentially the same parameter choices as led to the earlier $r = 0.126$ bound, i.e. that in the limit of low population size the age at first parturition approaches five years from above, the annual pregnancy rate 0.5 from below, and the annual natural mortality rate 0.01 from above. Transient effects do not appear able to reconcile the observed rate of increase with less extreme values of demographic parameters than led to the previously imposed upper bound of 0.126 on the maximum possible annual growth rate. Although use of extreme values reported for demographic parameters for Northern Hemisphere humpback whale populations, rather than those considered here, would reduce this suggested maximum rate of 0.12, the conclusion that transient effects have a very limited impact on observed population growth rates would be unlikely to change. KEYWORDS: HUMPBAC WHALE; SOUTHERN HEMISPHERE; MODELLING; GROWTH; PREGNANCY RATE; PARTURITION.

Hedley, S.L., Bannister, J.L. and Dunlop, R.A. 2011. Abundance estimates of Southern Hemisphere Breeding Stock 'D' humpback whales from aerial and land-based surveys off Shark Bay, Western Australia, 2008. *J. Cetacean Res. Manage (special issue 3)*:209-21.

Single platform aerial line transect and land-based surveys of Southern Hemisphere Breeding Stock 'D' humpback whales *Megaptera novaeangliae* were undertaken off Shark Bay, Western Australia to provide absolute abundance estimates of animals migrating northward along the western Australian coast. The aerial survey flew a total of 28 flights, of which 26 were completed successfully, from 24 June–19 August 2008. The land-based survey was undertaken from Cape Inscription, Dirk Hartog Island, Shark Bay, during the expected peak of the whales' northward migration, from 8–20 July. During the first week of the land-based survey, some double count effort was undertaken to provide information on the numbers of pods missed from the land station. The assumed period of northward migration was 2 June–7 September. Estimated abundance of northward-migrating whales during that time is 34,290 (95% CI: (27,340–53,350)), representing an annual rate of increase of 12.9% (CV = 0.20) since an estimate of 11,500 in 1999. This estimate is based on an estimate of relative abundance of surface-available whales of 10,840 (8,640–16,860), and an estimated $g(0)$ of 0.32. There were considerable practical difficulties encountered during the land-based survey which reduced the effectiveness of the dual-survey approach for estimating $g(0)$ for the aerial survey. Furthermore only about 15% of whales were estimated to be within the visual range of the land-based station. Alternative approaches for estimating $g(0)$ from these data are therefore also presented, resulting in considerably higher estimates of around 0.6–0.7, and yielding a conservative abundance estimate of 17,810 (14,210–27,720). KEYWORDS: HUMPBACK WHALE; SOUTHERN HEMISPHERE; SURVEY-AERIAL; SURVEY-SHORE-BASED; MIGRATION; AREA-AUSTRALIA.

Paxton, C.G.M., Hedley, S.L. and Bannister, J.L. 2011. Group IV humpback whales: their status from aerial and land-based surveys off Western Australia, 2005. *J. Cetacean Res. Manage. (special issue 3)*:223–34.

