Annex F

Report of the Sub-Committee on Bowhead, Right and Gray Whales

Members: Kitakado (Convenor), Acquarone, Baker, Bannister, Best, Bickham, Borodin, Brandon, Brandão, Breiwick, Broker, Brownell, Childerhouse, Cipriano, Cooke, Donovan, Dupont, Fadeev, Ferguson, Funahashi, Gales, George, Givens, Hedley, Heide-Jørgensen, Hiruma, Hoelzel, Honda, Ilyashenko, Iñíguez, Jackson, Jenkerson, Kanda, Kasuya, Kato, Lang, Lockyer, Mate, Matsuoka, Moore, Morishita, Nikulina, Øien, Okamura, Palka, Pastene, Perrin, Reeves, Robbins, Rosa, Rose, Rosenbaum, Rowles, Scordino, Schweder, Simmonds, Stachowitsch, Suydam, Thomas, Tyurneva, Uoya, Urbán-Ramirez, Vladimirov, Wade, Walløe, Waples, Weller, Witting, Young, Zerbini.

1. INTRODUCTION

1.1 Opening remarks, election of Chair and appointment of rapporteurs

Kitakado welcomed the participants and was elected Chair. Brandon and Suydam were appointed to act as rapporteurs with assistance from Givens and Kanda.

1.2 Adoption of Agenda

The adopted agenda is given as Appendix 1.

1.3 Review of available documents

The documents available for discussion by the sub-committee included SC/63/BRG1-8, SC/63/BRG10-21, SC/63/BRG23-26, SC/63/O8, Carroll *et al.* (In press), Jackson *et al.* (In press), North Atlantic Right Whale Consortium (2010), Frasier *et al.* (2011), Bannister *et al.* (2011), SC/63/ProgRepAustralia and Perryman *et al.* (2011).

2. BOWHEAD WHALES

2.1 Bering-Chukchi-Beaufort (B-C-B) seas stock of bowhead whales

2.1.1 Stock structure

SC/63/BRG13 reported on mitochondrial DNA sequence data from three genes, control region, cytochrome b, and ND-1 from 296 bowhead whales representing the Bering-Chukchi-Beaufort Seas (B-C-B) stock, the eastern Canadian arctic (Canada) stock and the Sea of Okhotsk (Okhotsk) stock. Previously described methods were used to identify recurrent substitutions and estimate mutation rates in the control region and in two protein coding genes. The sequence matrix was extended to include the multiple substitutions to produce a fully resolved haplotype network. An estimation of mtDNA mutation rate in bowheads (2.8% per million years) is reduced relative to most other whales. But, bowheads have maintained a relatively high female effective population size and the estimated time to most recent common ancestor of the mtDNA is 1.16 million years. Calculations of F_{ST} and migration estimates for the three stocks showed that Canada and the B-C-B did not have a statistically significant F_{ST} and the estimated number of migrants, 46 per generation, is consistent with previous studies. Okhotsk had a significant F_{ST} with both B-C-B and Canada. The F_{ST} between Okhotsk and B-C-B based on the 3-gene sequence is about double a previous report based on control region alone. Migration estimates are low between Okhotsk and both B-C-B (3.41 migrants per generation) and Canada (2.87). Tests for neutrality differed between control region and the protein coding genes with both of the latter showing evidence of selection or a rapid population expansion. This result was likely due to a lack of resolution in the control region due to recurrent mutations and the authors suggest caution in the interpretation of evolutionary or population genetic data based solely on control region. The study gives examples of how mtDNA sequence data can provide improved resolution in a variety of evolutionary and population genetic applications.

The sub-committee noted that these results were important with respect to the estimates of substitution rates which are used in conversions between effective population size and census population size. It was also noted that a previous study (Ho *et al.*, 2007), using similar methods had found higher mutation and pedigree rates in ancient samples. Therefore, even with a given species there appears to be the potential for variability in these rates through time, which would impact the results of genetic reconstructions of historical population trajectories (e.g. Bayesian skyline plots). Therefore, it is important to consider which time-frame different samples belong to when extrapolating rates for those types of analyses.

Members of the sub-committee noted that the F_{ST} value for the Sea of Okhostk was based on small sample sizes, and therefore should be viewed with caution until more samples are available to be analysed. Further, another analysis by Alter *et al.* (2007) showed very different F_{ST} values for the Sea of Okhostk, based on a larger sample size. Bickham replied that additional samples were now available from the Sea of Okhostk, and that plans were under way to employ the approach developed in SC/63/BRG13 to perform a re-comparison based on the larger sample size.

In discussion, it was noted that this study did not pick up a signal for a bottleneck related to removals from commercial whaling. In this respect, the results were consistent with previous genetic studies of bowheads, which also failed to detect any signal of a bottleneck. However, more accurate and extended data exist now, and analyses are planned to re-investigate this issue with the improved information.

SC/63/BRG14 examined nucleotide sequence data from the X and Y chromosomes of bowhead whales. The inheritance patterns, expected neutral mutation rates, and effective population sizes of the X and Y chromosomes differ from those of both the maternally inherited mitochondrial DNA and the bi-parentally inherited autosomes which are the typical elements used in population genetics. Methods to analyse 21,750 nucleotides for USP9Y (Y chromosome) and 11,150 nucleotides for USP9X (X chromosome) were presented. Single nucleotide substitution in USP9Y and 9 variable sites in USP9X including 7 point mutations and two variable microsatellite satellite repeats were observed. Variation in the X chromosome is of a level comparable to that expected from theoretical mutation rates for this element. However, much less variation than expected was observed in the Y chromosome based on theoretical mutation rates and from previous studies on human Y chromosome variation. It was concluded that bowheads have experienced a Y-chromosome selective 'sweep' in the recent evolutionary past which contrasts markedly with a previously presented estimate of 1.16 million years for the time to most recent common ancestor for mtDNA. These data show a distinct difference exists in the population biology of male and female bowhead whales.

In discussion it was noted that this low level of variation on the Y chromosome was consistent with estimates from other species of cetaceans. The 'super-male' hypothesis of non-random male mating success was also noted for bowheads, and in this context the methods presented in SC/63/BRG14 may hold promise for better understanding of reproductive patterns in this and other species, contingent on sufficient sample sizes (which are effectively smaller for males, given the lower levels of diversity observed on the Y chromosome).

The sub-committee noted that during the previous *Implementation Review*, it had concluded that B-C-B bowheads represented a single stock and that there was no new information presented at this meeting to alter this conclusion for the upcoming *Implementation Review*.

2.1.2 Abundance

SC/63/BRG1 presented independent observer data from the spring 2010 ice-based survey of bowhead whales near Barrow, Alaska (see SC/63/BRG3 for details of the survey and data treatment). The authors used these data to estimate detection probabilities to replace very old estimates used since 1986. The 2010 survey employed a two-perch independent observer protocol. Specifically, two teams of observers stood at fixed survey sites ('perches') situated atop pressure ridges near leads and open water. All sightings and other data were recorded independently at each perch. Each recorded sighting could be of a single animal or a group.

A novel capture-recapture estimation approach was applied, within the general framework of Huggins (1989). 'Captures' occurred when a whale group was sighted by a perch. An observer team could have sighted a whale group more than once, labelling it a 'duplicate' after the first instance. For some sightings ('conditionals') the observer team could not say whether the group had been previously seen. Sightings from one perch were connected into series of sighting 'chains', where each chain presumably represented a sequence of sightings of the same whale group. 'Recaptures' occurred when the same group was sighted by the other perch. Recaptures were determined post hoc by independent expert review of the combined data from both perches. When a sighting from one perch appeared to match a sighting from the other perch, a 'match' was declared. Matching methods are discussed in SC/63/BRG3. Multiple matches among multiple chains from both perches can occur, creating complex data structures.

Whale group size data for sightings within chains were sometimes not consistent. Moreover, the presence of conditional sightings rendered the existence of some captures and recaptures uncertain. To resolve these two issues, the authors presented a novel method for weighted data analysis within the Huggins (1989) framework, and investigated several approaches for reconciling inconsistencies in group size data. The latter work recognised that bowhead allegiances to groups can be weak and brief so that some inconsistencies may be due to (new) whales joining groups and/or departures. Broadly, the capture-recapture data could be analysed either at the level of groups or individual whales. The authors recommended a whale-level analysis that reconciled group sizes via a deconstructed mode method, with a mode group-level analysis as a supporting approach.

For the authors' recommended analysis approach, the mean estimated detection probability was 0.468. Detailed detection probability estimates depended on the effects of visibility, distance, group size, lead condition, whale passage rate, and some two-way interactions of these factors. Estimates ranged from about 0.70 to less than 0.10, with standard errors of roughly 0.03. The detection probability estimates in SC/63/BRG1 were somewhat lower than those of Zeh and Punt (2005) from 26-year-old data obtained using a different experimental method. The authors believed that the new lower values could be attributed to changes in the environment, the abundance and migration of the whales, and the survey method. The authors planned to apply their detection probability estimates in conjunction with 2011 survey counts to produce an overall estimate of absolute abundance for this bowhead population.

In discussion it was suggested that a simulation modelling framework might be developed for the migration to test the effectiveness of the matching process. In response, the author agreed that it would be useful to investigate match uncertainty, while noting that there was an enormous amount of complexity involved in this suggestion, and that previous efforts at modelling the migration had been contentious. Other statistical methods and independent re-matching might allow estimation of false positive and false negative matching rates.

There was a lengthy discussion on the potential of observer effects, and possible differences in detection probabilities between years (given observers have not been constant during the entire time series). Attempting to understand the apparent observer effect in 2010 was complicated by the fact that the recorded observer is the person operating the theodolite on a three person team, and hence not actually responsible for many of the detections. To further complicate matters, observer teams were intentionally rotated between perches and observers were randomly mixed between teams in order to minimise the potential for any such effect. While the observer crews were different between 2010 and 2011, the authors believed it was worthwhile to further investigate the causes of observer effects and their implications for analysis. It was also noted that it was not necessarily appropriate to assume that those correction factors should be applied to earlier abundance estimates, because it is known that there have been changes in the population and environmental conditions over that time.

In discussion it was noted that perch heights had differed between 2010 and 2011, and that in a few cases there was a statistically significant perch effect, but the author noted that the estimated effect is very small (~2%). Moreover, perch height is only one of the things that determine how effective a perch may be. Other factors include how far a perch is located from the edge of the ice lead, the topography of the ice (obstructions) between the perch and the lead, etc. In reality, there are not a lot of alternative perches to choose from to get repeated measures of perch-height, and so it is effectively impossible to tease these factors apart. Observers integrate all these factors when they assign the visibility ratings used in the estimation of detection probabilities.

SC/63/BRG3 provided a summary of the 2010 ice-based survey of bowhead whales migrating past Barrow, Alaska. The survey began on 31 March and ended on 28 May.

Two observation perches were used (sequentially) in 2010, and each location had both a primary perch and a second independent observer (IO) perch. The 2010 survey season began with an unusual pulse of bowheads in late March which has not been recorded in any prior year. An early lead development (possibly associated with climate change) together with an increasing bowhead population are two explanatory factors for the whales observed in late March. A total of 1,332 new (including 12 calves) and 242 conditional whales were seen in 397 hours of watch from the primary perches. New whales are defined as primary sightings (not re-sightings), seen for the first time in a day and the season. The period when independent observations were made was from 30 April to 25 May. A total of about 1,200 new whales were seen in 304 hours of IO watch. Field methods for operating IO perches were developed, as were methods for real-time and post hoc matching of whale sightings between perches. Custom software, BHTracker, was developed to aid with matching. A total of 759 matches were made from 3,188 whale sightings, although many of the 3,188 sightings were known re-sightings of the same animal(s), so the effective matching rate is much higher than 759/3,188. Substantial portions of the bowhead migration occurred during times when sighting was impossible due to ice and weather conditions. Therefore, no abundance estimate was attempted from the 2010 data. However, the survey yielded a large amount of IO data, from which estimates of detection probabilities will be made.

In discussion, it was suggested that automated matching software might be helpful during the matching process. It was noted that the approach in SC/63/BRG3 extends existing software to facilitate matching (inputting time, swim direction and speed, date, link code, group size etc.). The extrapolated tracks were subsequently plotted by the software and were made available. But, the observers found this information less informative than relying on their own experience.

Suydam summarised efforts during April through early June 2011 to collect data for estimating the population size of B-C-B bowheads. In both 2009 and 2010, attempts to estimate bowhead population size failed because the sea ice was closed during substantial portions of the migration. In 2011, two efforts were attempted: (1) an on-ice census with visual and acoustic monitoring; and (2) an aerial survey to obtain vertical photographs to estimate population size, using a photo-id 'sight-resight' approach. Both efforts have been successful. The on-ice effort began in early April and continued into early June. By late May, almost 900 hours of watch effort had occurred and almost 3,500 'new' whales were seen. A 7-element array of bottom founded acoustic recorders was deployed in April and recorded whale calls throughout the census. Additionally, ~180 hours of independent observer data were collected to supplement the 2010 data set for estimating detection probabilities. The aerial survey, a collaboration between the US National Marine Fisheries Service's National Marine Mammal Laboratory and the North Slope Borough, obtained ~4,300 photographs of approximately 2,000 animals between 19 April and 28 May in ~115 flight hours.

