Annex L

Report of the Sub-Committee on Small Cetaceans

Members: Rogan (Convenor), Aguilar, Alves, Amaral, Andreu, Baker, Bejder, Best, Bjørge, Bräger, Brito, Brownell, Cañadas, Carvalho, Cerchio, Chilvers, Choi, Cipriano, Collins, Corkeron, Cozzi, De Decker, Deimer-Schüette, Dinis, Engel, Flores, Fortuna, Fossi, Freitas, Fuentes, Funahashi, Gallego, Galletti, Gaspari, Hammond, Hoelzel, Holloway, Holm, Ilyashenko, Iñíguez, Jaramillo Legorreta, Kaschner, Kasuya, Kock, Krahn, Lauriano, Lens, Liebschner, Luna, Lusseau, Marsili, Mazzariol, Melton, Miller, Muller, Murphy, Northridge, Øien, Palka, Panigada, Parsons, Perrin, Podesta, Prieto, Reeves, Ridoux, Ritter, Rojas-Bracho, Rosa, Rosenbaum, Rowles, Scheidat, Sequeira, Siciliano, Silva, Simmonds, Stachowitsch, Stockin, Štrbenac, Suydam, Urban, Vazquez, Vely, Verborgh, Weller, Williams, Ylitalo, Zerbini.

1. OPENING REMARKS

Rogan welcomed the participants to the meeting, noting that the priority topic for the sub-committee this year was the review of the taxonomy, population structure and status of common dolphins.

2. ELECTION OF CHAIR

Rogan was elected Chair.

3. ADOPTION OF AGENDA

The adopted Agenda is given in Appendix 1.

4. APPOINTMENT OF RAPPORTEURS

Scheidat, Northridge and Reeves acted as rapporteurs.

5. REVIEW OF AVAILABLE DOCUMENTS

Documents relevant to the work of the sub-committee were SC/61/SM1-37, Natoli *et al.* (2008), Natoli *et al.* (2006), Cañadas *et al.* (2004), Cañadas and Hammond (2008), Tavares *et al.* (In press), Reeves and Brownell (2009), Jefferson *et al.* (2009), Bearzi *et al.* (2003), Van Bressem *et al.* (2006), Bilgmann *et al.* (2008), Dabin *et al.* (2008), Hamer *et al.* (2008), Mirimin *et al.* (2009), Danil and Chivers (2007), Evans and Teilmann (2009, pp.111-30), Murphy *et al.* (2009b), Murphy *et al.* (In review) and Cañadas *et al.* (2009)

6. REVIEW TAXONOMY, POPULATION STRUCTURE AND STATUS OF COMMON DOLPHINS

Currently, the genus *Delphinus* comprises two species and four subspecies: the short-beaked common dolphin *Delphinus delphis delphis*, distributed in continental shelf and pelagic waters of the Atlantic and Pacific Oceans; the Black Sea short-beaked common dolphin, *D. delphis ponticus*; Gray's common dolphin (long-beaked form), *D. capensis capensis*, distributed in nearshore tropical and temperate waters of the Pacific and South Atlantic Oceans; and the Indian long-beaked common dolphin, *D. capensis tropicalis*, which occurs in the Indian Ocean.

6.1 Taxonomy

Natoli *et al.* (2006) assessed genetic diversity over a broad geographic range, including among long- and short-beaked morphotypes, and tested alternative hypotheses about the relationship between geographic distance, morphotype and population genetic structure. 199 samples were compared for 9 microsatellite DNA loci and 369bp HVR1 control region mtDNA. For the microsatellite DNA data, F_{ST} and RHO_{st} (complementary measures of structure based on inbreeding coefficients) showed the strongest isolation for a long-beaked population off South Africa, but also indicated structure between the North and South Atlantic samples, and for comparisons either side of the North Atlantic. An assignment method implemented in the program STRUCTURE supports the same interpretation, and mtDNA data shows a consistent pattern. A key result is the PHI_{st} value for the comparison between the long-beaked forms off South Africa and from the Eastern North Pacific (ENP) – 0.521 – quite a high value (PHI_{st} is based on both haplotype frequency differences and the level of divergence between haplotype sequences). It indicates that these two long-beaked populations do not share recent common ancestry. There was a signal for expansion in some local populations, and a coalescent method provided evidence for similar structure as seen for the inbreeding coefficients. Neighbour-Joining and Bayesian trees showed poor lineage resolution and the only regional sample supported in a separate lineage was the ENP long-beaked sample, and even then the bootstrap support was relatively low. The primary interpretations were that population structure exists in the Atlantic on a relatively broad geographic scale, that the morphotypes were not supported as reciprocally monophyletic lineages, and that instead it appeared as though morphotype could result from local selection, independent of phylogenetic background within the broader *Delphinus* lineage.

SC/61/SM11 revisited the worldwide phylogeography of common dolphins using sequences of the mitochondrial DNA cytochrome *b* gene. The study included 279 samples from the Atlantic, Pacific and Indian Oceans, including populations described as short-beaked, long-beaked and the very long-beaked '*tropicalis*' form. Individuals were grouped into putative populations according to their morphology and geographic origin. Nucleotide and haplotype diversity values were high for most putative populations. Pairwise fixation indices showed significant levels of genetic differentiation between putative populations, with the long-beaked population from the NE Pacific and the '*tropicalis*' population from the Indian Ocean being the most differentiated.

Despite this differentiation, the resulting haplotype network indicated the existence of four genetic clusters that do not correspond to taxonomy or geographical origin of the individuals. Cluster 1 included long-beaked individuals from the NE Pacific and the '*tropicalis*' form from the Indian Ocean; cluster 2 included most of the short-beaked individuals from the NE and NW Atlantic and from the SW Pacific and also long-beaked individuals from South Africa; cluster 3 included the '*tropicalis*' form from the Indian Ocean, long-beaked individuals from the NE Pacific and South Africa and short-beaked individuals from the NE and NW Atlantic and the NE Pacific; and finally, cluster 4 included short-beaked individuals from the NE and SW Pacific. Haplotypes shared by the two recognised species (*D. delphis* and *D. capensis*) and one of the two recognised subspecies (*D. capensis tropicalis*) were found in clusters 1, 2 and 3. The Bayesian phylogenetic tree supported the non-monophyly of the recognised species and subspecies, with the basal group being cluster 3 as indicated in the network. The results showed that the distribution of mitochondrial lineages does not agree with the morphology-based taxonomy (i.e. the designation into short-beaked and long-beaked species). For instance, one individual from South Africa, which was classified according to coloration criteria as having 85.7% characteristics of the long-beaked form and 14.3% characteristics of the short-beaked form, was analysed in this study and included in cluster 2, sharing a haplotype with short-beaked specimens from the North Atlantic and SW Pacific. Furthermore, all long-beaked specimens from South Africa were clearly differentiated from the long-beaked specimens from the NE Pacific. Therefore, if monophyly of mitochondrial lineages is considered a required criterion to define species, then common dolphins probably constitute one widely distributed super-species, with some differentiated, locally adapted populations perhaps in the process of speciation. Preliminary results with microsatellite DNA markers also seem to support the existence of these differentiated populations, some of which may be incipient species, in the different oceans.

This study further illustrates the difficulties of delineating taxonomic units in common dolphins using a genealogical perspective, because processes such as incomplete lineage sorting and hybridisation may be confounding population history. Further analyses, including samples from additional geographic regions and use of additional molecular markers and more powerful statistical analyses, are currently under way to: (i) clarify patterns of population history and their chronology and temporal progression; (ii) test for historical and contemporary hybridisation between taxa; and (iii) assess levels of gene flow between major oceanic regions.

Although preliminary in some respects, this study establishes that the distribution of mitochondrial lineages at a global scale does not agree with the current taxonomy (i.e. recognition of a short-beaked and a long-beaked species) or with the geographical origins of individuals. Perrin suggested that a new paradigm is needed, perhaps along the lines suggested in SC/61/SM11 that common dolphins represent a single, widely distributed 'super-species', with numerous partially isolated populations, some of which exhibit a high degree of local adaptation and may be in the process of speciation (i.e. incipient species).

In discussion, it was suggested that for delimiting species, it is preferable to take a character-based rather than a tree-based approach initially and to use genetic data to test hypotheses based on morphology, i.e. on 'morphology-verified' specimens and/or regional biogeographical inferences. Perrin expressed the view that in the case of *Delphinus* there appears to have been a convergence in morphology, with traits such as beak length having evolved separately in different areas. Given the plasticity of character development in common dolphins, a character-based, regional approach based on morphology has already been followed and found to be misleading. There was a strong consensus among participants that the existing morphological 'bins' are not supported by genetic 'binning'. For example, the long-beaked forms in South Africa and the eastern North Pacific are clearly similar morphological types with different lineages. It was emphasised that in referring to the various morphological types, care should be taken to avoid expressions such as 'North West Pacific *capensis*-type' and instead the various populations should be denoted in less committal terms such as 'long-beaked form in the North West Pacific'.

It was also agreed that the single-gene approach is inadequate for resolving species of *Delphinus*. Several different processes could have given rise to observed global patterns. For example, old introgression could have led to the unexpected clustering of long-beaked specimens from the NE Pacific, very long-beaked specimens from the Indian Ocean ('*D. capensis tropicalis*') and short-beaked specimens from the NW and SE Atlantic (SC/61/SM11). Ongoing hybridisation also may be complicating the picture. The next level of analysis, therefore, should be to investigate the processes that have led to the observed global patterns of morphology and phylogeography of common dolphins. This will necessitate the use of additional markers, especially nuclear markers, possibly including Single Nucleotide Polymorphisms (SNPs), introns and Short Interspersed Nuclear Elements (SINES) and possibly also whole mitochondrial sequencing. Amaral indicated that she had already explored nuclear introns to some extent and found relatively little variability, something that has been experienced by other researchers working on right whales and humpback dolphins.

The sub-committee thanked the authors for bringing this paper to the meeting, and **encouraged** the continuation of this work to further elucidate the taxonomic issues.

6.2 Population structure

A number of papers were received dealing with population structure and were discussed on a regional basis.

Pacific Ocean

Chivers *et al.* (2008) presented genetic evidence for population structure of short-beaked common dolphins in the eastern North Pacific (ENP), where they are managed in US waters as a single stock referred to as the CA/OR/WA stock that includes all animals off California, Oregon and Washington out to 300n.miles from shore. The distribution is nearly continuous within the CA/OR/WA stock boundaries and common dolphins are the most abundant small cetaceans in this region. Despite the nearly continuous nature of their distribution, data on colouration patterns, pollutant levels, reproductive seasonality and genetics suggest there is more than one demographically independent population (DIP) within the stock. The main objective of the study by Chivers *et al.* was to test the null hypothesis of panmixia within the CA/OR/WA stock using mtDNA control region sequence data. Specimens were assigned to strata defined as putative populations prior to analysis. These strata included two stocks recognised for management in tropical waters of the ENP and four putative populations defined by temperate oceanic habitats within the CA/OR/WA stock area. Statistically significant genetic differentiation was detected among the four putative populations within the CA/OR/WA stock. The differences detected among habitat-defined strata suggested that there are at least four DIPs within the stock, each apparently adapted to particular ocean conditions. The sub-committee noted that the level of genetic differentiation was in contrast to the findings to date in the NE Atlantic, and that stock boundary revisions will be needed to improve conservation management of this form in the ENP.

Hoelzel reported preliminary results of analyses of genetic population structure of common dolphins at a fine geographic scale in the Gulf of California (GC) and along the Pacific coast of Baja California and southern California. Individuals were genotyped using mtDNA control region sequences (776bp) and 18 microsatellite loci. An initial analysis showed differentiation between the short-beaked and long-beaked forms (putative populations pooled; mtDNA F_{ST}=0.019, p<0.000; Φ_{ST}=0.387, p<0.000 and microsatellite loci F_{ST}=0.027, p<0.000). However, there was also differentiation across the Baja California peninsula, and among northern and southern samples both along the outer coast and within the GC. Furthermore, this held for comparisons both within and between the putative species. The only set of samples apparently not differentiated was that consisting of short-beaked animals (designated as '*D. delphis*') on the outer coast. The Neighbour-Joining phylogenetic reconstruction of the 88 haplotypes showed the long-beaked form ('*D. capensis*') as a monophyletic group, although the bootstrap support was not strong, and a phylogeny including previously published '*D. capensis*' haplotypes (Rosel *et al.*, 1994) based on just 400bp no longer supported this lineage.

In discussion, Weller pointed out that a cruise by the Southwest Fisheries Science Center planned for late 2009 would extend into the area covered in the study by Segura and Hoelzel, and therefore additional samples can be expected to be available in the near future. In discussion, the sub-committee welcomed these results and looked forward to receiving an update on the analysis.

SC/61/SM20 described an on-going molecular study by Stockin and colleagues who are examining population structure of common dolphins in New Zealand (NZ). To date, 92 samples have been analysed for 577 bps of the mtDNA (D-loop region) and compared against 177 published sequences (370 bp) from 8 different populations including long- and short-beaked morphotypes. The NZ animals exhibited high genetic variability (gene diversity=0.991, nucleotide diversity=0.018). In total, 65 haplotypes were identified, three of which were shared with short-beaked forms from the eastern North Atlantic, Argentina and North Pacific.

An additional three haplotypes were shared with long-beaked forms in the North Pacific and South Africa. The NZ animals showed significant genetic differentiation (F_{ST} analysis) when compared with all others except short-beaked animals in the North Pacific. The Φ_{st} analysis confirmed these results but also indicated no significant differentiation when compared to the western North Atlantic population.

Rooted Neighbour-Joining (NJ) and Bayesian trees were reconstructed using all 152 haplotypes and a homologous sequence of *Stenella attenuata* as an outgroup. Although the Bayesian analysis identified more lineages than the Neighbour Joining tree, neither resolved any clustering consistent with geographical origins. Although not significant, the Tajima's D value was high (D=-1.234, p=0.077) and the Fu's Fs was highly significant (f=-24.28, p=0.000) indicating population expansion. The mismatch distribution analysis supported these results showing a unimodal distribution.

Intrapopulation structure within New Zealand waters was examined by comparison of three putative populations; coastal, Hauraki Gulf and oceanic (SC/61/SM20). Anecdotal information suggests that inshore and offshore animals bycaught in fisheries differ in size and pigmentation. In addition, Neumann *et al.* (2002) suggested that common dolphins in the Hauraki Gulf exhibit a higher degree of site fidelity compared with animals from neighbouring waters. From mitochondrial DNA analysis, shared haplotypes among the putative populations were found to be rare. The F_{ST} analysis indicated significant genetic differentiation between Hauraki Gulf individuals and the other putative populations, but not between coastal and oceanic groups (Stockin, 2008). In discussion, the sub-committee **encouraged** continued analysis in this area, using nuclear markers.

A recently published study by Bilgmann *et al.* (2008), based on samples from biopsied and bycaught common dolphins off South Australia and SE Tasmania and analysing both mitochondrial and microsatellite data, found significant differentiation between the animals in South Australia (eastern Great Australian Bight and Spencer Gulf) and those in SE Tasmania. The authors noted that although a simple model of isolation by distance did not appear to account for the observed genetic differentiation, this could not be completely ruled out because of incomplete sampling in areas between South Australia and SE Tasmania. No significant differentiation was found within South Australia.

In discussion of this paper it was noted that common dolphins occur along the Australian coast to the east and north of the sampling area and the authors are **encouraged** to extend their sampling programme into waters along the coast of Victoria.