Single platform aerial line transect and land-based surveys of Southern Hemisphere Group IV humpback whales were undertaken to provide absolute abundance estimates of animals migrating northward along the western Australian coast during June–August 2005. The aerial survey was designed to cover the whole period of northward migration but the resulting estimates from that survey alone could only, at best, provide relative abundance estimates as it was not possible to estimate $g(0)$, the detection probability along the trackline, from the data. Owing to logistical constraints, the land-based survey was only possible for a much shorter period (two weeks during the expected peak of the migration in mid-July). This paper proposes three methods that utilise these complementary data in different ways to attempt to obtain absolute abundance estimates. The aerial line transect data were used to estimate relative whale density (for each day), allowing absolute abundance from the land-based survey to be estimated for the short period of its duration. In turn, the land-based survey allowed estimation of $g(0)$ for the aerial survey. Absolute estimates of abundance for the aerial survey were obtained by combining the $g(0)$ estimate with the relative density estimates, summing over the appropriate number of days. The most reliable estimate of northward migrating whales passing the land station for the period of the land-based survey only was 4,700 (95% CI 2,700–14,000). The most reliable estimate for the number of whales passing through the aerial survey region for the duration of that survey (55 days from June through to August) was 10,300 (95% CI 6,700–24,500). This is a conservative estimate because the duration of the aerial survey was almost certainly shorter than the period of the migration. Extrapolation beyond the end of this survey was considered unreliable, but abundance from the estimated start of the migration to the end of the survey (87 days from mid April to August) was estimated to be 12,800 (95% CI 7,500–44,600). The estimated number of whales depends crucially on the assumed migration and period of migration. Results for different migration parameters are also presented. The point estimates of abundance, whilst higher than those from a previous survey in 1999 (when adjusted for survey duration) are not significantly so. The peak of the whales' distribution was found at c.90m water depth. KEYWORDS: ABUNDANCE ESTIMATE; DENSITY; HUMPBACK WHALE; LINE-TRANSECT; METHODOLOGY; MIGRATION; MODELLING; SOUTHERN HEMISPHERE; SURVEY - AERIAL; SURVEY - COMBINED.

Forestell, P., Kaufman, G.D. and Chaloupka, M. 2011. Long term trends in abundance of humpback whales in Hervey Bay, Australia. *J. Cetacean Res. Manage. (special issue 3)*:235–42.

Seasonal abundance estimates of humpback whales resident during the austral winter in Hervey Bay, Queensland, Australia between 1987 and 2007 were obtained from a capture-mark-recapture study using photo-identification images of 3,155 individual whales. Hervey Bay is a major southbound stopover site for Breeding Stock E humpback whales returning to Antarctic waters from overwintering in the vicinity of the Great Barrier Reef. Annual survival, recapture and abundance estimates were derived using a Cormack-Jolly-Seber modelling approach and a Horwitz-Thompson type abundance estimator. The best-fit model was a 2-ageclass Brownie-Robson type model that estimated apparent annual survival for the non-transient winter stopover ageclass at approximately 0.945 (95% confidence interval: 0.929–0.957). Apparent annual abundance of winter stopover humpback whales in Hervey Bay was estimated to have increased significantly over the past 21 years at ca. 13.4% per annum (95% CI 11.6–15.2). The most recent Hervey Bay winter stopover population (2007) was estimated to comprise ca. 6,246 post-yearlings (95% CI 5,011–7,482). This estimated rate of population increase is similar to estimates for other surveys along the east Australian coast but significantly higher than the intrinsic rate of increase (r_{max}) estimated recently for several recovering Southern Hemisphere humpback whale stocks based on the feeding ground sampling. KEYWORDS: HUMPBACK WHALE; ABUNDANCE ESTIMATE; MARK-RECAPTURE; PHOTO-ID; AUSTRALIA; SOUTHERN HEMISPHERE; STATISTICS.

Noad, M.J., Dunlop, R.A., Paton, D. and Cato, D.H. 2011. Absolute and relative abundance estimates of Australian east coast humpback whales (*Megaptera novaeangliae*). *J. Cetacean Res. Manage. (special issue 3)*:243–52.

The humpback whales that migrate along the east coast of Australia were hunted to near-extinction in the 1950s and early 1960s. Two independent series of land-based surveys conducted over the last 25 years during the whales' northward migration along the Australian coastline have demonstrated a rapid increase in the size of the population. In 2004 we conducted a survey of the migratory population as a continuation of these series of surveys. Two methods of data analysis were used in line with the previous surveys, both for calculation of absolute and relative abundance. We consider the best estimates for 2004 to be 7,090±660 (95% CI) whales with an annual rate of increase of 10.6±0.5% (95% CI) for 1987–2004. The rate of increase agrees with those previously obtained for this population and demonstrates the continuation of a strong post-exploitation recovery. While there are still some uncertainties concerning the absolute abundance estimate and structure of this population, the rate of annual increase should be independent of these and highly robust. KEYWORDS: ABUNDANCE ESTIMATE; HUMPBACK WHALE; MIGRATION; SURVEY-LAND; TRENDS.

