Report of the Scientific Committee

Bled, Slovenia, 7-19 June 2016

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

**This report is presented as it was at SC/66b.
There may be further editorial changes (e.g. updated references, tables, figures) made before publication.**

International Whaling Commission
Bled, Slovenia, 2016

Annex F

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

Members: Walløe (Convenor), Suydam (co-Convenor), Baird, Baker, Bannister, Bell, Bickham, Branch, Brandão, Brownell, Butterworth, Cipriano, Clapham, Cooke, Currey, DeWoody, Diallo, Donovan, Double, Findlay, Fortuna, Fossi, Galletti Vernazzani, George, Givens, Goodman, Greig, Haug, Hoelzel, Holm, Iñíguez, Ivashchenko, Jackson, Jaramillo-Legorreta, Jimenez, Johnson, Kato, Kitakado, Lang, Litovka, Lundquist, Mallette, Matsuoka, Minton, Moore, Morita, Moronuki, Murase, Øien, Okazoe, Palka, Paniego, Punt, Reeves, Reyes, Rojas-Bracho, Rose, Rosenbaum, Rowles, Scordino, Sironi, Stachowitsch, Stimmelmayr, Reeves, Thomas, Tiedemann, Urbán, Vermeulen, Wade, Waples, Wimmer, Witting, Woo Kim, Yasokawa, Yasunaga, Ylitalo, Yoshida, Zerbini, Zharikov

1. INTRODUCTORY ITEMS

1.1 Convenor's opening remarks
Walløe welcomed the participants.

1.2 Election of Chairs
Walløe was elected Chair and Suydam was elected co-Chair.

1.3 Appointment of rapporteurs
Johnson and Baird were appointed to act as rapporteurs.

1.4 Adoption of Agenda
The adopted agenda is given as Appendix 1.

1.5 Review of available documents
The documents available for discussion by the sub-committee included SC/66b/BRG01-26, SC/66b/DNA04, Jackson *et al*. (2016), Marón *et al*. (2015), McAloose *et al*. (2016), Meschersky *et al*. (2015) and Wilson *et al*. (2016).

2. BOWHEAD WHALES

2.1 Bering-Chukchi-Beaufort (B-C-B) Seas stock of bowhead whales
2.1.1 New biological information
The sub-committee received updated estimates of abundance and trend for the B-C-B Seas stock of bowhead whales based on the 2011 ice-based visual and acoustic surveys (Givens *et al*., 2016). The 2011 abundance is estimated to be 16,820 with 95% confidence interval of 15,176-18,643 individuals, with an estimated annual rate of population increase of 3.7% (2.9%-4.6%). These results are slightly different than what had previously been reported, but the change has no management implications. The difference was due to a revision in the method used to correct for whales passing during periods when one or both sighting stations were temporarily closed.

The sub-committee **endorsed** the updated abundance estimate provided in Givens *et al*. (2016).

SC/66b/BRG04 provided an update on the progress of the bowhead aerial photographic-identification program. The program is a consortium including the North Slope Borough, National Marine Fisheries Service and LGL Limited and stands with other long-term photographic datasets worldwide for large whales containing over 21,000 images from 1980 to 2011.

The most recent aerial photographic survey for bowhead whales was conducted near Point Barrow, Alaska from 19 April to 6 June in 2011. The matching and scoring of the 2011 season against earlier years has essentially been completed, and basic results of that effort were presented. In 2011, a total of 4,594 photographs containing 6,801 bowhead whale images were collected (not accounting for re-sightings). In scoring all images for quality and scar identification, researchers found 465 naturally marked whales in spring and all whale images were evaluated for feeding evidence and anthropogenic scars. Approximately 33% of the whales had mud on them suggestive of feeding; however, examination of landed whales in 2011 indicated that little feeding occurred during the spring migration. Approximately 3% of the whales had scars induced from anthropogenic sources, most of which were from line entanglement. The scoring criteria for photographic matching does not explicitly include the peduncle, where rope-scars typically occur. Preliminary results from scoring images specifically for entanglement injuries suggest higher rates of entanglement than those estimated from previous years. Forty-two with-in-year recaptures were found in the 2011 catalogue (1.9% of the whales were captured on more than one survey day), which was consistent with previous years. Fifty between-year matches found for 2011, and a total of 118 inter-year matches between all years (1985, 1986, 2003, 2004, 2005 and 2011). Considering all matches, 19 were females with an accompanying calf in at least one year. A workshop was held at the National Marine Mammal Laboratory in Seattle on 28- 29 March 2016 to review the photographic analysis process and make recommendations for future abundance surveys and peer-reviewed publications. Suggestions for publications include the following: population estimates, rates of anthropogenic scaring, calf production and scar

accumulation rates. Finally, the authors thanked the US Fish and Wildlife Service Coastal Impact Assistance Program for providing major funding together with the North Slope Borough, for supporting this multi-year effort.

The sub-committee discussed how the presented data could theoretically be used to estimate calving frequencies, but only one female was observed with a second yearling. Previously, calving intervals were estimated to be 4, 4, and 7 years (Rugh *et al*. 1992). The authors noted that without annual surveys more may be learned about calving intervals from analysing baleen rather than photographic-identification data. The sub-committee **recommended** that photographs be taken of landed whales for their inclusion in the photographic-identification catalogue. Photographs from landings typically do not include photographs of the back, which are necessary to match photographs to those taken from aerial surveys, but the proper photographs can be obtained in some cases.

SC/66b/BRG14 presented a possible outline for a bowhead health report. Data sources include the North Slope Borough health assessment program, federally funded ship and aerial surveys, industry monitoring programs and other sources. The envisioned report would be a succinct, possibly annual, bowhead whale health report summarising basic health and life-history information. In depth analyses of bowhead health data would continue to be summarised in peer reviewed publications in addition to the proposed report. The anticipated Aboriginal Whaling Scheme will likely contain important advice related to the kinds of topics that might trigger an unscheduled implementation review. Examples include major mortality events (e.g., suggested by a large number of stranded animals), major changes in whale habitat and dramatically lower abundance estimates. Examples of bowhead whale health topics that might be used in the report include the following: index of calf production from aerial surveys, body condition metrics (e.g., girth/length), pregnancy rates of harvested whales, gross pathological findings, hematology, hunter observations, annual tally of beach-cast whales, percent of landed whales determined to be feeding and other factors. The information could be presented in tabular form on an annual or biannual basis.

The sub-committee **recommended** that a report be generated every other year. Furthermore, it was **recommended** that details be provided on how to properly archive tissue samples for future work.

SC/66b/BRG03 provided information to the sub-committee about plans for the next population survey for B-C-B bowhead whales. A survey is planned for spring 2017, which may be conducted as an ice-based census or as an aerial survey where photos are collected for a mark-recapture estimate. The decision on which approach to use will be determined by several factors including the safety and stability of the shorefast sea ice (e.g., thickness and sufficiently tall pressure ridges), funding and other issues.

SC/66b/BRG07 reported on ongoing efforts to build single nucleotide polymorphisms (SNP) and mtDNA databases for bowhead whales. The SNP panel was designed from transcriptome data plus previously designed SNPs from Morin *et al*. (2010). Samples included 252 B-C-B and 33 Okhotsk individuals. Samples were analysed for genetic distances, Fst and expected/observed heterozygosities for each population. Of the 96 loci, 55 loci passed quality control standards (including 48 autosomal, 1 Y chromosome and 6 X chromosome loci). Forty-two samples were discarded due to poor data quality. The B-C-B population showed 12 loci deviating from Hardy-Weinberg Equilibrium, while the Okhotsk population showed 2 loci deviating. The Fst value between BCB and Okhotsk was 0.05 (and was significant), a similar value to those found in previous studies using mtDNA and microsatellites. The methods used to generate the presented results have the advantage of being comparable among labs, as the loci are not anonymous. In the future, the authors plan on adding additional SNPs and using sex chromosome SNPs and mtDNA to explore historical demography.

The sub-committee **recommended** that US researchers seek to develop collaborations with Greenland (Denmark), Canadian and other researchers for future population genetic studies on bowhead whales. One purpose of this recommendation is to include adequate numbers of samples from multiple stocks of bowheads, not just from B-C-B bowheads. The sub-committee is especially interested in including more samples from bowheads that occur in western Greenland and eastern Canada.

SC/66b/BRG17 reported on a symposium held on 14-15 October 2015 by Battelle Memorial Institute and the North Slope Borough of Alaska (NSB) at Battelle's main campus in Columbus, Ohio to examine the role of genomics in bowhead whale conservation and management. The conference brought together researchers on genomics and bowhead biology and stakeholders including the North Slope Borough, the IWC, representatives from the oil and gas industry and indigenous communities. The goals of the workshop included the following: (1) obtain guidance and advice on the future of the bowhead whale genetics and genomics program, (2) inform the NSB and the Alaska Eskimo Whaling Commission (AEWC) about current applications of genomics research and how advances in this field might benefit the bowhead genomics program, (3) discuss AEWC's perceived risks to pursuing genomics research on bowheads and (4) educate current and potential collaborators regarding the political and social realities of conducting research in an extreme environment related to an endangered species, which is the central focus of the native Alaskan's culture and subsistence diet. The meeting included two invited lunch presentations, 1.5 days of technical presentations, social networking events and a panel discussion of the meeting accomplishments and conclusions. The lunch presenters included Harry Brower Jr. of the North Slope Borough, who discussed the bowhead whale's role and importance in native Eskimo culture, and Hans Thewissen, who discussed his research on whale evolution and fossil history from his latest book, *The Walking Whales*. Presentations included topics on the biology of bowhead whales, results of the NSB

funded bowhead whale genetics program, biomedical and evolutionary research in the area of genomics, the importance of bowheads to research in ageing and cancer, population genomics and metagenomics.

The authors reported that both the research community and the NSB benefitted from exchanging their perspectives on the challenges of conducting research on bowhead whales. The NSB and AEWC discussed the need to protect the rights of the community to derive benefits from their natural resources, and the research community discussed the importance of bowhead whales as an animal model for the study of disease and aging from which all of society might benefit. The NSB and the Department of Wildlife Management emphasised the need for researchers to justify their work based upon a clear benefit to the local community and to the goals of the NSB mission statement. It was concluded by the author that a better system of loaning materials and tracking their use among researchers is needed.

2.1.2 New catch information

SC/66b/BRG03Rev1 reported on harvests conducted in 2015 during the aboriginal hunt for bowhead whales in Alaska. In 2015, 49 bowhead whales were struck resulting in 39 landings. Total landed was lower than the previous 10-year (2005-2014) average (41.8, sd = 8.5). Efficiency (landed/struck) in 2015 was 80%, which was higher than the previous 10-year average (75.3%, sd = 7%). Of the landed whales, 19 were female and 20 were male. Based on total length, 12 of the 19 females were presumed to be mature (>13.4m). Ten of those animals were examined, and seven were pregnant or had recently given birth. Two were pregnant with small foetuses, three with term foetuses and two had recently given birth, suggesting a high pregnancy rate in 2015. It was reported that a small individual, that was a calf, was accidentally harvested, and will be reported as an infraction. Two other fresh carcasses were found dead (not due to hunting) and utilised for human consumption. Multiple (~11 whales) dead and floating bowheads were reported in the Chukchi and Beaufort seas by the Aerial Survey of Arctic Marine Mammals project (ASAMM; funded by the Bureau of Ocean Energy Management). Most of these carcasses were small whales and several appeared to have died from killer whale attacks, though none of the reported floaters were retrieved, so assessments of external signs of trauma or potential cause of death were based on examination of photos.

The sub-committee discussed the cause of death for the fresh carcasses, and was informed that one of which was assumed to have died from entanglement in crab fishing gear that originated from the Bering Sea and the second may have died from attacks by killer whales or ship strike. It was reported that killer whale depredation has increased in the last two decades, as documented by an increased number of landed whales with killer whale scars (George *et al*. 2015). Furthermore, aerial surveys in the area are now sighting killer whales more frequently (Clarke *et al*. 2015), as they were also documented in the 1980s in the Chukchi Sea. Acoustic monitoring for killer whales off of the coasts of Canada and the United States is ongoing and will be summarised in 2017. The sub-committee **recommended** that the seasonality of both acoustic and visual sightings of killer whales be presented in the future as well.

2.1.3 Management advice

The sub-committee **agreed** with their past advice that the Bowhead Whale SLA continues to be the most appropriate way for the Committee to provide management advice for this population of bowhead whales. The Commission adopted catch limits for a six-year block in 2012, i.e., 2013-2018. The total number of whales landed shall not exceed 336 and the number of annual strikes shall not exceed 67; however, there is a carryover provision that allows for any unused portion of a strike quota from past years be carried forward to future years provided that no more than 15 strikes be added for any one year. The sub-committee **agreed** that these limits will not harm the stock.