Data from both efforts will be used to estimate the 2011 population size of B-C-B bowheads. Acoustic recorders will be retrieved in July or August 2011. Visual and acoustic data will be checked and analysed in the coming year. Vertical photographs will also be analysed and compared with previous photos. All these data will be made available as soon as possible (under the restrictions of the IWC's Data Availability Agreement [DAA]) but it unlikely that their provision for the Scientific Committee's planned 2012 *Implementation Review* of B-C-B bowheads can be achieved. It should be noted that the last estimate of population size for B-C-B bowheads was from 2004. Thus, under the draft Aboriginal Management Scheme, a new estimate is not needed until 2014.

The sub-committee thanked the authors for these updates and for the considerable time and effort necessary to complete both the ice based and aerial surveys, and it recognised the work of the field crews who endured considerable hard-ship and personal risk to complete the surveys successfully.

It was noted that an upcoming *Implementation Review* will assess if any new information has become available which indicates that the set of trials used to test the *Bowhead SLA* did not adequately address the range of plausible parameter space during the previous *Implementation Review*. But, an *Implementation Review* does not require a new abundance estimate. Further, if a new abundance estimate becomes available between two *Implementation Reviews*, the quotas may be re-adjusted without trigging an *Implementation Review* during the interim.

2.1.3 Other information

SC/63/BRG5 reported results from an ageing study of B-C-B bowhead whales, based on the analysis of fifty-two eye globes (from 42 individual bowhead whales) using aspartic acid racemisation (AAR). Objectives of the current data collection, in addition to estimating the ages of the whales whose eyes were sampled, were to extend previous work (George *et al.*, 1999) by estimating the racemisation rate (k_{Asp}) for bowheads. This was done by comparing estimates of age between whales in the sample for whom ages had been obtained by a different method (e.g. baleen ageing or ovarian corpora counts), and to further evaluate the AAR ageing method via analysis and comparison of paired eyes from individual bowhead whales.

Racemisation rate (k_{Asp}) and D/L ratio at birth $(D/L)_0$ were estimated using $(D/L)_{act}$ from 27 bowhead whales with age estimates based on baleen or ovarian corpora data and 2 term fetuses. The estimates were $k_{Asp} = 0.977 \times 10^{-3}$ yr^{-1} and $(D/L)_0 = 0.0250$. The nonlinear least squares analysis that produced these estimates also estimated female age at sexual maturity at 25.86 years. Male age at sexual maturity was more difficult to estimate due to a limited number of samples available from males in certain age/size classes.

Estimates of age were obtained for 41 whales. One male exceeded 100 years of age; the oldest female was 88. Four other male bowheads have been estimated to be over 100 via AAR, and four females via ovarian corpora counts. A strong linear relationship between k_{Asp} and body temperature was estimated by combining bowhead data with independent data from studies of humans, fin whales, and minke whales.

The results quantify the relationship between racemisation rate and temperature and suggest that it is linear, at least over the range of body temperatures considered. These results suggest that it is better to estimate k_{Asp} for the species being studied, as done in this study, than to use values based on another species. However, this was not an option for George *et al.* (1999) because they lacked AAR and independent age data from the same whales. If the estimate of k_{Asp} from SC/63/BRG5 is used in place of the previous value to calculate ages from that D/L data, the resulting ages would be 1.2 times higher than those reported in George *et al.* (1999).

In discussion it was noted that the average age at sexual maturity was very high compared to other baleen whales. The author noted that the estimation of the age-at-maturity was aided by the fact that several newly mature whales (i.e. 1 or very few corpora albicantia) were available in the samples to calibrate the AAR estimates. It was also noted that the maximum age in George *et al.* (1999) was over 200 years, which is higher than the maximum ages reported in SC/63/BRG5, but based on a sample set. Given the apparent high survival rate of B-C-B bowheads, and their history of commercial exploitation, the high age estimates were considered consistent with a population recovering to its equilibrium age structure.

The sub-committee **recommended** that future studies using these techniques should be applied to other species of whales.

2.1.4 Catch information

SC/63/BRG2 summarised the data from the 2010 Alaskan hunt. A total of 71 bowhead whales were struck resulting in 45 animals landed, a bit more than the previous 10-year average of 39.0 (SD=7.7). The efficiency (no. landed/no. struck) of the hunt was 63%, which is lower than the average during 2000-09 (mean=77%, SD=7%). Challenging sea ice conditions, weather, and equipment malfunctions contributed to a poor hunt during the spring. Of the landed whales, 20 were males, 23 were females, and sex was not determined for two animals. Of the 23 females, 4 were presumably mature (based on length >13.4m), although two others were near that length of maturity (13.1 and 13.3m). Two females were pregnant, one with a 1.2m foetus and one with a 4.2m male foetus. One dead whale was found floating in Kotzebue Sound in early July entangled in crab pot gear similar to that used by commercial crabbers in the Bering Sea.

In discussion, Suydam noted that different equipment had been used in 2010, and this might have resulted in a higher struck and lost rate. In 2011, the struck and lost rate appears to have returned to the recent average.

Borodin reported that two male bowheads were taken in Chukotkan waters in 2010. Lengths were measured at 15.5 and 12.4m, with estimated weights of 52.7 and 30.5 tonnes.

2.1.5 Preparation for Implementation Review

An *Implementation Review* for B-C-B bowheads is planned for 2012. As part of the DAA, data used for providing management advice must be made accessible to Scientific Committee members no later than six months prior to the 2012 meeting. An extensive data set was made available for the previous *Implementation Review* in 2007. New data likely to be available for the *Implementation Review* in 2012 are summarised in Table 1. Individuals interested in obtaining data for analyses relevant to the *Implementation Review* are encouraged to contact the Secretariat as soon as possible, in order to facilitate the prioritisation of data preparation.

The sub-committee **recommended** that if any information is available on dive-time from the telemetry data, these data should be made available for analysis in the context of deriving availability correction factors for the abundance estimates.

Table 1

Preliminary list of data likely available for an *Implementation Review* of B-C-B bowheads in 2012.

Population size/trend	
Detection probabilities	Data from 2010
Aerial survey photogrammetry	Photo matching from 2003-04
Genetics	
mtDNA control region	New data since 2007
mtDNA protein coding genes	New data
XY	New data
Microsatellites	No new data since 2007
SNPs	New data
Catch data	New data since 2007
Age data	New data since 2007
Corpora data	New data
Movements	
Satellite tagging	Tracks of ~50 whales
Traditional knowledge	New summaries since 2007

2.1.6 Management advice

The sub-committee **reaffirmed** its advice from last year that the *Bowhead SLA* remains the most appropriate tool for providing management advice for this harvest. The results from the *SLA* show that the present strike and catch limits are acceptable.

2.2. Eastern Arctic bowhead whales

2.2.1 Stock structure

Historically, bowhead whales in the Eastern Arctic had been believed to constitute two separate stocks (IWC, 2009). However, in 2009 the sub-committee received and reviewed a considerable amount of information from a number of data sources (including substantial telemetry data, mtDNA data, and demographic information) to clarify the stock structure (IWC, 2009). The current working hypothesis of a single stock was established by the Scientific Committee on the basis of this information. However, the sub-committee agreed in 2010 that 'the degree of population structure still needs to be tested with additional molecular markers (nuclear loci) before any conclusion is finalised about the number of stocks in this region' (IWC, 2009, p.171) and it encouraged the submission of such an analysis.

The sub-committee did not receive such an analysis this year, but it notes that a large number (>30) of microsatellite loci have been developed and applied in analyses of population genetics and stock structure in Bering-Chukchi-Beaufort Seas bowhead whales. It recalls that some genetic samples exist for the eastern Canadian Arctic (at least 47 whales as of 2007). It therefore **recommends** that an assessment of variability and population differentiation among bowheads from the eastern Canada and West Greenland be completed using (at least) the above loci and all available samples from these regions. The sub-committee expressed interest in having these results presented, preferably at the 2012 Annual Meeting. A useful addition to that paper would be a discussion of the limitations of the available data and the feasibility of conducting additional genetic analysis, including commenting on areas for which no samples are available or likely to become available. This could help inform future management recommendations.

The term 'working hypothesis' implies that a single stock is currently judged to be the most plausible. The relative plausibility of this hypothesis compared to the two-stock scenario could be increased (or decreased) if the above microsatellite analysis were completed. However, the sub-committee reaffirms that the status quo is currently sufficient for its efforts to assess and manage this population of whales when relevant work adopts the single-stock 'working hypothesis' and treats the two-stock scenario as less plausible. A clearer resolution of the stock structure question could become necessary if abundance estimates decreased substantially or takes increased substantially.

The sub-committee also noted that existing data pertinent to the question of stock structure are held by Canada. However, requesting data and making recommendations for collecting future samples has been complicated because Canada is not a member nation of the IWC.

2.2.2 Abundance

SC/63/BRG18 presented a genetic mark-recapture estimate for bowhead whales in Disko Bay, West Greenland. Genotype and sex was determined for 342 individuals (74 males and 268 females) sampled between 2000 and 2010. There were 21 between-year recaptures (four males and 17 females). A mark-recapture estimate of whales captured in 2010 and compared to all individuals captured between 2000 and 2009 resulted in an estimate of 1,747 bowhead whales (SE=399, 95% CI: 966-2,528) constituting the abundance of the spring aggregation in Disko Bay.

In discussion it was noted that in the future it would be interesting to use these methods to estimate survival rates of bowheads in this area.

Heide-Jørgensen presented a review of available winter and summer abundance estimates for different areas of eastern Canada and western Greenland (Appendix 2).

2.2.3 Catch information

Reeves presented a compilation of catch data from Canadian sources during 1994-2010 (Appendix 3), and reported that the Canadian quota in 2011 was set at a maximum of 4 bowheads.

The sub-committee thanked Reeves for collecting this information. In discussion, it was noted that the reported lengths were generally quite high, but it was not possible to know how accurate those estimates were given the available information. The sub-committee **recommended** that the IWC should continue to contact Canada requesting updates about bowhead catches.

Witting reported that in 2010, three bowhead whales were harvested in Disko Bay, West Greenland, and biological samples were obtained from all three (SC/63/ProgRepDenmark).

2.2.4 Management advice

In 2007, the Commission agreed to a quota (for the next five years) of two bowhead whales struck annually (plus a carryover provision of two unused strikes from the previous year) off West Greenland but, the quota for each year shall only become operative when the Commission has received advice from the Scientific Committee that the strikes are unlikely to endanger the stock.

In 2008, the Committee was pleased to have developed an agreed approach for determining interim management advice. The sub-committee **agreed** that the current catch limit for Greenland will not harm the stock. It was also aware that catches from the same stock have been taken by a non-member nation, Canada. It noted that should Canadian catches continue at a similar level as in recent years (Appendix 3), this would not change the sub-committee's advice with respect to the strike limits agreed for West Greenland.

3. RIGHT WHALES

3.1 North Atlantic right whales (incl. abundance)

Robbins provided an update on North Atlantic right whales for the period 1 November 2009 to 31 October 2010 (North Atlantic Right Whale Consortium, 2010). The report reflected the work of more than 100 individuals and groups that conduct coordinated research on this population across its known range. A shared photographic catalogue suggested that there were 473 North Atlantic right whales in 2009. This was based on the number of unique, catalogued individuals seen alive between 2003 and 2009, not including calves observed through 2009 that could not be reliably identified. It did not explicitly account for un-photographed whales in the population and may change slightly as additional data are incorporated into the catalogue. Five right whale deaths were documented during the reporting period. Additionally, there were 4 new entanglement cases documented.

The most recent US government stock assessment of the North Atlantic right whale reported that a minimum of 345 individuals were alive in 2005, based on the individuals photographed in that year, or both before that year and after (Waring *et al.*, 2009).

3.2 North Pacific right whales (including abundance)

No update was available this year for estimates of abundance for the Sea of Okhostk. For the eastern North Pacific, a recent estimate of approximately 30 whales using a feeding area in the Bering Sea and Aleutian Islands (Wade *et al.*, 2010) remains the most recent abundance estimate within that region.

3.3 Southern right whales (including abundance)

3.3.1 New scientific information

SC/63/BRG19 reported on progress with establishing the Southern Ocean right whale catalogue, approved last year by the Commission (IWC, 2011, p.36). The catalogue aims to be a depository of right whale photographs south of 40°S that researchers can use to compare to coastal catalogues. A total of 206 photographs, taken between 1974 and 2008, were obtained from various international research organisations and scientific expeditions and compiled in a catalogue using the photo-id programme BigFish (Pirzl *et al.*, 2007). The catalogue is constructed in such a way that any available feature (left side head, right side head, front/top of head, pigmentation/scarring, etc.) can be used as a search criterion. Of the 92 animals identified, 76 were represented by photographs taken of the top of the head (depicting both left and right sides), four individuals from both left and right sides of their head, nine from left side only and three from right side only. All but one individual were seen once: SO0065A was re-sighted after four years in the same region (Area IV). Any additional data accompanying the photographs has been captured in an associated database. These data will be shared with users of the catalogue as per conditions set by the provider of the photographs following the protocol used by the administrators for the Antarctic Humpback Whale Catalogue (Allen *et al.*, 2010). Further collections of images (including those collected during SOWER) still need to be received and accessioned, and funds are being sought in this regard.