Paton, D.A., Brookes, L., Burns, D., Franklin, T., Franklin, W., Harrison, P. and Baverstock, P. 2011. Abundance of east coast Australian humpback whales (*Megaptera novaeangliae*) in 2005 estimated using multi-point sampling and capture-recapture analysis. *J. Cetacean Res. Manage. (special issue 3)*:253–60.

The humpback whales (*Megaptera novaeangliae*) that migrate along the east coast of Australia were hunted to near extinction during the last century. This remnant population is part of Breeding Stock E. Previous abundance estimates for the east Australian portion of Breeding Stock E have been based mainly on land-based counts. Here we present a capture-recapture abundance estimate for this population using photo-identification data. These data were collected at three locations on the migration route (Byron Bay – northern migration, Hervey Bay and Ballina – southern migration) in order to estimate the population of humpback whales that migrated along the east coast of Australia in 2005. The capture-recapture data were analysed using a variety of closed population models with a model-averaged estimate of 7,041 (95% CI 4,075–10,008) whales. KEYWORDS: HUMPBAC WHALE; ABUNDANCE ESTIMATE; PHOTO-ID; CAPTURE-RECAPTURE.

Paton, D.A. and Kniest, E. 2011. Population growth of Australian east coast humpback whales, observed from Cape Byron, 1998 to 2004. *J. Cetacean Res. Manage. (special issue 3)*:261-68.

Humpback whales (*Megaptera novaeangliae*) that migrate past the east coast of Australia comprise part of Group V (E(i) breeding stock). From 1995 to 2004 an annual 16 day survey was conducted from Cape Byron (28°37'S, 153°38'E), the most easterly point on the Australian mainland, monitoring the peak of the humpback whale northern migration. The annual rate of increase between 1998 and 2004 of humpback whales observed off Cape Byron is 11.0% (95% CI 2.3–20.5%). This rate of increase is consistent with that recorded from other studies of the humpback whale population off the east coast of Australia. The large confidence intervals associated with this estimate are due to considerable inter-annual variation in counts. The most likely explanation for this being the short survey period, which may not have always coincided with the peak of migration, and in some years a large proportion of whales passed Cape Byron at a greater distance out to sea, making sightability more difficult. KEYWORDS: HUMPBAC WHALE; SURVEY-SHORE-BASED; TRENDS; GROWTH; MIGRATION; SOUTHERN HEMISPHERE; PACIFIC; OCEANIA.

Garrigue, C., Franklin, T., Constantine, R., Russell, K., Burns, D., Poole, M.M., Paton, D., Hauser, N., Oremus, M., Childerhouse, S., Mattila, D.K., Gibbs, N., Franklin, W., Robbins, J., Clapham, P. and Baker, C.S. 2011. First assessment of interchange of humpback whales between Oceania and the east coast of Australia. *J. Cetacean Res. Manage. (special issue 3)*:269-74.

The interchange of individual humpback whales between the wintering grounds of Oceania (South Pacific) and the east coast of Australia were documented by individual identification photographs collected from 1999 to 2004. Interchange was assessed using regional catalogues of fluke photographs, totalling 672 individuals from Oceania (represented by New Zealand, New Caledonia, Vanuatu, Fiji, Samoa, Tonga, Niue, Cook Island, French Polynesia and American Samoa) and 1,242 individuals from Hervey Bay and Byron Bay representing the southbound and the northbound migration along the east coast of Australia (EA). Overall, there were seven documented movements between EA and Oceania. Four instances of movement of four individuals were documented between EA and the closest breeding grounds of New Caledonia. A further three movements were recorded between EA and a small catalogue (n = 13) from the New Zealand migratory corridor. In contrast, during this same period, 20 cases of interchange were documented among nine breeding grounds: French Polynesia, Cook Islands, Niue, American Samoa, Samoa, Tonga, Fiji, Vanuatu and New Caledonia. The low level of interchange between Oceania and the east coast of Australia has important implications for understanding the stock structure and abundance of humpback whales in the South Pacific. KEYWORDS: HUMPBAC WHALE; PHOTO-ID; MOVEMENTS; SITE FIDELITY; PACIFIC OCEAN; BREEDING GROUNDS.