2.2 Other bowhead stocks

2.2.1 New biological information

SC/66b/BRG05 provided an update on data collection and analysis of data regarding bowhead whales in the Okhotsk Sea. Starting in 2011, photographic-identification and genetic data have been collected annually in the western part of the sea. Using genotyping, at least 109 individual whales have been identified to date. Last year samples were collected in Udskaya Bay, and whales in this area were observed regularly throughout the summer. Numerous observations by scientists, and other reliable sources, of killer whale attacks and of floating bowhead whale carcasses in the area raised concerns regarding the potential impacts of such attacks on the population. Rare late-summer sightings of bowhead whales were reported from Penzinskiy Gulf (in the northeastern corner of Shelikhov Bay). Some progress is being made to calibrate the genotyping process and incorporate data into a single database for studies conducted in 1995-96 and in 1999-2000 (in total 65 individuals) to obtain improved abundance estimates based upon the capture-recapture method.

In discussion it was noted that although the estimate is only for the western region of the sea, it is believed to be a more realistic minimum estimate than any number that has previously been reported. The population is small and subject to both anthropogenic and natural risks, and for these reasons the sub-committee **recommended** further research be encouraged. Specifically, the sub-committee **recommended** a more comprehensive abundance estimate and comparing life-history characteristics and health metrics of this population to those of the B-C-B population. The collection of whale lice was discussed and it was noted that the lice collected in the Okhotsk Sea could be compared to those collected in Alaska. Furthermore, it was **recommended** that field efforts be put towards tagging to collect data on migratory routes and other areas that should be searched for sightings, beyond those known to contain higher sighting rates (Ivannikov and Doroshenko 2001). The topic of killer whale predation was discussed, in particular the lack of sea ice in the summer and the fact that killer whales are not a new species to the area, yet predation has recently increased.

The sub-committee's attention was drawn to the recent availability of two new bowhead whale abundance estimates of the EC-WG stock. Doniol-Valcroze *et al*. (2015) presented a fully corrected estimate of 6446 (95% CI 3,722-11,200) based on data from a line-transect aerial survey of the summering grounds of this stock in August 2013. The authors acknowledged that not quite the entire summer range of the stock was covered by the survey but also expressed the view that the negative bias was likely small. Another newly available abundance estimate for this stock based on genetic mark-recapture methods is 7660 (95% HDI 4,500-11,100) (Frasier *et al*. 2015).

The sub-committee welcomed the abundance estimates and were pleased with their congruence. Unfortunately, the sub-committee could not endorse the estimates because of a lack of time to properly review them, and, instead, **recommended** they be brought forward for review in 2017.

2.2.2 New catch information

One female bowhead whale was taken in West Greenland in 2015. In Canada one bowhead was landed and one struck and lost.

3. GRAY WHALES

3.1 Stock structure and movements

3.1.1 Stock structure and movements

SC/66b/DNA04 reported on efforts to sequence the genome of two western gray whales (WGWs) and one eastern gray whale (EGW). From an assembly that contains ~95% of the genes conserved in vertebrates, roughly 22,000 genes (a number similar to other cetacean genomes) were annotated. Ultimately, a panel of 92 SNPs that included 88 protein-coding markers, two molecular sexing markers (for redundancy) and two mitochondrial markers was developed. Overall genotyping error rates were low and observed heterozygosity was 0.33 across all autosomal markers. All of the inferences regarding population structure are preliminary, as the sample consisted of a single EGW and 28 WGWs (i.e., ~20% of the WGW population). Linkage disequilibrium and heterozygosity excess estimate the effective population size (N_e) of WGWs at N_e=14. The sampled EGW was genetically similar to the WGWs, i.e., principal components analysis revealed a single cluster of genotypes when including all samples, and the sampled EGW was no more or less related to the sampled WGWs than expected by chance alone. Overall, the kinship analysis (based on the proportion of alleles shared among loci by two individuals) corroborated the population analysis (based on minimising population deviations from Hardy-Weinberg equilibrium), in that neither indicated that the sampled EGW was genetically distinct from the WGW samples. The authors hope to obtain more EGW samples for more critical tests of population structure. Ultimately, these markers should prove a valuable genotyping platform, and the genome sequence will serve as a valuable resource for basic studies across a diversity of disciplines. The authors are currently collaborating with others who are also developing a SNP panel, an effort that it is expected to yield hundreds of SNP loci.

The sub-committee thanked the authors for presenting this research and for making the genome available. A discussion was generated about the definition of WGW used for the analysis, whether or not the samples were identified using photographic-identification and the overall goal. The authors responded as follows: samples were assigned to populations using geographic location of collection, samples are linked to the Institute of Marine Biology (IBM) Sakhalin photographic-identification catalogue and the overall goal is to use genetics to clarify the population structure of gray whales that summer adjacent to Sakhalin Island. More samples are available from recent biopsies and those samples are expected to be available for future analysis. Furthermore, the sub-committee **recommended** that gray whale samples collected in other range states, including Japan and China, be requested and made available for this cooperative study. Japanese scientists indicated their interest in sharing samples provided a formal request be submitted.

3.1.2 Report from intersessional workshop

Donovan reported on the third Workshop on the Rangewide Review of the Population Structure and Status of North Pacific Gray Whales, held in La Jolla California from 18-20 April 2016 (SC/66b/Rep07). This was the second technical workshop following the major rangewide workshop that began in 2014 with a the available information on *inter alia* stock structure, abundance and biology to develope an initial modelling framework for gray whales throughout the North Pacific. The 2016 Workshop reviewed the progress made intersessionally on recommendations made at the previous workshops and the 2015 Annual Meeting of the Scientific Committee (IWC, 2015). This progress included additional work on the comparison of photographic catalogues, development of SNP assays for use with gray whales to improve genetic analyses, information from a new research cruise to improve sample sizes (genetic and photo-identification) for the feeding areas between northern California and Kodiak Island, improved estimates of ship strikes and bycatches.

The Workshop's primary focus was to review and build upon the excellent intersessional work undertaken by Punt in 2015. This work focussed on undertaking trials agreed upon at SC66a and, intersessionally, focussed on three priority stock structure hypotheses , numbered as at the first workshop:

(1) Hypothesis 3a. Although two breeding stocks (Western and Eastern) may once have existed, the Western stock is assumed to have been extirpated. Whales show matrilineal fidelity to feeding grounds, and the Eastern stock includes

three feeding sub-stocks or feeding aggregations: Pacific Coast Feeding Group (PCFG), Northern Bering Sea (NBS)/Southern Chukchi (SCH)-Northern Chukchi-Gulf of Alaska ('Northern') and WFG.

(2) Hypothesis 3e. Identical to hypothesis 3a except that the Western breeding stock is extant and feeds off both coasts of Japan and Korea and in the northern Okhotsk Sea west of the Kamchatka Peninsula. All of the whales feeding off Sakhalin overwinter in the eastern North Pacific.

(3) Hypothesis 5a. Identical to hypothesis 3a except that the whales feeding off Sakhalin include both whales that are part of the Western stock and remain in the western North Pacific year-round, and whales that are part of the Eastern stock and migrate to the eastern North Pacific.

During discussions at the workshop it was agreed to add the following hypothesis:

(4) Hypothesis 6b. Two breeding stocks – one includes whales from the PCFG and Northern feeding sub-stocks that migrate to Mexico and largely breed with each other, and the other includes all whales that feed off Sakhalin and breed largely with each other whether on the ENP or WNP migratory routes/wintering grounds.

The workshop reviewed initial results from the simulations and on the basis of these and other new information refined the list of trials ; the full trial specifications are provided in Annex G of SC/66b/Rep07. The Workshop agreed that the projections would assume that future subsistence whaling by the Makah tribe would occur during the migratory period and would be based on 'the SLA variant with research' (IWC, 2014) recommended by the Scientific Committee. Other subsistence catches would be based upon the *Gray Whale SLA*.

It was agreed that the results of the projections should be summarised by:

(a) time-trajectories of mature female numbers relative to carrying capacity, catches by stock due to aboriginal whaling, and incidental catches (defined to include both fishery-related and ship-strike mortality) by stock;

(b) the conservation-related metrics used for the implementation for the PCFG SLA; and

(c) a table for the proportion of catch of WFG whales by sub-area (20 and 100 years).

The Workshop agreed on an extremely ambitious workplan to try and provide results for consideration at SC66b, recognising that this may not be possible given the short time between the close of the workshop and SC66b and the other commitments of the relevant scientists.

In concluding his report, Donovan thanked Punt for his tireless computing work and Weller and the Southwest Fisheries Science Center for once again providing excellent facilities. He noted that after the workshop work had begun to update the scientific components of the draft CMP for WGW. Good progress was made and this work will continue during the year. Completion will depend in part on the results of the ongoing simulation work.

Punt provided a summary of the progress made on the modelling aspects of the workplan from the April 2016 intersessional workshop. He noted that the 60 model runs based on the stock-structure hypotheses 3a, 3e and 5a and the reference model for stock structure hypothesis 6b have been conditioned, and the results were circulated to the Steering Group. Figures were presented that showed diagnostic results for the fits for three reference case models based on stock structure hypotheses 3a, 3e and 5a. In general, the fits were adequate, but the model-predicted immigration rates tended to be less than the pre-specified value, while the increase in abundance for the PCFG feeding aggregation occurs earlier than expected given the data. Punt noted that additional model runs suggested that the latter was due to the pre-specified rate of natural increase ($MSYR_{1+} = 0.045$) combined with the an immigration rate of 2 animals per year leading to a faster rate of increase than the data suggest; estimating $MSYR_{1+}$ leads to an improved ability to match the pre-specified rate of increase because $MSYR_{1+}$ is estimated to be less than 0.045. He also noted that not constraining the model to mimic the decline in abundance from 1999 to 2001 in the California counts, or changing when the pulse migration into the PCFG occurred, improves the ability to mimic the abundance estimates for the PCFG feeding aggregation.

Punt noted that projections had been undertaken for the five cases outlined in SC/66b/Rep7 and used to compute the performance measures identified by the April Workshop, including the proportion of the human-related mortality by sub-area that is from the WFG feeding aggregation.

In discussions of both SC/66b/Rep07 and Punt's modelling results, the sub-committee thanked everyone involved, but especially Punt, for their effort and diligence in producing model results in such a short period of time. Due to the complexity of the subject and the limited amount of time available to fully interpret the results, the sub-committee **recommended** that there be a follow-up intersessional meeting this year and that it be scheduled so most of the necessary people are able to attend. The primary focus of the workshop will be to interpret model results and evaluate the potential implications for conservation and need satisfaction for each hypothesis.

Additional discussion on Punt's results pointed out that the models for hypothesis 6b had not been run, and Punt agreed to run those models.

3.2 Western North Pacific gray whales

3.2.1 New biological information

SC/66b/BRG21 reported on a juvenile female gray whale that was found floating dead in Sagami Bay, and was later necropsied after stranding in Ito, Japan. One of the caudal vertebrae showed discospondylitis. The authors speculated there may be a genetic cause for this pathological problem. An animal with this disease may suffer disabilities that limit its manoeuvrability. A more severe case of discospondylitis had been found in another young female gray whale found dead in a set net in Tokyo Bay in 2005. The gray whale population in the western Pacific is small; therefore, limited genetic diversity may have serious negative consequences for the future of this population.

The stranded animals and sightings described in SC/66b/BRG21 and SC/66b/BRG11 likely means there was a total of three gray whales off Japan in 2015 and early 2016. The sub-committee **strongly recommended** increased collaboration to compare photos from the whales seen in Japan with photographic-identification catalogues for gray whales. The sub-committee **recommended** efforts be made to conduct post-mortem analysis with experienced veterinarians to better understand pathological conditions. Furthermore, it was discussed whether a genetic condition might have caused discpondylitis. Several sub-committee members who are veterinarians suggested that there are many other possible causes of diseases such as discspondylitis beyond genetic causes.

SC/66b/BRG12 reported on the Russian Gray Whale Program (formerly called the Russia-U.S. Program) research on critically endangered WGWs summering off northeastern Sakhalin Island, Russia, a program that has been ongoing since 1995. Findings were reviewed from 2015 research activities and combined with data from previous years, in some cases ranging back to an opportunistic survey in 1994. Photo-identification research conducted off Sakhalin Island in 2015 resulted in the identification of 60 whales, including eight calves. Two previously unidentified non-calves were observed. The updated catalogue now comprises 245 photographically-identified individuals. However, not all of these 245 whales can be assumed to be alive. Of the eight cow-calf pairs identified in 2015, all eight mothers had been sighted in the study area prior to 2015, and all had been recorded to have had other calves between 1994-2014. The 2016 field program will begin in early July.