Atlantic Ocean

MEDITERRANEAN AND BLACK SEA

The study by Natoli *et al.* (2008) was prompted by data suggesting that common dolphins in the Mediterranean Sea are declining and that their status is deteriorating in that part of their range. 118 samples were genotyped for 9 microsatellite DNA loci and sequenced for 428bp HVR1 control region mtDNA. F_{ST} comparisons illustrating population structure for microsatellite DNA showed differentiation between the eastern and western sites within the Mediterranean, and for mtDNA, also between the Alboran Sea and sites in Portugal and Galicia. Genetic assignments implemented in the program GeneClass supported the differentiation between samples from the Ionian and Alboran Seas. There were two apparent migrants from the Alboran Sea into the Ionian Sea, and one apparent migrant in the opposite direction. Among nine samples from intermediate geographic regions, four failed to assign to either population, suggesting the need to investigate the possibility of further fine-scaled structuring within the Mediterranean. A coalescent method that assesses bi-directional migration rates indicated the possibility of movement by females mostly from east to west in the Mediterranean, and from south to north in the adjacent Atlantic Ocean. This method indicated a comparatively low rate of migration between the Mediterranean and the Black Sea, although the Black Sea sample was small. There was an expansion signal for Portugal and Galicia, supported by both neutrality tests and a minimum-spanning network. Major points of interpretation were: (a) the existence of fine-scaled structure between the eastern and western basins within the Mediterranean Sea – something seen for various marine species, including bottlenose dolphins (*Tursiops truncatus*), striped dolphins (*Stenella coeruleoalba*) and various fishes; and (b) a need for further sampling and study to assess the possibility of further structure in the central portion of the Sea.

In discussion, it was noted that other studies have also shown that the short-beaked form of common dolphins in the Black Sea, *D. delphis ponticus* (which was examined recently by the sub-committee) are genetically differentiated from common dolphins in the Mediterranean.

NORTH EAST ATLANTIC

Mirimin *et al.* (2009) examined population structure of short-beaked common dolphins in the North Atlantic using both mitochondrial and nuclear genetic markers. A large number of samples were obtained from seasonal and spatial aggregations of common dolphins in the western and eastern Atlantic, mostly using opportunistic sampling (stranded or bycaught individuals). Genetic variability was investigated using nuclear (14 microsatellite loci, n=254) and mitochondrial (360 bp of the control region, n=297) genetic markers. Levels of genetic diversity were relatively high in all sampled areas and no evidence of recent reduction of effective population size was detected at the nuclear loci. Population structure was detected between the two main regions (wNA and eNA) and was more pronounced at the mitochondrial (F_{ST}=0.0018, p<0.001) than at the nuclear markers (F_{ST}=0.005, p<0.05), suggesting at least two genetically distinct populations in this ocean basin. In contrast, no significant genetic structure was detected between temporal aggregations from within the same regions, suggesting seasonal movement at a regional scale. Results from this study support the hypothesis of a single genetic stock in the waters off the south-western coast of Ireland and in the western English Channel and a single stock off the US Atlantic coast. However, the authors noted that due to the opportunistic nature of sampling, and the fact that large parts of the known range in the North Atlantic remain unsampled, including along the mid-Atlantic ridge, other genetically distinct populations may exist.

SC/61/SM27 presented results from the EC NECESSITY project, which was completed in 2007. One of the aims of the study was to test the hypothesis that there was panmixia among the sampled areas and to assess the possible impact of bycatch on the genetic variability of common dolphins in the NE Atlantic. Genetic analysis was carried out on 152 common dolphins sampled from six Atlantic areas including Portugal, France, western English Channel, Celtic Sea, Ireland and Scotland. 25 microsatellite loci and 556 base-pairs (bp) of the mt DNA control region were used in the analysis.

Analysis of molecular variance (AMOVA) found (and estimated fixation indexes indicated) no significant genetic structure among all sampled areas, i.e. most genetic variability resided within, rather than between, sample areas. This lack of genetic structure was observed using both microsatellite and mtDNA control region markers. Using genotypes from 20 microsatellite loci, the Bayesian approach using the program STRUCTURE indicated that individuals from the sampled areas belong to the same genetic stock. No significant differentiation was detected when the sexes were analysed separately. For mtDNA sequence data, Fu's test of selective neutrality reported a lack of a significant negative Fs value for common dolphins off Scotland. This suggests that Scotland's marginal position in the range of common dolphins may have led to lower exchange rates of migrants to neighbouring aggregations.

In conclusion, the study revealed that common dolphins from the NE Atlantic have high levels of genetic variability, which do not appear to have been affected by strong recent demographic changes, such as a reduction in population size due to high incidental mortality rates. Population structure analyses indicated that common dolphins found in the western English Channel and off the Atlantic coasts of Ireland, France and Portugal are part of the same population. These findings suggest the presence of a large 'coastal' or neritic panmictic (random-mating) population in the NE Atlantic, maintained by strong gene flow. However, the possibility of a recent population split cannot be ruled out. For example, it is possible that not enough time has passed to cause significant genetic differentiation. Although the present study included a large dataset of 152 individuals, the high levels of genetic variability found at both nuclear and mtDNA control region markers may suggest that larger sample sizes are required to obtain more realistic population-wide estimates of gene frequencies. The authors concluded that as more samples are collected each year, genetic structure should be re-assessed using a larger dataset and testing different classes of markers.

Freitas provided some preliminary genetic data and analyses for common dolphins from the Azores and Madeira. The material analysed came from 91 individuals sampled in the Azores and 56 in Madeira, via either biopsy or skin-swab. A total of 36 distinct haplotypes were identified from the Azores and 31 from Madeira; 13 haplotypes were shared between the two archipelagos. Gene diversity was 0.953 in the Azores and 0.975 in Madeira and nucleotide diversity was 0.013 in both archipelagos. The microsatellite loci were globally very polymorphic, with high levels of observed and expected heterozygosity. For the whole dataset, allelic diversity ranged between 5 and 17 (mea$n$=12.9±SD 6.1). Mitochondrial and nuclear DNA revealed no genetic structure between the archipelagos, between groups of islands or in relation to habitat features. Tests for sex-biased dispersal also did not support the hypothesis of higher gene flow in males than females. The sub-committee thanked the authors for making these preliminary results available for discussion and encouraged further analysis to allow comparisons within the NE Atlantic.

In discussion, the lack of sampling in offshore areas was noted and, as recommended in SC/61/SM27 and elsewhere, e.g. Murphy *et al.* (2009a), there is a need for future studies that incorporate animals from offshore (i.e. off-shelf) waters (e.g. via biopsy sampling there) and for further analyses using additional genetic markers. Amaral briefly mentioned her analyses of mtDNA control region and cytochrome *b* markers in common dolphins from the NE Atlantic. So far, no evidence of population structure has been detected (Amaral *et al.*, 2007).

In contrast, Hoelzel presented preliminary results of an ongoing investigation (in collaboration with Andre Moura) of putative populations along the coast of Portugal. The results of analysis using neutral microsatellite DNA loci were compared to results obtained using markers potentially linked to loci under selection. All 15 microsatellite DNA loci were checked for deviation from HW equilibrium and for possible allele calling errors. Loci were compared for their mean F_{ST} (forced average) against heterozygosity to assess the probability of selection (higher F_{ST} than expected for a given H suggests directional selection, while lower than expected F_{ST} suggests balancing selection). A matrix incorporating F_{ST} values based on the 'neutral' loci (n=11) was compared with results from analysis using the 'selected' loci (n=4) and only the latter showed significant signs of population structure, suggesting structure within animals inhabiting Portuguese waters. This work is broadly consistent with results from a cranial morphometrics study carried out on a larger geographic larger scale by Murphy *et al.* (2006b), which revealed some evidence of population differentiation within the NE Atlantic, with segregation of female Portuguese common dolphins from more northern areas, such as Ireland, the UK and Galicia in NW Spain. Although recognising that the results were preliminary, the sub-committee **encouraged** that this work continue and that these loci are used cover a wider geographic area in order to improve understanding of population structure in the NE Atlantic.

SC/61/SM34 examined a series of ecological tracers of increasing integration periods (from days to lifetime) in order to assess potential 'ecological' population structure of common dolphins in the NE Atlantic. It was expected that this information would complement that derived from genetic studies. Ecological tracers considered include stomach content data, with an integration period of only a few days; fatty acid composition of blubber, with an integration period of several weeks; carbon and nitrogen isotopic ratios in muscle, with an integration period of months; cadmium in liver, with an integration period of years; and cadmium in kidney, which presumably would accumulate over nearly the lifetime of the animal. From these indicators, and particularly from those tracers with an integration time of close to a lifetime (cadmium in kidney), it was hypothesised that animals from oceanic habitats, animals from northern neritic habitats (north of the Channel) and animals from southern neritic habitats (south of the Channel) generally would not have the same habitat and resource utilisation profiles and therefore could be considered as fairly distinct demographic sub-units. The authors suggested that a single-stock scenario based solely on genetic results and the three-stock scenario based on ecological tracers as outlined in SC/61/SM34 could be used to bracket the range of possible population structure for common dolphins in the NE Atlantic.

In discussion, it was noted that some of the links shown in fig. 6 and the consequent sub-units illustrated in fig. 7 of the paper were questionable and required further consideration. For example, the sample sizes for some of the sites were small (oceanic Bay of Biscay n=10, offshore western Ireland n=8) and temporal differences among the samples were not taken into account.

It was also noted that it might have been helpful if a suite of organic contaminants had been included in the array of ecological tracers investigated in this study. In response to a question of whether comparisons of these contaminants would be feasible, it was noted that organic contaminants had been analysed for some of the animals used in this study. However, only females have been studied to date and future samples should incorporate male common dolphins from the region. No additional information was presented to the sub-committee in relation to stock structure. Notwithstanding the complexity in taxonomy, it was noted that within the Pacific, stock structure appears to be complex, with evidence of population separation over relatively small areas in the NE Pacific and elsewhere, possibly requiring a reassessment of stocks. In contrast, in the North Atlantic, apart from differences detected between the Black Sea and Mediterranean, within the Mediterranean, and between the western North Atlantic and eastern North Atlantic, little or no genetic differentiation has been detected over large geographical areas on either side of the North Atlantic. The sub-committee noted that lack of detection of genetic structure does not necessarily mean that structure does not exist and encouraged additional sampling in areas that have not previously been sampled, in addition to the use of additional markers, including the use of markers not under selection and ecological markers. In addition, the sub-committee suggested that for a better understanding of population structure of common dolphins in the NE Atlantic, future studies should focus on distribution, abundance and seasonal movements, with particular reference to offshore, northern and southern limits of occurrence.

6.3 Abundance and distribution

Information on abundance and distribution was presented in a number of papers and the results on abundance estimates are summarised in Table 1.

Atlantic Ocean

Hammond provided a brief summary of the results of the Small Cetacean Surveys of the North Sea (SCANS II) survey in July 2005 concerning common dolphins. The survey area covered the continental waters of the NE Atlantic including the North Sea and Irish Sea from coastal waters out to the 200m contour using a combination of ship and aerial platforms. While the survey was aimed primarily at harbour porpoises (*Phocoena phocoena*) information on all cetacean species was collected. The majority of common dolphins were sighted around the coasts of Spain, Portugal and France, in the Celtic Sea and off the west coast of Ireland. The estimate of total abundance of common dolphins was 63,366 associated with a fairly high CV of 0.46. Density surface modelling provided a prediction of how common dolphin density was distributed in the study area.

In discussion, the lack of sightings of common dolphins in the North Sea during this survey was noted. However, in the last decade the frequency of strandings and sightings of common dolphins along the Danish coast has increased slightly. Abundance in part of the SCANS II survey area (the Celtic Sea) had been estimated in the SCANS survey in 1994 (Hammond *et al.*, 2002). It was noted that the estimates were not comparable because responsive movement to the survey vessel had not been taken into account in the 1994 survey. As described by Cañadas *et al.* (2004), responsive movement can have a very large effect on abundance estimates (see later). It would not be informative to compare the uncorrected estimate from 2005 with the (uncorrected) estimate from 1994 as it is not known if the amount of responsive movement was similar between the two surveys. The most recent 2005 estimate is considerably more reliable and robust, and therefore the 1994 estimate should be disregarded.

SC/61/SM6 provided information on abundance and distribution of common dolphins generated during the CODA (Cetacean Offshore Distribution and Abundance in the European Atlantic) project survey in July 2007. The study area encompassed an area from northern Spain to northern Scotland, in the deeper waters off the continental shelf, approximately 200n.miles from the coast. The survey was stratified into four blocks and surveyed by five ships. Survey methods replicated the methods used during the SCANS II survey. A total of 165 sightings of small odontocetes including 104 common dolphins, 33 striped dolphins and 28 common or striped dolphins were made from the primary platform during 9,494km of search effort. Abundance was calculated for both common and common/striped dolphins combined using design-based methodology as well as density surface modelling. Estimates were found to have a higher precision when surface modelling is applied. For common dolphins alone the abundance estimate for the model-based method was 116,709 (CV 33.7%) and for common and striped dolphins, combined, it was 259,605 (CV 36.9%). The distribution of common dolphins showed a clear preference for the Bay of Biscay. Combining the CODA estimates with the SCANS II estimates results in an overall estimate of 185,204 (CV 27.2%) common dolphins (estimate of SCANS based on design-based estimate and CODA on model-based estimate).

In discussion, it was noted that group size was highly variable and a strong responsive movement was observed. In the ship-board survey of SCANS II, mean group size also showed a high variability between areas. $g(0)$ for common dolphins was 0.6 in the SCANS II survey. Differences in pigmentation among the different areas were not investigated during the surveys. In relation to combining the estimates from both surveys, it was noted that the CODA and SCANS II surveys had been designed with a common boundary so that estimates of abundance could be summed. However, animals may have been distributed differently in the two survey years (2005 and 2007), leading to additional variance. The CV of the combined estimate is thus underestimated. The sub-committee **encouraged** a re-analysis of the combined SCANS II and CODA data, using density surface modelling.

SC/61/SM9 presented a summary of information on common dolphins in Norwegian waters. During dedicated surveys conducted since the 1980s, no confirmed sightings of common dolphins have been made and this species can be considered rare in Norwegian waters. The most northerly sighting was at 72ºN. In total 77 records of common dolphins are in the incidental observations database, but species identification is not always certain. There seems to have been a slight increase in records of common dolphin sightings after 2000, but there are no data on effort. Most common dolphins were seen in the period June to September. Over the period 1979 to 2008, seven incidents of stranded or bycaught common dolphins have been recorded. Common dolphins are normally associated with warmer waters than those usually found along the Norwegian coastlines. An influx of warm water may have resulted in more occasional visitors of this species.

The sub-committee discussed the occurrence of other small odontocetes in Norwegian waters and whether there had been an increase in observations in recent years. Approximately 95% of the sightings are white-beaked dolphins and white-sided dolphins. Other species such as striped dolphins and Risso’s dolphins are seen very rarely. It was also suggested that the slight increase in animals sighted in coastal waters could be related to a general increase in public awareness. It was noted that although SCANS II recorded no common dolphins in the North Sea, the Norwegian database included some incidental sightings in the North Sea, indicating occasional or seasonal influxes.

With regard to the problem associated with ship-board surveys and vessel attraction by small cetaceans, Cañadas *et al.* (2004) examined the data for common dolphins collected during a double-platform, line transect cetacean survey in the NE Atlantic in 1995 (NASS survey). The aim was 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. There was a strong indication that animals were attracted to the vessel. $g(0)$ was estimated to be 0.796. Density estimates obtained under the assumption that no responsive movement occurred were about six times higher than when it was taken into account. The sub-committee commended the authors for analysing this dataset and for highlighting the importance of considering responsive behaviour when estimating abundance.

Cañadas *et al.* (2009) continued the analyses presented by Cañadas *et al.* (2004). The more recent paper used data from three survey programs, the North Atlantic Sightings (NASS 1987, 1989, 1995 and 2001), the MICA93 program and the SCANS survey in 1994, to examine the distribution of common dolphins in the NE Atlantic. In a preliminary analysis, the different data sources were combined in a spatial modelling approach including latitude, longitude and depth as explanatory variables. The resulting distribution map showed a gap of common dolphin occurrence on the Mid-Atlantic ridge, which is probably due to poor coverage of this area. The sub-committee congratulated the authors of the two previous papers on conducting a combined analysis of these different datasets. It also encouraged that the presented data be combined with more recent data such as that from SCANS II or the newer T-NASS surveys, if feasible. The sub-committee discussed the potential problem of combining data that were collected a decade apart. It was concluded that such an approach, though not useful for abundance estimates, is potentially useful for examining distribution patterns over a large geographical scale.