Garrigue, C., Constantine, R., Poole, M.M., Hauser, N., Clapham, P., Donoghue, M., Russell, K., Paton, D., Mattila, D.K., Robbins, J. and Baker, C.S. 2011. Movement of individual humpback whales between wintering grounds of Oceania (South Pacific), 1999 to 2004. *J. Cetacean Res. Manage. (special issue 3)*:275-82.

The movement of individual humpback whales between regional breeding grounds of Oceania (South Pacific) was documented by individual identification photographs collected from 1999 to 2004. Photographs were collected with comparable effort across the six years in four primary island breeding grounds: New Caledonia, Tonga (Vava'u) the Cook Islands and French Polynesia (Mo'orea and Rurutu); with smaller effort in adjacent regions: Vanuatu, Fiji, Samoa, Niue and American Samoa. Interchange among wintering grounds was assessed first with all usable photographs included in each regional catalogue, representing 1,080 regional sightings (including within-region and between-region resightings) of 949 individual whales from Oceania. From this, 28 cases of movement between (mostly adjacent) regions were documented. Previously undocumented interchange was found between regions of central Oceania and the western South Pacific. No individual was sighted in more than two regions during this six-year period. The documented movement between regions was one-directional, except for one individual sighted first in French Polynesia, then in American Samoa and then back in French Polynesia (each in different years). Only one whale was resighted in more than one region during the same winter season. No directional trend was apparent and movement between regions did not seem to be sex specific. A systematic quality control review of all catalogues was then implemented to calculate standardised indices of within-region return and between-region interchange, resulting in a quality controlled catalogue of 776 regional sightings of 659 individuals. The standardised indices confirmed that the probability of between-region interchange was low, relative to within-region return, supporting the assumption of multiple management units or stocks in Oceania. The relative isolation of breeding regions and the movement of individuals across the longitudinal borders of Antarctic management Areas V and VI has important implications for the allocation of historical catches from the Antarctic and therefore, for assessing current levels of recovery for breeding stocks. KEYWORDS: HUMPBAC WHALE; PHOTO-ID; MOVEMENTS; SITE FIDELITY; SOUTH PACIFIC; SOUTHERN HEMISPHERE.

Félix, F., Muñoz, M., Falconi, J., Botero, N. and Haase, B. 2011. Entanglement of humpback whales in artisanal fishing gear in Ecuador. *J. Cetacean Res. Manage. (special issue 3)*:283-90.

Southeastern Pacific humpback whales (Breeding Stock G) congregate along the northwest coast of South America during the austral winter (July–October). Information collected from stranded animals for more than a decade in Ecuador and Colombia indicates that entanglement in fishing gear is a major threat for this population during the breeding season. Twelve new cases are reported here of live individual whales entangled in artisanal gillnets on the central coast of Ecuador from 2004 to 2007. The varying severity of the entanglement and the behaviour of the animals involved indicated that they had differing chances of survival. The findings confirm that the problem persists, although the impact on the population is unknown. The necessity of taking conservation measures to reduce the current level of entanglement is reiterated. Creation and training of rescue teams seems an appropriate alternative in the short-term, but in the long-term it will be necessary to design and implement actions with a wider regional scope, since the problem extends also to at

least other two neighbouring countries. KEYWORDS: INCIDENTAL CATCHES; GILLNETS; HUMPBACK WHALE; BREEDING GROUNDS; SOUTH AMERICA; SOUTHERN HEMISPHERE.

Félix, F., Palacios, D.M., Salazar, S.K., Caballero, S., Haase, B. and Falconi, J. 2011. The 2005 Galapagos humpback whale expedition: a first attempt to assess and characterise the population in the Archipelago. *J. Cetacean Res. Manage. (special issue 3)*:291-300.