In discussion it was noted that the timing of another photo-identification program being funded jointly by Exxon Neftegas Limited (ENL) and Sakhalin Energy has varied in timing over the years, and there is a need to compare photos with the joint Russia-US survey. The authors of SC/66b/BRG12 mentioned that there had been an increase in the use of salmon set nets in areas used by gray whales. The sub-committee expressed concern about the increased risk of entanglement to gray whales. The sub-committee **recommended** that fishing effort be decreased in the primary areas used by WGWs, if at all possible.

SC/66b/BRG16 reported on the migratory movements of photographic-identified gray whales in the western North Pacific, which are currently enigmatic. Historical evidence indicates that coastal waters off Japan were an important part of the migratory route, but modern day observations of gray whales off Japan are uncommon. Fewer than 30 sightings and strandings of gray whales in Japanese waters were documented between 1990 and 2016. This paucity of records may reflect a truly rare occurrence of this species off Japan or could possibly be related to limited research effort or reporting of opportunistic sightings.

The report included information on the migratory movements of a photographically-identified gray whale moving multiple times back and forth between Sakhalin Island, Russia and the Pacific coast of Honshu, Japan between 2014 and 2016. Sighting records for this whale off Japan occurred during March-May, which corresponds with the time when gray whales in the eastern North Pacific (ENP) are migrating north from Mexico to the Bering Sea. It was also sighted off Japan during January-February, a period that corresponds with the ENP southbound migration when whales are moving from the Bering Sea to Mexico. The individual was sighted in August in the Sakhalin Island feeding area, corresponding with the time when ENP whales are on their summer feeding grounds in the Arctic. It is hypothesised that the March-May and January-February records from Japan, inclusive of an earlier recorded movement of a whale from Sakhalin to Japan in 2007-2008 (Weller *et al*. 2008), represent sightings during the north-south migration within the western North Pacific. These movements appear to link a wintering area somewhere off Asia to the summer feeding area off the north eastern coast of Sakhalin Island.

3.2.2 Conservation status

SC/66b/BRG11 reported on the status of conservation and research efforts on WGWs in Japanese waters over the previous year. Three sightings from platforms of opportunity (POP) were reported in Sagami Bay, Tokyo Bay and near the Izu Islands, Japan. Photographic-identifications confirmed that one individual was also sighted off Kozushima Island of Tokyo in March 2015, which was identical to the whale reported in Weller *et al*. (2015). When the sighting was reported, Fisheries Agency of Japan immediately asked relevant authorities to take necessary actions to avoid entanglement and reminded them of regulations related to the conservation of gray whales. Two strandings of females (8.9 and 7.0 m in length), due to unknown causes other than entanglement, were reported in Wadaura and Arai Beach. The animal stranded at Wadaura was confirmed to be a different individual from the animal sighted off Kozushima Island in 2015 (Nakamura *et al.* pers. comm.). The other individual stranded in Arai beach was female and approximately 8.5m in length and had discospondylitis (SC/66b/BRG21). Both strandings were reported to the Fisheries Agency of Japan, and as a result of the increased number of sightings of gray whales, on 27 April the Fisheries Agency

again issued a notification to all coastal prefectural governments drawing their attention to the increasing sightings and reminding them of domestic regulations concerning the conservation of gray whales.

The sub-committee discussed photographic identification of stranded whales and the authors informed the sub-committee of their intention to match photographs of the stranded individuals to animals in the established photo-identification catalogues. A potential cause of death was discussed, and the authors indicated that neither external nor internal injuries from entanglement or ship strikes were evident for one of the whales, and the other was too decomposed to examine.

SC/66b/BRG25 provided an updated population assessment of the Sakhalin feeding aggregation of gray whales. This study was conducted using photo-identification data collected by the Russian Gray Whale Project on the summer feeding ground off Sakhalin Island from 1994 to 2015 fitted to an individually-based population model. The model is structured by age, sex and reproductive status, and annual transition probabilities of individuals between stages are modelled. The model allows for individual, stage-related and temporal heterogeneity in sampling probability in the (successful) pregnancy rate and in the calf/yearling 'survival and return' rate (to the Sakhalin feeding grounds). Comparison of model fits using the AIC criterion revealed strong evidence for differential sampling availability by reproductive stage and by individual, but no evidence for individual variation in productivity. There was strong evidence for annual variation in pregnancy rates and calf survival/return rates, but no evidence of variation in non-calf survival rates. The level of immigration is estimated to have been low or zero.

Using the best fitting model, the aged 1+ (non-calf) population size is estimated to be 175 animals (Bayesian 95% credibility intervals 158-193) in 2016, and to have been growing over the previous 10 years (2005-2015) at an average rate between 2% and 4% p.a. Forward projections of the population model to 2025, assuming no change in the means and variances of demographic parameters, indicate a high probability (>95%) of continued population increase. The results indicate that both the pregnancy rate and the calf/yearling survival/return rate were unusually low in 2008. Projections of the population on the assumption that the average net reproductive rate would be reduced to the 2008 level show that under these circumstances the population would likely stop recovering.

The sub-committee thanked Cooke for the updated estimate of population size and other parameters for western gray whales. The sub-committee discussed the significance of new whales identified that were not seen as calves. Cooke noted that the expected number of calves sighted in a year is 15-20, but the number is expected to fluctuate and not all calves are seen each year. The newly recorded whales could represent individuals that were simply not seen as calves, or they could represent immigrants into the population. It was noted that if they represent immigrants, it could impact the population from a genetics and evolutionary perspective because of the small size of the population; however, genes can enter the population even without immigrants. The population model estimates that the new individuals are mainly whales that had not previously been photographed as calves. If that is the case, it was suggested that the number of new whales observed each year should decrease rather than stay steady as the photo identification database grows. Cooke responded that the re-sighting rate of non-cows is about the same for whales originally seen as a calf and those first seen as non-calves. The sub-committee **recommended** that the photographic-identification databases be reconciled, combined and made publically available to increase the probability of matches and improve the results used for estimating population size and other parameters.

The sub-committee also discussed the availability and reconciliation of genetic databases with photographic-identification databases. Not all photographed individuals have been sampled, and like the photographic-identification databases, the genetic data generated in different labs have not been combined. The sub-committee **recommended** that the genetic databases be combined and that body condition data be added to the databases.

The SD working group discussed SC/66b/FI48 (see Annex I) and a summary of that discussion was presented to the BRG sub-committee. SC/66b/FI48 incorporated previous suggestions by the sub-committee to increase the number of mitochondrial loci examined (IWC, 2011).

3.2.3 Conservation advice

The sub-committee acknowledged and welcomed the important work of the IUCN WGWAP as reflected in the updated report provided to this meeting (Appendix 2) and **recommended** its continued involvement in conservation and research efforts for western gray whales. The sub-committee noted that extensive seismic surveys were conducted in 2015 in the vicinity of Sakhalin Island by at least two different companies. Both survey programs were closely monitored with a large contingent of marine mammal observers. The surveys were completed without reports of any obvious effects to gray whales, but the monitoring data are still being analysed. The sub-committee **commended** Sakhalin Energy for the efforts put forth to monitor and report on the results of its seismic survey monitoring and mitigation programme (MMP). It also commended Sakhalin Energy for responding to WGWAP recommendations, communicating with WGWAP and making much of its work transparent through WGWAP. The sub-committee and WGWAP have not received information from ENL which also conducted large-scale seismic surveys in the area in 2015.

The sub-committee **agreed** with the recommendations of the WGWAP as summarised in Appendix 2. WGWAP and the sub-committee have both expressed concerns about oil and gas activity in this region and its potential impact on western gray whales.

The sub-committee reiterated **strong concerns** regarding disturbances in this area. Seismic surveys are not expected to be conducted near Sakhalin in 2016, but it was noted that the construction of a pier within Piltun Lagoon and barge traffic could be disruptive to gray whales in the area. The sub-committee **recommended** that the WGWAP Noise Task Force and members of the IWC pre-meeting acoustic masking workshop (SC/66b/Rep10) coordinate efforts to determine how recommendations from the workshop could be applied to this population.

3.3 Eastern North Pacific gray whales

3.3.1 New biological information

SC/66b/BRG06 reported the results of methods developed for mercury (Hg) and hormone analyses in EGW for future application to WGW whale skin and blubber biopsies. Tissue samples from stranded EGWs were used as surrogates for WGW biopsies. Previous reports by the authors to the IWC (SC/65a/BRG23, SC/66a/SD04) detailed the use of the ELISA method to measure progesterone levels in blubber of gray whales. The ELISA method is not well suited for use on biopsies where the amount of tissue is limited. Here, Liquid chromatography/mass spectroscopy (LC/MS) was used to simultaneously detect progesterone, testosterone and hydrocortisone from 50mg of gray whale blubber. Standard curves were developed for the three hormones, and cholic acid was validated as an appropriate internal standard. The successful detection of multiple steroid hormones from a single analysis using LC/MS is noteworthy because this was not possible using the ELISA method. Future plans include additional hormones to be added to the gray whale panel, comparisons between hormone quantities determined by ELISA and LC/MS, optimisation of conditions for the negative ion mode of MS for hormones like estradiol and extension of this research to other marine mammals.

SC/66b/BRG08 reported on the collection of photographic-identifications of gray whales in Mechigmensky Bay, Russia in 2013-2015, as previously recommended by the IWC SC. The field seasons extended over 48 boat-hours and analysed >3000 photographs under special IWC methods (Hammond *et al.,* 1990; Tyurneva *et al.,* 2013). In 2015, two calf-cow pairs were first sighted in Chukotka waters. There were no re-encounters in 2015 with whales photographed in the same area in previous years. This project initiated the Chukotka regional catalogue, which now includes 41 individuals, and is available online.

Comparison of whales from Mechigmensky Bay with the Sakhalin and Kamchatka catalogues showed no matches. Future plans include the following: (1) collection of photographs of gray whale feeding areas off Chukotka (e.g., the Anadyr Gulf and Koryak coastal), (2) collection and analysis of photographs from whales harvested in Chukotka and (3) comparison of all Chukotka data and catalogue photographs with photographs from Baja California, Mexico.

The sub-committee thanked and **acknowledged** the work done for this paper and its contribution to the knowledge of geographic areas from which we know the least about this species. The sub-committee **recommended** the authors continue this valuable work. The sub-committee also noted the value of making the catalogue publically available. The sub-committee discussed the relationship of this photographic-identification database to other databases. The author stated that a collaborator is working with other groups to combine data, but was not entirely sure if photographs from gray whales near Kumchatka would be included. The sub-committee was pleased to hear that there will be an attempt to compare the Chukotka images with photos from Baja California. The availability of samples from whales in this geographic area was also discussed. The authors noted that genetic samples have been taken from >100 harvested whales, and, typically, 50-70 whales are sampled each year. The sub-committee **recommended** that the Russian and US sample sets be reconciled and combined.

SC/66b/BRG10 reported on sampling performed by TINRO-Center and ChukotTINRO scientists. In coastal waters of the Chukchi Peninsula (Mechigmenskiy Bay, northwestern Bering Sea, Russia) tissues and organs of gray whales and Pacific walruses were sampled after the animals were harvested by Chukotka Natives. Necropsy samples included muscle, kidney, liver and blubber of ~100 g per tissue and 100 ml of blood per individual. All samples were frozen at -24ºC and delivered to and analysed by TINRO-Center Laboratory of Applicable Ecology. The biologically active components of iron, zinc and copper represented the highest concentration levels of all those tested in the sampled tissues, and cadmium and mercury had the lowest levels. Iron, zinc, copper, arsenic and mercury levels were significantly higher in the liver than other sampled tissues.

Chukotka Natives consume intestines and meat of whales and walruses. The Russian State Sanitary, Epidemiological and Hygienic Requirements monitor and limit, where necessary, the availability of meat derived from marine mammals with concentrations of toxic elements such as arsenic, cadmium and mercury beyond those deemed acceptable. The maximum permissible concentrations for arsenic, cadmium and mercury are 5, 0.2 and 0.5 (mg/kg mass), respectively. The concentrations of toxic elements in the analysed muscle samples of gray whales and walruses did not exceed the maximum permitted levels.

The sub-committee thanked the authors for this work.

SC/66b/BRG/18 reported on the 2015 NOAA Fisheries Southwest Fisheries Science Center (SWFSC) Collaborative Large Whale Survey (CLaWS) conducted from 9 July through 9 November aboard NOAA Ship Reuben Lasker. The survey was a collaborative effort between the SWFSC and the NOAA Fisheries Alaska Fisheries Science Center. The study was conducted in US and Canadian waters of the ENP between Kodiak Island, Alaska and San Diego, California. The survey had the three following major research components: (1) a range-wide assessment of gray whales that summer south of the Aleutian Islands, (2) a dedicated visual line-transect and acoustics survey for endangered North Pacific right whales in the Gulf of Alaska (SC/66b/BRG/01) and (3) sampling (photographic and biopsy) of blue, humpback and fin whales.