Table 1

Abundance estimates of common dolphins.

Area	Type	Abundance	Year	Survey platform	Comments	Reference
North East Atlantic						
Celtic Sea	Short-beaked	75,450 (CV 0.67; 95%CI=23,000-249,000)	1994	Vessel	SCANS, not corrected for $g(0)$, not accounted for responsive movement	Hammond *et al.* (2002)
NE Atlantic continental shelf	Short-beaked	63,366 (CV 0.46, 95%CI=26,973-148,865)	2005	Aerial/ vessel	SCANS II survey, $g(0)$ for the vessel, responsive movements accounted for	SCANS-II (2008)
Offshore NE Atlantic	Short-beaked	116,709 (CV 0.34, 95%CI=61,397-221,849)	2007	Vessel	CODA survey; best abundance estimate model based; $g(0)$ for the vessel, responsive movements accounted for	SC/61/SM6
Central and eastern North Atlantic	Short-beaked	273,159 (CV 0.26; 95%CI=153,392-432,104)	1995	Vessel	W Block of the NASS-95 Faroese survey; model-based analyses; correction factors for responsive movement and $g(0)$ were applied	Cañadas *et al.* (2009)
Mediterranean and Black Sea						
Mediterranean (Alboran Sea)	Short-beaked	19,428 (95%CI=15,277-22,804)	1992 to 2004	Vessel	Model based estimate; non systematic survey design, $g(0)$ not calculated; responsive movement was considered	Cañadas *et al.* (2008)
Turkish Strait systems of the Black Sea	Short-beaked, *D. delphis ponticus*	773 (95%CI=293-2,059) 994 (95%CI=390-2, 531)	1997 1998	Vessel	No $g(0)$ estimated, responsive movement not considered	Jaramillo-Legorreta *et al.* (2003); IWC (2004)
Western North Atlantic						
Northwest Atlantic	Short-beaked	53,625 (95% CI=35,179-81,773)	2007	Aerial	T-NASS survey in the Canadian strata; no correction factors were applied	SC/61/SM35
Labrador coast	Short-beaked	-	2007	Aerial	Not enough sightings to estimate abundance	SC/61/SM35
Newfoundland East stratum	Short-beaked	576 (95%CI=314-1,056)	2007	Aerial	No $g(0)$ applied	SC/61/SM35
Scotian Shelf	Short-beaked	53,049 (95%CI= 34,865-80,717)	2007	Aerial	No $g(0)$ applied	SC/61/SM35
Florida to Bay of Fundy	Short-beaked	120,743 (CV 0.23)	2004	Aerial/ vessel	Includes correction factor for responsive movement and $g(0)$	SC/61/SM12
South Atlantic						
California/Oregon/ Washington stock	Short-beaked	392,733 (CV 0.18)	2001/ 2005	Vessel	Includes correction factor for $g(0)$	Forney (2007); Carretta *et al.* (2008); Carreta (2008)
California	Long-beaked	15,335 (CV 0.56)	2001/ 2005	Vessel	Includes correction factor for $g(0)$	Forney (2007)
Gulf of California, Mexico	Long-beaked	61,976 (95%CI=31,295-154,153)	-	Vessel		Gerrodette and Palacios (1996)
Gulf of California, Mexico	Short-beaked	2,681 (95%CI=14,287-72,316)	-	Vessel		Gerrodette and Palacios (1996)
Southern coast of South Africa	Long-beaked	22,200 (CV 0.35)	1982 and 1983	Aerial/ vessel	No correction factor used, non-design based survey design, based on very few sightings, combining two different survey platforms (aerial and vessel)	SC/61/SM33
Pacific						
Eastern Tropical Pacific	Short-beaked	1,840,889 (CV 0.445) 540,725 (CV 0.317) 3,630,548 (CV 0.572) 2,330,910 (CV 0.342) 1,148,256 (CV 0.289) 2,277,456 (CV 0.255) 3,127,203 (CV 264)	1986 1987 1988 1989 1990 1999 2006	Vessel	$g(0)$ applied, no correction for responsive movement	Palacios *et al.* (2008); Wade and Gerrodette (1993)

Silva presented a summary of current knowledge on distribution and habitat preferences of short-beaked common dolphins in the Azores using data from 1999 to 2008. The short-beaked form was present in the Azores year-round. Sighting rates were lower in summer than during the rest of the year. During summer, animals were often found in shallow waters at short distance from the shore. During the rest of the year they were found in medium depth waters and avoided shallow coastal waters. No abundance estimates are available for common dolphins in the waters around the Azores.

SC/61/SM29 provided information on common dolphin distribution and occurrence in Madeira obtained from shipboard and aerial surveys, opportunistic sightings and stranding records between 2001-08. A clear seasonal pattern was also found in this region, with the highest densities in winter and spring.

In discussion, it was noted that winter surveys were less frequent than summer surveys in the areas of the NE Atlantic, including the Mediterranean, where seasonal movement occurs, and that there appears to be inter-annual variation in movements, possibly related to water circulation patterns and/or shifts in prey distribution. For example, a high density of common dolphins was observed in the English Channel in 2004-05 (De Boer *et al.*, 2008).

SC/61/SM8 presented information on the differences in spatial distribution of two small delphinids (short-beaked common dolphins and Atlantic spotted dolphins) around two islands of the Azores Archipelago, Pico and Sao Miguel. In discussion, the sub-committee noted that while the data was robust enough to look at differences in the use of the area by the different species, it should not be used to describe habitat preferences.

Information on occurrence and relative abundance of common dolphins at three sites along the Portuguese coast was presented in SC/61/SM16. Boat-based visual surveys were conducted in three different geographic locations. In Nazaré only short-beaked common dolphins were observed, while in Peniche, harbour porpoises (*Phocoena phocoena*) were also observed and in Sesimbra, sightings included bottlenose dolphins (*Tursiops truncatus*), striped dolphins (*Stenella coeruleoalba*), and minke whales (*Balaenoptera acutorostrata*). Common dolphins were the most commonly sighted species and large groups seemed to aggregate along submarine canyons. It was suggested that great depths near shore are suitable habitats for pelagic species such as common dolphins. More surveys are planned for the coming years.

SC/61/SM35 presented information on the distribution of short-beaked common dolphins observed during the 2007 T-NASS (Trans North Atlantic Sightings Surveys). The principle aim of the T-NASS project was to estimate the abundance of cetaceans in the Northern North Atlantic from survey data collected during the summer 2007. The surveys were conducted with the participation of Canada, Greenland, Iceland, the Faroes, Norway, and the Russian Federation, as well as observers on fishery surveys. The surveys were co-ordinated with the European CODA survey and the American SNESSA survey. In addition to the boat vessels, aerial surveys were also conducted. Off Canada, the distribution of common dolphins ranged from about 56.9° to 42.4°N, being most frequently sighted on the Scotian Shelf and off southern Newfoundland. Most sightings occurred in the mid- and outer-shelf areas, rather than near shore. Abundance estimates were 576 for the Newfoundland survey strata and 53,049 for the Scotian shelf strata, resulting in a total estimate of 53,625 (95% CI 35,179-81,773) animals. No correction factors were applied to this estimate. In the North East Atlantic part of the survey area, where survey conditions were generally poor, common dolphins were not observed by dedicated surveys, even in areas where they had previously been seen (e.g. NASS surveys). The few common dolphin sightings that were seen were made from the fishery surveys MAR-ECO were moving towards or on the mid-Atlantic ridge. It was not possible to derive an abundance estimate from this part of the survey area.

The sub-committee welcomed the abundance estimate for common dolphins in Canadian waters. On whether the results of the T-NASS survey could be combined with surveys conducted at the same time, the sub-committee were informed that this will be considered at a combined workshop of T-NASS, CODA and SNESSA being organised in advance of the 2009 biennial Marine Mammal Science conference. The sub-committee noted that there seemed to be a change in density of short-beaked common dolphins west beyond the CODA area. Several potential reasons for this were identified: (i) differences in sighting conditions, e.g. sea state; (ii) uncertain species identification (as other dolphin species were sighted); (iii) a true reduction in common dolphin density; (iv) ship effect; and (v) inter-annual distributional shifts. In addition, due to poor weather conditions, some of the survey tracks were not covered in these areas.

SC/61/SM12 presents a summary of the current knowledge of common dolphin distribution in the NW Atlantic. Population estimates for the short-beaked form in NW Atlantic are 120,743 (CV=0.23). Large schools are often seen in waters between 100-2,000m depth. There is a seasonal shift in their distribution being more northern in the summertime and more southern in the winter. Strandings have been reported year round on Cape Cod.

In discussion, the sub-committee questioned whether the ship-based survey data in the NW Atlantic were tested for responsive movement of common dolphins to the survey vessel. No reactions were documented for common dolphins thus no correction factor was applied. Potential reasons of this lack in observed reaction could be the use of high-powered binoculars (although the same were used in SCANS II and CODA), the survey vessel used, which is not very quiet or a general difference in behavioural response. In the Mediterranean, previous tests did not show any significant responsive movement (Cañadas and Hammond, 2008). However, new analyses are ongoing with more years of data collected under a wider range of conditions. Given the bias in abundance associated with not correcting for responsive movement, the sub-committee recommends that surveys should examine this where the data are available in previous surveys and in all areas where surveys are being routinely carried out.

Murphy presented information relating to common dolphins from a recent ASCOBANS-HELCOM small cetacean population structure workshop (Evans and Teilmann, 2009). Sightings data were compiled into maps from a number of different sources. Common dolphins were observed during the MAR-ECO project along the mid-

Atlantic ridge between approx. 43-50°W (28 groups totalling 273 individuals - see Doksaeter *et al.*, 2008). Although the sightings spanned years from 1963 to 2007, the majority of the records were since 1980 and most of the offshore sightings occurred during the summer. These data suggest that common dolphins are distributed all across the NE Atlantic to the mid-Atlantic ridge. There is some suggestion of a hiatus between 30-40°W but this may reflect a lack of survey effort in this area.

It was also noted in the workshop report that there is some evidence of a long-term trend in the strandings data. Strandings of common dolphins increased along the Dutch and Danish coasts between the 1920s and 1950s and declined along the Irish coast and SW coast of England from the 1930s to the 1970s, suggesting a shift in distribution in western European waters. There is also some evidence of seasonal movements of common dolphins in the NE Atlantic, with an increase in density of common dolphins in the Celtic Sea, and the western English Channel in the winter (De Boer *et al.*, 2008). Brereton *et al.* (2005) reported a 10-fold increase in density of common dolphins in the western English Channel during the winter. In contrast, Kiska *et al.* (2007) reported larger aggregations of common dolphins in the northern Bay of Biscay in the summer, when compared to the western English Channel. Such seasonal shifts may be associated with changes in feeding opportunities.

Mediterranean

Bearzi *et al.* (2003) gave an overview of the ecology, status and conservation of common dolphins in the Mediterranean Sea. These dolphins remain relatively abundant only in the westernmost portion of the basin (Alborán Sea), with sparse sightings records off Algeria and Tunisia, concentrations around the Maltese islands and in parts of the Aegean Sea, and relict groups in the south-eastern Tyrrhenian and eastern Ionian Seas. Otherwise, these dolphins are rare in, or completely absent from, Mediterranean areas where information is available.

Cañadas and Hammond (2008) presented information on the abundance and habitat preferences of common dolphins in the SW Mediterranean. The Mediterranean sub-population of the short-beaked form of common dolphin is believed to have suffered a steep decline in the Mediterranean in recent years. The Alborán Sea is considered the most important remaining Mediterranean habitat for common dolphins, and thus constitutes a vital source of information for the development of conservation measures. Spatial modelling was used to estimate abundance and explore habitat use of common dolphins in this area. From 1992 to 2004, 37,385km of non-systematic line transects generated 738 sightings in a 19,189km^2 study area. The point estimate of abundance was 19,428 (95% CI=15,277 to 22,804) dolphins. Average density was higher in summer than in winter, and higher in the western Alborán Sea than in the eastern Gulf of Vera. No overall trend in abundance was observed in the Alborán area. However, a decline was observed in the Gulf of Vera, with a summer density 3-fold lower in the period from 1996 to 2004 than in 1992 to 1995. A potential link of this decline with prey depletion due to the exponential growth of aquaculture in the area was noted. It was also found that groups with calves and feeding groups preferred more coastal waters, a result that could have important implications for the development of conservation measures for common dolphins in the Mediterranean.

In discussion, it was suggested that an apparent gap in sightings records at the northeastern edge of the Alborán Sea is related to the Almerie/Oran thermal front, or alternatively to a lack of sightings in the area due to generally worse sightings conditions here. It was also noted that a series of photo-id mark-recapture abundance estimates calculated for common dolphins in a small area of western Greece indicated a rapid decline from about 150 animals in 1996 to a few tens in 2007 (Bearzi *et al.*, 2008).

On previous occasions the sub-committee has recommended that a survey be carried out to obtain basin-wide estimates of abundance for cetaceans in the Mediterranean. Given current knowledge of population structure, the high numbers of bycatch in previously unsurveyed waters (Tudela *et al.*, 2005) and the concern about the status of common dolphins in the Mediterranean, the sub-committee reiterates its recommendation that planning and implementation proceed as quickly as possible and that a survey be carried out to estimate abundance of common dolphins in this region.

In the Black Sea, common dolphins are present and relatively abundant around the shelf waters, but absent from the Sea of Azov. They are also present in the Turkish Strait Systems (Jaramillo-Legorreta *et al.*, 2003). Current estimates are that there are tens of thousands in the Black Sea (Birkun, 2006); these are currently, as noted previously, classified as Black Sea common dolphins, *Delphinus delphis ponticus*.

South Africa

SC/61/SM33 presented an assessment of the abundance of common dolphins (believed to be of a long-beaked form) over the continental shelf south of South Africa based on sightings made during a Bryde's whale aerial survey in December 1982 and ship-based survey in January/February 1983, using standard line transect methodology. Effort and sightings in each survey were stratified by zone (west coast, south coast) and water depth (0-100m, 100-200m). Assuming $g(0)=1$, similar numbers of schools were estimated in each survey (52-58 aerial, 40-59 ship-based), but estimated school sizes were statistically different (means 454 for aerial and 159 for ship-based). As the former were obtained from composite aerial photographs of each school, they were considered more reliable than the ship-based values, which were estimated by eye. Given the small number of primary sightings on each survey (12 aerial and 6 ship-based), a combined estimate of abundance was prepared using school density estimates weighted by the inverse of their variances, and using the aerial estimate of school size. The resultant estimate (22,200 individuals, CV=0.35) was similar to a published figure of 15,000 to 20,000 (Cockcroft and Peddemors, 1990).

The sub-committee thanked the authors of the paper for this attempt to analyse the common dolphin data from the 1982/83 surveys. It was also noted that the use of photographs during the aerial surveys allowed for a very accurate estimate of group size of common dolphins. However, the sub-committee voiced concerns about the reliability of the resulting estimates, specifically; (i) survey design for the aerial survey included tracks parallel to the coast, which is not a representative survey design (thus making extrapolation to the sample area difficult); and (ii) the extremely small sample sizes raise problems. For example, the detection function of the ship survey was based on six primary sightings. While recognising that the small sample size is the main concern regarding the results of the paper, it was noted that the post stratification of in- and offshore areas reduced bias. It was also noted that the paper contained useful information on group size and distribution.