It has been known for some time that humpback whales (*Megaptera novaeangliae*) occur in waters of the Galápagos Islands, an oceanic archipelago located 1,000km west of Ecuador, South America (1°S, 91°W), but their presence there has been poorly documented. Although presumed, no linkage has been established between Galápagos and southeast Pacific humpback whales (Breeding Stock G), the nearest breeding stock. An expedition to Galápagos was carried out between 31 August and 10 September 2005 to document the presence of humpback whales, their distribution, and their relationship to other stocks in the Pacific. Surveys covered 722km of the central and southern parts of the archipelago. Only one adult with a newborn calf was found at Santa Fé Island (0°47'S, 90°05.1'W), yielding an encounter rate of 0.27 whales per 100km of survey. A hydrophone with a response frequency range of 0.25–25kHz was dropped 25 times, but no whale sounds were heard. A skin sample was obtained by darting of the adult at Santa Fé, and was used for genetic analysis of the mtDNA control region. The haplotype of the Galápagos specimen has been found in a few individuals sampled previously off Colombia, Ecuador and the Antarctic Peninsula, thus establishing at least some degree of relatedness with Breeding Stock G. The observations, combined with a compilation of historical and recent sighting information in the archipelago, support the idea that Galápagos is a breeding area for the species. Further studies are needed to establish the level of discreteness, size and other basic aspects of the Galápagos humpback whale population. KEYWORDS: BREEDING GROUNDS; GENETICS; HUMPBACK WHALE; SOUTH AMERICA; SURVEY-VESSEL; GALÁPAGOS ISLANDS; BREEDING GROUNDS; OPPORTUNISTIC SIGHTINGS.

Félix, F., Castro, C., Laake, J.L., Haase, B. and Scheidat, M. 2011. Abundance and survival estimates of the southeastern Pacific humpback whale stock from 1991-2006 photo-identification surveys in Ecuador. *J. Cetacean Res. Manage. (special issue 3)*:301-08.

Southeastern Pacific humpback whales (Breeding Stock G) breed along the northwestern coast of South America and farther north up to Costa Rica. Photo-identification surveys conducted aboard whalewatching vessels during the migration/breeding season from June to September between 1991 and 2006 off the coast of Ecuador (2°S, 81°W) have produced a database of 1,511 individual whales. Comparisons of photographs produced 190 between-year re-sightings of 155 individual whales. Closed and open capture-recapture models were used to estimate abundance and survival. The best estimate of abundance in 2006 with the Chapman modified-Petersen was 6,504 (95% CI: 4,270–9,907; CV = 0.21). Abundance estimates from open population models were considerably lower due to heterogeneity in capture probability which produced a 'transient' effect. Our best estimate of true survival was 0.919 (95% CI: 0.850–0.958). Heterogeneity most likely occurred from inter-annual variation in sampling and unknown structure and variation in the migration timing and corridor. A more extensive collaborative effort including other wintering areas further north as well as integrating breeding-feeding data will help to reduce heterogeneity and increase precision in abundance and survival estimates. KEYWORDS: HUMPBACK WHALE; ABUNDANCE ESTIMATE; SURVIVORSHIP; MARK-RECAPTURE; PHOTO-ID; SOUTH AMERICA.

Johnston, S.E., Zerbini, A.N. and Butterworth, D.S. 2011. A Bayesian approach to assess the status of Southern Hemisphere humpback whales (*Megaptera novaeangliae*) with an application to breeding stock G. *J. Cetacean Res. Manage. (special issue 3)*:309-18.

The Bayesian stock assessment methodology presently being applied in the Comprehensive Assessment of the Southern Hemisphere humpback whales, which uses a sex- and age-aggregated population model, is detailed. This methodology is applied to Breeding Stock G, which winters off the west coast of South America. This application takes into account the recently updated historic catch series, as well as the most recent estimates of absolute abundance and population trend information. KEYWORDS: HUMPBACK WHALE; BAYESIAN ASSESSMENT; SOUTHERN HEMISPHERE; MODELLING.