The sub-committee thanked the authors for their work on this important study, and **recommended** that the catalogue be expanded to include photos from other data-bases (e.g. SOWER and platforms of opportunity like cruise ships), and **endorsed** the proposal for funding continued work on the southern right whale photo-id catalogue (Appendix 4).

SC/63/BRG11 reported the first Southern right whale aerial surveys in Golfo San Jorge, Santa Cruz, Argentina. Flights had been carried out since 2007, covering 80 n.miles between Comodoro Rivadavia (45°47'S/67°27'W) (Chubut) and Bahía Mazzaredo (46°58'/66°31'W) (Santa Cruz), using a helicopter of the Prefectura Naval Argentina. Preliminary information on habitat use of this species were collected as well as photo-id of the individuals which served to create a catalogue, which can be further used for potential individual comparison with other regions. Furthermore, behavioral records revealed a change in the displayed behaviors with the presence of the helicopter. It remains to be clarified whether the noise generated by the aircraft is triggering the animals' response, or another cue, such as the shadow of the helicopter, is eliciting a change in the behavior.

In discussion it was noted that keeping the helicopter farther off to one side of the focal animal might reduce the level of avoidance, and that marked differences in avoidance behaviour have been noted between altitudes of 300 vs. 400-500ft during helicopter surveys of right whales off South Africa. The Scientific Committee thanked the authors for their work and looks forward to future updates from this study.

SC/63/BRG17 reported the first record of a southern right whale becoming entangled in a kayak rope. On 4 July 2010 a group of two southern right whales was recorded on video interacting with a kayak off Chapadmalal (38,20°S/ 57,68°W), province of Buenos Aires, Argentina. This report is based on an extensive analysis of the video as well as an extensive interview with the coastal observers and the kayakers.

Baker presented a study by Carroll *et al.* (In press) on stock structure among coastal calving grounds of Australia and New Zealand (NZ), where two stocks show signs of recovery (NZ subantarctic and southwest Australia) and two show little or no signs of recovery (Mainland NZ and southeast Australia). Over 1,000 samples were collected from southern right whales at six locations across these four putative stocks, although sample sizes were small from locations in Australia. Mitochondrial (mtDNA) control region haplotypes and multilocus genotypes (13 microsatellite loci) were used to identify 707 individual whales and to test for genetic differentiation. Following pooling of samples from some locations, there were significant differences in mtDNA haplotype frequencies among three putative stocks, presumably due to maternal fidelity to calving grounds. In contrast, there was no significant differentiation across sampling locations for the 13 microsatellite loci, suggesting ongoing or recent historical reproductive interchange. The study also documented the movement of seven individual whales between the NZ subantarctic and Mainland NZ, based on the matching of multilocus genotypes. Given the available evidence, the authors hypothesise that individual whales from the NZ subantarctic are slowly recolonising mainland NZ, where a former calving ground was extirpated.

Baker then presented results of a single-stock assessment of the New Zealand southern right whale, supported in part by the National Institute of Water and Atmospheric Research (NIWA), New Zealand, and reported as part of the 'Taking Stock' initiative (Jackson *et al.*, In press). The study reconstructs the historical of decline and slow recovery of the nationally endangered New Zealand southern right whale using a Bayesian logistic population dynamic model incorporating mark-recapture abundance estimates from the Auckland Islands (based on individual photo-id records from the years 1995-98 (Patenaude, 2002)), revised estimates of whaling catches by 19th century whalers including accounting for animals struck but lost, and population growth rate estimates from con-specific populations. Estimates of the minimum historical population size (N_{min}), based on the number of surviving control region mitochondrial DNA lineages (Carroll *et al.*, In press), were used to constrain the lower bounds of these population trajectories (Jackson *et al.*, 2007). The reconstructions suggest that right whales in New Zealand waters prior to whaling numbered 27,000 whales, although uncertainties in the spatial distribution of catches of right whales in the southwest Pacific are such that the pre-whaling abundance could have been as high as 40,000. Low estimates of minimum abundance (~25 mature females) confirm that the population came perilously close to extinction during the late 19th and early 20th centuries, and the estimated growth rate (4.6%) suggested a slower recovery than reported for some other southern right whale breeding stocks.

In discussion it was noted that the history of these right whales in this area was consistent with matrilineal fidelity to breeding areas acting as a limiting factor in re-colonisation (Clapham *et al.*, 2008). It was noted that a similar situation of re-colonisation was occurring around Namibia, where there had been extensive whaling as well. Members of the sub-committee also noted the value of including estimates of N_{min} in reconstructing historical trajectories using population dynamics models. Bannister commented that the high catch scenario of around 52,000 was approximately twice that obtained by Dawbin (1986) of '26,000 or more' for catches in the southwest Pacific.

Hedley reported on a recently-developed multistate mark-recapture estimation framework, that was used to model the population dynamics of southern right whales occurring along the western and southern Australian coast. Counts and photo-id records have been collected annually from aerial surveys of southern right whale breeding grounds off southern and western Australia since 1993, and from land-based work at one site along the coast (the Head of Bight) since 1991. The count data from the aerial surveys provide 'census' counts of the population present each year. Obtaining reliable and precise estimates of the population size is made more difficult by the cohort-like structure that the typical three-year breeding cycle imposes, with considerable inter-annual fluctuations in the counts as the whales occasionally prefer to skip-breed (giving a four-year breeding interval). A multistate Mark-Recapture model that may be applied jointly to aerial survey count data and photo-id data was developed to address this issue and to consider efficient ways of surveying this population (which appears to be increasing at a steady rate). Although at the outset of the project it was envisaged that the data from the Head of Bight might be used in some way to complement the aerial surveys (and possibly reduce their frequency), the analysis concurred with previous results which suggested markedly different population dynamics between whales primarily breeding at the Head of Bight compared to those breeding along the western and southern Australian coastline as a whole. Simulation studies presented concluded that for monitoring purposes, there is considerable loss of precision if aerial surveys were conducted less frequently, though this could be largely recovered if there were several consecutive years of count and photo-id data collected subsequently. Further model development is still required to address questions relating survey frequency to the loss in power to detect environmental linkages, but given the relatively short (albeit almost 20-year) series of data and the cohort-like structure, the authors conclude that any reduction in survey frequency would significantly detract from the value of the data in this regard.

Bannister reported that the annual percentage increase rate during 1993-2010, for right whales surveyed along the southern coast of Australia between Cape Leevwin (western Australia) and Ceduna (south Australia) (occupied by the majority of the 'Australian' population) was estimated to be 6.79% (95%CI: 3.9 - 9.8%). Cow-calf pairs were estimated to have increased by 6.82%. The total area surveyed was 2,892km; total current abundance of the 'Australian' population as a whole was estimated to be 3,500 (SC/63/ProgRepAustralia).

3.3.2 Preparation of Workshop on Southern Right Whales
The Workshop on the Southern Right Whale Assessment is now planned to be held at Puerto Madryn, Argentina, in September 2011. Brownell (Convenor of the steering group) reported on progress, including suggested participants and draft agenda (see Appendix 5). The sub-committee thanked the members of the steering group for this update and looks forward to receiving the report of workshop next year.

4. NORTH PACIFIC GRAY WHALES

4.1 Stock structure and movements
The sub-committee received numerous papers on stock structure and movements of North Pacific gray whales. Generally, the papers occurred within three categories: satellite tagging, photographic studies, and genetics. This section is organised accordingly.

Satellite tagging
SC/63/BRG26 provided a summary of the preliminary results of the Research Program of the Okhotsk-Korean Gray Whale Population Project using satellite telemetry. This project required a collaborative effort between Russian and US scientists. The purpose of the project was to deploy tags on 12 western gray whales to discover migration routes and wintering areas. Additionally, the collaboration would attempt to collect biopsy samples for genetics analyses as well as photo-id data across years and locations. The collaboration succeeded in obtaining the required permits and personnel for working near Sakhalin. The collaboration is anticipated to continue in summer 2011, with an expected report to the Scientific Committee in 2012.

SC/63/BRG20 reported further on details associated with preparations for satellite tagging of western gray whales off northeastern Sakhalin Island, Russia. The fieldwork occurred during September and early October 2010. As outlined in various Scientific Committee documents and reports of the IUCN Western Gray Whale Advisory Panel (e.g. Weller *et al.*, 2009; Western Gray Whale Advisory Panel, 2010), one of the safeguards of the tagging project was to tag only known males that were identified real-time (i.e. in the field while tagging was being attempted) from previous photo-id and genetic studies conducted by the Russia-US western gray whale research program from 1997 to 2009. This in-field individual recognition required the participation of Amanda Bradford (University of Washington), a long-term collaborator in the Russia-US program, who has the ability to recognise individual western gray whales by sight. However, Bradford was not in the field during the 2008 and 2009 field seasons. Thus, a pre-tagging study was implemented with the goal of allowing Bradford to spend time on the water regaining efficiency and confidence in her ability to identify individual whales, which was successful. This pre-tagging effort was encouraged by the Scientific Committee for western gray whale satellite tagging (Weller *et al.*, 2009).

SC/63/BRG23 summarised the results of tagging a western Pacific gray whale (WGW). On 4 October 2010, a subcutaneous Argos tag was applied (following protocols established by the Scientific Committee) to a 13-year-old male (given the nickname 'Flex' by the researcher team that initially photo-id'd animals) in good body condition off Piltun Lagoon, northeastern Sakhalin Island. This whale was first seen as a calf off Sakhalin in 1997. State-space modeling of near-shore movements for 68 days post-tagging identified a small home range foraging area within 45km of the tagging site. These data are unique as local weather conditions during this time of year generally prevent other forms of whale observation. On 11 December, the tagged whale departed Sakhalin and began migrating across the Okhotsk Sea, Bering Sea, and Gulf of Alaska. By 5 February, Flex was within 20km of the central Oregon coast, overlapping spatially and temporally with the last few weeks of the usual eastern gray whale southbound migration. Flex's migration segments were linear, high speed (averaging 6.5km/h), and included deep water far offshore, suggesting open-water navigation skills not previously attributed to gray whales, who are considered coastal and shallow-water oriented. State-space modeling (considering directionality and speed) identified the basin-wide movements as 'migration' rather than 'wanderings' associated with foraging. Flex's movements do not preclude other migration routes or winter destinations for WGWs. Additional tagging is needed to identify other areas of use. The resulting data will have application to conservation efforts and could identify potential anthropogenic threats.

Mate provided information about a photographic study to examine the effects of implanted satellite tags on gray whales. He and his colleagues tagged 18 animals off the Oregon and California coast of the US from September to December 2009. Photographs were taken at the time of tagging and follow-up images were taken through May 2011. Fifteen whales were photographed on up to nine occasions during 21 months after tagging, including 11 animals with tags attached up to 351 days and 14 whales without their tags up to 607 days after tagging.

Mate further reported that experienced marine mammal veterinarians, comprising Geraci, Gulland, M. Moore and Gales reviewed the photographs. The examination of the existing material is not yet complete, but once it is, the photos will become more generally available. Some of the examiners suggested that the images are a uniquely valuable collection for visually assessing superficial wound healing from tagging. Initial observations showed that the lesions at the tag location looked small and not very damaging. The images showed the expected tissue granulation stages with efficient healing as the end product and do not suggest any long-term effects. The holes around the tags were small, only marginally wider than the tag diameter, suggesting minimal movement of the tag in the animal. The appearance of the scar after tag loss is approximately equivalent to the hole made by the tag and not larger as you would expect if there had been abscessation, or extensive soft tissue necrosis or granulation. None of the photos show any generalised swelling around the tag site. There was agreement that if serious trauma of muscle had occurred, such as might have occurred with the differential movement of muscle and blubber that might have resulted in an abscess, necrosis, or scarring of tissue. If this were the case, larger surface lesions might ultimately have been seen. Based on obvious external signs, the time between tagging and the multiple resightings show that deeper tissue damage is unlikely to be a regular or common feature of the wound healing process from implantable tags.

Several questions were asked by the sub-committee about the relationship between surface healing, as revealed in the photos, and subsurface healing. Mate stated that two of the veterinarians had similar concerns. However, after examination of the photos, there was a general consensus that in the photos, the tagged gray whales looked well healed and that the surface healing suggested that the subsurface wound was probably well healed too. To help prevent infection, tags were washed and rinsed thoroughly, treated with alcohol, covered in a long term antibiotic, placed in a bag and gas sterilised, so the tag was not directly handled before deployment.

There was a lengthy discussion about the possibility of tagging western gray whale females. It was noted the Scientific Committee had previously encouraged the tagging study on eastern gray whales with follow-up photographs as a tool to aid in the decision of whether to tag western gray whales, including females. The sub-committee noted that with every tagging programme, a cost/benefit analysis is appropriate. An examination of the photos by experienced veterinarians helps to assess the risks of tagging females. Further, obtaining information about western gray whale females is important and there is a need for information about their movements. Mate's study to follow previously tagged female gray whales showed their tags lasted as long as males and with similar healing. This helps to reduce the concerns about tagging animals, including females, from a small population, such as western gray whales.