Western Atlantic

Information on the distribution of common dolphins in the western Atlantic Ocean was presented in Jefferson *et al.* (2009). Published and unpublished data sources were reviewed and included sightings, strandings and captures. In total 460 records were compiled and entered into a GIS database. 364 records were considered confirmed or accepted and were included in the further analyses. There were no valid records in the Gulf of Mexico. All valid records in the Caribbean were in shallow depths of less than 120m along the coast of Venezuela, suggesting a distributional hiatus with the MW Atlantic. Four putative stocks were described by the authors: South Brazil Bight Stock (most likely long-beaked form), Brazil-Argentina Stock (most likely short-beaked), Venezuelan Stock (long-beaked form, isolated, past hunting pressure) and Western North Atlantic Stock (short-beaked form). These results are different from what has been commonly accepted as distribution for this genus in the Atlantic. Most areas of distribution coincide with moderate to strong upwelling and common dolphins appear to avoid warm, tropical waters. The sub-committee marked the importance of this paper and how this changes the formally held ideas on stock structure in the region. As the presented paper highlighted, large areas in the western Atlantic Ocean have not been subject to dedicated survey effort. The sub-committee **recommends** that marine surveys being carried out in this region include small cetacean data collection, to better understand distribution and that attempts be made to obtain abundance estimates.

Tavares *et al.* (In press) presented information on biogeography of common dolphins in the south western Atlantic Ocean. Data from strandings, incidental catches and sightings were reviewed from 1992-present. A total of 184 records of common dolphins were compiled. Distributional patterns led the authors to suggest at least three stocks in the SW Atlantic: one located in northern Brazil and two others from southeastern Brazil to central Argentina and that distribution was closely associated with areas of high productivity. Cranial analysis revealed that both short and long-beaked forms occur in this area.

Information on abundance and distribution of common dolphins, *Delphinus* spp., off northeastern Venezuela was presented in SC/61/SM2. Common dolphins are widely distributed over the entire northeastern basin, including waters off Araya and Paria Peninsula and around Margarita, Coche and Cubagua islands. Areas of higher densities for *Delphinus* spp. are located on the northeastern coast, which coincides with the focal location of sardine fisheries and the most active upwelling in the areas. Further studies are recommended with a focus on trophic ecology and continuity of behavioural sampling paired with systematic line-transect estimations of abundance.

The sub-committee welcomed the presentation of the results of these papers to the sub-committee and noted that they compliment the data presented earlier on the distribution of common dolphins (Jefferson *et al.*, 2009). Given the likelihood, based on our current knowledge of distribution patterns, of stock structure in this region, the sub-committee **recommends** that work to better inform our understanding of population structure be carried out in this large geographical region, including southern Brazil.

Pacific Ocean

NORTH EAST PACIFIC

Carretta *et al.* (2008) summarises the most recent estimates of abundance for short-beaked form of common dolphins off California, Oregon and Washington (USA). These estimates are based on two Summer/Autumn shipboard surveys that were conducted in 2001 (Barlow and Forney, 2007) and 2005 (Forney, 2007). The distribution of short-beaked common dolphins throughout this region appears to be variable, due in part to seasonal and inter-annual oceanographic changes. As such, these dolphins may spend time outside the US EEZ making a multi-year average abundance estimate most appropriate for conservation management within US waters. The authors concluded that the 2001-05 geometric mean abundance estimate for short-beaked common dolphins off California, Oregon and Washington waters is 392,733 (CV=0.18)

Carretta *et al.* (2008) also summarises the most recent estimates of abundance for long-beaked form of common dolphins off California (USA) which are 20,076 (CV=0.71) and 11,714 (CV=0.99) based on 2001 and 2005 ship-based line transect surveys (Barlow and Forney, 2007; Forney, 2007). The 2001 estimate of 20,076 (CV=0.71) is based on a new multiple-covariate line transect analysis (Barlow and Forney, 2007) and thereby supplants the previous estimate of 306 (CV=1.02) reported by Barlow (2003). Since the distribution and abundance of long-beaked common dolphins off California seemingly varies seasonally and inter-annually, these dolphins may move between Mexican and US waters. As with the short-beaked form, the authors concluded that a multi-year average abundance estimate is the most appropriate for management within US EEZ waters off California. The geometric mean abundance estimate, based on two ship surveys conducted in 2001 and 2005, is 15,335 (CV=0.56) long-beaked common dolphins (Barlow and Forney, 2007; Forney, 2007).

SOUTH WEST PACIFIC

There have been no systematic surveys to address distribution or abundance of common dolphins within New Zealand waters (SC/61/SM20). Available data were compiled from a number of different sources over a number of years. Collectively, these data suggest common dolphins occur around much of North Island (NI) New Zealand. However, common dolphins primarily appear to be concentrated off the NE coast of the North Island, with a limited distribution off the South Island (SI). While common dolphins have been observed in the Marlborough Sounds and off Westport and Jackson Bay on the west coast, the southerly distribution along the east coast of the South Island appears mostly limited to Banks Peninsula. There is limited information on the offshore distribution of common dolphins in New Zealand, although animals are bycaught along the continental slope off the Taranaki Bight and in deeper waters west of Auckland. Common dolphins are also known to strand in the Chatham Islands and are assumed to occur in the Tasman Sea between New Zealand and Australia. Occurrence in coastal waters is considered seasonal in many regions, the exceptions being Hauraki Gulf (north east coast of NI) and off Wellington (southern coast of NI). In these two regions, common dolphins occur inshore year round. According to Stockin *et al.* (2008b) common dolphins occur in Hauraki Gulf year-round, in water depths ranging from 7 to 54.8m (mean=39.5m) and in water temperatures of 12 to 24ºC (mean=17.95, SD=3.30). Group size ranges from 2 to *ca* 200 animals, with larger groups (>50 animals) most frequently recorded in the winter. Smaller groups (in 70% cases containing calves) are most frequently observed in shallower waters during the spring and summer. Other studies (e.g. Constantine, 1995; Neumann, 2001) also suggest seasonal movement offshore during the autumn and winter.

There are no current abundance estimates for common dolphins in New Zealand. Photo-id studies were carried out in Hauraki Gulf (resulting in a catalogue of over 600 marked recognisable individuals) and by Neumann *et al.* (2002) in the Bay of Plenty. Currently, both Bay of Plenty and Hauraki Gulf catalogues are being cross-matched, with a view to investigating movement between areas and site fidelity. Sightings data resulting from aerial surveys conducted off the east coast of the NI, west coast NI and east coast SI report only small groups of common dolphins ranging from 10 to 30 animals. Larger aggregations involving 50+ animals were rare except in Cook Strait where during the austral winter, larger aggregations of up to 200 animals have been recorded travelling through the area.

No information was provided to the sub-committee on the distribution of common dolphins in the Indian Ocean or elsewhere.

The sub-committee noted that in general, large parts of the range of common dolphins have not been covered by surveys nor abundance estimates generated (see Table 1). The sub-committee **recommends** that further studies be conducted at regional and local scales to better quantify abundance and distribution. Quantification of abundance in areas where there is concern over the status of the species (e.g. Mediterranean) or where levels of bycatch are known to be high (e.g. Peru, Korea and Australia) should be prioritised. In addition, surveys to better elucidate distribution (and abundance) should be carried out in the southwestern Atlantic and southwestern Pacific, where gaps in distribution have been noted and in the mid-Atlantic, to establish if there is a continuous distribution of this species across the North Atlantic.

6.4 Life history

Dabin *et al.* (2008) addressed the issue of the persistence of ovarian scars in the short-beaked common dolphin, by examining the ovaries of 187 females of known age and known reproductive status, collected stranded along the Atlantic coasts of France. The number of *corpora albicantia* (CA) did not increase with age after sexual maturity is reached, suggesting that ovarian scars are not persistent or that their number at any one time results from the ovulation rate and from a healing or regression rate operating concomitantly. Pregnant females, which stop ovulating during gestation, showed *ca* 40% less CAs than resting mature females of similar age, suggesting that most CAs would heal quickly, with a half-life of less than a year, although the largest scars may persist longer. The authors consider that these results limit the potential for reconstructing individual reproductive lifetime history in the common dolphin.

In response to a point made in discussion that younger females can have a surprisingly large number of CAs (i.e. from 12.3 ± 8.4, 0-34, n=64 in the 9 to 15 year-old classes), Ridoux indicated that the breeding season is prolonged in common dolphins, perhaps up to about six months, and that numerous ovulations may be possible during a single season.

Best expressed concern that the study had not included histology and for an animal with such small ovaries, histological examination would be advisable. He also cautioned that extrapolation of the pattern observed in common dolphins to other cetaceans with larger *corpora lutea*, is not necessarily appropriate and Ridoux agreed that more case studies of the persistence of *corpora albicantia* in other species of small cetaceans would be informative. Several participants also drew attention to the difficulty of distinguishing between *corpora albicantia* from pregnancy (gestation) and those from infertile ovulations. Perrin reported that the number of CA is correlated with age in *Stenella* spp in the ETP.

SC/61/SM5 analysed the reproductive status of 55 female common dolphins stranded along the coast of Galicia, north-western Spain, between 2001 and 2003. The largest sexually immature individual was 194cm and the smallest sexually mature individual was 170cm. The youngest sexually mature individual was 8yr old and the oldest immature individual also was 8yr old. The average age at sexual maturity appeared to be about 9yr, which is in broad agreement with the findings of Dabin *et al.* (2008) who estimated the average age at sexual maturity as 8.9yr (SE=0.1).

SC/61/SM12 provided some life history data from common dolphins bycaught in a driftnet fishery in the western North Atlantic. The annual pregnancy rate was between 25 and 33% and there was evidence that reproduction was seasonal and highly synchronised with a peak during July. Age at sexual maturity in females was about 8yr and males about 9.5yr. It was noted that the sample was biased towards males, perhaps because mortality was selective. Therefore the results of the study could also be biased to some degree.

Murphy *et al.* (2009b) estimated female growth and reproductive parameters using teeth, gonads and other biological data collected by European stranding and bycatch observer programmes over a 16 year sampling period (between 1990 and 2006). Age was determined for 515 individuals and the maximum age in the sample was 29 years. Body lengths ranged from 91 to 239cm. Length at physical maturity was estimated using the Richards model as 202cm. Sexually immature females ranged from 91 to 210cm and 0 to 12 years of age. Sexually mature females ranged from 165 to 227 cm and 6.5 to 26 years. Average age at sexual maturity was estimated as 8.22 years using a general linear model method. Average length at sexual maturity was calculated as 188cm using the adjusted SOFI method. The average length at birth was 93cm and the average weight at birth was 8.7kg. The gestation period was estimated to be 362.7 days or 0.99 years. Previous studies by Murphy *et al.* (2004; 2005) had suggested that the mating and calving period extends from May to September for this species in the NE Atlantic. Murphy *et al.* (2009b) estimated 19 July as the average date of conception. Individual conception dates ranged from 5 April to 2 October, though 40% of individuals were conceived in July.

The estimated annual pregnancy rate (APR) is 26% with a calving interval of 3.79 years was also calculated. A slightly higher pregnancy rate of 33% was estimated for the control group of 'healthy' individuals (not suffering from any infectious or non-infectious disease that might have inhibited reproduction) although there was no significant difference in the proportion of pregnant individuals between the control group and the whole NE Atlantic sample. The whole sample was divided into two time periods, the 1990s and 2000s, in order to investigate evidence for density-dependent compensatory responses. No significant difference was found in the proportion of pregnant females between the two time periods, or the proportion of females simultaneously pregnant and lactating. Overall, a low APR was observed throughout the sampling period. A significant increase was observed in the proportion of mature females between the 1990s (45%) and the 2000s (54%). However, it cannot be ruled out that this was due to sampling bias. Using generalised linear models with age and decade terms as explanatory variables, no significant differences were observed in the ASM between decades. Power analysis was undertaken to determine the sample sizes required for detecting statistically significant temporal and geographic variations in the APR, using an initial pregnancy rate of 25%. Results suggested that a sample size of 150 females provides a statistical power ≥80% to detect an absolute decrease of ≥13% in pregnancy rate between two time periods. If an increase occurred in the pregnancy rate, a sample size of 150 females would be needed to detect a ≥15% increase in the pregnancy rate at the same power.

The sample size of mature females used to estimate the pregnancy rate in European waters was 248, and it took 16 years of effort by various European stranding and bycatch observer programs to attain that size of sample. It will be important for these programmes to continue so that the pregnancy rate can be monitored in the future. Although the study by Murphy *et al.* (2009b) focused on the detection of statistically significant changes in the pregnancy rate, such changes could become biologically significant before they are statistically detectable. No significant differences were found in this study that could be construed as evidence of density-dependent compensatory responses. The low APR reported throughout the sampling period may indicate either that the level of anthropogenic mortality had not caused a substantial population decline, or that the prey base was declining at approximately the same rate as the dolphin population. There is as yet no evidence either way.

In response to a question of whether potentially high rates of foetal mortality had been taken into account in the study, Murphy indicated that in estimating pregnancy rate, females that died during the mating/calving period of May–September had been excluded, and also that a large percentage of the studied sample had been obtained during the second trimester. Therefore, in her view the pregnancy rate estimated in this paper is likely close to the actual pregnancy rate for the population.

Vázquez drew attention to the fact that in future analyses of this kind, an effort should be made include samples from the Basque area of northern Spain. The sub-committee noted the importance of strandings schemes in obtaining biological information for small cetaceans and to help in samples useful to elucidate stock structure. The sub-committee encouraged the continuation of existing strandings monitoring programmes that incorporate standardised protocols and **recommended** further collaboration in the establishment of new stranding programmes.

Pierce *et al.* (2008) analysed samples collected under the EC BIOCET project from common dolphins stranded along the Irish, Scottish, French and Galician (NW Spain) coasts between 2001 and 2003. The parameters assessed included age, reproductive status, number of corpora scars, ovary weight, diet, fatty acid profiles, and levels of various PCB congeners, PBDEs and HBCDs. Redundancy analysis undertaken on the BIOCET data indicated that the 'number of *corpora albicantia* (CA)' and 'pregnancy' were the third and seventh explanatory variables for concentrations of PCBs in the blubber tissue of common dolphins. The authors also reported that 40% of the samples were above a threshold for adverse effects on the immune system and reproduction in other mammals – 17mg/kg PCB lipid weight based on experimental studies of both immunological and reproductive effects in seals, otters and mink using the commercial PCB mixture Aroclor 1254 (Kannan *et al.*, 2000).

Further analysis of BICOET data by Murphy *et al.* (In review) reported no significant relationship was observed between number of CAs and age in sexually mature female common dolphins although a large proportion of resting mature females had a high number of CAs. A quasi-Poisson model of the number of CAs in relation to age and pregnancy explained 68.5% of deviance and indicated an asymptote in number of CAs around age 15, with fewer CAs present in the ovaries of pregnant females. The dolphin (quasi-Poisson) model for number of CAs was not improved by including PCB burden (∑18PCB congeners). The tendency was for the number of CAs to increase linearly with ∑18PCB but this was not statistically significant. A similar result was observed for PBDEs, while no clear tendency was apparent for HBCDs.

No significant relationship between age and Aroclor 1254 (∑-ICES7 PCB congeners*3) was observed for the dolphins in this study. However, a significant increase in contaminant burden and number of corpora scars was observed in sexually mature females. When the threshold of 17mg/kg was applied to the data, the majority of individuals above this threshold were resting mature females with a high number of CAs. This suggests that either: (a) due to high contaminant burdens, females are unable to reproduce, thus continue ovulating; or (b) females are not reproducing for some other reason, either physical or social, and have started accumulating higher levels of contaminants. However, information on health status for these individuals was lacking, and it was not known if they were unable to reproduce for other reasons. Additional analyses on a 'control group', i.e. animals diagnosed as bycaught, that were assessed for evidence of any infectious or non-infectious disease that would be expected to inhibit reproduction. Results from the control group study suggested that high contaminant burdens, above the threshold level, were not inhibiting ovulation, conception or implantation in female common dolphins although the potential effects on foetal survival require further investigation. Further, it appears that some females may go through a large number of infertile ovulations prior to a successful pregnancy, birth and survival of their young. Data also suggested, based on a decline in contaminant levels with increasing corpora scar number, that although there were non-breeding (ovulating) females in the population, almost all females eventually become pregnant. Interestingly, within the control group of healthy individuals, a significant positive correlation between age and number of corpora scars was observed in mature female common dolphins.