During the survey > 3,000 cetacean sightings, >10,000 photographs and 139 tissue/genetic samples were collected. In summary the survey accomplished the following. (1) *Gray whales* - A catalog of 140 unique gray whales photo-identified was compiled during the study. (2) *Right whales* - Despite extensive search effort in a portion of the Gulf of Alaska known to have been of historical importance to North Pacific right whales, no visual sightings were made, but four distinct acoustic localisations of calling whales were recorded (SC/66b/BRG/01). (3) *Blue whales* – Thirteen sightings of blue whales (13 individuals) and acoustic detections were documented in offshore waters of the Gulf of Alaska (SC/66b/BRG/01).

The sub-committee complimented the researchers for their efforts to study the ENP gray whales in areas where they are not often surveyed. It was noted that the study photographed 140 unique gray whales, and that the PCFG contains approximately 200 individuals. The authors mentioned that they contacted many local research programs along the range of the surveys so that any photographs and data collected concurrently could be compared. However, within the region between western Vancouver Island and Kodiak, which was a focus of the study because it had not been well-surveyed in the past, no additional gray whale survey efforts were known to be occurring during the CLaWS survey.

The sub-committee was interested to know how the US and Russia are planning to share genetic samples and collaborate in analyses. US scientists responded that in the past it has been difficult to get Russian samples imported into the US, but that this might be a good time to revisit those efforts. There is interest for collaboration between the two countries. The sub-committee **recommended** that Russia and the US collaborate on exchanging both genetic and photo identification data.

SC/66b/BRG19 provided data concerning the overall the numbers of gray whales residing in Laguna San Ignacio, Baja California, Mexico during the 2016 winter. Those numbers were similar to the past five winters (2011-2015), except for an unexpected early departure of single adult whales (i.e., breeding males and females) and lower numbers of cow-calf pairs at the end of the season in late-March and early-April. For the second year, the lowest numbers of gray whales since 2012 were counted in Bahia Magdalena, suggesting a decline in the use of that area by gray whales in 2015 and 2016, coincident with a SST that was 2-3.5°C warmer than SSTs of 2012 and 2013. Photographic identification effort in Laguna San Ignacio included 320 hours over 56 days in 2016. A total of 11,882 digital images were obtained from 830 gray whale sightings that yielded 688 individual whales. These included 439 single whales that averaged 7.9 days in the lagoon (range 1 to 31 days) and 249 females with calves that averaged 32.8 days in the lagoon (range 1 to 80 days). Researchers working in the Bahia Magdalena region obtained 3,546 digital images from 143 sightings of gray whales during 184.5 hours of effort over 18 days during the 2016 season. From these images, 151 individual whales were identified (75 single whales and 76 cow-calf pairs). Of these, five single whales averaged 1.48 days in the lagoon complex (range 1 to 15 days) and 34 cow-calf pairs that were re-sighted two or more times in Bahía Magdalena lagoon complex averaged 7.2 days in the lagoon complex (range 1 to 50 days).

The sub-committee thanked the authors and noted that this study in the lagoons of Baja California, Mexico is a good example of a long-term study providing valuable information. Some cow-calf pairs observed in this study appeared to leave the lagoons earlier than normal. The authors were not certain whether that was the case in 2015. Scordino noted that whales are often seen off Washington, US in May, but few were seen in May of 2015 and 2016. Based on when whales left the lagoons and timing of whales migrating north past California, it appeared that the northern migration was early.

SC/66b/BRG20 provided information about the minimum ages of breeding female gray whales in San Ignacio Lagoon. Ages were determined from photographs obtained during from 1977-1983 (Jones and Swartz), 1996-2000 (Urban *et al*.) and 2005-2016 (LSIESP/UABCS). Matches of individual whales were used to estimate their minimum ages as the number of years from the time of the earliest photograph to the most recent. Photographs of 17 "recaptured" whales confirmed 16 female and one presumed male with minimum ages ranging from 25 to 46 years, and confirmed that these females are continuing to reproduce and visit Laguna San Ignacio with their new calves each winter. These are the oldest photographic-identification data for any living gray whales, clearly demonstrating the fidelity of breeding female gray whales to Laguna San Ignacio, and underscore the value of long-term photographic-identification based research.

The sub-committee thanked the authors and **recommended** they continue photographing whales as a method for better understanding longevity of gray whales. There were questions and discussion about how this long-term study might inform the analysis of fine-scale reproductive interval of gray whales. The author replied that it has been an annual

study, but was broken over three different periods, and that estimates of reproductive intervals were slightly different for each period.

In discussion it was asked whether the presence of 16 females and 1 male in this study reflects the overall patterns of how much time males versus females spend in the study area. The author stated that females usually stay in the lagoon much longer than males and are therefore more likely to be photographed. Females also exhibit more site fidelity than males (who move to different lagoons).

A discussion occurred about the estimate of the 76-77 year old female mentioned report by Rice and Wolman (1971). This estimate was primarily based on the number of corpora albicantia (i.e., ovarian scars), the inter-calving interval and the age at sexual maturity. Urban indicated that the current project was only aimed at estimating ages from photographed whales, not ovarian scars from dead beach-cast whales. The sub-committee **recommended** that efforts be made to collect and preserve ovaries from beach-cast, dead whales so future analyses of ovarian scars could be conducted.

The sub-committee noted recent information on gray whale distribution and numbers in the Chukchi and western Beaufort seas from the Aerial Survey of Arctic Marine Mammals (ASAMM) program. Gray whales are commonly seen from August through October, especially in the southern Chukchi Sea and along the Alaskan coast from Point Hope to Barrow, with over 100 calves seen in 2014 (Clarke *et al*. 2015). A peer-reviewed paper on gray whale distribution and habitat use from ASAMM data is in-prep and can be provided next year.

3.3.2 Catch information

The sub-committee **thanked** the authors for submitting SC/66b/BRG15, which outlined the aboriginal need for whales by Native Chukotkans. The sub-committee did not discuss the paper because it addressed an issue that was relevant to the Commission and not the SC. The sub-committee noted that the Russian Federation would present the paper to the Aboriginal Subsistence Whaling sub-committee of the Commission and call attention to its concerns about aboriginal need and the definition of "stinky whales".

The data on aboriginal subsistence whaling in the Russian Federation in 2015 were presented in SC/66b/BRG22. Fifteen local communities were involved in whaling in 2015. Subsistence harvests were supervised by Department of Industrial and Agricultural Policy of the Administration of Chukotka Autonomous Region. A total of 125 gray whales were struck in 2015, including 1 whale that was struck but lost, and one stinky (inedible) whale. Harpoons, darting guns and rifles were used for hunting. Approximately 47% of whales demonstrated aggressive behavior. Mean numbers of harpoons and darting guns spent for each whale were approximately the same as for the 2014 season, while the total and mean numbers of cartridges was slightly smaller. Body length of whales taken in Chukotka waters in 2015 varied between 8 and 13.6 m (mean = 9.8 m). Body weights of those whales were between 6 and 26.8 tons (mean = 10.5 tons). In 55 cases, sampling of tissues was performed. A total biomass of approximately 1300 tons was acquired during the 2015 whaling season, including approximately 650 tons of edible components (blubber and meat). Approximately 14,000 people live in traditional local whaling coastal communities and individual annual consumption of whale products in 2015 was approximately 46 kg per year, less than half of the consumption in the1980s. Therefore, the authors concluded that current catch quota does not meet the need of indigenous people of Chukotka in whaling products.

In discussion the authors indicated that methods for estimating landed and consumed weights were different among years, but that recently it has been done using growth and weight curves (Rice and Wolman 1971). The sub-committee noted that those growth and weight curves were calculated for the north-bound and south-bound migration and **recommended** that uncertainty be incorporated in the future. The authors agreed.

3.3.3 Management advice

As in previous years, the sub-committee **agreed** that the *Gray Whale SLA* remains the appropriate tool to provide management advice for eastern North Pacific gray whales. It was also **agreed** the proposed Makah whaling management plan remains the appropriate tool to provide management advice for hunts in Washington State, US, provided that a research program monitors the relative probability of harvesting a PCFG whale in the Makah Usual and Accustomed Fishing Grounds (IWC, 2014). The sub-committee **agreed** that the present block quota was in agreement with the *SLA* and would not harm the stock.

4. RIGHT WHALES

4.1 New information on southern right whales

SC/66b/BRG09 summarised the results of a series of annual flights to survey southern right whales in winter/spring off the coast of southern Australia, between Cape Leeuwin (Western Australia) and Ceduna (South Australia) over the 23-year period 1993-2015. The surveys have provided evidence of a population trend of around 6% per year, and a current (at 2014) population size of approximately 2300 of what has been regarded as the 'western' Australian right whale subpopulation. With an estimated population size in the low thousands, it is presumed to be still well below carrying capacity. No trend information is available for the 'eastern' subpopulation of animals occurring around the remainder of the southern Australian Coast, to at least as far as Sydney, New South Wales and its population size is relatively small,

probably in the low hundreds. A low 'western' count in 2007 was regarded as an anomaly, but a lower than expected count in 2015 gives weak evidence that the growth rate may be starting to show signs of slowing, though an exponential increase remains the best description of the data. If the low 2015 count is anomalous, future counts may be expected to show an exponential increase, but if it is not, modelling growth as other than simple exponential may be useful to explore in the future.

The sub-committee discussed the suggested correlation between environmental factors and reproduction in North Atlantic right whales (Greene and Pershing 2004) as a potential cause of anomalous counts. The sub-committee **recommended** that the photographic-identification data available from the surveys reported in SC/66b/BRG09 (i.e. from the 'western' Australian sub-population) should be analysed to provide estimates of population size and trend.

Jackson *et al*. (2016) reported a population assessment of the whaling impact and pre-exploitation abundance of the New Zealand southern right whale. This assessment used a Bayesian population dynamics model integrating data from the following sources: nineteenth century catches, genetic constraints on bottleneck size and individual sightings histories informing abundance and trend. Different catch allocation scenarios were explored to account for uncertainty in the population's offshore distribution. From a pre-exploitation abundance of 28,800-47,100 whales, nineteenth century hunting reduced the population to approximately 30-40 mature females between 1914 and 1926. Currently, the population is estimated to be at 12% of its pre-exploitation abundance.

In discussion it was noted that estimates of population growth were similar to those estimated without the use of genetics, i.e., 4.8-5.6% (unpublished results). The model used information on mtDNA to constrain the minimum population size that would have survived the bottleneck induced by nineteenth century whaling. The constraint allows the population to be larger than what would be determined without the constraint. The population dynamics were estimated to be similar without the constraint, and it was noted that the constraint induced from the bottleneck, which causes the estimation of small early population sizes, could be relaxed if one allowed for stochastic population dynamics. The constraint scales up sub-adults where there is the potential that all females do not contribute to future offspring, so the number of unique haplotypes was multiplied by a factor of 1.5 to account for this. Nevertheless, the estimate of ~ 30,000-40,000 individuals represents a large proportion of the pre-exploitation estimate of abundance for the entire southern population (~60,000 individuals); therefore, the sub-committee **recommended** that the estimate for historical population size of southern right whales be revisited (i.e., scaled up to be approximately twice what was originally estimated).

Findlay provided a brief overview of the 2015 southern right whale survey conducted off the southern Cape coast of South Africa. Results include surveys carried out during 30 September to 14 October in 2015, which represent a single season of a largely standardised 37-year time-series. Funding limitations caused the 2015 survey to start at Wilderness in the east rather than Nature's Valley, as was done in previous years, because of the minimal (<1%) sightings of cow-calf pairs seen in the region from Wilderness to Nature's Valley during the 2013 and 2014 surveys. A total of 249 cow-calf pairs (498 individuals) and 15 unaccompanied adult southern right whales were sighted during the 2015 survey. These counts are less than what would be expected based on previous years and estimated increases. However, the number of cow-calf pairs recorded in 2014 was greater than expected. Consequently, the 2014 photographic-identification images are currently being reviewed for individuals that would have been expected to be calving in 2015 based on a three-year calving cycle. The author recommended that 2016 sightings also be checked for individuals that would have been expected to calve in 2015. In concert with the decline in unaccompanied adults since 2010, the author noted an increase in reports of incidental sightings on the west coast. Thus, the author recommended that a west coast survey become an important component of future research, as the decline could reflect the westward movement of whales outside the current survey area. Furthermore, it was reported that fewer unaccompanied whales has led to fewer available target groups for the boat based whale watch industry, which are only supposed to approach unaccompanied whales. Consequently, boat operators are assumed to be approaching cow-calf pairs.

These surveys have been conducted since 1979, representing a very informative long-term data set. Unfortunately, the future of the survey remains uncertain. The sub-committee **strongly recommended** the continuation of the survey and that the Commission request its continuation of the South African Commission in advance of October 2016, the date in which the survey should take place.