The sub-committee re-iterated that conservation risk to western gray whales is large because of the small size of the population and the potential anthropogenic impacts. Potential risk from tagging animals from this population is probably small compared to potential conservation risk from anthropogenic impacts (e.g. by-caught, hunting, etc.) that might be experienced in areas where animals might occur. The benefit of tagging both sexes is extremely high, as long as the tagged animal is healthy and proper precautions are taken.

The sub-committee noted that there was a need to be clear about specific objectives of tagging, the needed sample size, and a clear understanding of when the objectives have been reached. The sub-committee **agreed** that specific objects were needed, but also noted that only one western gray whale has been tagged and more tagging is needed to help identify migration routes between wintering and summering areas. It was not clear what the ultimate sample size should be, but stopping at one tagged western gray whale was clearly not sufficient to answer the objectives.

The sub-committee congratulated and thanked Mate and his colleagues for their success at tagging a western gray whale and the follow-up study related to healing of previously tagged eastern gray whales. The results from tracking Flex provided new and unexpected information. Mate noted that there were 12 tags still in Russia that are available for tagging more animals in 2011.

The sub-committee noted that a review of the criteria that were used in 2010 when choosing a whale to tag was called for. If females are to be tagged in 2011, the criteria need to be revised in light of these expanded tagging efforts in order to continue to minimise risk to western gray whales.

A small Working Group (Reeves, Weller, Brownell, Gales, Donovan, Ilyashenko, Lang, Mate, Rowles) was designated to further consider if the design and field protocols for a 2011 satellite tagging should be changed from those applied in 2010. The small group re-iterated that the primary objective of the study was to produce information on the movements of gray whales to allow development of effective conservation and management measures (the programme was recommended under the conservation plan endorsed by the Committee and the Commission last year). Six topics were addressed by the Working Group.

(1) Health risk assessment: In addition to the information presented by Mate during the sub-committee's formal sessions, the working group received follow-up advice from four veterinarians (Frances Gulland and Michael Moore, plus Teri Rowles and Nick Gales both of whom were present) on the potential for subdermal trauma and specifically on the degree to which the tagging of a pregnant female might compromise her health or her ability to carry the pregnancy to term. The Working Group recognised that while tagging may cause a certain amount of discomfort (pain) and invasive techniques such as this always carry some level of health risk (e.g. pregnant females are immune-compromised to some extent), this risk is sufficiently low and the potential conservation benefits sufficiently high in this case, that the main focus of determining candidates to tag should be the scientific importance of the data that might be obtained.

(2) Design: The aim should be to tag 12 animals which are, to the extent possible, broadly representative of the non-calf, non-juvenile population of gray whales off Sakhalin Island in the 2011 open-water season. Given that the sex ratio of adults in this population is approximately 60% males and 40% females, this would mean placing 6-8 of the tags on males and 4-6 on females. The effort to locate candidate whales should involve searching broadly within the Piltun feeding area and not biasing the effort too much in one area (e.g. towards or away from shore). The field team will need to have some flexibility (i.e. how many of each sex to tag) in choosing animals based on conditions experienced in the field.

(3) Candidate whales: The previous requirement that only whales judged to be healthy and in good body condition (to the extent this can be determined visually in the field) should be candidates for tagging is maintained. In addition, the following cannot be considered as candidate whales:

- 'small' animals (calves, yearlings, juveniles);
- females accompanied by calves; and
- to the extent possible to determine, females that have weaned their calves in 2011 as such females may have depleted energy reserves and be in poor body condition.

Other than the above, all animals, regardless of their sighting history (e.g. whether they are known to have travelled to the eastern Pacific in previous years), can be considered candidate whales except efforts should be made to avoid retagging Flex.

(4) Participation by Amanda Bradford: The Working Group noted the major contribution that Amanda Bradford can make to many aspects of the field work, but especially her unparalleled expertise in the identification and visual assessment of body condition of individual whales in this population. This expertise is needed to help determine which whales should not be considered candidates for tagging based on body condition or their status as calves, mother-calf pairs or yearlings. In addition, her experience will be very important for: (a) recognising individuals in real time to assist in guiding the team to achieve a reasonable distribution of the tags on males and females; and (b) assisting the field team to determine whether some of the more readily identifiable individuals have already been biopsied and therefore need not be resampled (at least in the case of males, see below).

(5) Biopsies: As only known males were to be considered candidate whales last year, the previous protocol did not require that animals also be biopsied. This year, biopsy sampling is an integral element of the tagging effort, for two reasons. Firstly, although the sex of many and perhaps most of the male candidate whales will be known after the fact as long as suitable photographs are taken for subsequent catalogue matching, there will be some (and perhaps many) instances where the only way to determine the sex will be by obtaining a new biopsy. Secondly, biopsies from tagged females (regardless of whether they have been biopsied previously) have the potential to provide valuable information on reproductive status using hormone analyses as long as the sample is preserved frozen. Having the ability to properly preserve biopsy samples will also allow investigation about which trophic level whales are foraging. Therefore, biopsies of tagged whales should be collected routinely when feasible.
(6) Follow-up studies: Although follow-up studies to assess the potential effects of tagging on the whales remain essential, they should now include, in addition, a special effort to follow the reproductive performance of any females tagged in 2011. This should include hormonal analysis of biopsies to determine whether an individual was or was not pregnant when tagged. It will require special handling of these samples; the details will be provided by Rowles to the Joint Aministrative Steering Group to ensure that appropriate facilities are made available.

Even though there was continued concern among some members about risks of tagging females, especially reproductive females, the sub-committee **strongly recommends** that the tagging study on western gray whales continues, including tagging of females. Furthermore, the sub-committee **encourages** the additional tagging of animals from the eastern population, including whales from the Pacific Coast Feeding Group (PCFG). Additional information concerning movements of all components of the population of North Pacific gray whales would be helpful for determining stock structure.

Genetics

SC/63/BRG10 presents an updated analysis of genetic differentiation between gray whales in the eastern and western North Pacific using samples collected from 142 individuals on the primary feeding ground off Sakhalin Island, Russia, in the western North Pacific (WNP) and samples collected from areas used for feeding (*n*=106 samples from individuals feeding north of the Aleutians) and migrating (*n*=122 samples obtained from animals between California and southeastern Alaska) in the eastern North Pacific (ENP). Consistent with the results of previous studies, significant levels of differentiation were found between WNP and ENP gray whales using both mitochondrial (e.g. Sakhalin versus Chukotka, F_{ST}=0.082, p<0.0001; Φ_{ST}=0.037, p<0.001) and nuclear (e.g. Sakhalin versus Chukotka, F_{ST}=0.010, p=0.001; F_{ST}=0.037, p=0.001) markers (*n*=8 loci). No significant differentiation was detected when the two sample sets collected in the ENP were compared. In addition, comparison of the mtDNA haplotype, sex, and genotypes (8 to 13 loci) of all analysed samples (*n*=380; includes an additional 10 samples collected off southeastern Kamcahtka) were used to identify samples with identical genetic profiles, and these genetic matches were used to infer movements of individuals between areas. Four of the ten samples collected off southeastern Kamchatka were genetically matched to individuals sampled off Sakhalin; these findings are consistent with photo-id studies documenting movements of animals between these areas. Two genetic matches were identified between Sakhalin and southern California, suggesting movements of two animals between the WNP and the ENP. Both of the animals involved in the ENP-WNP matches have shown consistent return to the Sakhalin feeding area over time; one of the animals was first identified as a non-calf male off Sakhalin and the other is a known reproductive female. Within the ENP, the two samples were collected within three days of each other in March 1995 when the animals would likely be migrating north.

While the significant levels of mitochondrial and nuclear genetic differentiation between the ENP and WNP support the continued recognition of the animals feeding off Sakhalin as a distinct unit, the movements detected in the genetic comparisons, in combination with information from telemetry and photo-id studies, suggest that some of the animals summering off Sakhalin overwinter in the ENP in at least some years. Given that recent records document gray whales in Japanese waters during winter and spring, these results suggest that population structure in gray whales may be complex, such that not all of the animals which feed off Sakhalin share a common wintering ground. If some proportion of the animals that feed off Sakhalin overwinter in the ENP, then the number of animals remaining in the WNP year-round may be smaller than previously estimated.

The sub-committee discussed the conception date of gray whales and whether westerns and eastern would be in the same location when breeding occurred. Rice and Wolman (1971) suggested that conception dates were typically in November and December based on a mean birth date of mid-January and a gestation period of approximately 13 months. Mate questioned the timing of the complete breeding season because there are no sightings of mating activities in the Pacific NW during southward migration. Mating activity had been observed regularly for northbound whales. Mate suggested that some breeding may thus occur during the northbound migration in March and April. However, some sub-committee members pointed out that mating behaviour has been observed in male groups of northward migrating groups and feeding groups. The question about timing of breeding relate to the genetic distinctness of eastern and western gray whales. Maintaining genetic distinctness at the mitochondrial and nuclear DNA levels requires segregation of eastern and western whales during breeding. More information is needed in the timing of breeding and conceptions of gray whales. Brandon suggested a re-analysis of foetal growth was possible using an available data set of foetal lengths that expands that of Rice and Wolman (1971), and may provide some additional insights into the timing and variability of conception dates.

The sub-committee **encouraged** additional genetic comparisons between Sakhalin and Baja California, Mexico. The genetic comparisons between western gray whales and gray whales in Baja would be valuable because Baja may represent a more random sample than any individual feeding region, and that such a comparison might provide additional information on the overlap between eastern and western gray whales. Furthermore, comparing gray whales sampled in Kamchatka with Sakhalin and Baja animals would also be valuable. Lang reported that plans to compare the Sakhalin samples with those from the lagoons are underway, although additional samples are needed for whales using areas near Kamchatka.

In discussion it was noted that the archetype for gray whales may need reconsideration and that the current concept of movements and distribution of gray whales may be wrong. Gray whales could be more similar to humpbacks where feeding grounds are separate but a common breeding area is shared. However, some concern was raised about the issue of small sample sizes, and whether that might lead to spurious results in the mtDNA and nuclear DNA comparisons. It was noted that the Lang *et al.* study (SC/63/BRG10) had relatively large sample sizes from the areas investigated, and thus the results are currently valid. The study would be improved with increased sample size of course, and from samples in different feeding areas.

Lang presented a recent publication by Fraiser *et al.* (2011), which analysed information on stock structure within the eastern North Pacific (ENP), with a focus on understanding the relationship of the PCFG (referred to in the paper as the Southern Feeding Group) to the rest of the ENP population. Mitochondrial (mtDNA) sequence data was generated from 40 samples which were collected from animals in Clayoquot Sound, British Columbia and which were used to represent the PCFG. This data was compared to published mtDNA sequence data (LeDuc *et al.*, 2002) from samples collected from 105 individuals, most of which stranded along the migratory route in the ENP. Significant mtDNA differentiation (F_{ST}=0.0125, p=0.0303; Φ_{ST}=0.0311, p=0.0254) was found between the two groups, and analysis with MIGRATE provided estimates of θ ($N_e\mu$ for mtDNA) which were significantly different (p<0.001) between the PCFG and the other ENP samples. The authors concluded that these results suggest that the maternal lineages of the PCFG represent a distinct seasonal subpopulation and therefore that the PCFG requires separate management consideration.

In discussion, the dispersal rate estimate (<1% per generation) was discussed in terms of whether this referred to emigration from the PCFG into the northern feeding group, or immigrating from the northern feeding group into the PCFG. Lang replied that it was not completely evident how to interpret the migration rate given the information in the paper.

There was also some discussion about the small size of the PCFG and whether the inclusion of multiple samples collected from the same whale may have influenced the results. Lang stated that the authors only used photos of known animals, to avoid including multiple samples from the same individuals. Eventually, microsatellite DNA will become available to help ensure that the sample set does not include duplicate whales. Additional concerns were expressed about comparing a small feeding group (i.e. PCFG whales) with samples collected on the migratory route of the larger eastern population. Lang mentioned that Lang *et al.* (2011) makes direct comparisons among feeding areas. Here results were similar to Fraiser *et al.* (2011) and thus, she felt the results of the comparison were reasonable.