In response to a question on the potential impact of contaminants on male common dolphins, Murphy replied that she had considered investigating the potential effects of contaminants on male reproduction, and is currently studying this in male harbour porpoises from the UK. Additional information on contaminants is given in Item 6.6.

6.5 Ecology

Feeding ecology

Very little is known about the ecology of western North Atlantic short-beaked common dolphins (SC/61/SM12). The highly significant male bias observed in the sex ratios of the biopsy, stranding and bycatch sample sets (Westgate, 2005) suggests that *Delphinus* display sexual segregation over the spatial scale of their habitat. This could be in the form of larger scale habitat partitioning or actual school based sexual segregation. Seasonal changes in the distribution of western North Atlantic short-beaked common dolphins may be related to changes in the abundance or distribution of their prey but to date very little is known about their feeding ecology.

Information on the diet and feeding ecology of the short-beaked common dolphin in the northeast Atlantic was presented in SC/61/SM14. Stomach contents from 129 individuals were used from two different sources: (i) samples were obtained from dolphins found stranded along the Irish coast (n=76) between 1990 and 2004, representing neritic foraging; and (ii) individuals incidentally captured in the Irish albacore tuna (*Thunnus alalunga*) driftnet fishery (n=58) between 1996 and 1999, representing offshore foraging. In both groups, the foraging strategy appears to involve targeting relatively small-sized shoaling fish. A total of 46 prey species were recorded consisting of 31 fish and 15 cephalopod species. Fish were numerically the most important prey group (95% prey numbers), with cephalopods comprising only 5%. A small number of crustaceans were also recorded. For the inshore group, gadoids comprised 59% of the fish component of the neritic dolphin diet, and the most commonly occurring fish were *Trisopterus* spp. (Norway pout and poor cod), which comprised 45% by number, followed by *Gobiidae* (28% by number). In contrast, for the offshore group, myctophids dominated the fish component, accounting for 54% of the fish recovered. Prey size for the offshore group corresponds closely to data published in previous studies in the NE Atlantic, with a modal size class of 4-5cm. In contrast in inshore waters, the average prey size is considerably larger at 9.7cm (SD = 6.45, range 1-60cm), although no correction factor was applied. Nine dolphins from the offshore group had only milk in their stomachs (aged 0-3 months), while three (aged 3-6 months) had both milk and solid food suggesting that weaning occurs between 3 and 6 months.

Bearzi *et al.* (2003) summarised the sparse information available on feeding ecology of common dolphins in the Mediterranean basin, where they are found in both neritic and pelagic habitat. As elsewhere in their range, common dolphins in the Mediterranean consume a wide variety of prey but especially small, shoaling fish such as anchovies, sardines and sauries that are often chased at and near the surface. Eurybathic cephalopods and crustaceans have also been found in stomach contents. There are reports by local fishermen in some areas of ‘cooperative’ fishing in which the fishermen take advantage of fish aggregations actively chased towards the surface by common dolphins. Other reports refer to common dolphins surrounding nets and feeding on small pelagic fish that escape or protrude through the mesh.

The sub-committee discussed possible reasons for the observed decline in common dolphins of the Mediterranean. One possibility is that prey has been depleted, and some data points to this. It is also possible that the distribution of the common dolphin has changed and that animals have moved to the southern part of the Mediterranean.

SC/61/SM20 provided an overview of the current knowledge of the diet and feeding ecology of New Zealand common dolphins. Qualitative insights into the diet of New Zealand common dolphins were given in Neumann and Orams (2003), using underwater video footage taken during feeding activities in the Bay of Plenty. Kahawai, jack mackerel, yellow-eyed mullet, flying fish and garfish were identified as potential prey items. The first quantitative dietary assessment for the New Zealand common dolphins was provided by Meynier *et al.* (2008). In this study, 53 common dolphins collected from around the North Island were examined. Stomach contents derived from 42 beachcast and 11 bycaught carcasses collected between 1997 and 2006 were examined. Although the diet of bycaught and stranded individuals comprised a diverse range of fish and cephalopod species, the most prevalent prey identified included arrow squid, jack mackerel and anchovy. Stranded animals and those bycaught within neritic waters, were found to feed on both neritic and oceanic prey. Moreover, this mixed prey composition was evident in the diet of common dolphins bycaught in oceanic waters, suggesting likely inshore/offshore movements on a diel basis. This was supported by prey species identified within the fresh fraction of the stomach contents. Although the sample size is small (n=53) if inshore-offshore movements are occurring on a diel (as well as seasonal) basis, it would suggest the same common dolphins facing pressure from inshore tourism operations are those that are nocturnally feeding on the deep scattering layer, and subsequently most at risk from being caught in fishing gear. This research is on-going and future work will include the application of fatty acid and stable isotope analyses to the larger samples sizes of blubber and teeth, in addition to stomach content analysis.

Feeding behaviours of common dolphins differ between different study sites around New Zealand waters and are likely to represent prey and/or habitat differences. Activity budgets detailed in SC/61/SM20 suggest behaviour varies seasonally, with group size and water depth. The Hauraki Gulf was identified as an important feeding area for New Zealand common dolphins. There was some discussion on the impact of vessels on the behaviour of the animal and further studies were **encouraged** by the sub-committee in this regard.

6.6 Habitat degradation

SC/61/SM12 lists potential threats to the habitat of short-beaked common dolphins in the NW Atlantic. Potential threats to habitat include pollution, halogenated contaminants and anthropogenic noise; however, none of these threats have been directly quantified with respect to NW Atlantic short-beaked dolphins. It is worth noting that this population spends considerable time in the waters adjacent to the Gulf Stream. Changes in ocean circulation patterns brought on by global climate change may have impacts on the ecology of NW Atlantic pelagic dolphins including NW Atlantic short-beaked dolphins.

SC/61/SM20 also looked at pollutants. Trace elements, polychlorinated biphenyls (PCBs) and organochlorine (OC) pesticide levels were recently examined in tissues collected from stranded and bycaught common dolphins from New Zealand waters (Stockin *et al.*, 2007). The concentrations of mercury (Hg), selenium (Se), chromium (Cr), zinc (Zn), nickel (Ni), cadmium (Cd), cobalt (Co), manganese (Mn), iron (Fe), copper (Cu), tin (Sn), lead (Pb), arsenic (As) and silver (Ag) were determined in blubber, liver and kidney tissue. PCBs (45 congeners) and a range of organochlorine pesticides including dieldrin, hexachlorocyclohexane (HCH) and dichlorodiphenyltrichloroethane (DDT) and its metabolites DDE and DDD were determined in blubber samples. Cr and Ni were not detected in any of the samples and concentrations of Co, Sn and Pb were generally low. Concentrations of Hg ranged from 0.17 to 110mg/kg wet weight. Organochlorine pesticides dieldrin, hexachlorobenzene (HCB), o, p'-DDT and p, p'-DDE were present at the highest concentrations. Sum DDT concentrations in the blubber ranged from 17 to 337 and 654 to 4,430µg/kg wet weight in females and males, respectively. Similarly, Σ45CB concentrations ranged from 49 to 386 and 268 to 1,634µg/kg wet weight in females and males, respectively (Stockin *et al.*, 2007). The mean transmission of ΣDDTs and International Council for the Exploration of the Sea seven chlorinated biphenyls congeners (ICES 7CBs) between a genetically determined mother-offspring pair was calculated at 46% and 42%, respectively. Concentrations of organochlorine pesticides determined in Stockin *et al.* (2007) were within similar range to those previously reported for Hector's and bottlenose dolphins from New Zealand waters (Jones *et al.*, 1999).

Common dolphins are the focus of several commercial tour boats, operating within the North Island, with at least 13 permits currently targeting *Delphinus* in the Bay of Islands, Hauraki Gulf and Bay of Plenty regions. During a recent impact assessment in the Hauraki Gulf, foraging and resting bouts were significantly disrupted by boat interactions to a level that raises concern about the sustainability of this impact (Stockin *et al.*, 2008a). Impacts identified were similar to those previously reported (e.g. Lusseau, 2003) for bottlenose dolphins.

6.7 Directed takes

SC/61/SM17 gives an update on historical accounts of the occurrence and capture of common dolphins along the Portuguese mainland. Historical oral sources indicate that common dolphins, locally known as '*toninhas*', were observed and captured in large numbers along the Portuguese mainland coast during the late 19^{th} and 20^{th} centuries. Historical occurrences given by naturalists and scientific surveys conducted by biologists indicate their regular presence with particular preference for certain areas. Between 1976 and 1978, research directed at quantifying the numbers of captured cetaceans in fish markets along the Portuguese shore was conducted and resulted in a total count of 45 cetaceans. Most captures were of small cetaceans (87% short-beaked form of common dolphins), even though four baleen whales were registered. These cetacean captures were part of a local non-industrial fishery, as they were not the main target, but were opportunistic catches or even bycatches of other fisheries. Delphinids were not protected by law at the time and were caught with hand harpoons or accidentally drowned in fish nets, sometimes sold at major fish markets such as Sesimbra, Peniche and Póvoa de Varzim. In geographic areas where recent cetacean sightings are rare and information is sparse, such as Portugal, the investigation of historical naturalist observations, whaling data and opportunistic sightings information, contribute new data on the occurrence of common dolphins in a poorly studied region.

SC/61/SM18 presented information on captures of '*toninhas*' in Angola during the 20^{th} century. References to the capture of '*toninhas*', a Portuguese word used mainly to name common dolphins, *Delphinus delphis* (but eventually also including harbour porpoises, *Phocoena phocoena* and striped dolphins, *Stenella coeruleoalba*), are part of the 20^{th} century fishing statistics of Angola. National fishing books from this former Portuguese colony, were consulted in the National Institute of Statistics in Lisbon and data between 1940 and 1969 was obtained. Information on fish captures is given in tons. A total of 25 tons of '*toninhas*' was reported. If we consider these animals may weigh between 75 to 150kg each, we can evaluate the total number of captured individuals as varying between 320 and 650. Each year there were some variations in the amount of captures, but they were caught regularly throughout the period. Although there is some uncertainty about species identification, as several small dolphins occur off Angola, it is evident that a fishing effort focused on these cetaceans occurred in the region. This is a small but relevant contribution to the knowledge on captures of small cetaceans in the region, and also provides evidence of historical distribution.

The sub-committee commended the authors of both SC/61/SM17 and SC/61/SM18 on their efforts to investigate historical data sources for catch data both in Portugal and Angola. In discussion, the sub-committee noted the difficulty in determining whether the animals were targets for the fishery or were bycaught, although in some cases photographs exist showing harpoon marks, indicating a direct catch. Species identification is not absolutely certain and furthermore, for the animals caught off Angola, it is also likely that the common dolphins hunted were not *Delphinus*, but tropical dolphins of other genera/species. Angolan catches showed a reduction in takes between 1954 and 1955, but the reason for this is not known. The sub-committee also noted that long-beaked common dolphins are taken by harpoon in local fisheries in Peru (SC/60/SM19) and Venezuela (Romero *et al.*, 1997).

SC/61/SM20 provided an overview of common dolphins held in captivity in New Zealand. During its 44 years in operation, Marineland held a total of 41 common dolphins, including two stranded individuals, one captive-born and several captured individuals off the Hawkes Bay region. However, the recent death of their last remaining common dolphin and the impending expiration of the existing permit (July 2009) means it is unlikely that any further cetaceans in New Zealand will be held in captivity. Bringing in to, or breeding of cetaceans in captivity is not considered essential for the conservation management of any marine mammal species in New Zealand.

No other data was available to the sub-committee to review directed takes of common dolphins.

6.8 Incidental takes

SC/61/SM30 presented the results of a survey aimed at assessing the number of dolphins taken annually by the demersal pair trawl fishery off NW Spain and to identify the most influential operational factors affecting the bycatch rate. Pair trawlers have been operating in the region since the mid 1980s and mainly target blue whiting, although mackerel, hake and horse mackerel are also taken as secondary targets. Observers placed onboard the trawlers monitored about 900 fishing operations between March 2001 and December 2003. The results of the study show that short-beaked common dolphins dominated the bycatch and that about 327 individuals of this species are caught every year by the fleet in the area. Most capture events involved only one or two individuals, although there were a few isolated capture events that involved up to fifteen individuals. The sex ratio was skewed towards males and the catch mainly included older juveniles and young adults. Three factors significantly influenced the bycatch rate: depth, as all captured dolphins came from sets made in waters shallower than 300m; time of the day, since vulnerability of dolphins to bycatch appeared higher at night, and seasonality, as the bycatch rate was significantly higher during the period when the seawater remains stratified (Summer). Taking this into consideration, the authors propose that the bycatch rate could be significantly mitigated if the vessels are not allowed to trawl during the night and in waters shallower than 250m deep. This measure is likely to be acceptable to fishermen because the main target species, the blue whiting, is more abundant in deep waters than in shallow.

The sub-committee discussed the significance of the difference in bycatch rates between day and night tows. Although fishermen confirmed that bycatch mostly occurs during the night, nets are often set during the day and hauled in at night or *vice versa*. When tows that were made exclusively in daylight were compared to those made exclusively at night, a higher bycatch rate was found during night time tows, but the difference was not significant. It was noted that it is therefore uncertain that changing the fishing to daytime would significantly reduce bycatch.

The sub-committee remarked that the observed distribution of ages in the catches is not what would be expected from a stable age distribution of a population. Similar skewed distributions of bycaught common dolphins, with a bias to juveniles and males, have been observed in other areas in pelagic fisheries. Several possible reasons for this were identified: (i) a geographical segregation of different ages; (ii) certain segments of the population visit the net more frequently than others; (iii) the vulnerability of some individuals to be caught might be higher than others; and (iv) different age and/or sex classes might associate with different types of fishing vessels. In contrast, the common dolphin bycatch in the Summer driftnet fishery was dominated by sexually mature individuals and individuals <1yr (Murphy *et al.*, 2006a; Rogan and Mackay, 2007).

In discussion, it was noted that possible mitigation methods, particularly the use of acoustic deterrents to deter (or alert) dolphins have been tested. If dolphins follow fishing vessels to visit the net these acoustic devices might potentially attract them. However, information provided in SC/61/SM37 shows that pinger use can be effective in reducing common dolphin bycatch in pelagic trawls, although the mechanism of how it works is not clear.

Northridge reported that within the NE Atlantic region in recent years much attention has been paid to the monitoring of dolphin bycatch in pelagic trawl fisheries. The EU funded project 'Petracet' (Northridge *et al.*, 2006) aimed to monitor about 5% of annual fishing effort among the main French, Irish, UK, Danish and Dutch pelagic trawl fisheries operating in the Celtic Seas and Bay of Biscay region. Dolphin bycatch was estimated in the pelagic fisheries monitored at around 622 (489 in the bass and 133 in the albacore tuna fishery) animals per year; 96% of these were common dolphins. Other fisheries that were observed were for anchovy (371 observed tows), horse mackerel (44 tows) and mackerel (92 tows). As no cetaceans were observed in any of those the best estimate of the bycatch rate in those fisheries is zero. However, it is clear from previous studies that some bycatch might be expected in the horse mackerel and mackerel fisheries at least (Couperus, 1997; Morizur *et al.*, 1996).