SC/66b/BRG02 reported the most recent, i.e., 2014-15, information on the mortality of southern right whales at Península Valdés, Argentina (Rowntree *et al*. 2013). The work represents a continuation of efforts started in 2003 by the Southern Right Whale Health Monitoring Program, established by a consortium of non-governmental organisations to monitor the health status of this population by conducting post-mortem examinations. A total of 737 stranded individuals have been recorded on the Península Valdés calving ground and surrounding areas along the Argentine coast since 2003, 23 of which were found in 2014 and 42 of which were found in 2015. As in previous years, most of the stranded whales were newborn calves (87% and 90% of strandings in 2014 and 2015, respectively; 89% for both years combined). More stranded whales were recorded in Golfo Nuevo (74% in both years) than in Golfo San José (22% in both years). One stranded whale was found on the outer coast of the peninsula in 2014 and one in 2015 (4 and 2% of annual strandings, respectively). Additionally one stranded whale (2%) was found near the city of Rawson (to the south of Península Valdés) in 2015. Most whales were found during August-September (65%) in 2014 and during July-

August (60%) in 2015. All whales were deceased when reported or found, and post-mortem examinations were performed when and to the extent that carcass condition allowed. Four hypotheses were generated during a workshop prompted by the IWC Scientific Committee and held in Puerto Madryn, Argentina in 15-18 March 2010 (SC/62/Rep01) to explain the high mortalities (Thomas 2013). Two additional hypotheses were added during a second workshop held in Península Valdés, Argentina, 5-6 August 2014 (SC/66a/Rep09). Based on recommendations that resulted from SC/62/Rep01 and SC/66a/Rep09, the Program focused its efforts on collecting samples and information to further investigate the proposed hypotheses.

The sub-committee recognised the large amount of work that went into determining which hypothesis best fits the data. Moving forward, the sub-committee **recommended** that data from multiple areas be carefully analysed in a single framework to further investigate the causes of variation in calf mortality. The natural progression for cohort sizes to stabilise over time (e.g., the dilution of two large cohorts and one small cohort in Argentina (Cooke *et al*. 2015) and the dilution of two small cohorts and one large cohort in South Africa) appears to occur in the absence of environmental factors; therefore, the causes of intervals could be similar across areas.

Wilson *et al*. (2016) investigated the potential involvement of harmful algal blooms (HABs) in deaths of southern right whales off of Península Valdés, Argentina since 2005 by examining the timing of the southern right whale deaths, biotoxins in samples from stranded individuals, the abundance of the diatom *Pseudo-nitzschia* spp. and the dinoflagellate *Alexandrium tamarense* in tissue samples from stranded individuals, timing of shellfish harvesting closures, seasonal availability of prey at Península Valdés and abundance of chlorophyll as determined from satellite data. Tissue samples from stranded whales included trace levels of paralytic shellfish toxins (PSTs) and domoic acid (DA) and faeces samples included fragments of *Pseudo-nitzschia* spp. frustules providing evidence of exposure to HAB toxins. Additionally, whales were present at Península Valdés during times of high levels of PSTs that led to closures of the shellfish industry and times of high levels of *Pseudo-nitzschia* spp. and *A. tamarense*. On average, more calves were found stranded when the abundance of *Pseudo-nitzschia* was above average than when the abundance was at average levels.

The sub-committee welcomed the analyses provided by Wilson *et al*. (2016) which detailed the exposure of southern right whale calves to harmful algal blooms in response to increased calf mortality in waters off Península Valdés. It was noted in discussion that measured biotoxin levels present in stranded whales found in the calving grounds off Península Valdés were higher than those measured for bowhead whales (Lefebvre *et al*. 2016). The possibility that the cause of death for calves in the early season was due to exposure of the foetus to biotoxins in utero was also raised in discussion, which would cause a temporal disconnect between exposure and mortality and complicate the identification of HAB toxins as the cause of death. Unfortunately, annual aerial photographic-identification surveys are only conducted once per year, in September, after most calves have been born. Without multiple aerial surveys per year it is difficult to determine how long cows have been exposed to biotoxins present in the calving ground, and if biotoxin levels in stranded individuals are the result of exposure to biotoxins present in the calving or feeding grounds.

McAloose *et al*. (2016) summarised results of 212 post-mortem examinations from 605 southern right whales found stranded between 2003-12 along the shores of Península Valdés, Argentina, representing the first long-term study to summarise post-mortem examinations of stranded animals from this area. Strandings included a peak number of deaths (116) in 2012 and a large number of deaths across years of calves-of-the-year (544 or 89.9%; average = 60.4 yr^{-1}). Of the 212 conducted examinations, 208 (98.1%) were from calves-of-the-year, with 48.0% of these being newborns or neonates. A probable cause of death was established for 14 of the strandings, and included ship strike (n = 1), blunt trauma or lacerations (n = 5), pneumonia (n = 4), myocarditis (n = 2), meningitis (n = 1), or myocarditis and meningitis (n = 1). Ante-mortem lesions caused by Kelp Gull (*Larus dominicanus*) parasitism was the most common gross finding across stranded individuals, and was associated with systemic disease in a single 1-2 month old calf. Immunohistochemical labeling for canine distemper virus, *Toxoplasma gondii* and *Brucella* spp., and Polymerase chain reaction (PCR) for cetacean morbillivirus (CeMV), influenza A, and apicomplexan protozoa were negative on formalin-fixed, paraffin embedded lung and brain samples from a subset of whales; PCR for *Brucella* spp. was positive in a newborn/neonate with pneumonia. PCR of skin samples from whales with gull parasitism were negative for CeMV, poxvirus and papillomavirus.

It was noted by the sub-committee that unknown pathogens have yet to be explored.

Marón *et al.* (2015) summarised gull parasitism on southern right whales off the coast of Península Valdés, and how it has increased over the last three decades. Pairs attacked by gulls spent less time nursing, resting and playing than pairs not under attack. In successive attacks, gulls opened new lesions on the whales' backs or enlarged preexisting ones. Increased wounding could potentially lead to dehydration, impaired thermoregulation and energy loss to wound healing. The presence, number and total area of gull-inflicted lesions on living mother-calf pairs between 1974-2011 was assessed from aerial survey photographs (n = 2680) and on dead calves between 2003-2011 from stranding photographs (n = 192). The percentage of living cows and calves with gull lesions increased from an average of 2% in the 1970s to 99% in the 2000s. In the 1980s and 1990s, cows and calves had roughly equal numbers of lesions (1-5), but by the 2000s, calves had more lesions (≥9) covering a greater area of their backs compared to cows. Living cow-calf pairs and dead calves in Golfo Nuevo had more lesions than those in Golfo San José in the 2000s.

In discussion, the authors noted that they believe the intensified gull harassment could be compromising calf health and thereby contributing to the high average rate of calf mortality observed in recent years, but it cannot explain the large year-to-year variance in calf deaths since 2000. The authors also noted that attack rates decrease once the gull nesting season begins in early October and that it has been suggested that whales could choose to use an alternative calving area, e.g., southern Brazil, though it does not appear that they do so. A kelp gull culling program was implemented by the government of Chubut Province around the whale watching area of Puerto Pirámides from 2012-2014. The effects in the reduction of attack rate appear to be relatively short-lived because of the large number and the wide distribution of gulls beyond the whale watching area. The sub-committee **recommended** that an updated gull population assessment be conducted given that the last assessment was performed in 2008.

Previous research indicates that calves and adults change their behaviour in the presence of gulls, but in different ways, with calves engaging in oblique respiration (Fazio *et al*. 2015) and adults engaging in a variety of resting positions (Rowntree *et al*. 1998, Sironi *et al*. 2009).

Reports presented to the sub-committee and previous research (Cooke *et al*. 2015) confirm that calf mortality is not constant with respect to time; therefore, the sub-committee **recommended** scientists explore if fluctuations in mortality rates correlate with environmental factors such as increased gull abundance.

The conclusions and recommendations of SC/66a/Rep09 were summarised, where the goal of SC/66a/Rep09 was to update the information available regarding the mortality of southern right whales around Península Valdés, Argentina. Five main hypotheses for the high calf mortality identified by SC/62/Rep01 were reviewed, and new information pertaining to each hypothesis was discussed. SC/66a/Rep09 concluded that progress had been made since SC/62/Rep01 in a number of areas. SC/66a/Rep09 also supported the strong recommendations made by the IWC Scientific Committee that research and long-term monitoring of this stock continue without interruption. Whilst recognising the progress made, the report stressed that further commitment is required to develop long-term actions to ensure the effective conservation of southern right whales and their habitat in accordance with the objectives of the IWC's Conservation Management Plan.

In summary, the following six hypotheses have been proposed to explain right whale die-offs at Península Valdés (SC/62/Rep01, SC/66a/Rep09, SC/66b/BRG02, Marón *et al*. (2015), McAloose *et al*. 2016 and Wilson *et al*. 2016):

(1) cow nutritional stress;

(2) exposure to HAB- and/or bacteria-associated biotoxins in (a) the feeding ground resulting in *in utero* exposure of the calf or (b) the calving/nursery ground;

(3) infectious disease (viral, bacterial, protozoal, etc.);

(4) kelp gull and southern right whale interactions and its effects on whale behaviour and health;

(5) density-dependent processes and their effects population dynamics; and

(6) a decline in food availability and its effects on body condition and health.

The sub-committee **agreed** with and reiterates the recommendations on research priorities described in SC/62/Rep01 and SC/66a/Rep09. Based on the information available since the workshops about potential locations of feeding grounds for Península Valdés right whales (SC/66b/BRG26) and in relation to lag-effects related to mortalities (e.g., nutrition, HABs and biotoxins), the sub-committee **recommended** that these efforts be better understood. The sub-committee **recommended** continuation of the work to understand habitat-use, dispersal and migratory patterns at different scales, in connection to overall population demography. The sub-committee **recommended** continued exploration of methods to encounter and observe live calves prior to death, and to gather individual health information on both cows and live and recently deceased calves. The sub-committee **recommended** that more work be done to elucidate the differences between nutritional stress imposed on calves induced from the inability of cows to feed and other types of physiological stress resulting from open wounds (e.g., electrolyte and fluid loss and thermoregulation), energetic expenditure related to avoidance behaviours, and other stressors experienced by whales. Methods to advance such knowledge should include satellite tracking, stable isotope analysis, nutritional condition and lipid content analyses, population genetic analysis, oceanography surveys and assessment of biotoxin presence and distribution, and behavioural observations. The sub-committee acknowledged the importance of the relevant CMP, as well as **recommended** the continued cooperation and collaboration between all research groups and stakeholders to build the knowledge needed to answer this complex situation.

SC/66b/BRG/13 presented new data on the presence of southern right whales on the Patagonian shelf of Argentina during summer 2016. Line transect visual observations were made during three opportunistic surveys on the Argentinean shelf (including the Patagonian Shelf) in January and February 2016. In total, 53 whales in 27 groups were observed, with group sizes ranging from 1 to 5 individuals. No calves were detected. The majority of individuals (90%) were observed on 19 January, 150nm far from the coast, on the Patagonian Shelf, southeast of Península Valdés, along the 100m isobath. These data are in line with previous research that indicated the Patagonian Shelf likely represents a portion of this species' feeding grounds (Zerbini *et al*. 2015; Valenzuela *et al*. 2009). This study aims to increase the

knowledge of migratory routes and summer feeding ground locations in the southwest Atlantic Ocean. Future research may explore the use of conducting biopsy samples to enable analyses related to stress responses and associated time-lags. The authors recommend that an increased amount of effort be allocated to this area, as well as the remaining Argentinean shelf, to investigate intra-annual presence and habitat use.

The sub-committee **recommended** that future surveys allocate effort to areas other than those along the isobath, which is currently the only surveyed area, and reporting of the results in conjunction with satellite imagery.