Photographs

SC/63/BRG6 provided results from a comparison of long-term photographic studies on western North Pacific (WNP) gray whales off Sakhalin Island, Russia, with eastern North Pacific (ENP) gray whales. The purpose was to detect possible population mixing. The WNP/ENP catalog comparison involved 181 and 1,200 individuals, respectively, and resulted in six matches (three males, two females, and one whale of unknown sex). Three of the six whales were first identified as calves (with their mothers) off Sakhalin. All ENP sightings of Sakhalin whales occurred off southern Vancouver Island, BC, and were collected during only two days of effort. Three whales were identified on 02 May 2004 and 25 April 2008, respectively. The three whales in 2004 were together in a single group, while the three whales in 2008 were in two groups in close proximity. All six whales were sighted off Sakhalin prior to their ENP sightings and five were observed off Sakhalin subsequent to being sighted in the ENP. Four whales were sighted in both the ENP and WNP in the same year, three in 2004 and one in 2008. As the ENP catalog represents only a fraction of the total number of individuals in the ENP population (~19,000), it is likely that more WNP/ENP exchange has occurred than was detected during this comparison. Although these matches provide new records of WNP to ENP movements, winter/spring observations of gray whales off Japan, including a 2006/07 photo-match from Honshu to Sakhalin (Weller *et al.*, 2008), indicate that not all gray whales identified off Sakhalin share a common wintering ground. Thus, it is possible that the number of whales in the WNP population is smaller than previously estimated and therefore of increased conservation concern.

Weller and Urban reported on an ad-hoc effort to expand upon the WNP/ENP gray whale catalogue comparison reported in SC/63/BRG6. To this end, a preliminary 'scan' inspection of the 2006-10 photo-catalogues (each comprising hundreds of individuals) from Laguna San Ignacio (LSI) in Baja California, Mexico, was conducted to look for matches to the Russia-US catalogue of western gray whales from Sakhalin Island. This comparison, conducted in a non-comprehensive manner and relying on long-term familiarity with whales in the Sakhalin catalogue, produced four matches. In combination with the six WNP/ENP photo-id matches described in SC/63/BRG6 and two genetic matches detailed in SC/63/BRG10, a total of 12 western gray whales (six males, five females and one whale of unknown sex) first identified off Sakhalin Island have been matched to three locations in the ENP (Vancouver Island, Southern California and LSI). Comprehensive matching effort of WNP and ENP is planned but is pending available funding (see Appendix 7). It is hopeful that information will be available by 2012 meeting. Photos and samples should be integrated among nations and areas.

The sub-committee **commended** the authors on the new information linking whales sighted near Sakhalin Island with animals sighted off the west coast of North America. Some committee members expressed surprise concerning the number of matches given the small number of whales in the western population and only 1,200 whales being included in the ENP catalogue. It was noted that the close proximity of WNP gray whales matches at Vancouver Island, Canada noted in SC/63/BRG6 may not be due to WNP whales traveling together but rather due to whales independently congregating on herring spawns.

As described in SC/63/BRG12, photographic identification of the western gray whale population has been conducted since 2002 to study the migration and biology of this species. The research covered two feeding areas near Sakhalin Island, Piltun and an offshore area off the northeastern coast and the third area, Olga Bay, in Southeast Kamchatka. Whales have only been observed in Olga Bay over the previous few years. The Sakhalin WGW Catalogue (2002-10) now contains 187 identified individual gray whales. In 2010 a total of 105 individuals were seen in the Piltun area, including 7 cow-calf pairs. The analysis of the photo-id data collected offshore Sakhalin indicates that inter- and intra-year movements of gray whales occur both within and between the Piltun and offshore areas. The variability in using the available feeding grounds offshore Sakhalin by the gray whales is likely a normal behaviour aimed at exploiting the ever-changing forage habitat.

Whales from the Sakhalin catalogue have also been discovered to move between the Sakhalin feeding area and offshore southeast Kamchatka. The comparison of photo-id results from Sakhalin and Kamchatka regions in 2010 showed that 80 individuals were only seen offshore Sakhalin. Twenty-three whales were only seen offshore Kamchatka, and 25 whales were seen both offshore Sakhalin and offshore Kamchatka. Thus, a total of 128 from the Sakhalin catalogue whales were identified off Sakhalin and Kamchatka in 2010. In 2010, three cow-calf pairs were seen in Olga Bay in the beginning of the field season. Later, during the same summer, all three calves were observed in the Piltun area. The identification of cow-calf pairs in Olga Bay in June-July survey is important. At present, the catalogue of gray whales photo-identified on the Kamchatka shelf during 2004 and 2006-10 contains 140 fully identified animals. A total of 78 of these whales were also observed in different areas of the Sakhalin shelf as well in 2010 and previous years. The sightings of whales indicate that visits of the known Sakhalin gray whales to the Kamchatka Peninsula and their movement between these regions are common. It is likely that some of the gray whales enter Olga Bay to feed early in the season and then later move to Sakhalin, and possibly to other feeding areas as well.

The sub-committee thanked the authors for their efforts. It was noted that ~120 animals, almost the entire population of western gray whales, were identified in 2010. Working in Olga Bay can be challenging but it is also providing new and interesting information. Olga Bay is especially interesting because it is about half way between the Sakhalin feeding area and locations where eastern gray whales feed in the northern Bering Sea.

There was some discussion about collecting photos of harvested whales around Chuktoka. It was noted that this might be very difficult but is also valuable. The sub-committee **strongly recommended** that photos (and genetic material) be collected from harvested whales in Chukotka and the photos be compared with the western gray whale catalogue.

SC/63/BRG24 presented a review of information related to eastern gray whales re-occupying their historic range. The author suggested that as the eastern population has increased it has expanded into previously used territory, and that perhaps the Eastern and Western populations are not isolated. He noted that the Eastern population abundance reached or even exceeded the initial pre-whaling abundance in 1980-88, 1998 and in 2007. The size of the population may be near carrying capacity of around 15,000 to 22,000 whales. Between 1965 and 1979 western gray whales were only sighted 6 times in the south China Sea, Sea of Japan and Sea of Okhotsk. During the 1995 to 2007 years only 13 (including 8 juveniles) were recorded near Hokkaido and Honsu. Stranding of whales and observation of 'skinny' whales on the American shores and in the Sakhalin areas were synchronous. However, the eastern and western 'populations' have different population dynamics. The whales arrive at the coast of the Sakhalin Island and the Eastern Kamchatka usually from the North, and again shift to the north at the beginning of winter. Gray whales show fidelity to feeding and breeding areas. However, a gray whale which was recorded off the coast of Israel and Spain in May 2010 within the area of extinct Atlantic population demonstrated that this species is a nomadic. Additionally, the male, 'Flex' which was tagged near Sakhalin reached the US coast. The western part of the species range in the Pacific is being re-inhabited not only by potentially survived whales of the relict Western 'population', but probably by Eastern animals re-inhabiting historic parts of the species range. The author concluded that at the same time, some individuals have continued or just started to use the historical winter areas to the South of the Okhotsk Sea.

Integration of different data types

Flex's movements, genetic matches and photographic matches show that western and eastern gray whales mix to some degree, but sightings and entanglements in the western Pacific near Japan show that a segment of the western population migrates south instead of east. Tracking additional animals of both sexes and both populations will provide additional insights into migratory routes, breeding/calving locations, and wintering areas of western gray whales. Reproductive areas may be critical for management decision related to possible anthropogenic impacts.

The sub-committee **agreed** there was a need to integrate existing data and collect new data. A small group (Weller, Lang, Donovan, Olga, Scordino, Kato) was established for developing a plan for integrating various types of data to better elucidate stock structure (see Appendix 7). It was noted that all range states should be involved.

Brownell reported that between 1955 and 2009, SC/63/O8 reported 23 records of western gray whales from Japanese waters, including at least 11 specimens from 1968 to 2007. Brownell noted that there are only ten known records of western gray whales in China from 1922 to 1996 (Wang, 1999), but these are represented by only six specimens from 1933 and 1996. A sample from the 1996 specimen has been deposited in the archives at the Southwest Fisheries Science Center. High priority needs to be given to analysing available samples from western gray whales from Japan and China as soon as possible as called for by the Scientific Committee since 2005. Given recent evidence that the Sakhalin feeding area may represent a mix of individuals overwintering in the ENP and individuals overwintering in the WNP, analysis of samples from areas in the WNP used for migrating and/or breeding, such as Japan and China, will greatly contribute to our understanding of gray whale population structure.

The sub-committee was reminded that last year a mtDNA analysis was presented to the sub-committee based in part on stranded and by-caught gray whales in Japan. The study was carried out in a collaboration between Russian and Japanese scientists.

The sub-committee noted that as it continues to consider new information on stock structure and movements of North Pacific gray whales, a working definition of terms and more consistent usage would be helpful. All of these terms are descriptions of groups of organisms below the species level, and the inconsistency in usage reflects the difficulty associated with the fact that such subdivisions attempt to divide the continuum of genetic relatedness into [more-or-less] discrete subunits. The sub-committee also noted that the Working Group on Stock Definition (SD) has been considering such issues (see Annex I). Given the complexity of gray whale stock structure, the sub-committee **encouraged** participation of those involved in analysis of North Pacific gray whale population structure in the review of terminology to be conducted by the SD group next year.

4.2 Western North Pacific gray whales

4.2.1 Abundance

SC/63/BRG8 reviewed findings from the collaborative Russia-US research program on western gray whales summering off northeastern Sakhalin Island, Russia. The western gray whale population is critically endangered and its continued ability to survive is of concern. The most recent population assessment by Cooke *et al.* (2008), using a Bayesian individually-based stage structured model, resulted in a median 1+ (non-calf) estimate of 130 individuals (90% Bayesian CI=120-142). The collaborative Russia-US research program on western gray whales summering off northeastern Sakhalin Island, Russia, has been ongoing since 1995 and has produced important data that has be used to determine the conservation status of this critically endangered population. SC/63/BRG8 reviewed findings from 2010 research activities and combines such with data from previous years, in some cases ranging back to an opportunistic survey in 1994. Photo-id research conducted off Sakhalin Island in 2010 resulted in the identification of 43 whales, including four calves. One previously unidentified non-calf was observed. When combined with data from 1994-2009, a catalog of 186 photo-id'd individuals has been compiled. Not all of these 186 whales can be assumed to be alive, however. No new reproductive females were recorded in 2010, resulting in a minimum of 26 reproductive females being observed since 1995. Additional effort off eastern Kamchatka identified 19 whales, including six individuals previously encountered off Sakhalin. In addition to a number of biological difficulties that western gray whales are facing, the large-scale offshore oil and gas development programs near their summer feeding ground, as well as fatal net entrapments off Japan during migration, pose significant threats to the future survival of the population.

SC/63/BRG21 summarised results of shore- and vessel-based distribution surveys conducted offshore northeast Sakhalin, Russia, in August-September 2010 and provided some comparisons with data for the period 2004-09. The results obtained confirm that overall distribution of gray whales in this region remains unchanged – the animals are located throughout the season in two traditional feeding areas: the shallow-water near-shore Piltun area and the deeper-water Offshore area. In 2010, gray whales were concentrated in the central and northern sections of the Piltun area, in the eastern part of the Offshore area and, to some extent, in the adjacent Arkutun-Dagi license area. As compared to 2009, there was a slight decline in the maximum number of gray whales sighted in the near-shore Piltun area in 2010 (from 73 to 66) and an increase of approximately 42% in their maximum number observed in offshore Sakhalin waters (from 26 to 37 animals). Based on comparative analysis of the survey and photo-id data, total number of gray whales in the northeast Sakhalin feeding range in 2010 is assessed at 110-120 individuals, which indicates a relatively stable level of their abundance for the period 2004-10.

Members of the sub-committee pointed out that oil and gas seismic surveys had been conducted in 2010, and wondered if any analyses had been conducted related to disturbance of whales. The author responded that they are comparing the distribution of whales during days with seismic activity compared to days without seismic activity. Their preliminary analysis suggested there was no difference between times with and without seismic in the nearshore area and that whales were concentrated in part of the offshore area. The sub-committee **requested** that results from a more quantitative analysis of anthropogenic impacts to gray whales using a comprehensive data set be presented at the 2012 meeting of the Scientific Committee. The author noted that there are plans for that type of analysis to occur and expects to have more information for the sub-committee in 2012.

The sub-committee also discussed the complication of multiple seismic surveys occurring in 2010. An analysis of impacts from one survey is important but caution is needed because there may be cumulative impacts from the multiple activities occurring near Sakhalin in 2010. The sub-committee urged that analyses of impacts consider all the anthropogenic activities that occurred during the season.

4.2.2 Other issues

SC/63/BRG4 summarised anthropogenic sound levels associated with pile installation in waters offshore of Piltun bay, northeast of Sakhalin Island. The Sakhalin-1 project is located offshore northeast Sakhalin Island in the vicinity of feeding areas of the western gray whale. In 2009, piles were installed for foundation support for operations, such as the drilling of extended reach wells from shore to develop the offshore oil field. Pile installation involved drilling a hole, leaving the loose material in place, vibrating the pile into the hole, and finally driving the pile to a designed resistance (i.e. depth). In 2009, pile installation took place between April 8 and September 12 and only occurred during the day for discrete time periods (i.e. not continuous all day). No pile driving operations occurred at night and they were performed for less than 3 hours/day. Pile installation was conducted for more than 4 hours/day for only 7 days and pile installation was never conducted for more than 5 hours/day.