Since 2004 EU member states have been obliged to monitor 10% of Winter fishing effort (December to March) for pelagic trawling in EU Atlantic waters, and 5% during the rest of the year under EU Council Regulation 812/2004. More recent observations suggest a possible decline in bycatch rate in the bass and tuna pelagic trawl fisheries. Observations in the French pair trawl fisheries in 2007 included 13 common dolphins caught in 240 observed tows in the bass fishery (some of which may have used bycatch mitigation measures, which complicated interpretation), compared with 75 common dolphins in 285 observed tows in 2003/4, leading to an estimate of 165-243 common dolphins in this fishery in 2007. The relevant figures for the tuna fishery in 2007 were 1 common dolphin in 145 tows (compared to 14/150 in 2003/4) leading to an annual estimate of 22 common dolphins caught in that fishery.

The sub-committee discussed potential reasons for the observed decline in bycatch:

(1) the use of pingers was successful;
(2) a decrease in local abundance;
(3) a distributional shift; and
(4) the fleet changed or fishing effort decreased.

It was also noted that at the moment there is no clear stock definition, which is important when considering the impact of bycatch on common dolphins in this area.

SC/61/SM37 summarised recent estimates of common dolphin bycatch in UK fisheries including the bass pelagic pair trawl fishery in the Channel. In the UK bass pair trawl fishery estimated bycatches peaked at 439 animals (95% CI 379-512) in the winter of 2003/04 and declined to 84 in 2005/06. Since that season effort has been low, but since December 2006 the majority of tows have been made with acoustic deterrent devices deployed. Between December 2006 and December 2008, 33 tows had been observed using functional pingers, with no dolphin bycatch incidents. Eight common dolphin bycatches were recorded in three observed tows in which the pingers were absent or broken. These observations might be compared with 77 bycatch incidents among 300 observed tows during 2001-April 2006. The fact that eight dolphins (7+1) were recorded in two of three tows in which devices were not operating suggests no obvious decline in the underlying bycatch rate, and also suggests that the acoustic deterrent devices are effective. More observations will be needed to quantify the extent of this effect.

Common dolphin bycatch is also known to occur, especially in the winter months, in several other UK fisheries, notably those involving large meshed static nets. Between 2005 and 2008 some 3,077 static net fishing operations have been monitored on UK-based set-net vessels in the Irish Sea, Celtic Sea and English Channel. A total of 22 bycaught common dolphins has been observed, but only in those fisheries targeting hake, monkfish, turbot and pollack. A combined estimate for these four fisheries using fishery specific bycatch rates averaged over all four years of observation, together with fishery specific effort estimates for 2008, yields a total bycatch figure for 2008 of 594 common dolphins (CI: 22-797). This estimate is a provisional one, as the variation in the observed bycatch rate from year to year warrants further investigation, as does the spatial distribution of the bycatch.

The sub-committee discussed the possibility of extrapolating the bycatch estimates to fisheries taking place in all regions. Although there has been some improvement in the available data, it is still difficult to obtain a complete compilation of fishing effort. It was also highlighted that the pelagic trawl fishery is not the only concern. The static net fleet also has bycatches of common dolphins (SC/61/ProgRepFrance). This fleet has not been investigated and a focused attention on the set-net fishery would be advisable.

SC/61/SM5 presents information on the short-beaked common dolphin in Galicia, NW Spain. Carcasses of 80 known bycatches were recovered from fishing boats collaborating in a recovery scheme, mainly since 2006. Galicia has an average of 250 marine mammal strandings per year of which common dolphins are the most frequently recorded species and make up 47% of the strandings. Between 1990 and 2007, 1,747 common dolphins stranded along the Galician coastline of which 606 were considered to be 'fresh' enough to see evidence of fisheries interactions. Of these, 41% of the animals (93 females and 153 males) showed evidence of fisheries interactions (CEMMA, unpublished data). The rate of recorded fishery interactions in stranded common dolphins has increased over time from 16% in 1996 (González, 1999) to 23% in 1990-99 (Lopez *et al.*, 2002) and is estimated to be currently around 41%. However, it should be noted that not all bycaught animals arrive to shore as strandings, some bycaught animals may not show evidence of fisheries interactions and bycatch diagnosis is not possible for heavily decomposed animals, so these results are most likely underestimates. The authors noted that common dolphin and fisheries interactions in Galicia appear to greatly exceed the maximum allowable limits recommended by ASCOBANS and the IWC and are most probably unsustainable. However, gaps in our knowledge of this population and the need for more robust abundance and distribution data, limit our knowledge of the impact of bycatch on common dolphins in the area.

The sub-committee noted that there is no obvious seasonal pattern in the bycatch diagnosed from strandings data, although there is one visible in the fishery, suggesting that there are un-monitored fisheries where bycatch is occurring. Given that all these fisheries operate in the NE Atlantic, and that, in general, the data are compiled on a country by county basis, the sub-committee **recommends** a regional effort to compile data of all nations and to include the set-net fisheries in the monitoring programme. Taking into account previously high bycatches in some fisheries (e.g. Rogan and Mackay, 2007; Zeeburg *et al.*, 2006), that in other fisheries there are seasonal fluctuations in fishing effort and location, the probable movement of animals over a large geographical area, the incomplete sampling of all fishing fleets, and the low observer cover, the sub-committee noted that from the information available, at a minimum 1,000 common dolphins are taken in fisheries annually in this large geographical region.

SC/61/SM12 presents information on the bycatch of short-beaked common dolphins in the western North Atlantic between North Carolina, USA and Nova Scotia, Canada. Abundance estimates, as noted previously, for this single population are 120,743 (CV=0.23). Large schools are often seen in waters between 100-2,000m depth. There is a seasonal shift in their distribution being more northern in the Summer and more southern in the Winter. Strandings have been reported year round on Cape Cod. The population has been historically impacted by several fisheries but recent bycatch estimates are below the Potential Biological Removal (PBR) level. Additional threats to the population have not been quantified. Short-beaked common dolphin mortalities have been documented in the following US fisheries: Atlantic pelagic drift gillnet, Northeast and Mid-Atlantic gillnet, Northeast and Mid-Atlantic bottom trawl, and Mid-Atlantic mid-water trawl (including pair trawl) fisheries. Short-beaked common dolphins have also been documented to be hooked and released alive in the pelagic longline fishery. On average 415 (CV=0.15) animals were taken annually as incidental bycatch in these fisheries during years/fisheries which had at least some observer coverage. The Atlantic pelagic drift gillnet and Mid-Atlantic bottom trawl fisheries had the highest annual averages: 185 animals (CV=0.03) and 181 animals (CV=0.34), respectively. In discussion, the sub-committee noted that an increase in observer coverage in the fishery probably led to an increase in accuracy of the numbers.

Little is known on bycatch in Atlantic Canadian waters. A total of 47 incidental catches were recorded, which included one common dolphin. The incidental mortality rate for common dolphins was 0.007/set. An unknown number of common dolphins have been taken in an experimental salmon drift-gillnet fishery off Greenland (Read, 1994).

Recent fishery mortality and injury for short-beaked common dolphins of the US California, Oregon, Washington stock is given in Carretta (2008). Mean annual takes reported are based on 2002-06 data with an average estimate of 77 (CV=0.38) animals taken annually. A summary of recent fishery mortality and injury for long-beaked common dolphins of the US California stock is also reported in Carretta (2008). Mean annual takes of long-beaked common dolphins in this region are based on 2002-06 data, suggesting an average estimate of 16 (CV=0.46) animals taken annually.

Estimates of bycatch in the South Pacific are rare. It was noted from the progress reports and the summary table (see Appendix 3) and from previously reported information that bycatch is reported from for example, Peru and Korea. Bycatch of dolphins along the coast of Peru has previously been reported in SC/61/SM19. Interactions observed from a port in northern Peru from 2005 to 2007 consisted of 231 animals caught in gillnets, 1 in a longline and 21 directed takes. The most commonly captured species was the long-beaked form of common dolphin. The sub-committee **encourages** continued and further observer cover in this large geographical area.

Hamer *et al.* (2008) summarised measurement, management and mitigation of operational interactions between the South Australian Sardine Fishery and the short-beaked form of common dolphin in that region. This study arose from recommendations given in response to a legislated ecological assessment of the South Australian Sardine Fishery in 2004, urging it to: (i) attempt to mitigate operational interactions with marine mammals if excessive levels were detected; and (ii) improve the accuracy of their reporting of these events. An initial observer programme revealed high rates of encirclement and mortality (1.78 and 0.39 dolphins per net-set, respectively) of short-beaked common dolphins. This equated to an estimate of 1,728 encirclements and 377 mortalities across the entire fleet over the same period. A code of practice (CoP) was subsequently introduced aimed at mitigating operational interactions. A second observer programme revealed a significant reduction in the observed rates of dolphin encirclement (0.22; down 87.3%) and mortality (0.01; down 97.1%) with an estimate of 169 and eight, respectively. The authors also recommended that the abundance, movements and boundaries of the common dolphin population in the region be determined, so that the impact of fishing activities on their status can be established. The sub-committee noted that the code of practice seems to work well and also **recommends** the assessment of abundance of these dolphins, along with further work on stock structure in the area (see Item 6.2).

SC/61/SM20 summarises some information relating to bycatch of *Delphinus* within NZ waters. Data were obtained from two sources – reported bycatch data from the Ministry of Fisheries (MFISH) and data from beach cast carcasses examined at Massey University. Between 1998 and 2008, 115 common dolphins were reported to MFISH as incidental bycatch within New Zealand commercial fisheries. An additional 24 unidentified dolphins, likely representing *Delphinus*, were also reported by MFISH observers during the same period. Of the confirmed dolphins bycatch reported, 86% (n=99) occurred within the commercial trawl fishery for jack mackerel (JMA). The remaining 14% of common dolphins were incidentally captured by vessels targeting hoki, skipjack tuna, barracouta, snapper and trevally (*Pseudocaranx dentex*). Observer effort (based on number of trawls observed) within the JMA fishery ranged from 5 to 40% during 1998 to 2008. Observed bycatch of common dolphins varies inter-annually, and this fishery is seasonal with most animals being caught between November to February. Most captures occur in the early hours of the morning either on or close to the shelf edge, in areas frequently associated with the deep scattering layer. An extrapolation to fleet level was attempted and it was estimated that *ca* 600 common dolphins were bycaught in this fishery between 1998 and 2008. This is based on the number of reported common dolphins bycaught and observer effort (based on vessels with onboard observers) within the JMA fishery. It was noted that this estimate fails to take into consideration a number of unknown variables and assumes the probability of bycatch is equal in all areas, which of course is unlikely to be the case. The latest bycatch data for 2009 indicate nine common dolphins were incidentally killed during the recent January/February observer programme. During this period, extensive observer coverage was applied to quantify the extent of *Cephalorhynchus*-fisheries interactions. In light of these data, and in absence of any abundance estimates for *Delphinus* in New Zealand waters, a more rigorous assessment of *Delphinus* bycatch is required.

Of 586 dolphins which stranded along the NZ coast between 1998-2008, 133 were examined. Results from post-mortem examinations suggest 28% of individuals (n=24) exhibited trauma and lesions indicative of net entanglement. Lesions identified appear to be consistent with those inflicted by set-nets. It is not clear whether such lesions have resulted from commercial or recreational set-nets.

SM/61/SM33 reported that while 1,074 common dolphins had been taken in shark nets off KwaZula-Natal, South Africa, between 1980 and 2000, annual catches had fallen to an average of five individuals since 2006, due to a number of reasons, including mitigation measures.

SC/61/SM19 presented a modelling approach to defining bycatch limits for NE Atlantic common dolphins. Bycatch of short-beaked common dolphins in the NE Atlantic is an international conservation issue. SC/61/SM19 assessed the impact of previous bycatch in this area, assuming a single stock structure and calculated preliminary bycatch limits that would be expected to achieve a specific conservation objective. The main result of the assessment was that the combination of data and model used was not informative about the main population parameters of interest: population growth rate, maximum population growth rate and carrying capacity. Given the shortcomings of the assessment, a preferable approach to calculating bycatch limits is a fully-tested procedure that can be expected to achieve conservation objectives in the face of the large uncertainties. We developed tunings of two such procedures Potential Biological Removal (PBR) and *Catch Limit Algorithm* (*CLA*) for common dolphins in the NE Atlantic. Preliminary bycatch limits ranged from 0.1-1.1% of the most recent point estimate of abundance depending on the procedure and the tuning to meet specific conservation objectives.

The *CLA* approach enables time series of abundance and bycatch estimates to be incorporated into the assessment.

Although the approach can be used to work on stocks within small areas, in the case of the NE Atlantic common dolphins there is no genetic evidence of stock structure within the overall area of interest (Celtic Shelf and Biscay) so that in the implementation presented to the sub-committee a single stock had been assumed.

There was some discussion on the relative benefits of the PBR and a *CLA* approach. Using the PBR has the advantage that it involves a single simple equation that can be readily applied with just two or three pieces of information. The recovery factor (F) in the PBR enables the bycatch limit to be tuned to the current status of the population. To some extent this is equivalent to the *CLA* approach as described in SC/61/SM19, but a time series of abundance and removals (bycatch) helps to refine this tuning element; by including more information on the dynamics of the stock a more robust estimate of allowable take should be possible. It was noted that, in fact, there is only a single abundance estimate for the area of concern, and only a few estimates of bycatch in a few of the relevant fisheries, which might limit the utility of the *CLA* approach. It would be possible however, to explore the range of potential bycatch limits using different scenarios based on postulated historical bycatch data.

Another key aspect of either approach is to be able to decide on the stock unit. The entire NE Atlantic might be considered one such unit, or just that area for which an abundance estimate has been made by SCANS/CODA, or an approach such as that taken in SC/61/SM34, where ecological tracers are used, could help to define appropriate stock units. A particular problem with common dolphins in the NE Atlantic is that there are evident aggregations – presumably for feeding – during Winter on the shelf, which is where much of the bycatch occurs, while each such aggregation could include several putative breeding stocks that separate out during the Summer breeding season.

It was noted that there are parallels here with the RMP, and the best way to address these concerns would be to do an in-depth assessment by gathering together the range of opinions on how the population might be structured, then to create scenarios or hypotheses about the population structure, assigning some levels of plausibility to each, and then to run the model to see what bycatch limits might be required to fulfil the conservation objectives. The advantage of such an approach is that it makes best use of all the available information. Current models are extremely conservative because of the large degree of uncertainty and by including as much of the available information as possible uncertainty should be reduced.

The continued lack of any specific EU conservation objectives was noted again, though objectives have been adopted by member states of ASCOBANS (for harbour porpoise) which might be used in the interim as was done in SC/61/SM19.

Finally, it was noted that the development of such an assessment procedure could take a long time, as we are only slowly accumulating the relevant bycatch estimates, stock structure information and abundance time series. Even when data are available, however, the principle impediment is reaching agreement on the appropriate conservation objectives, and finding some consensus on the most useful stock structure and the likely range of bycatch estimates. In the short term, the more simple PBR approach could always be adopted.

The sub-committee **welcomed** the development of this *CLA* approach and **encouraged** people who have suitable data to further develop the method.

6.9 Other

Van Bressem *et al.* (2006) described diseases, lesions, traumas and malformations of the skull, head, trunk and appendages as well as the skin of the genital tract from a sample of 930 long-beaked common dolphins in Peru collected between 1985 and 2000. A tabulated summary of previous studies of lesions and diseases of common dolphins worldwide is also presented. Miscellaneous lesions of the skull, teeth, head, trunk, appendages, skin and genital tract were observed in 120 of the 930 dolphins. *Crassicauda*-caused cranial lesions, osteomyelitis, osteolysis, traumatic lesions, dental and periodontal diseases, several cutaneous lesions, ovarian cysts and orchitis are all described. The authors conclude that long-beaked common dolphins from the SE Pacific are affected by a variety of acquired, congenital, traumatic, infectious and parasitic diseases. Some of these were reported to be severe enough to impair normal vital functions and behaviour. Of all the diseases encountered, morbillivirus, poxvirus and *Brucella* sp. infections, as well as *Crassicauda* sp. infestations appear to have the highest potential for significant adverse impact on population abundance by increasing natural mortality and/or by negatively affecting reproduction. Nevertheless, interactions with artisanal and industrial fisheries on Peru's continental shelf are responsible for the large majority of human induced mortality, and are thought to be the principal cause of debilitating physical traumas in this dolphin population.