SC/66b/BRG26 presented results from a satellite tagging project carried out in Península Valdés, Argentina. This study was designed to determine the migratory routes and migratory destinations of whales wintering in Golfo Nuevo, and was motivated by the need to address the various hypotheses put forward to explain the high mortality of southern right whale calves observed in the region over the past years. Twelve integrated transdermal implanted tags were deployed in juvenile and adult whales in October 2014 and September 2015. Tag duration varied between 10 and 237 days (average of 90 days). Tagged whales visited the outer Patagonian shelf east of Península Valdés and north of the Falkland/Malvinas Islands, the Scotia Sea near South Georgia/Islas Georgias del Sur and the South Sandwich Islands/Islas Sandwich del Sur, and the South Atlantic basin between 38° and 58°S. State-space models were used to estimate behavioral states and suggested areas of potential foraging importance in the Patagonian shelf, the subtropical convergence and the continental shelf break east of South Georgia/Islas Georgia del Sur. A preliminary investigation of movement patterns relative to oceanographic features indicated that southern right whales may be using anti-cyclonic cold eddies in the Subtropical Convergence for foraging. In addition, dive profiles suggest potential differences in how juvenile and adult whales explore the water column. Movement patterns showed substantial individual and yearly variation. In 2014, two of the tagged animals preformed long-range movements into the South Atlantic Basin, while two other individuals remained at the Patagonian shelf for the period they were monitored. In contrast, six out of seven individuals tagged in 2015 stayed close to the South American mainland and never ventured into the basin for the nearly 3 months they were tracked. Despite the relatively small sample size, this study provides new insights into current feeding areas used by whales from Península Valdés. The authors recommend additional satellite tagging to better understand how representative and consistent the 2014 and 2015 seasonal movements towards their feeding destinations will be in the future, particularly if different cohorts of animals (especially females and mothers) exhibit fidelity or inter-annual variation, while taking into account animals of different age, sex and reproductive classes.

The sub-committee inquired whether additional information on prey available to the tagged whales was available, and was informed that, currently, offshore sampling is extremely sparse, although the collection of such data from sighting surveys is beginning. The sub-committee **recommended** that a priority be placed on collecting information with respect to what the whales are feeding on in the area. This information could be used to investigate the exposure of whales to HAB and its subsequent effects on mortality, particularly calf mortality, and the effects of nutrition on productivity.

It was noted in discussion that currently there are no restrictions on which animals can be tagged, although tagging efforts were initially targeted towards juveniles because tags were known to last longer on juveniles than adults. Tags used in this study were 28 cm long and were fully integrated (i.e., the anchor and transmitter are one piece) to minimise the risk to animals. Previous studies have shown that the interface of the transmitter and the anchor are more likely to fail in non-integrated tags (Robbins *et al*. 2013). In 2015, an emphasis was placed on tagging cows because the main question pertained to the movements and migratory routes of cows. Mothers with bigger calves are preferentially tagged over mothers with smaller calves because they are assumed to be closer to initiating the migration to the feeding grounds. Furthermore, timing of the tagging is planned to improve the chances of recording migration soon after deployment. Of the 7 whales tagged in 2015, 3 were known individuals from the catalog held by the Instituto de Conservación de Ballenas and Ocean Alliance and identified for the first time in 1995, 2010 and 2012.

SC/66b/BRG24 reviewed the eastern South Pacific (ESP) southern right whale Conservation Management Plan (CMP) actions taken between 2012 and 2016 and proposed actions to prioritise in the short term. The CMP for this critically endangered population of less than 50 mature individuals was submitted by Chile alone even though the population is found off Chile and Peru. The Plan was adopted by the IWC in 2012, and was set to be reviewed approximately every five years.

In addition to activities conducted under the CMP and reported in previous years, in 2015 additional opportunistic sightings were documented and an Entanglement Response Training Workshop was conducted in Viña del Mar, Chile in conjunction with the Chilean Ministry of Foreign Affairs, the IWC, the Fisheries Service (SERNAPESCA), the Chilean Navy and the Centro de Conservacion Cetacea (CCC). A similar training workshop is being planned for 2016 in Peru.

The author noted that it is likely that a breeding area exists in southern Chile, but this needs to be further investigated, and emphasised that determining the breeding area is critical for monitoring the species and to improve the collection of photographic-identification and genetic data. Thus, the author suggested that the most important target for the future should be to focus on increased efforts to identify a breeding area. Additionally, the author suggested other key proposed activities for advancing the research of ESP southern right whales including, at a minimum, the following: (a)

conduct coordination meetings among stakeholders, (b) increased effort with respect to collecting photographic-identification and genetic data,(c) additional entanglement response workshops in Chile and Peru,(d) increased species identification capacities along the coasts of Chile and Peru and (e) to provide advice on whale watching regulations. The author highlighted the importance of the CMP for facilitating the implementation of actions and enhancing international collaboration, both of which are important for the long-term recovery of the species.

The sub-committee **recommended** obtaining information about reproductive rates because of allele affects and their likely occurrence in small populations.

SC/66b/BRG23 reported on a revised version of the CMP submitted by Chile and Peru that included information from Peru, updated information from the species and proposed future actions that should receive priority. The authors included recommendations from SC/66b/BRG24 to prioritise actions. This revised CMP highlighted the efforts and commitment of range state countries towards the conservation of southern right whales.

In discussion, the sub-committee **welcomed** the involvement of Peru on this CMP. It was noted that animals were first sighted in Peru in the late 1990s sightings, and now as they are distributing further north including Peru in the management framework will likely help improve the management of this population. It expressed concern over the Critically Endangered status of this population, and **recommended** that all sources of anthropogenic mortality be keep to a minimum. The use of acoustic devices was proposed as a cost-effective approach for monitoring the presence of the species. The sub-committee **strongly recommended** that further research focus on identifying a breeding area and **endorsed** the 2016 revised CMP submitted by Chile and Peru (SC/66b/BRG23).

4.2 New information on North Pacific right whales

SC/66b/BRG01 reported the results of a visual and acoustic survey for North Pacific right whales in historical habitats located in the northwestern Gulf of Alaska. Over 6,200 km of tracklines were visually surveyed between 15 July and 20 September 2015 within the Gulf of Alaska; the survey design was based largely upon the location of historical catches of right whales, including catches from illegal Soviet whaling in the 1960s. There were no sightings of North Pacific right whales. In total, 330 hours of acoustic monitoring (using DiFAR sonobuoys) occurred during the period 6-27 August 2015. Right whale vocalisations (gunshots and up calls) were detected on two days in August within the Barnabas Trough region on Albatross Bank within Critical Habitat confirming that this area continues to be an important habitat well into late summer. Overall, the lack of sightings and paucity of acoustic detections underscore the likely critically endangered status of right whales in a region where the species was once abundant. Historical catches suggest that May and June are the optimal months for sighting right whales in the area, but logistical constraints prevent surveys from taking place during these months.

It was reported that four schools (five individuals) of right whales were sighted in the northern part of the Sea of Okhotsk during the 2015 Russian survey (SC/66b/IA17). Additionally, three schools (four individuals) were sighted in the western North Pacific during the 2015 JARPNII dedicated sighting survey, of which two individuals were successfully sampled for skin biopsies (SC/66b/IA10). The abundance of estimated right whales in the JARPNII offshore survey area was estimated to be 1147 (cv = 0.434) and 416 (cv = 0.653) in May to June of 2011 and July to August of 2008, respectively (Hakamada and Matsuoka 2016).

Since 1989, the Russian Federation and Japan (NRIFSF) have obtained a number of sightings in the Sea of Okhotsk and in the offshore western Pacific. Consequently, the sub-committee **recommended** scientists from Russia and Japan summarise these findings and present the results to the IWC SC in 2017.

A single sighting of the North Pacific right whale was reported to have occurred off the coast of Washington in 2013. The sub-committee **recommended** that data from passive acoustic recorders deployed year-round at multiple sites along the western coast of the United States be analysed for current and historical use of this area by right whales.

4.3 New information on North Atlantic right whales

The current status of the severely depleted North Atlantic right whale population is unclear. A recent stock assessment indicated a slow, relatively consistent increase in abundance of ~2.5% yr^{-1} over at least the last two decades, 1990-2010 (Waring *et al*. 2014). However, in recent years (2011 onwards), there has been achange among patterns of right whales' habitat use, coupled with low numbers of recorded newborn calves and possibly an increasing calving interval. Incorporating the more recent data into an ongoing analysis resulted in preliminary results suggesting that a small decline in the population size occurred during 2012-15.

Although a document updating the status of research on North Atlantic right whales was not presented to the sub-committee, the following activities and events were highlighted, and more information can be found at The North Atlantic Right Whale Consortium website (www.narwc.org), which includes a quarterly Right Whale newsletter and an annual 'Report Card':

(1) A new model is being developed to estimate North Atlantic right whale abundance using a Jolly-Seber-like treatment of resighting data in a hierarchal Bayesian framework. Preliminary results indicated that a small decline in the population size may have occurred during 2012-15, though analyses are still underway. A manuscript will be submitted for peer-review in the near future.

(2) A large network of bottom-mounted acoustic recorders has recently been installed, and is currently monitoring for right whales (and other baleen whales) from Florida, US to Newfoundland, Canada.

(3) A number of aerial, shipboard and passive acoustic surveys were conducted along the Atlantic coasts of the US and Canada during 2015. General observations from the surveys and long-term whale watch operations indicate changes in distribution. For example, there are now fewer animals sighted in the Gulf of Maine, Bay of Fundy and Roseway Basin and more animals sighted in the Gulf of St. Lawrence, Canada and along the mid-Atlantic US states (New York to Virginia). Changes in right whale distribution have increased the difficulty of maintaining the integrity of photographic-identification catalogues.

(4) Recent passive acoustic studies detected North Atlantic right whales in all seasons in the US mid-Atlantic states (Hodge *et al.* 2015) and in all months off the coast of Virginia, US (Salisbury *et al.* 2015). Systematic aerial surveys documented the seasonal presence of North Atlantic right whales in US mid-Atlantic waters (McLellan *et al.* 2007, Mallette *et al*. 2015). All documented North Atlantic right whale sightings off Virginia, US were offshore of the designated Seasonal Management Area (SMA) and exhibited open-mouthed swimming behavior consistent with feeding (Mallette *et al.* 2015).

(5) While there has not been an extensive systematic survey effort for North Atlantic right whales in the New York, US area, other recent analyses show that whales may migrate through the New York Bight and appear to be present in more months than typically, or previously, expected (Antunes *et al*. in prep).

(6) Between 27 June and 13 July 2015, three right whale deaths were documented in the Gulf of St. Lawrence, Canada. These strandings were the first right whale deaths documented in the Gulf since 2001. Only one of these animals was retrieved and examined. This individual, an adult female right whale (known as 'Piper' since 1993), was partially necropsied by veterinarians in Quebec, Canada (Dr. Stéphane Lair). The necropsy did not find signs of recent entanglement or trauma; however, the head of the individual was not examined.

(7) There is also ongoing research on distribution and habitat preferences, prey dynamics, population health, vocalisations, bycatch mitigation and anthropogenic impacts from vessels, fishing activities (Knowlton *et al*. 2012) and noise.

(8) Extensive visual, acoustic and aerial surveys are planned for eastern Canadian and US Atlantic waters again in 2016.

In discussion, it was noted that US regulatory authorities are considering proposed geological and geophysical seismic surveys off the US mid- and south–Atlantic states. Reviewing some of the data noted above, right whale experts recently provided information to US agencies stating that the proposed seismic surveys would substantially increase the risk that the population will slip further into decline and would jeopardise its survival.

The sub-committee **recommended** that a comprehensive update on North Atlantic right whales be submitted next year. Ideally, the update would include recent research findings, ongoing research projects and updates recent information on mortality and calving, in addition to the status of mitigation measures that are occurring in both the US and Canadian waters.

The historical distribution of North Atlantic right whales was discussed, and it was agreed that the historical distribution was previously more extensive than the known, current distribution. Right whales are currently functionally extinct in the eastern North Atlantic, although there have been a few recent sightings in historically used areas. For example, an animal photographed in the Norwegian fjord had previously been photographed off the North American coast. Right whales were hunted historically in many areas from northwest Africa to Norway and Iceland, especially in the Bay of Biscay. Furthermore, there has been at least one sighting as well as acoustic detections of right whales in the Cape Farewell Ground off Greenland, indicating at least the occasional presence of a few animals there.

5. REVIEW OF ABUNDANCE ESTIMATES

The sub-committee recommended that the agreed abundance estimates be updated as in Table X.

6. WORK PLAN AND BUDGET REQUESTS

6.1 Work plan

In the coming two years, the work planned for bowhead whales includes continuing ongoing research, updating and reconciling several photographic-identification and genetic catalogs and investigating methods to provide an updated abundance estimate for whales in the Okhotsk Sea. Furthermore, the last *Implementation Review* for B-C-B bowheads was conducted in 2012 and the next should be completed in 2018 within the sub-committee.

The primary activity planned for gray whales is continuation of the workshop for the range-wide review of population structure and status. Work will include (1) updating the CMP for western gray whales, (2) running models for hypothesis 6b, (3) interpreting model results and (4) evaluating the potential implications for conservation and need satisfaction for each hypothesis. The workshop Convenors will be Donovan and Punt.

Table X
Summary of the work plan for BRG.

Item	Intersessional 2016/17	2017 Annual Meeting (SC/67a)
Bowhead whales		Review new information, prepare for Implementation Review in 2018. Provide management advice.
Gray whales	Continuation of review of population structure and status	Review results from intersessional workshop and new research. Provide management advice
Right whales		Review results of new research
Item	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
Bowhead whales		Implementation review - BCB stock (with AWMP). Provide management advice.
Gray whales		Review new information. Prepare for Implementation Review in 2019. Provide management advice.
Right whales		Review results of new research.