Associated with the pile installation, a comprehensive monitoring program was implemented. Hydrophones were deployed to record the character of sounds and to monitor impulses and other sounds from the operation. Impulses were recorded at stations 7km to the north and 11km to the south but only at greater distances on days with calm weather and low ambient noise conditions. Additionally small acoustic recorders were deployed at several locations for short periods of time (days) to characterise the sound field more completely. All of the piles for which acoustic data were available were analysed except those where the signal to noise ratio (S/N) was <6dB or the pile driving time was <3 minutes. The maximum SPL_{rms} and SEL values varied significantly from installation to installation due to location, environmental characteristics, and the subsurface conditions (e.g. the presence of permafrost) near the pile. Propagation models were developed and acoustic field were calculated as SPL_{rms} and SEL.

Whale densities in the Piltun Area were higher in 2009 than in 2008 with levels comparable to 2007. Whale distribution and behaviour data are being analysed using multivariate techniques to further understand the potential link between onshore pile installation activities (sound exposure) and the abundance, location, and behavior of whales and perhaps benthos distribution.

Propagation maps show that impulses from pile-driving are highly directional toward the east and sound levels drop off rapidly toward the north and south. This would tend to limit exposure of feeding gray whales to elevated sound levels. RMS sound pressure levels estimated within the feeding area range from 134.3 to 98.7 dB re 1µPa (rms) which are below levels believed to cause significant behavioural reactions in 10% of feeding gray whales for impulsive sounds (Malme *et al.*, 1988). The data set collected in 2009 can be used to verify whale behavioural thresholds for pile driving sounds.

Sub-committee members asked how the sound measurements and data on whale disturbance will be used. The author responded that knowledge from this study will be available for future pile driving or other activities in the Piltun area. The sub-committee appreciated receiving the information and were pleased that a multivariate analysis would be conducted and that behavioural and distributional data were collected during pile driving. The authors were cautioned about referencing Malme *et al.* (1988) as a definitive work on how gray whales respond to anthropogenic sounds, because of limited sample size in that study. An improved and more comprehensive analysis and improved understanding of impacts to gray whales from pulsed and more constant sounds is needed to protect the small population of western gray whales. The sub-committee also requested that the sound propagation model should include the shallower water along the beach near Piltun. This is precisely the area where gray whales are feeding, including cow-calf pairs. Similar to the case involving seismic surveys, the authors were encouraged to assess not only the impacts from pile driving but also from the other anthropogenic activities that may be contributing to cumulative impacts. The author stated that assessing cumulative impacts may be problematic because multiple companies are operating in the area and not all share information about their activities or monitoring results openly. The sub-committee encouraged the companies to work closely together and with the WGWAP and BRG and to openly share information about activities and monitoring results.

With regards to oil and gas activities near Piltun, the subcommittee learned at its 2010 meeting about a planned seismic survey during the time when gray whales would be in the area. Members wondered if the seismic survey that was conducted by Rosneft Shelf during the summer of 2010 off of Sakhalin had impacted Flex. Mate replied that it appeared that the tagged whale may have remained in the general area of survey but there are limitations on the precision of the satellite tagging locations and specific information about the seismic survey, such as when and where the airgun arrays were in operation. Apparently Rosneft is working on a report that evaluates the distribution, movements, and behavior of gray whales relative to the seismic survey, including movements of Flex. The sub-committee noted that while it will likely be difficult to make conclusions about the impact of seismic activity on the Flex in particular, that other monitoring efforts may be helpful for assessing impacts on western gray whales in general. The sub-committee welcomes additional details about the 2010 monitoring effort at our 2012 meeting. A comprehensive data set and quantitative assessment should provide additional information about reactions of gray whales to seismic surveys.

Reeves provided a summary of the activities of IUCN's Western Gray Whale Advisory Panel (WGWAP) (see Appendix 6). That report describes multiple seismic surveys that were conducted near Sakhalin in 2010, including the Rosneft survey mentioned, above. The other surveys included one by Sakhalin Energy and another by Gazprom. The surveys conducted by Sakhalin Energy and Rosneft apparently had corresponding monitoring and mitigation plans. As mitigation, the nearshore Sakhalin Energy survey was planned to begin as early as possible to avoid gray whales. The survey started a bit late but was concluded by 2 July. The monitoring data, including acoustic and visual information on whale distribution and behavior, will be useful once analysed. The two other seismic surveys occurred later in the year when more gray whales were present and temporally overlapped. It was not known whether the Gazprom survey included and monitoring or mitigation. A small seismic survey is planned for 2011 for preparation work for specific sighting of a development structure. Mitigation and monitoring plans are in place for 2011.

As it had done last year, the sub-committee acknowledged the important work of the IUCN WGWAP and welcomed this year's update on the panel's activity (Appendix 6). Furthermore, the sub-committee recommends that appropriate monitoring and mitigation plans be implemented for oil and gas activities that occur in the range of western gray whales. The sub-committee also encourages oil and gas companies to work together in sharing environmental data, including information about gray whales, and to develop a plan to coordinate seismic surveys and other noise producing activities to protect gray whales.

Ilyashenko mentioned that it was peculiar to see in the IUCN document a request to the Prime Minister of the Russian Federation to stop the seismic survey off Sakhalin. He stated that if there is any desire to give recommendations on corporate activities, correspondence should be directed to the appropriate corporation. Given the results of satellite tagging and other information on western gray whales, Canada, the US, and Mexico should be included as range states on the Implementation of the Conservation Plan for western North Pacific gray whales.

SC/63/BRG15 reported the results of field studies the western gray whales food supply distribution patterns in two feeding grounds off the Northeast coast of Sakhalin: Piltun and Offshore feeding areas in 2002-10. Whale distribution and photo-id studies registered changes in western gray whales distribution and abundance in the Piltun and Offshore feeding areas in 2002-10. To explain these year-to-year differences, potential correlations with benthic data were investigated. The basic food resources for gray whales in the Piltun feeding area are small benthic animals – amphipods (*Monoporeia affinis*) and sand lance fish (*Ammodytes hexapterus*). Results show that differences in amphipod biomass in the Piltun area between years were statistically significant. Results also show that sand lance were an additional food source for gray whales in the northern part of Piltun area in water depths >20m during 2004-05 and 2010 when there was a greater frequency of occurrence of sand lance than during other years. According to statistical analysis, whales in this area fed more often in spots where frequency of occurrence of sand lance was highest. Food benthos biomass in the deep-water Offshore feeding area was stable during 2002-10, and no long time variations were observed; whales fed in a depth range of 41-61m during all years in a zone of high abundance of ampeliscid amphipods (*Ampelisca eschrichti*).

The report on gray whale prey items near Sakhalin was welcomed by the sub-committee and the authors were congratulated for their success. Some questions were asked about whether gray whales feed on sand lance. The author responded that in some areas where gray whales were feeding, the only prey items present were sand lance, suggesting that gray whales were feeding on them. The sub-committee recommended that faecal samples be collected from gray whales in Sakhalin to confirm prey items. It was noted that if whales are eating sand lance off Sakhalin, then the whales could also be eating sand lance off Japan that are possibly contaminated with radioactivity. The sub-committee encouraged long term monitoring of prey items. Further the sub-committee recommended a more quantitative analysis of prey items of gray whales off Sakhalin. A better understanding of prey would be useful for understanding the distribution of whales off Sakhalin.

SC/63/O8 reported that there had been no stranding, entrapment or entanglement of gray whales in Japan during the period from May 2010 to April 2011 (i.e. there has not been an entrapped or entangled animal in Japan since January 2007.). It also reported that no sighting report had been made during the concerned period. Regarding research activity, it informed that morphological analysis of two gray whale skeletons, which had been derived from animals entangled in the coastal waters of Miyagi Prefecture in 2005, was ongoing. With respect to administrative actions to reduce the possibility of the net-entrapment/entanglement problem, Uoya from the Fisheries Agency of Japan (FAJ) reported that FAJ was engaged in updating the Manual for Coping with Stranding of Cetaceans (published in 2004), which also dealt with by-catch issues, so that it would reflect the prohibition of catch, sale and possession of gray whales (under the Fisheries Resources Protection Act), which had entered into force in 2008. Finally, Uoya expressed FAJ's intention to continue educational activities and other practicable measures in relation to this issue, noting that the net-related mortality was a range-wide issue, but not particular to Japan.

The sub-committee appreciated receiving the information presented in SC/63/O8. Conservation concerns for western gray whales remain paramount. Improving conditions and reducing mortality is a range wide issue and Japan plays an important role in conserving this small population of whales. The sub-committee hopes that Japan is able to continue to address issues of bycatch of western gray whales.

Kato announced that tissues from western gray whales in Japan were lost due to the earthquake and tsunami in March 2011. Even though soft tissues were lost, some bone samples are still available. The tsunami hit the research station in northeast Japan and many samples were lost. Fortunately, DNA from many samples was preserved in Tokyo.

Reeves advised the sub-committee of reports indicating that at least three seismic surveys may take place off northeastern Sakhalin again in summer 2011.

4.2.3 Conservation advice

The sub-committee again recognises that the problem of net entrapment of western gray whales is a range-wide issue. It welcomes the efforts of Japan to reduce mortality, and notes that net entrapments could occur in other range states, including Canada, US and Mexico.

As it had done last year, the sub-committee **acknowledged** the important work of the IUCN WGWAP and welcomed this year's update on the panel's activities (Appendix 6). The sub-committee **re-emphasised** its view that its work is important and **strongly recommended** continuation of the Panel.

In 2009, the sub-committee welcomed the report of the IUCN range wide workshop. An important aspect of the results from that workshop was the object of developing a conservation plan for western gray whales. Therefore the sub-committee was also enthused to receive a report on the draft Conservation Plan for Western North Pacific Gray Whales (Brownell *et al.*, 2010) and **commended** the authors for this important document.

The overall goal of the Western Gray Whale Conservation Plan is to manage human activities that affect western gray whales and maximise the population's chances for recovery, based on the best scientific knowledge.

4.3 Eastern North Pacific gray whales

4.3.1 Abundance

SC/63/BRG7 summarised information about the counts of southbound whales migrating past Granite Canyon, California. Those counts form the basis of abundance estimation for the eastern North Pacific stock of gray whales, with the observed count being rescaled by a series of correction factors to estimate the total number of whales passing during the migration. Since the 2006/07 migration, the 'traditional' approach of counts by a single observer who hand-records entries onto a data form has been replaced by a 'new' counting approach whereby a paired team of observers work together and use a computer to log data and visualise whale sightings. A quantitative comparison of the performance of the traditional and new counting approaches revealed differing pod size estimation biases (Durban *et al.*, 2010), highlighting the need for new calibration data specific to the new counting method and new observers before recent count data can be reliably rescaled to estimate abundance. Appropriate correction factors for the new counting approach are currently being estimated. In the interim, SC/63/BRG7 presents 'naïve' indices of abundance from counts made during four recently monitored migrations (2006/07, 2007/08, 2009/10 and 2010/11) using the approach of Laake *et al.* (In press). The observed whale passage rates (whales/hr) over time within each survey were smoothed using a generalised additive model to predict the total number of whales passing during the migration without applying correction factors. Abundance indices ranged from 11,408 to 12,570, with generally increasing precision (CV=0.04-0.08) over the four migration years, related to an increase in the hours of observation effort possible. These abundance indices were consistent with those reported for 23 previous migrations, and were comparatively stable across the four recent years, indicating consistency of the new counting approach. Counts using the new approach in 2006/07 produced a higher estimated abundance index than the traditional counts conducted simultaneously in the same year, suggesting an increase in detection probability. However, it is not possible to relate these indices to the true level of abundance until an appropriate assessment of the detection bias of recent counts has been completed.

The sub-committee noted that the thermal imaging component of the study sounds promising. The sub-committee requests a more detailed discussion about the gray whale counts at the 2012 meeting, including a more detailed discussion about the promising technique of using thermal imaging to help correct the counts for whales migrating past the counting location during the night.

4.3.2 Other information

The sub-committee appreciated receiving information on whales harvested in Chukotka (SC/63/BRG16). Even though the authors were not able to attend the SC, the sub-committee hopes to continue receiving information about harvested whales in Chukotka.

SC/63/BRG25 presented results of the annual census of gray whales in breeding lagoons in Baja California, Mexico. Two of three lagoons (Ojo de Liebre and San Ignacio) were surveyed annually. There is considerable variation in the number of whales that use the two lagoons. The number of whales using Ojo de Liebre was about 45% higher in 2011 than in the previous year. There were also more whales in San Ignacio lagoon. The increase in sightings was especially apparent for cow/calf pairs. Some of these pairs remained in the lagoons until May. The number of calves in the breeding lagoons and on the northward migration has previously been linked to the timing of sea ice retreat in the Bering Sea and the Arctic Ocean. Earlier ice retreat likely provides whales with a longer time period to feed in the summer, which presumably results in more calves. The 2011 survey has just been completed and more information will be available soon about whether the correlation continues.