6.10 Consideration of status

The considerable uncertainty about taxonomy and population structure of common dolphins made it difficult for the sub-committee to assess the conservation status of stocks.

The sub-committee had a brief discussion on possible stock units under which to consider status. Although recent genetic studies suggest some population structure is discernible in the eastern Pacific and around Australia and New Zealand, in most areas, including the NE Atlantic there is no genetic evidence of population structure, which makes the description of stock units challenging. The sub-committee agreed that there was currently no general answer as to how to define stocks of common dolphins, nor any simple way to define units of conservation concern.

One area of conservation concern is the Mediterranean Sea where, particularly in the central and eastern portions of the basin, common dolphins have declined considerably (Bearzi *et al.*, 2003). Although historical directed takes and ongoing bycatch have contributed to this decline, there is reason to believe that other factors such as pollution and prey depletion are also involved (e.g. Bearzi *et al.*, 2003). Re-distribution into other areas may also be a factor in reduced sightings records in parts of the Mediterranean. The sub-committee noted that systematic survey coverage of large portions of the central and eastern Mediterranean is lacking. In part due to concern about the status of common dolphins, the sub-committee **repeated its previous**

recommendation that a basin-wide synoptic survey be carried out in the Mediterranean as soon as feasible.

The sub-committee also took note of large and potentially unsustainable catches of common dolphins off Peru noted in last year's report (IWC, 2009, p.323). Those catches, both directed and incidental, have continued for many years and there have been no abundance estimates for that region. The sub-committee also **expressed concern** about ongoing fishery bycatch of common dolphins in the NE Atlantic and in other areas where stock structure remains unresolved and/or bycatch data are poor or lacking, or where abundance estimations are lacking. It **recommended** that efforts continue in these regions to improve understanding of stock structure and obtain better estimates of bycatch, to better assess fisheries impact.

7. PROGRESS ON PREVIOUS RECOMMENDATIONS

IWC Resolution 2001-13 (IWC, 2002) directs the Scientific Committee to review progress on previous recommendations relating to critically endangered stocks of cetaceans on a regular basis.

7.1 Vaquita

The sub-committee received new information on the critically endangered vaquita (*Phocoena sinus*). SC/61/SM23 reported on recent survey work addressing abundance and distribution of vaquita. Estimates of vaquita abundance are currently so low that it has become necessary to reconsider the design and methodology of acoustic surveys that have previously been used in order to obtain reliable data for monitoring population trends and habitat use in the context of the Vaquita Recovery Plan.

Between mid-September and late November 2008, a survey was performed in the Gulf of California in order to test new acoustic equipment and sampling designs. Three different vessels were used in order to test autonomous (A-Tag, T-POD and C-POD) as well as towed passive acoustic hydrophone arrays detectors (using Porpoise Detector and Rainbow Click Detector). Two sampling designs were used, firstly by towing acoustic equipment behind a sailboat and secondly by deploying equipment at selected points anchored to buoys or used aside one of the boats in a static configuration. In addition, visual data were gathered for population density estimation as well as oceanographic data necessary for an adequate monitoring scheme design.

In total, more than 1,800km were travelled and more than 1,600 hours of acoustic recordings were obtained. A total of 128 vaquita groups were sighted and 39 certain acoustic detections were recorded. Analysis of the data gathered in the autonomous equipment is still ongoing. A dedicated workshop will be held during 2009 in order to initiate the actual monitoring scheme.

The Government of Mexico also provided updated information on the latest recovery actions. The Recovery Program (PACE), operated by the Environment Minister (SEMARNAT) has been applying resources for buy-outs, rent-outs and fishing gear changes since 2007. The enforcement of the refuge polygon is being taken care of by Environment Protection Agency (SEMARNAT-PROFEPA) with dedicated funds. The Fisheries National Commission (CONAPESCA) is assessing all fishing licenses and permits and the National Fisheries Institute (INAPESCA) is testing alternative fishing gears. A public awareness and environmental education programme is being implemented together with the State Government of Baja California. So far, 500 illegal fishing boats have been removed from any fishing activities; 246 were bought-out; 161 changed to other fishing gears; and a shrimp farm is being rebuilt, which potentially will result in an additional 180 boats being retired.

The sub-committee **welcomed** the actions by the Government of Mexico to eliminate bycatches in the refuge polygon and **encouraged** continuation of the described efforts to monitor relative abundance and trends. However, until it is demonstrated that the recent rapid decline has been stopped and reversed the sub-committee **reiterates its extreme concern** for the future of the vaquita. It **strongly recommended** that, if extinction is to be avoided, all gillnets should be removed from the upper Gulf of California immediately, and certainly within the three year schedule, started in 2008. In order to meet this schedule, the Committee **encouraged** the international community, including member countries and NGOs, to assist the Government of Mexico in the task.

7.2 Harbour porpoise

SC/61/SM36 presented data from an ongoing observer programme in several Norwegian fisheries, to monitor and estimate levels of bycatch in Norwegian gillnet fisheries. 501 porpoises were observed bycaught over a three year period, mostly in ICES Area IIa (northern Norwegian coastal areas). The sub-committee **welcomed** this information and noted that this information will contribute to the assessment of harbour porpoise status in the region and **encouraged** the authors to provide extrapolated estimates of total porpoise bycatch for next year's meeting.

The issue of small scale recreational gillnet fisheries was raised and it was noted that this type of fishery is widespread in several countries. However, there are few cases of good statistics on this type fishery, which is in places substantial. Work was underway to see whether it would be possible to obtain additional information on recreational fisheries from ongoing surveys in Norway.

Scheidat and Bräger presented a summary of new information on abundance and bycatch estimates of harbour porpoise in the SW Baltic Sea. The information was a summary of several papers presented at the 2009 ASCOBANS meeting (Herr *et al.*, 2009; Koschinski and Pfander, 2009; Scheidat *et al.*, 2009; Teilmann *et al.*, 2009). In the study area two populations of harbour porpoises occur: the highly endangered population of the Baltic Proper (east of the Linham and Darss ridge) and the population of the Inner Danish Waters. Over the last several years aerial surveys have been conducted using line transect distance sampling surveys. Abundance estimates have been made for different seasons. Four different estimates of annual bycatch for the German coastline were presented at the ASCOBANS meeting. Minimum bycatch estimates for this region were generated using two different approaches: (1) analysing the proportion of bycaught animals of stranded animals to estimate the number of bycaught and then stranded animals; and (2) by extrapolating information obtained through interviews with fishermen. The resulting annual numbers of bycaught animals ranged from about 50 to 150 animals. When applying these numbers to the local abundance estimates it is clear that bycatches must be at least 1% of the abundance estimate and possibly much higher than 1.7%.

Teilmann *et al.* (2009) had presented information on the distribution of porpoises in the Inner Danish waters based on satellite telemetry. The results indicate that porpoises are fairly resident in two parts of the German waters, the Fehmarn Belt and the Flensburg Fjord. These areas are also most likely the areas of highest conflict with the local fishery. During both the SCANS and the SCANSII survey, the Inner Danish Waters were surveyed. The point estimates between these two surveys show a decline of about 30% in abundance. Although not significant due to large confidence intervals, the results suggest a possible decline in abundance of harbour porpoises over the last decade. The high bycatch rates observed along the German coast have most likely serious implications for the local stock in the southwestern Baltic and consequently for the population in the Inner Danish waters. Additionally, the continuing bycatch pressure is a danger to the Baltic Proper porpoises. Accurate and seasonal data on bycatch and abundance estimates with a focus on the population of the western Baltic and Inner Danish Waters (not national stocks) is needed to address this issue as soon as possible.

The sub-committee noted that the estimates of bycatch, based on the number of stranded animals with evidence of bycatch and on interviews are both likely to be underestimates. The issue is made difficult because of the large number of part time or amateur fishermen, all fishing close to shore in a mixed stock area.

The sub-committee **recommends** that more detailed estimates of bycatch should be obtained, and **encouraged** continued abundance surveys. The sub-committee stressed its concern about the conservation status of both the porpoise population in the Inner Danish waters and the Baltic proper and noted that the Jastarnia Plan has made proposals for minimising the impact of gillnets throughout the wider region.

7.3 Narwhal

At its meeting in 2007 (IWC, 2008, pp.314-15) the sub-committee reiterated previous recommendations that the stocks of narwhals and belugas in West Greenland should remain the focus of major conservation concern. At that time, the NAMMCO Scientific Committee had expressed its concern about quotas set for some narwhal stocks and about the fact that removals from the West Greenland stock of belugas 'were still above the recommended level of 100'. At a joint meeting of the NAMMCO Scientific Committee Working Group on the Population Status of Narwhal and Beluga in the North Atlantic and the Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga Scientific Working Group in February 2009, new data were presented on stock structure, catches, movements, behaviour, abundance and population dynamics of both species (Anon., 2009). Large numbers of narwhals use an area in south-eastern Baffin Bay as a winter feeding ground and the JCNB expressed support for measures recently taken by Canada's Department of Fisheries and Oceans to restrict commercial fishing for Greenland halibut in that area. These fish are important prey of narwhals. New data on age estimation suggested, based on aspartic acid racemisation of eye lenses, that narwhals live considerably longer (i.e. >90 years, both sexes) than previously believed. In this regard, the Joint Working Group began planning for a workshop on age estimation in narwhals and belugas for late 2010 or 2011. The report summarised available information on two ice entrapment events in 2008, one near Pond Inlet in November that resulted in more than 625 narwhals being harvested by local hunters, the other involving 30-45 narwhals that became entrapped in the Sermilik Fjord system of East Greenland in February. The following new abundance estimates from aerial survey data (fully corrected for availability and perception bias) were presented for narwhal stocks in Greenland and the Canadian High Arctic: Inglefield Bredning 8,447, Melville Bay 6,235, East Greenland 6,583, Canadian High Arctic all areas >60,000. The continuing difficulties of obtaining reliable estimates of struck/lost rates for application to catch records were noted, and it was acknowledged that better data are required on this. With regard to the West Greenland stock of belugas, the Joint Working Group's report noted that catches had been reduced in response to previous advice and modelling suggested that this should be having a positive effect on the population's conservation status. However, no new data on beluga abundance were presented.

The sub-committee **welcomed** this new information and **recommends** that provision of reports from the Joint Working Group and from relevant workshops and meetings (e.g. on monodontid age estimation) under the aegis of either NAMMCO or the JCNB are provided routinely for the sub-committee's consideration.

7.4 Other

At its 2007 meeting, the sub-committee reviewed the status of killer whales and noted that in many areas, abundance estimations were few or absent. SC/61/SM10 presented information on an aerial survey for Antarctic minke whales in east Antarctica in December 2008, in which a notably large number of killer whales were also observed. The survey was completed using a fixed-wing aircraft and flown at 700ft. The survey area was rectangular in shape with a northern extent along latitude of 64°47'S down to the coast; the western boundary was at 105°52'E longitude and an eastern boundary at 113°15'E longitude; with a total area of 60,600km^2. During December 2008 the sea ice edge was around 50-100km north of Vincennes Bay, but the bay itself had started to empty of ice. Allowing for errors in group-size estimation, around 370 killer whales were observed throughout the survey area; with group-sizes ranging from one to twenty. Based on their distribution, relatively small size and pale cape, it is likely that the killer whales sighted during the aerial survey were either Type B or Type C, or a combination of the two types. These animals were distributed almost exclusively in less than 20% sea ice concentration, with most in ice-free areas. Most of the killer whales were observed in water less than 750m in depth, with a peak in observations around 500m. Due to the sheer number of killer whales observed, these animals featured often on the digital stills and video images taken with cameras mounted in the base of the aircraft. Adults, juveniles and calves were identifiable within these images. Another aerial survey is planned in the same region of east Antarctica next summer and there is every possibility that a large number of killer whales will again be observed. In concert with altimeter and aircraft orientation data, there may also be an opportunity to extract killer whale body lengths from video and digital still images.

SC/61/SM26 reviewed existing data on occurrence patterns and diet of Ross Sea killer whales ('type C'), and presented data on numbers observed in the SW Ross Sea since 2002. These 'resident' whales appear to feed principally on fish, including Antarctic toothfish (*Dissostichus mawsoni*). On the basis of sea watches on the outer coast of Ross Island beginning in 2002-03, sighting frequency and average group size began to decrease from 2006-07 and thereafter; prevalence also decreased in nearby McMurdo Sound. Trends with respect to environmental change and to the initiation of industrial fishing for toothfish beginning in 1996-97 are discussed. Consistent with a decrease in the catch-per-unit-effort of scientific fishing for toothfish in McMurdo Sound, the authors suggest that the change in Ross Sea killer whale numbers is related to a contraction of the toothfish stock, and not to changes in the physical environment. They surmised that in this closely-coupled foodweb, composed of very abundant penguin, seal and whale components, the loss of the toothfish option for Ross Sea killer whales would force more direct competition for the smaller-fish prey. The authors concluded that killer whales may have opted to move out of the region.

8. OTHER PRESENTED INFORMATION

The sub-committee received other papers, which were not discussed at the meeting, but are summarised here. SC/61/SM1 gives an overview of worldwide mass stranding events of pygmy killer whales, *Feresa attenuata*. Events were documented in South Africa, Indonesia and Taiwan. Taiwan was identified as a major hot spot for mass stranding events and it is hypothesised that the most plausible explanation is anthropogenic sound.

SC/61/SM7 presents results of aerial surveys conducted in the Pelagos Sanctuary (NW Mediterranean) to estimate the Winter abundance (January, February) of striped dolphins (*Stenella coeruleoalba*). A total of 131 cetacean sightings of were made: striped dolphins (*n*=114), common bottlenose dolphins (7), fin whales (1), sperm whales (1), Cuvier's beaked whales (1) and unidentified small dolphins (7). Using the multiple covariate methods MCDS method, the uncorrected striped dolphin population size was estimated to be 19,578 (%CV=19.2; 95% CI=12,318-27,039), with a density of 0.2218 individuals km^{-1} (%CV=19.23; 95% CI=0.1395-0.3063). $g(0)$ estimation is planned to take place during a survey July-August 2009.

SC/61/SM13 presents information on the occurrence, distribution and conservation status of the common bottlenose dolphin (*Tursiops truncatus*) in Madeira Archipelago (Portugal). Systematic nautical surveys (2001-02, 2004; 2007-08; 7,759km) were conducted, as well as photo-id studies (1997-2007) and data on stranding records (1997-February 2009) were collected. All data combined shows that Madeira Archipelago is an important area for this species, with year-round presence, high occurrence and heterogeneous distribution within the archipelago which indicates the existence of important sub-areas used for feeding, nursing and resting.

Summer abundance estimates of striped dolphins (*Stenella coeruleoalba*) in the Pelagos Sanctuary are presented in SC/61/SM25. A vessel survey was carried out in the Ligurian-Provençal Sea (NW Mediterranean) in August 2008. Fifty-three sightings of four cetacean species were made: striped dolphins (*n*=37), fin whales (12), sperm whales (3) and Cuvier's beaked whales (1). Striped dolphin populations size resulted to be 13,232 (%CV=35.55; 95% CI=6,640.0-26,368), with a density of 0.23 individuals km^{-1} (%CV=35.55; 95% CI=0.11-0.45). The central value of the 2008 estimate was almost half of that of a survey conducted in 1992 in the same area with comparable effort and platform (*n*=25,614; %CV=25.3; 95% CI=15,377-42,658).