Other work planned for gray whales over the next two years includes review of ongoing studies of gray whales at Baja lagoons and review of catch data.

The sub-committee will review new research on the biology of right whales, particularly with respect to calf mortality, and estimates and trends from long-term photographic-identification studies.

6.2 Budget requests

The sub-committee **recommended** the following five requests for funding:

(1) conduct a technical workshop on the rangewide population structure and status of North Pacific gray whales to allow for the compilation and review of the results of the simulation trials agreed by the Committee at the third workshop and SC66b. The workshop is anticipated to be the final workshop, allowing the committee to conclude its review (Convenors: Donovan and Punt) (£15,000; Item 3);

(2) co-organise, with the US Office of Naval Research, a workshop on cetacean tag development, tag impact assessments and tagging best practices. Expected outcomes include recommendations for future tag development, for additional studies to assess tag impacts to individual animals and a 'best practice' guide to conduct tagging on cetaceans (Convenors: Zerbini and Rowles) (£15,000; Item 4.1);

(3) funding for the 2016 right whale aerial photographic survey in South Africa to continue the time-series, which began in 1979 (Convenor: Findlay) (£20,000; Item 4.1);

(4) passive acoustic monitoring of the critically endangered eastern South Pacific southern right whale to improve CMP outputs (Convenor: Galletti) (£29,000 over two years; Item 4.1); and

(5) purchase of location-only satellite tags for deployment on Southern right whales off Península Valdés, Argentina in 2016 to address hypotheses put forward to explain the high rates of calf mortality (Convenor: Zerbini) (£10,830; Item 4.1).

7. ADOPTION OF REPORT

The Report was adopted at 17:00 on 15 June 2016. The sub-committee thanked Walløe and Suydam for their excellent Chairmanship.

References

Clarke, J.T., Brower, A.A., Ferguson, M.C., Kennedy, A.S., and Willoughby, A.L. 2015. Distribution and relative abundance of marine mammals in the eastern Chukchi and western Beaufort Seas, 2014. Annual Report, OCS Study BOEM 2015-040 [Available at afsc.noaa.gov/nmml/PDF/2014_ASAMM_FinalAnnual Report_19october15_clean.pdf].

Cooke, J., Rowntree, V., and Sironi, M. 2015. Southwest Atlantic right whales: interim updated population assessment from photo-id collected at Península Valdés. *J. Cetacean Res. Manage.* (*Suppl.*), 16: SC/66a/BRG23.

Doniol-Valcroze, T., Gosselin, J.-F., Pike, D., Lawson, J., Asselin, N., Hedges, K., and Ferguson, S. 2015. Abundance estimate of the Eastern Canada – West Greenland bowhead whale population based on the 2013 High Arctic Cetacean Survey. Department of Fisheries and Oceans, *Can. Sci. Advis. Sec. Res. Doc.*, 2015/058. v + 27 pp.

Fazio, A., Argüelles, M.B., and Bertellotti, M. 2015. Change in southern right whale breathing behaviour in response to gull attacks. *Mar. Biol.*, 162: 267-2273. doi: 10.1007/s00227-014-2576-6.

Frasier, T.R., Petersen, S.D., Postma, L., Johnson, L., Heide-Jørgensen, M.P., and Ferguson, S.H. 2015. Abundance estimates of the Eastern Canada-West Greenland bowhead whale (Balaena mysticetus) population based on genetic capture-mark-recapture analyses. Department of Fisheries and Oceans, *Can. Sci. Advis. Sec. Res. Doc.*, 2015/008. iv + 21 pp.

Givens, G.H., Edmondson, S.L., George, J.C., Suydam, R., Charif, R.A., Rahaman, A., Hawthorne, D.L., Tudor, B., Delong, R.A., and Clark, C.W. 2016. Horvitz-Thompson whale abundance estimation adjusting for uncertain recapture, temporal availability variation and intermittent effort. *Environmetrics*, 27: 134-146.

George, J.C., Sheffield, G., Reed, D.J., Tudor, B., and Suydam, R. 2015. Evidence of injuries from line entanglements, killer whales, and ship strikes on Bering-Chukchi-Beaufort sea bowhead whales. *J. Cetacean Res. Manage.* (*Suppl.*), 16: SC/66a/HIM10.

Greene, C.H. and Pershing, A.J. 2004. Climate and the conservation biology of North Atlantic right whales: the right whale at the wrong time? *Front. Ecol. Environ.*, 2: 29-34.

Hakamada, T. and Matsuoka, K. 2016. The number of blue, fin, humpback and North Pacific right whales in the western North Pacific in the JARPNII Offshore survey area. Paper SC/F16/JR13 presented to the Expert Panel Workshop of the Final Review on the Western North Pacific Japanese Special Permit Programme (JARPN II), 22-26 February 2016, Tokyo, Japan (unpublished). 15pp. [Paper available from the Office of this Journal].

Hammond, P.S., Mizroch, S.A., and Donovan, G.P. (eds.) Individual recognition of cetaceans: use of photo-identification and other techniques to estimate population parameters. Rep. Int. Whal. Comm. (Special Issue N 12) U.K. 440 pp.

Hodge, K.B., Muirhead, C.A., Morano, J.L., Clark, C.W., and Rice, A.N. 2015. North Atlantic right whale occurrence near wind energy areas along the mid-Atlantic US coast: implications for management. *Endang. Species Res.*, 28: 225-234.

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.)* 13: 154-174.

International Whaling Commission. 2014. Report of the Scientific Committee. Annex F. Report of the Sub-Committee on Bowhead, Right, and Gray Whales. *J. Cetacean Res. Manage. (Suppl.)* 15: 214-32.

International Whaling Commission. 2015. Report of the Scientific Committee. Annex F. Report of the Sub-Committee on Bowhead, Right, and Gray Whales. *J. Cetacean Res. Manage. (Suppl.)* 16: 204-223.

IUCN. 2009. Report of the 6th Meeting of the Western Gray Whale Advisory Panel, Geneva, April 2009. http://cmsdata.iucn.org/downloads/wgwap_6_report_final.pdf

IUCN. 2016. Report of the 16th Meeting of the Western Gray Whale Advisory Panel, Moscow, November 2015.

Ivannikov, D.V. and Doroshenko, N.V. 2001. Results of the cetacean ship-based survey in the Sea of Okhotsk in September-October 2001. *J. Cetacean Res. Manage.* (*Suppl.*), 11: SC/55/O3.

Jackson, J.A., Carroll, E.L., Smith, T.D., Zerbini, A.N., Patenaude, N.J., and Baker, C.S. 2016. An integrated approach to historical population assessment of the great whales: case of the New Zealand southern right whale. *R. Soc. open sci.* 3: 150669. doi: 10.1098/rsos.150669.

Knowlton, A.R., Hamilton, P.K., Marx, M.K., Pettis, H.M., and Kraus, S.D. 2012. Monitoring North Atlantic right whale *Eubalaena glacialis* entanglement rates: a 30 yr retrospective. *Mar. Ecol. Prog. Ser*., 466: 293.

Lefebvre, K.A., Quakenbush, L., Frame, E., Huntington, K.B., Sheffield, G., Stimmelmayr, R., Bryan, A., Kendrick, P., Ziel, H., Goldstein, T., Snyder, J.A., Gelatt, T., Gulland, F., Dickerson, B., and Gill, V. 2016. Prevalence of algal toxins in Alaskan marine mammals foraging in a changing arctic and subarctic environment. *Harmful Algae*, 55: 13-24. doi: 10.1016/j.hal.2016.01.007.

Mallette, S.D., Lockhart, G.G., McAlarney, R.J., Cummings, E.W., Pabst, D.A., McLellan, W.A., and Barco, S.G. 2016. Offshore energy planning for Marine Protected Species off of Virginia's coast: a synthesis of aerial surveys in the proximity of the Virginia wind energy area, 2012-2015. VAQF Scientific Report 2016-04.

Marón, C.F., Beltramino, L., Di Martino, M., Chirife, A., Seger, J., Uhart, M. Sironi, M., and Rowntree, V.J. 2015. Increased wounding of southern right whale (*Eubalaena australis*) calves by kelp gulls (*Larus dominicanus*) at Península Valdés, Argentina. *PLoS ONE*, 10(10): e0139291. doi: 10.137/journal.pone.0139291.

McLellan, W.A., Duggan, C.B., McAlarney, R.J., Tatem, S.A., and Pabst, D.A. 2007. Marine mammal aerial survey. Final Contract Report to NMFS SER. 158 pp.

McAloose, D., Rago, M.V., Di Martino, M., Chirife, A., Olson, S.H., Beltramino, L., Pozzi, L.M., Musmeci, L., Sala, L.L., Mohamed, N., Sala, J.E., Bandieri, L., Andrejuk, J., Tomaszewicz, A., Seimon, T., Sironi, M., Samartino, L.E., Rowntree, V., and Uhart, M.M. 2016. Post-mortem findings in southern right whales *Eubalaena australis* at Península Valdés, Argintina, 2003-2012. *Dis. Aquat. Org.* 119: 17-36. doi: 10.3354/dao02986.

Meschersky, I.G., Kuleshova, M.A., Litovka, D.I., Burkanov, V.N., Andrews, R.D., Tsidulko, G.A., Rozhnov, V.V., and Ilyashenko, V.Yu. 2015. Occurrence and distribution of mitochondrial lineages of gray whales (*Eschrichtius robustus*) in Russian far eastern seas. *Bio. Bull.* 42(1): 34-42. doi: 10.1134/S1062359014060077.

Rice, D.W., and Wolman, A.A. 1971. The life history and ecology of the gray whale (*Eschrichtius robustus*). American Society of Mammalogists. Harvard University, Museum of Comparative Zoology. 164 pp.

Robbins, J., Zerbini, A.N., Gales, N., Gulland, F.M.D., Double, M., Clapham, P.J., Andrews-Goff, V., Kennedy, A.S., Landry, S., Mattila, D.K., and Tackaberry, J. 2013. Satellite tag effectiveness and impacts on large whales: preliminary results of a case study with Gulf of Maine humpback whales. *J. Cetacean Res. Manage.* (*Suppl.*), 14: SC/65a/SH05.

Rowntree, V.J., Mcguinness, P., Marshall, K., Payne, R., Sironi, M., and Seger, J. 1998. Increased harassment of right whales (*Eubalaena australis*) by kelp gulls (*Larus dominicanus*) at Península Valdés, Argentina. *Mar. Mammal. Sci.*, 14(1): 99-115. doi:10.1111/j.1748-7692.1998.tb00693.x.

Rowntree, V.J., Uhart, M.M., Sironi, M., Chirife, A., Di Martino, M., La Sala, L., Musmeci, L., Mohamed, N., Andrejuk, J., McAloose, D., Sala, J.E., Carribero, A., Rally, H., Franco, M., Adler, F.R., Brownell Jr., R.L., Seger, J., and Rowles, T.. 2013. Unexplained recurring high mortality of southern right whale *Eubalaena australis* calves at Península Valdés, Argentina. *Mar. Ecol. Prog. Ser.*, 493: 275-289. doi: 10.3354/meps10506.

Rugh, D.J., Miller, G.W., Withrow, D.E., and Koski, W.R. 1992. Calving intervals of bowhead whales established through photographic identifications. *J. Mammal*., 73(3): 487-490.

Salisbury, D.P., Clark, C.W., and Rice, A.N. 2015. Right whale occurrence in the coastal waters of Virginia, U.S.A.: endangered species presence in a rapidly developing energy market. *Mar. Mam. Sci.*, 32: 508-519.

Sironi, M., Rowntree, V., Snowdon, C.T., Valenzuela, L., and Marón, C. 2009. Kelp gulls (*Larus dominicanus*) feeding on southern right whales (*Eubalaena australis*) at Península Valdés, Argentina: updated estimates and conservation implications. *J. Cetacean Res. Manage.* (*Suppl.*), 11: SC/61/BRG19.

Thomas, P., Uhart, M., McAloose, D., Sironi, M., Rowntree, V., Brownell Jr., R., Gulland, F., Moore, M., Marón, C., and Wilson, C. 2013. Workshop on the Southern right whale die-off at Península Valdés, Argentina. *J. Cetacean Res. Manage.* (*Suppl.*), 14: SC/65/BRG15.

Valenzuela, L.O., Sironi, M., Rowntree, V.J., and Seger, J. 2009. Isotopic and genetic evidence for culturally inherited site fidelity to feeding grounds in southern right whales (*Eubalaena australis*). *Mol. Ecol.*, 18(5): 782-792.