Shore-based surveys of northbound eastern North Pacific gray whale calves have been conducted each spring between 1994 and 2010 at the Piedras Blancas Light Station in central California. Perryman *et al.* (2011) provided an update of information from these counts for the period 2001-10. Estimates for the total number of northbound calves in 2001 to 2010 were 256, 842, 774, 1,528, 945, 1,020, 404, 553, 312 and 254, respectively. These calf estimates were highly variable between years, with no sign of a positive or negative trend. Calf production indices, as calculated by dividing the estimates of northbound calves by estimates of abundance for the population (Laake *et al.*, In press), ranged between 1.3-8.8% with an overall average of 4.1% during the 17-year time series (1994-2010). These annual indices of calf production include the impacts of early postnatal mortality but may overestimate recruitment because they do not account for the possibly significant level of predation on gray whale calves by killer whales occurring north of the survey site. The relatively low reproductive output in this population is consistent with the reports of little or no growth in this population over the same time period (Laake *et al.*, In press; Punt and Wade, 2010).

Based on comparisons of ice distribution taken from satellites and estimates of northbound calves, Perryman *et al.* (2002) suggested a link between the timing of the melt of seasonal ice in the Arctic and calf production in this population the following winter. These earlier ice model comparisons were based on the length of time that historical feeding grounds were ice-free. Perryman *et al.* (2011) presents an analysis of a more complete data set of ice cover for the Bering Sea and shows an even stronger relationship than reported previously; average ice cover in the Bering Sea explains roughly 70% of the inter-annual variability in estimates of northbound calves the following spring. In other words, a late retreat of seasonal ice may impact access to prey for pregnant females and reduce the probability that existing pregnancies will be carried to term.

The sub-committee thanked Weller, Perryman, Urban, and their collaborators for the long time series of data on the numbers of eastern Pacific gray whales. The data are very helpful for IWC but also to others outside of IWC. The sub-committee suggested that an integrated analysis with the lagoon counts in Baja and northbound calf counts in California might now be carried out in a more quantitative way, given the length of the time series. It was also suggested that correlations between calf production in western and eastern gray whales be examined.

4.3.3 Catch information

Russian Federation reported that a total of 118 gray whales (57 males, 61 females) was landed in Chukotka, Russia, in 2010. No whales were struck and lost. The longest female was 15m and the longest male was 14m. Many (49%) of the whales were aggressive during the hunt. One whale was considered unfit for consumption (i.e. it was 'stinky'). Biological samples were collected from 51 gray whales (including from the 'stinky' whale).

4.3.4 Management advice

The sub-committee agreed that the *Gray Whale SLA* remains the appropriate tool to provide management advice for eastern North Pacific gray whales. The sub-committee noted the ongoing work of the SWG on the AWMP for an *Implementation Review*. It agreed that the progress thus far on the *Implementation Review* had identified no reason to change the sub-committee's advice at least until 2012.

5. WORK PLAN AND BUDGET REQUESTS

The sub-committee **agreed** that its work plan for the 2012 Annual Meeting would be as follows.

(1) Review any new information on North Pacific gray whale stock structure and movements.
(2) Provide information to the SWG of AWMP for the *Implementation Review* on eastern North Pacific gray whales.
(3) Review stock structure and abundance in more comprehensive manner for Eastern Canada and West Greenland bowhead whales.
(4) Review the report of southern right whale workshop to be held in Argentina during September 2011.
(5) Review new information on all stocks of right whales, western North Pacific gray whales, and small stocks of bowhead whales.
(6) Review further genetic analyses of existing data on the evidence or otherwise for a bottleneck in the B-C-B bowhead population trajectory.

The sub-committee endorsed the following budget requests.

- Southern Ocean right whale catalogue (see Appendix 4).
- Southern Right Whale Assessment Workshop (see Appendix 5).
- Photo-id matching of various eastern and western gray whale catalogues (see Appendix 7).

6. ADOPTION OF REPORT

The report was adopted on 7 June 2011 at 3:25pm. The sub-committee thanked the Chair for his diligence and preparedness, which allowed the completion of discussions on a lengthy agenda in a timely manner. The Chair thanked the rapporteurs for their hard work and long hours drafting this report.

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Appendix 1

AGENDA

1. Introductory items
    - 1.1 Convenor's opening remarks
    - 1.2 Election of Chair
    - 1.3 Appointment of rapporteurs
    - 1.4 Adoption of Agenda
    - 1.5 Documents available
2. Bowhead whales
    - 2.1 Bering-Chukchi-Beaufort (B-C-B) seas stock of bowhead whales
        - 2.1.1 Stock structure
        - 2.1.2 Abundance
        - 2.1.3 Other information
        - 2.1.4 Catch information
        - 2.1.5 Preparation for *Implementation Review*
        - 2.1.6 Management advice
    - 2.2 Eastern Arctic bowhead whales
        - 2.2.1 Stock structure
        - 2.2.2 Abundance
        - 2.2.3 Catch information
        - 2.2.4 Management advice
3. Right whales
    - 3.1 North Atlantic right whales (incl. abundance)
    - 3.2 North Pacific right whales (incl. abundance)
    - 3.3 Southern right whales (incl. abundance)
        - 3.3.1 New scientific information
        - 3.3.2 Preparation of Workshop for southern right whales
4. North Pacific gray whales
    - 4.1 Stock structure and movements
    - 4.2 Western North Pacific gray whales
        - 4.2.1 Abundance
        - 4.2.2 Other issues
        - 4.2.3 Conservation advice
    - 4.3 Eastern North Pacific gray whales
        - 4.3.1 Abundance
        - 4.3.2 Other information
        - 4.3.3 Catch information
        - 4.3.4 Management advice
5. Work plan and budget requests
6. Adoption of Report

Appendix 2

SUMMARY TABLE OF ABUNDANCE ESTIMATES OF BOWHEAD WHALES IN EASTERN CANADA AND WEST GREENLAND

Mads Peter Heide-Jørgensen

Table 1

Abundance estimates of bowhead whales in Eastern Canada and West Greenland.

Year	Stock	Stock/area	Season	*N* (CV)	Corrections	Reference
1981	HB-FB	Hudson Strait	Winter	1,349 (0.60)	Fully corrected	Koski *et al.* (2006)
2003	HB-FB	Foxe Basin	Summer	1,525 (0.91)	Fully corrected	IWC (2009)
2002	BB-DS	Prince Regent Inlet	Summer	6,344 (0.38)	Fully corrected	IWC (2009)
2009	BB-DS	Isabella Bay	Summer	1,105 (0.39)	Fully corrected	Hansen *et al.* (2010)
2006	BB-DS	West Greenland	Winter	1,229 (0.47)	Fully corrected	Heide-Jørgensen *et al.* (2007)
2010	BB-DS	Disko Bay	Winter	1,747 (0.23)	Mark-recapture	SC/63/BRG18

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

Appendix 3

BOWHEAD WHALE HUNT RESULTS FOR THE EASTERN CANADIAN ARCTIC, 1994-2010

R.R. Reeves

Table 1

Bowhead whale hunt results for the eastern Canadian Arctic, 1994-2010.

Year	Community	Date of catch	Sex	Length (m)
1994	Igloolik (unlicensed)			
1996	Repulse Bay	17 Aug.	M	14.9
1998	Pangnirtung	21 Jul.	M	12.8
2000	Coral Harbour	11 Aug.	M	11.7
2002	Igloolik/Hall Beach	10 Aug.	F	14.2
2005	Repulse Bay	18 Aug.	F	16.4
2008	Hall Beach*	18 Aug.*	M	13.4*
2008	Kugaaruk*	4 Sep.*	M**	10.5*
2008	Kangiqsujuaq*	9 Aug.*	M	14.9*
2009	Rankin Inlet*	28 Aug.*	F	16.2
2009	Kugaaruk*#	n/a*	n/a*	n/a*
2009	Cape Dorset*	29 Sep.*	M*	15.8*
2009	Kangiqsujuaq*	22 Aug.*	F*	17.3*
2010	Pond Inlet*	5 Aug.*	M	12.8*
2010	Repulse Bay*	28 Aug.*	F	14.3*
2010	Kugaaruk*	3 Sep.*	***#	n/a

All information in this table comes from the indicated references EXCEPT that marked with a single asterisk, for which the source is Department of Fisheries and Oceans (unpublished). **=one additional whale was reported struck but not secured. ***=two animals were reported struck but not secured. #=reported catch was zero. See Fig. 1 for a map of locations mentioned in the table.

REFERENCES

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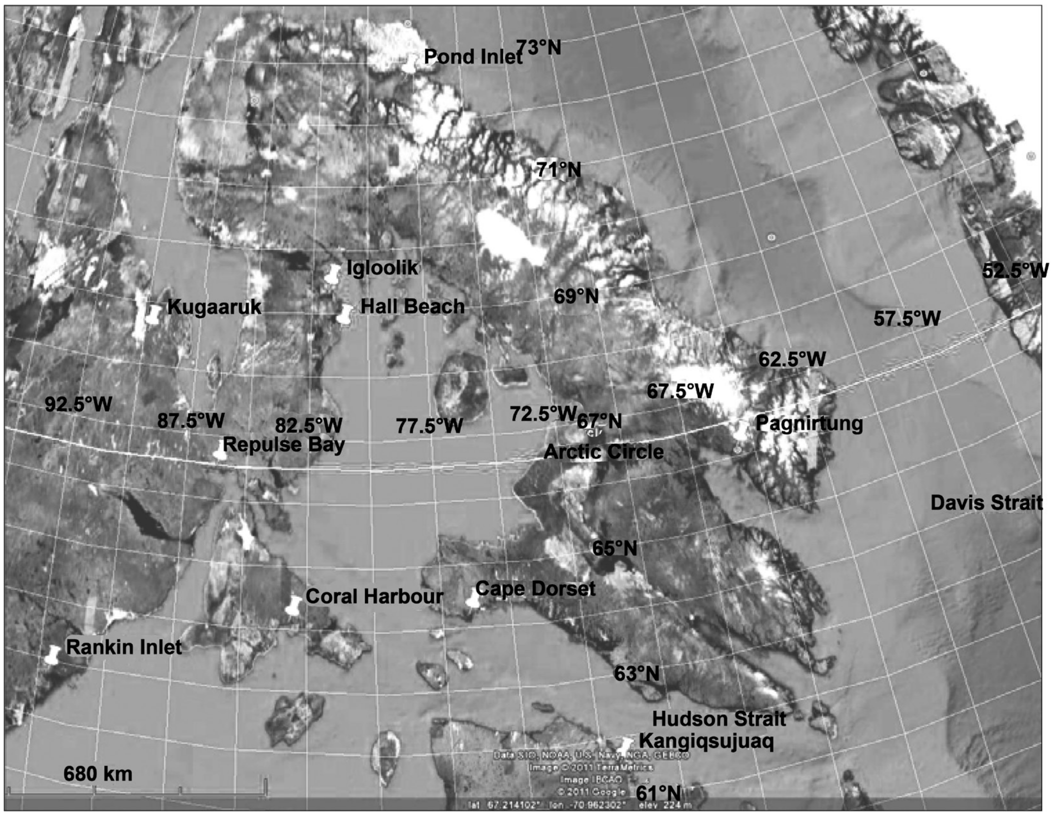

Fig. 1. Locations mentioned in Table 1.

Appendix 4

RESEARCH PROPOSAL - CONTINUATION OF FUNDING FOR SOUTHERN OCEAN RIGHT WHALE CATALOGUE

Proposer
Peter B. Best
Mammal Research Institute, University of Pretoria,
C/o Iziko South African Museum, PO Box 61, Cape Town, 8000 South Africa

Project executant
Ingrid T. Peters
Mammal Research Institute, University of Pretoria,
C/o Iziko South African Museum, PO Box 61, Cape Town, 8000 South Africa

Motivation

In 2010, the International Whaling Commission (IWC) approved funding to establish the Southern Ocean right whale catalogue. The catalogue aims to be a depository of right whale sightings south of 40°S that researchers can use to compare to the coastal catalogues. An interim report submitted to this meeting (SC/63/BRG19) summarises the progress to date on the development of the catalogue. A total of 206 images taken between 1974 and 2008 has so far been received, and these have been sorted and scored for image quality and whale distinctiveness. The catalogue is constructed in such a way that any available feature (left side head, right side head, front/top of head, pigmentation/ scarring, etc.) can be used as a search criterion. The images received represented 92 individuals, 76 identified from photographs taken of the top of the head, four from both left and right sides of the head, nine from the left and three from the right sides of the head. One re-sighting (four years apart but in the same Area) was found but the remainder were only seen once. Any additional data accompanying the photographs has been captured in an associated database. These data will be shared with users of the catalogue as per conditions set by the provider of the photographs following the protocol used by the administrators for the Antarctic Humpback Whale Catalogue (Allen *et al.*, 2010).

The catalogue is clearly far from complete. Permission and access has been requested from the IWC for the right whale photographs taken during IDCR/SOWER cruises to be included, while efforts continue to expand the scope of the catalogue by including data collected opportunistically e.g. through the British Antarctic Survey, the Japan/IWC blue whale cruise (1995/96) and Antarctic eco-tourism cruise ships. This proposal seeks funds to enable this work to continue.

Funds requested 2011-12

This proposal seeks £4,000.00 (5 months @ £800 per month) to continue the sourcing and cataloguing of right whale photographs and maintenance of the database.

Outcomes

It is anticipated that a trial version of the catalogue will be available for demonstration at the proposed right whale workshop in September 2011.