SC/61/SM28 presented information on human-related problems affecting wild dolphin populations off the Pacific coast of Guatemala. The main two problems identified were entanglement of dolphins in fishing nets and dolphin harpooning. Dolphins are harpooned to use their meat as shark bait. Mortality rates due to entanglement or harpooning have not been quantified or even studied in the country and therefore their effects on local cetacean populations are unknown.

A preliminary assessment of the Winter abundance of Atlantic spotted (*Stenella frontalis*) and common bottlenose (*Tursiops truncatus*) dolphins in the state of Aragua, Venezuela is presented in SC/61/SM32. Small boat surveys were conducted and 32 dolphin sightings were recorded, including 15 of *S. frontalis*, 7 of *T. truncatus* and 7 of mixed aggregations of these two species. A total of 2,549 dolphins were encountered and 5,932 pictures were taken for further analysis using capture-recapture methods. Mixed aggregations and spatial overlap between the two species suggest a very low level of interspecies competition.

9. TAKES OF SMALL CETACEANS

Reeves reported that a workshop had been held in Samoa in August 2008 with the principal goal of developing an approach to assessment of Indo-Pacific bottlenose dolphins, using as a case study the population in the Solomon Islands that has been the object of a live-capture fishery in recent years (Reeves and Brownell, 2009). The workshop report includes specifications for a photographic mark-recapture study to obtain an abundance estimate, notes on the kinds of information needed on life history parameters and threat factors other than direct removals, suggestions on how to obtain genetic samples for stock discrimination analyses and a discussion of cultural considerations to facilitate fieldwork in the Pacific Islands region. It also describes various methods that have been used to determine precautionary (i.e. sustainable) limits on removals for marine mammal populations including the rule-of-thumb advocated by the IWC Scientific Committee: (a) takes of >2% are cause for immediate reduction in removals; and (b) takes of >1% are cause for concern and signal the immediate need for research to assess stock status. The workshop concluded that the current quota set by the Government of the Solomon Islands of 100 dolphins exported per year is much higher than the local population of *Tursiops aduncus* is likely able to sustain.

It was noted in discussion that the first known catches of *Tursiops* at Guadalcanal Island in the Solomon Islands, where the live-capture fishery has been ongoing since 2003, took place in 1990. What started as a directed hunt using purse seines to take *Tursiops* for food later evolved into a fishery for live exports. The sub-committee **expressed its concern** at ongoing and past levels of take of *Tursiops* in the Solomon Islands.

SC/61/SM15 reported on interview and other surveys along the southwest coast of Madagascar that had revealed an ongoing hunt for small cetaceans. The people of this region, centred on the town of Anakao, are of a maritime culture and had developed a subsistence hunt in which animals were taken since at least the 1970s. It was estimated that around 6,500 small cetaceans, most likely humpback, spinners and bottlenose dolphins had been taken between 1975 and 2000. One school of around 100-200 spinner dolphins was taken in 2005. The hunt has been illegal since 2002 and is concealed, with the meat being quickly distributed among the community and the remains of the animals buried. It was reported that hunting pressure has increased since the introduction of monofilament nets in the late 1980s. Coastal surveys revealed a very low encounter rate with coastal species – but lots of diversity among cetacean species with deepwater species present close by. The total impact of the hunt is unknown. Given the low survey effort in this area, the sub-committee **encouraged** additional surveys in this region, to better evaluate impact, and noted these illegal catches with concern.

Funahashi again provided the sub-committee with a translation of the Japanese National Research Institute of Far Seas Fisheries' records of directed catches and associated quotas for small cetaceans from 1997-2007. The sub-committee agreed that this should be included as a part of its report (see Appendix 2). The sub-committee noted a new quota for 2007, for 350 Pacific white-sided dolphins, and a recent increase in landings of short-finned pilot whales. The sub-committee also noted that reported takes were generally below the quotas, notably among Dall's porpoises. The sub-committee considered whether this might be due to reduced demand or declining catch rates.

The sub-committee also **expressed concern** that data on small cetacean bycatch as reported in the national Progress Reports is incomplete, and is likely to give a misleading impression of the scale of bycatch in some countries. In previous years the Secretariat used to compile data from national Progress Reports and also from papers submitted to the meeting in order to produce a compiled summary table for this sub-committee. In recent years the practice of including additional estimates from papers presented to the Scientific Committee has been abandoned and the bycatch table (which appears as part of a separate Annex to the Scientific Committee Report) therefore currently only represents a partial picture of the levels of bycatch that have been reported to the Committee.

Furthermore, the practice of producing tables with estimates on a single year basis conceals ongoing bycatches in those fisheries that have not recently been monitored or not reported on annually. Fisheries that are subject to sporadic or occasional studies are therefore not well documented in the reports of this sub-committee under the present system.

The sub-committee also **recognised** that the Secretariat devotes a lot of time to compiling records that have been submitted as text documents; a more useful approach would be for member states to submit small cetacean bycatch records electronically in spreadsheet or database format. Furthermore, the present practice of listing each individual specimen does not allow estimates of total bycatch in a fishery to be presented in a practical way and can also be misleading through the confusion of observed (or inferred) individual bycatches with estimates of total bycatch in a specific fishery obtained through an observer programme.

The sub-committee therefore **recommends** that:

(1) data on small cetacean bycatch in national Progress Reports should be submitted electronically;
(2) two extra fields should be included to allow extrapolated totals and associated measures of error (CV or CI) to be included in the reports;
(3) the Secretariat is requested to revert to the practice of compiling national data together with records provided in meeting documents when preparing the summary small cetacean bycatch table, and that this table should be published as an annex to this sub-committee's report in the future;
(4) the Secretariat is requested to maintain the electronically submitted data, and any additional data submitted to the Committee, in a simple tabular database that can be interrogated for the work of the sub-committee as needed; and
(5) a summary table for the printed report should be produced as usual, but this should include records for the past five years for each fishery so that it will be easier to distinguish between absence of bycatches and lack of monitoring. Only the total numbers of animals reported or estimated need to be reported in this table, by country, by fishery and by year. This will enable the sub-committee to keep track of situations where bycatches may be reported in a fishery one year, and when no further sampling is done or reported, it may otherwise appear that bycatch has ceased. It will also enable late reporting and correction of bycatch estimates from previous years to be noted more easily; and
(6) member states should try to distinguish between fisheries with no reported bycatch and those for which there is no information.

A revised format for the submission of bycatch data in the annual report is shown in Table 2, which includes two extra location fields to make identification of the fishery within the FAO fishery inventory easier. A suggested format for the proposed table of small cetacean bycatch is also given in Appendix 3. Comments and bibliographic data should be included as footnotes in the published table. The establishment of an electronic data table (or database) by the Secretariat will raise issues of data control and data validation, but we suggest deferring discussion of these issues until the database has been established.

It is important to note each year in this sub-committee's report that the table of fishery bycatches contains data only for those member states that have submitted relevant data in their national Progress Reports, or where additional reports were found in papers presented to the sub-committee. Not all member states submit reports of small cetacean bycatch and this should be made clear.

The sub-committee noted the records of 340 individually reported finless porpoises in SC/61/ProgRepKorea, apparently caught in a trawl fishery in the Korean Strait, and **expressed concern** that this may not be sustainable.

Table 2
Revised format for the submission of bycatch data in the annual report.

Nation	Ruritania	Mexico
Species	Harbour porpoise	Narwhal
Number Observed/reports	18	1
Ratio of MALE to FEMALE (if known)	9:1	1:0
Fate	Dead	Dead
How observed?	Fishery observer	Diagnosed at necropsy
Number extrapolated to the fleet total (point estimate)	2,450	-
Range or CI or CV	0.3	-
Year of bycatch	2008	2006
Month or season	Winter	January
General location (text description or lat-long)	Gulf of Cadiz	92°W; 35°N
Fishery statistical area if known	IXa	-
FAO fishery area	27	31
Targeted fish species	Tuna	Unknown
Gear type	FPO	Unknown
Source or contact	Institute of Fisheries	Freda Stare
Bibliographic reference	Prog Rep Ruritania	Stare *et al.* (2008)
Comments or notes		Found wrapped in netting

10. OTHER

At the recent IWC Workshop on Climate Change (see Annex K), it was recommended that the sub-committee on small cetaceans consider a series of hypotheses that link climate to the population trajectories of small cetaceans with the aim of identifying species, areas and research situations that could be informative. It was acknowledged that the ongoing rapid change in global climate has major implications for many species of small cetaceans and therefore that improved understanding of how populations are likely to respond is important. However, given the shortage of time to discuss the matter at this meeting, the sub-committee agreed to establish an intersessional working group, which will work by correspondence (unless funds become available to allow it to meet) to pursue this matter further and report back at next year's Scientific Committee meeting. This intersessional working group (under Simmonds) was established, with the following Terms of Reference:

(i) collate and review existing research, taking into account the approach and recommendations developed by the IWC Climate Change Workshop;
(ii) identify key studies, species and areas, and opportunities for further research; and
(iii) develop recommendations for future research.

Members of the intersessional group include: Simmonds (Chair), Alter, Murphy, Rogan, Rose, Ritter, Scheidat, Suydam.

11. WORK PLAN

The sub-committee reviewed its schedule of priority topics which currently includes the following.

(1) Systematics and population structure of *Tursiops*.
(2) Status of ziphiids in the Southern Ocean.
(3) Status of small cetaceans in the eastern tropical Atlantic.
(4) Fishery depredation by small cetaceans.

The sub-committee noted that although a great deal of research has been completed recently and more is ongoing on the topic of *Tursiops* systematics and population structure, this item should wait for another year or two in the expectation that a clearer picture will emerge, thus allowing a more productive and conclusive discussion at that time.

A number of members expressed strong interest in ziphiids of the Northern Hemisphere, and based on concern about the effects of naval sonar, entanglement in some areas and new information on abundance and distribution, it was **agreed** to add Status of Ziphiids in the Northern Hemisphere as a new topic to be considered for a future meeting of the sub-committee.

Given that the venue for the next Scientific Committee meeting will be Morocco, it was **agreed** that the priority topic for next year's work should be the status of small cetaceans in the eastern tropical Atlantic. A report from the intersessional working group on climate change will also be considered at next year's meeting.

12. ADOPTION OF REPORT

The report was adopted at 17:15 on 8 June 2009. On behalf of the sub-committee Rogan thanked the Invited Participants and others for their contribution to the review and the rapporteurs for their hard work and assistance with the report.

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Appendix 1

AGENDA

1. Opening remarks
2. Election of Chair
3. Adoption of Agenda
4. Appointment of rapporteurs
5. Review of available documents
6. Review taxonomy, population structure and status of common dolphins
    - 6.1 Taxonomy
    - 6.2 Population structure
    - 6.3 Abundance and distribution
    - 6.4 Life history
    - 6.5 Ecology
    - 6.6 Habitat
    - 6.7 Directed takes
    - 6.8 Incidental takes
    - 6.9 Other
    - 6.10 Conservation status
7. Progress on previous recommendations
    - 7.1 Vaquita
    - 7.2 Harbour porpoise
    - 7.3 Narwhal
    - 7.4 Other
8. Other presented information
9. Takes of small cetaceans
10. Other business
11. Work plan
12. Adoption of Report

Appendix 2

DIRECT TAKES OF SMALL CETACEANS IN JAPAN BY TYPE OF FISHERY AND PREFECTURE OF DEPARTURE PORT, 1997-2007

Source: Small Cetacean Fisheries and Resource Study (in Japanese), National Research Institute of Far Seas Fisheries, Fisheries Research Agency. See *http://kokushi.job.affrc.go.jp/H20/H20_45.pdf.*

	Prefecture	Quota ~2006	Quota 2007 (08)	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Baird's beaked whale														
SW	Hokkaido	14	14	1	2	10	10	10	10	10	10	14	12	14
SW	Miyagi+Chiba	54	52	26/27	26/26	26/26	26/26	26/26	26/26	26/26	26/26	26/26	25/26	27/26
Short-fin pilot whale (Northern form)														
SW	Miyagi	36	36	50	35	60	50	47	47	42	13	22	7	-
Short-fin pilot whale (Southern form)														
SW	Chiba+Wakayama	36	36	5/22	3/46	13/31	7/49	4/36	1/35	-/27	-/29	1/24	-/10	-/16
D	Wakayama	300	277 (254)	204	84	211	109	210	55	55	62	40(2)	198(8)	243(5)
H	Okinawa	100	92 (85)	66	61	79	89	92	38	36	72	90	56	79
Risso's dolphin														
SW	Wakayama	20	20	20	20	12	20	17	12	19	7	8	7	20
D	Wakayama	300	295 (290)	60	157	250	367	350	220	186	437	340	232	312(8)
H	Wakayama	250	246 (242)	148	265	227	119	107	154	168	60	46	105	185
False killer whale														
D	Shizuoka	-	10 (10)	-	-	-	-	-	-	-	-	-	-	-
D	Wakayama	40	70 (70)	25	37	-	-	18	7	12	-	-	30(24)	-
H	Okinawa	10	20 (20)	3	8	5	8	8	-	4	3	1	5	4
Striped dolphin														
D	Shizuoka	70	63 (56)	-	-	-	-	-	-	-	-	-	-	-
D	Wakayama	450	450 (450)	545	376	520	235	418	565	382	554	397(2)	479	384
H	Chiba	80	72 (64)	-	-	-	-	-	-	-	-	-	-	-
H	Wakayama	100	100 (100)	57	73	76	65	66	77	68	83	60	36	86
Bottlenose dolphin														
D	Shizuoka	75	71 (67)	-	-	71	-	-	-	-	9	-	-	-
D	Wakayama	890	842 (795)	234	143	511	1,271	195	688	105	475	285(36)	285(80)	300(77)
H	Wakayama	100	95 (89)	57	95	68	79	44	38	52	43	66	75	97
H	Okinawa	10	9 (9)	8	7	8	8	8	3	7	10	10	12	4
Spotted dolphin														
D	Shizuoka	455	409 (365)	-	-	-	-	-	-	-	-	-	-	-
D	Wakayama	400	400 (400)	-	397	-	27	-	400	102	-	-	400(13)	-
H	Wakayama	70	70 (70)	23	63	38	12	10	18	30	2	13	5	16
White-sided dolphin														
D	Shizuoka	-	36 (36)	-	-	-	-	-	-	-	-	-	-	-
D	Wakayama	-	134 (134)	-	-	-	-	-	-	-	-	-	-	-
H	Iwate	-	154 (154)	-	-	-	-	-	-	-	-	-	-	-
H	Wakayama	-	36 (36)	-	-	-	-	-	-	-	-	-	-	-
Dall's porpoise (*Dalli* type)														
H	Hokkaido	1,500	1,451 (1,399)	999	994	670	1,203	1,413	1,328	1,655	647	1,240	719	841
H	Aomori	20	18 (16)	2	-	-	-	-	-	-	-	-	-	-
H	Iwate	7,200	6,969 (6,721)	7,433	4,116	5,632	6,106	6,960	6,057	6,427	3,796	5,394	3,312	2,975
H	Miyagi	280	269 (260)	99	193	77	204	57	229	226	171	246	181	254
Dall's porpoise (*Truei* type)														
H	Hokkaido	100	98 (95)	31	69	57	69	100	89	84	66	51	44	44
H	Iwate	8,300	8,054 (7,805)	9,976	6,013	8,371	8,589	8,120	8,243	7,325	9,109	7,733	7,758	7,243
H	Miyagi	20	16 (16)	-	-	-	-	-	3	3	-	-	-	-
Rough-toothed dolphin														
H	Okinawa	-	-	-	-	1	-	-	-	-	-	-	-	-
Killer whale														
H	Okinawa	-	-	1	-	-	-	-	-	-	-	-	-	-

(N) shows number sold alive within all catch, and including research use. SW=small type whaling; D=drive fishery; H=hand harpoon fishery; fisheries season for Dall's porpoise is August to the following July, Wakayama Prefecture's season is September to August, others are from October to September.