REFERENCE

Allen, J.M., Carlson, C. and Stevick, P.T. 2010. Interim Report: IWC Research Contract 16, Antarctic Humpback Whale Catalogue. Paper SC/62/SH17 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 8pp. [Paper available from the Office of this Journal].

Appendix 5

SOUTHERN RIGHT WHALE ASSESSMENT WORKSHOP

Workshop objectives:

(1) The examination of current understanding of distribution and population structure in the Southern Hemisphere;
(2) the examination of current stock size and recent population trends;
(3) biological parameters;
(4) update and review threats to SRW populations and status;
(5) identification of feeding grounds and links with nursery/breeding grounds;
(6) food, feeding and links with productivity/survival (e.g., those identified for southern right whales Annex K);
(7) update on historical catches and estimates of original population size;
(8) future research needs and conservation plans by region; and
(9) review progress on establishment of Southern Ocean Right Whale Photo-Identification Catalogue.

Steering Committee: Brownell (Convenor), Bannister*, Best*, Childerhouse, Crespo, Groch*, Iñíguez, Kitakado, and Sironi*

Dates: 13-16 September 2011.

Venue: Puerto Madryn, Argentina – host Enrique Crespo.

Participants: Scott Baker*, Bob Brownell, John Bannister*, Peter Best*, Steve Burnell*, Doug Butterworth*, Emma Carroll*, Simon Childerhouse, Justin Cooke*, Enrique A. Crespo, Greg Donovan, Barbara Galletti*, Karina Groch*, Miguel Iñíguez, Jen Jackson*, Toshihide Kitakado, Luis Pastene, Ingrid Peters*, Randy Reeves, Vicky Rowntree*, Mariano Sironi*, Peter Thomas, Koji Matsuoka, Uruguay – to be named by Steering Committee.

Local scientists: People around the venue working on right whales.

Funding needs: £24,000 *=those that need funding

DRAFT AGENDA

1. Arrangements for meeting
2. Election of Chairman
3. Appointment of rapporteurs
4. Adoption of agenda
5. Review of documents and available data
6. Population identity: distribution and population separation
7. Historical and modern catches
8. Biological parameters
9. Southern Hemisphere population status and comparisons
10. Factors potentially affecting recovery
11. Management advice
12. Review Southern Hemisphere right whale photo-id catalogue
13. Future research needs
14. Publication
15. Any other business
16. Adoption of report

Appendix 6

PROGRESS REPORT ON IUCN WESTERN GRAY WHALE ADVISORY PANEL WORK FROM JUNE 2010 TO JUNE 2011

R. Reeves, D. Weller, G. Donovan, J. Cooke, R. Brownell

The Western Gray Whale Advisory Panel (WGWAP), which is convened by the International Union for Conservation of Nature (IUCN), has held two formal meetings since SC/62. These were WGWAP-9 in Geneva, 3-6 December 2010, and WGWAP-10 in Geneva, 13-15 May 2011. As previously, the work of the Panel has consisted primarily of: (a) reviewing and commenting on western gray whale field research and monitoring work sponsored by Sakhalin Energy Investment Company (called Sakhalin Energy or SEIC); and (b) carrying out a variety of collaborative tasks with company-sponsored scientists and other outside experts. Increasingly, in recognition that much oil and gas activity by other companies takes place in the region, the panel also comments on the potential additive and cumulative effects of human activities on western gray whales. Besides the two panel meetings, two task force meetings took place over the last year, both in Geneva immediately preceding the WGWAP meetings. The Seismic Survey Task Force met on 29 November-1 December 2010 and 10-11 May 2011.

The reports of all WGWAP and task force meetings and most of the documents considered at WGWAP meetings are available on the IUCN Western Gray Whale website (*http://www.iucn.org/wgwap/*; note that the latest WGWAP and Seismic Survey Task Force reports were not yet posted at this writing but should be by the end of June 2011). Also available on this website is the cumulative list of formal recommendations made by WGWAP and its predecessors since 2004. This list includes an indication of implementation status for each recommendation. According to the WGWAP terms of reference, Sakhalin Energy is obliged to respond to relevant panel recommendations by either implementing them or explaining its reasons for not doing so, and the company responses become part of the public record.

At last year's Scientific Committee meeting, it was reported that a mitigation and monitoring programme for Sakhalin Energy's Astokh 4-D seismic survey was being developed jointly by the company and the WGWAP (IWC, 2011, p.183-84). The most important element of the programme was to begin the survey as early as possible in the summer open-water season, with the expectation that it would thus be completed before large numbers of whales arrived in the Piltun feeding area. The seismic survey was conducted from 18 June to 2 July. For the most part, despite several technical difficulties, implementation of the monitoring and mitigation efforts proceeded as planned. Data collected during the seismic survey on acoustics, whale distribution and whale behaviour are being analysed and are expected to provide useful insights for future mitigation planning.

Another seismic survey (by the Russian company Rosneft Shelf – Far East) took place in the northern part of the Piltun feeding area (Lebedenskoie field) later in the 2010 open-water season, and at the December 2010 WGWAP meeting the Panel learned that a third seismic survey (for Gazprom) had been conducted near the offshore portion of the feeding area between 15 August and 9 September 2011. Letters in advance from the Panel to government officials, including Prime Minister Putin, requesting that the Lebedenskoie survey be postponed pending establishment of a robust monitoring and mitigation programme to minimise disturbance to western gray whales (see *http://www.iucn.org/wgwap/wgwap/public_statements/*), have elicited no response. Moreover, it remains unclear whether any useful data will become available to assess gray whale movements and behaviour in relation to either of those non-SEIC seismic surveys in 2010.

The Panel learned in October 2010 that Sakhalin Energy had begun planning for a major new development project in the Piltun-Astokh field, called South Piltun, which likely would include the installation of a new offshore platform approximately halfway between the two existing platforms and directly opposite a core portion of the nearshore feeding area off the entrance of Piltun lagoon. Preparation work was to include a small-scale 2D seismic survey in the summer of 2011, for which the panel gave advice on monitoring and mitigation. Unfortunately, it was necessary to provide this advice in the absence of results from the aforementioned 2010 monitoring programme. In its reports for both WGWAP-9 and 10, the Panel emphasised that its provision of such advice should not be interpreted as an implicit endorsement of the South Piltun project overall (including the new platform and associated infrastructure). The Panel made a series of requests for detailed information on the company's South Piltun plans and the measures incorporated in those plans to ensure the protection of gray whales. This information is expected to be reviewed over the coming months. Finally, the Panel stressed that a piecemeal approach to assessment of the impacts of oil and gas development on the Sakhalin shelf, in which each new activity or item of infrastructure is considered in isolation, does not constitute 'good practice' from an ecological point of view as it ignores and dismisses cumulative or synergistic effects.

Among other items of potential interest to this sub-committee are the following.

- Results from a population assessment of Sakhalin gray whales using data from both photo-id teams working in the region were presented to the WGWAP. The estimate of the population size in 2009 (excluding calves) was 134 animals (90% Bayesian confidence interval 120-142), of which 33 (CI 29-38) were estimated to be reproductive females. The results indicate that the population has been increasing, and it is projected to continue to increase assuming there is no increase in mortality. The assessment was reviewed by Phil Hammond and Mike Lonergan at St Andrews, who identified some additional analyses that could be performed.
- The first-ever attempt to attach satellite tags on western gray whales was carried out in the autumn of 2010 by a team of Russian and American scientists. The results from tracking a single young male ('Flex', 13 years old) showed that not all gray whales summering off Sakhalin Island move south in the winter as had been assumed.

The next WGWAP meeting is planned for early in 2012. As stated in last year's progress report, the 5-year contract between IUCN and Sakhalin Energy will expire at the end of 2011. Discussions on a renewed contract under revised terms of reference were underway at the time of writing.

REFERENCE

International Whaling Commission. 2011. Report of the Scientific Committee. Annex F. Report of the Sub-Committee on Bowhead, Right and Gray Whales. *J. Cetacean Res. Manage (Suppl.)* 12:168-84.

Appendix 7

PACIFIC WIDE STUDY ON STOCK STRUCTURE AND MOVEMENTS PATTERNS OF NORTH PACIFIC GRAY WHALES

D. Weller, A. Lang, G. Donovan, O. Tyurneva, J. Scordino and H. Kato

MAIN OBJECTIVES

Results regarding mixing of western (WNP) and eastern (ENP) gray whales (SC/63/BRG6, BRG10, BRG23) illustrate the great conservation and management importance of a more comprehensive examination of gray whale movement patterns and population structure in the North Pacific. The sub-committee notes that for such an effort to be successful it must be international and collaborative. To facilitate this, and noting the existing safeguards for collaborators provided under the Committee's Data Availability Agreement (DAA), it **recommends** that a collaborative Pacific-wide study be developed under the auspices of the IWC, recognising that *inter alia* this will contribute to the Committee-endorsed Conservation Plan for Western North Pacific Gray Whales and incorporate previous recommendations made by the Committee. Such a study will involve collaborative analysis and sharing of existing data as well as the collection of new data. In order to facilitate development of the programme and ensure that work on some sub-projects begins as soon as possible, the sub-committee **recommends** the establishment of a steering group comprising Donovan representing the IWC and scientists from the range states involved (possibly including Kato, Lang, Rock, Scordino, Tyurneva, Urbán, Weller and others to be determined).

INITIAL SUB-PROJECTS

Existing data

(1) Compile a list[1] of existing photo-id and genetic samples (and research groups holding these samples) for the ENP and WNP and arrange for continuing and new collaborative comparisons and analyses aimed at providing information on gray whale stock structure, movements, migration routes and mixing rates of whales between summering and wintering grounds.

Of particular importance is the comparison of photo-id and genetic samples collected in areas traditionally allocated to the 'eastern' (e.g. Mexico, USA, Canada, Alaska, Chukotka and north-eastern Kamchatka) and 'western' (Sakhalin, Kamchatka/Sea of Okhotsk, Japan, Korea and China) populations; a number of photo-id comparisons have been reported at this meeting and a continuation and extension of these is required. Priority should be given to previous recommendations of the Committee (both BRG and AWMP) in this regard and those arising out of this year's discussions, for example: (1) genetic comparisons between Japan/Russia (i.e. Sakhalin, Kamchatka, Chukotka) due to their near proximity in the WNP and recent photographic links between Japan and Sakhalin (Weller *et al.*, 2008) and Sakhalin and Kamchatka (Tyurneva *et al.*, 2010); and (2) genetic comparisons between Kamchatka (which may represent a mixed feeding area for ENP and WNP) and all regions in the ENP and WNP.

These inter-area comparisons should endeavour to make use of all available regional samples, including those collected from catches, bycatch, strandings, sightings, bone, baleen, other tissues.

New or additional data

The sub-committee recognised the following four priorities:

(1) collection of information on the occurrence of gray whales in coastal waters of China - to facilitate this a marine mammal expert from China should be contacted (and possibly contracted) to gather all available information on gray whales in Chinese waters (including museum specimens) and to conduct local knowledge surveys – this should be encouraged to occur this summer when public interest may be highlighted by the planned satellite telemetry programme under IWC auspices;
(2) collection of photo-identification quality images from the Chukotkan hunt – whilst recognising the logistical difficulties, Russian scientists (e.g. from TINRO) studying the hunt are encouraged to collect and share such photographs;
(3) collection of genetic samples from the western and eastern Kamchatka region – the Russian scientists working in these regions are encouraged to try to collect and share biopsy samples; and
(4) collection of photographs and biopsies from un-/under-sampled 'far northern' feeding areas in the WNP and ENP, including areas in the Chukchi and Beaufort Seas (e.g. Wrangel Island and Barrow, Alaska).

The sub-committee **recommends** that the Steering Group encourages and facilitates this work.

PROGRESS TO DATE

During the meeting, agreement was reached between scientists from Japan, Mexico, Russia and the USA to share available photo collections (under the safeguards of the IWC DAA) for inter-area matching comparisons. The Steering Group is requested to try to facilitate agreements with Canadian scientists to complement these efforts.

Promising preliminary discussions regarding collaborative agreements for the sharing of genetic materials from Japan (under the safeguards of the IWC DAA) were held and will be the subject of further discussions within Japan. The sub-committee welcomed this information and the Steering Group will offer assistance if needed.

PROPOSED WORK PLAN (YEAR 1)

Inventory of existing data

(1) Compile a list of existing photo-id and genetic samples (and research groups holding these samples).

Photo-identification

(2) Phase I comparison of western gray whale catalogues (~200) to Mexican gray whale catalogue (~8,000) August 2011-May 2012.
(3) Phase II comparison of PCFG catalogue (~1,200) to Mexican gray whale catalogue (~8,000) August 2012-May 2013.

AUGUST 2011-MAY 2013 BUDGET REQUEST

(4) Phase I photo-matching August 2011-May 2012 - Total: \$10,240 USD/6,240 GBP.
(5) Phase II photo-matching August 2012 May 2013 - Total: \$15,360 USD/9,350 GBP.

REFERENCES

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

[1]A working inventory of existing photo collections and tissue samples has been compiled and investigations regarding the availability/existence of collections in some areas are needed.