Waring, G.T., Josephson, E., Maze-Foley, K., Rosel, P.E., editors. 2015. US Atlantic and Gulf of Mexico marine mammal stock assessments -- 2014. NOAA Tech Memo NMFS NE 231; 361 pp. doi: 10.7289/V5TQ5ZH0.

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

Weller, D.W., Takanawa, N., Ohizumi, H., Funahashi, N., Sychenko, O.A., Burdin, A.M., Lang, A.R., and Brownell, R.L., Jr. 2015. Photographic match of a western gray whale between Sakhalin Island, Russia, and the Pacific Coast of Japan. Paper SC/66a/BRG17 presented to the International Whaling Commission Scientific Committee, June 2015, San Diego, California US (unpublished) 2pp. [Paper available from the Office of this Journal]

Wilson, C., Sastre, A.V., Hoffmeyer, M., Rowntree, V.J., Fire, S.E., Santinelli, N.H., Ovejero, S.D., D'Agostino, V., Marón, C.F., Doucette, G.J., Broadwater, M.H., Wang, Z., Montoya, N., Seger, J., Adler, F.R., Sironi, M., and Uhart, M.M. 2016. Southern right whale (*Eubalaena australis*) calf mortality at Península Valdés, Argentina: are harmful algal blooms to blame? *Mar. Mam. Sci.*, 32(2): 423-451. doi: 10.1111/mms.12263.

Zerbini, A.N., Mendez, M., Rosenbaum, H., Sucunza, F., Andriolo, A., Harris, G., Clapham, P.J., Sironi, M., and Uhart, M. 2015. Tracking southern right whales through the southwest Atlantic: new insights into migratory routes and feeding grounds. *J. Cetacean Res. Manage. (Suppl.)*, 16: SC/66a/BRG22Rev1.

Appendix 1

Agenda

1. Introductory items
   1.1. Convenor's opening remarks
   1.2. Election of Chair(s)
   1.3. Appointment of rapporteurs
   1.4. Adoption of Agenda
   1.5. Review of available documents (BRG 1-26, DNA04, FORINFO 14, 16, 18, 27, 48)
2. Bowhead whales
   2.1. Bering-Chukchi-Beaufort (B-C-B) Seas stock of bowhead whales
      2.1.1. New biological information (BRG 04, 07, 17)
      2.1.2. New catch information (BRG 03)
      2.1.3. Management advice
   2.2. Other bowhead stocks
      2.2.1. New information (BRG 05)
      2.2.2. New catch information
      2.2.3. Management advice
3. Gray whales
   3.1. Stock structure and movements
      3.1.1. Stock structure and movements (DNA04, FORINFO48)
      3.1.2. Report from intersessional workshop
   3.2. Western North Pacific gray whales
      3.2.1. New biological information (BRG 11, 12, 16, 21, 25)
      3.2.2. Conservation status
      3.2.3. Conservation advice
   3.3. Eastern North Pacific gray whales
      3.3.1. New biological information (BRG 06, 08, 10, 18, 19, 20)
      3.3.2. Catch information (BRG 15, 22)
      3.3.3. Management advice
4. Right whales
   4.1. New information on southern right whales (BRG 02, 09, 13, 24, 26)
   4.2. New information on North Pacific right whales (BRG01)
   4.3. New information on North Atlantic right whales (oral presentation)
5. Review of abundance estimates
6. Work plan and budget requests
7. Adoption of report

Appendix 2

Progress Report on IUCN Western Gray Whale Advisory Panel (WGWAP) Work from June 2015 to May 2016

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

The Western Gray Whale Advisory Panel (WGWAP), which is convened by the International Union for Conservation of Nature (IUCN), has continued to provide advice, particularly to Sakhalin Energy Investment Company, concerning the gray whales that feed in summer off Sakhalin Island, Russia (see *http://www.iucn.org/western-gray-whale-advisory-panel*). The north-eastern Sakhalin Shelf is under development pressure from the oil and gas industry, and this gives cause for concern about the potential impacts on this small population of 'western' gray whales.

A number of changes in the Panel's composition have occurred since the last SC meeting. Membership was reconstituted through a recruitment process, with Reeves and Donovan re-appointed as Co-chairs. The other members (in addition to the authors of this WP) appointed or re-appointed from September 2016 are Alexander Burdin, Olof Linden, Lloyd Lowry, Doug Nowacek, Corinne Pomerleau, Brandon Southall, Grigory Tsidulko, and Alexander Vedenev. IUCN and Sakhalin Energy are negotiating an extension of the WGWAP project (under revised terms of reference) for another five-year tranche to begin 1 January 2017.

Five formal Panel meetings took place between June 2015 and May 2016, as follows:

1. 9th meeting of the Noise Task Force (NTF-9), 19-20 November 2015 in Moscow
2. 16th meeting of the Panel (WGWAP-16), 22-24 November 2015 in Moscow
3. 10th meeting of the Noise Task Force (NTF-10), 17-18 May 2016 in Gland, Switzerland
4. 2nd meeting of the Joint Programme Force (JPTF-2), 19 May 2016 in Gland
5. 1st meeting of the International Finance Corporation Performance Standards Task Force (PSTF-1), 20 May 2016 in Gland.

Final reports of the Panel and Noise Task Force meetings are available on the WGWAP website; reports of the remaining Task Forces will be posted shortly. In addition, all recommendations made by the WGWAP and its predecessor western gray whale panels can be viewed on a searchable database at http://www.iucn.org/western-gray-whale-advisory-panel/recommendations.

As anticipated in last year's update and discussed in the WGWAP Statement of Concern appended to that document (Reeves et al. 2016), the scale of seismic survey activity off the NE coast of Sakhalin during the 2015 summer open-water season was unprecedented, with three major survey programs taking place – one conducted by Sakhalin Energy in the Piltun-Astokh lease area from 8-29 July and two by Exxon Neftegas Limited (ENL). The ENL survey in the Odoptu license area took place from 11 June – 7 July, after which the survey vessels moved to the West Chayvo and Arkutun-Dagi license areas (south of Piltun-Astokh) where they operated from approx. 11 June – 28 July and approx. 7 July – 24 September, respectively. The two surveys on or near the Piltun (near-shore) gray whale feeding area were 'co-ordinated' to avoid overlap in timing such that ENL went first at Odoptu and Sakhalin Energy started immediately afterwards at Piltun-Astokh.

The Monitoring and Mitigation Program (MMP) for the 2015 Sakhalin Energy seismic survey program (described in some detail in attachments to last year's update; Reeves et al. 2016) and an initial evaluation of preliminary results of fieldwork was made at the recent Noise Task Force meetings (NTF-9 and NTF-10 reports). This evaluation benefited from the report of an independent observer (Grisha Tsidulko, under contract to IUCN) who observed MMP implementation at Sakhalin during most of July. At its November 2015 meeting in Moscow, the Panel also received a verbal presentation from ENL concerning implementation of that company's 2015 MMP (summarised in the WGWAP-16 report).

New information on salmon fishing effort in and near the Piltun feeding area was presented at the Moscow meeting. Also, evidence was received of a gray whale carcass found (and photographed) by a hunter on the SE coast of Sakhalin on 10 October 2010. "Line associated with the carcass, as shown in photographs, led experts to conclude that entanglement could not be ruled out as the cause of death (37 entanglement experts were contacted via the IWC's entanglement experts' network)" (WGWAP-16 report, item 9.6.1). Salmon set net fishing in proximity to the Piltun feeding area expanded considerably between 2013 and 2015. These nets overlap with the summer distribution of feeding whales, especially mother-calf pairs. In 2013, a whale was observed with a rope, possibly from the salmon fishery, wrapped around the caudal end of the peduncle.

Cooke presented to WGWAP-16 an updated population assessment based on photo-id data collected during 1995-2014 by the Russian Gray Whale Project (a continuation of the former Russia-US project; Burdin and Sychenko SC/66b/BRG12). This analysis showed that the population had continued to increase, with the non-calf population size reaching 160-200 animals by 2015. However, there have been apparent fluctuations in calf production and survival rates; these were unusually low in 2008, a year of anomalous gray whale distribution, which may have been linked to industrial disturbance. Projections based on reproductive/survival rates at the 2008 level showed that population recovery would be arrested. Such results highlight the importance of managing and mitigating the levels of disturbance.

The photo-id catalogues of the Russian Gray Whale Project and the industry-funded programme curated at the Institute of Marine Biology were last compared using data through the 2011 field season. Discussions between parties are underway to update this comparison.

An issue of ongoing concern to the Panel, as mentioned in previous updates to the SC, is ENL's construction of a pier inside Piltun Lagoon. An updated Statement of Concern was issued in May 2016 and is included here as Attachment 1.

References

Reeves, R., Weller, D., Cooke, J.G., Donovan, G. and Brownell, R.L., Jr. 2016. Progress report on IUCN Western Gray Whale Advisory Panel work from June 2014 to May 2015. *J. Cetacean Res. Manage.*17 (Suppl.):218-223.

Burdin, A.M. and Sychenko, O. 2016. Status of western gray whales off northeastern Sakhalin, Russia in 2015. SC/66b/BRG12.

Cooke J.G., Weller D.W., Bradford A.L., Sychenko O., Burdin A.M., Land A.R.and Brownell R.L. Jr. 2016. Updated population assessment of the Sakhalin Gray Whale aggregation based on a photo-identification study at Piltun, Sakhalin, 1995-2015. SC/66b/BRG25.

Attachment 1

Statement of Concern from the IUCN's Western Gray Whale Advisory Panel (WGWAP) with respect to the potential impacts of Exxon Neftegas Limited (ENL) ongoing pier construction project in Piltun Lagoon on gray whales, including mothers and calves, and their critical habitat around the lagoon entrance

26 May 2016

The Panel once again wishes to express its **extreme concern** about the potential impacts of ENL's ongoing pier construction project in Piltun Lagoon on gray whales, including mothers and calves, and their critical habitat around the lagoon entrance. Over the past decade, the Panel has repeatedly stated that Piltun Lagoon may be crucial to the productivity of feeding areas for western gray whales, and that the lagoon must, as a consequence, be carefully monitored and effectively protected from disturbance. This concern has been noted in publicly available meeting reports, accessible on the WGWAP website.

Our initial concerns about ENL's construction of a pipeline across the lagoon were summarised in a public statement in May 2008. Subsequently we summarised our concerns about activities associated with ENL's plans to construct a temporary unloading facility on the eastern shore of the lagoon (see Item 3.2 in the WGWAP-13 report and Item 10 in the WGWAP-14 report). These concerns included the following: (i) vessel traffic and potential for ship strikes on whales at or near the lagoon mouth; (ii) noise created by the tug boats and other vessels and equipment that would operate in this area, potentially forcing mothers and calves away from preferred habitat; (iii) disturbance of the lagoon ecosystem, e.g. from sand dumping and dredging; and (iv) risk of toxic spills if barges and supply vessels run aground.

In its 2014 report, the Panel noted that: (i) optional approaches (such as hauling cargo across the spit rather than through the lagoon mouth) could be used to accomplish ENL's objectives without the need for any of the disruptive and risk-prone activities proposed; (ii) source-level calculations for tug boats suggest that underwater noise levels would far exceed what is considered 'safe' for whales; (iii) at the very least, mitigation measures to reduce sound transmission into sensitive areas near the lagoon mouth (e.g. bubble screens, cofferdams) should be considered; and (iv) when evaluating this proposed project, consideration should be given to the implications for seals, seabirds, salmon and other biota near and inside the mouth of Piltun Lagoon.

The Panel has learned from reports by WWF-Russia and Sakhalin Environment Watch that fieldwork has already begun on this project and that it will continue through the 2016 open-water season. There appears to be no publicly available information on a mitigation and monitoring plan (MMP). As far as we are aware, ENL plans to conduct acoustic monitoring using only the standard 'Joint Programme' recording stations, which is obviously important for identifying particularly noisy acute events as well as for monitoring levels of aggregate, chronic noise from general disturbance of the area. However, if the acoustic monitoring is solely 'archival' and at fairly great range from the pier, this would mean there is no real-time or near-real-time acoustic monitoring that would allow the company to take appropriate action should exposure levels from pier-related activities be too high. We also consider it important that at least one acoustic buoy be stationed nearer the mouth of the lagoon, or even inside the lagoon itself. We understand that some visual monitoring of whale distribution (and possibly behavior) will take place, but we have not been able to obtain information on how many visual observers will be deployed, when and where they will be deployed (on land and/or on vessels), or what would be the trigger to initiate mitigation actions. In the absence of clear information on the company's plans for monitoring and mitigating the impacts of the extremely loud and sustained noise associated with this work, and on how it will address the potentially significant ecological disturbance both inside and immediately outside Piltun Lagoon, the Panel **reiterates its extreme concern** about this project. The Panel **urges** Russian authorities to: a) provide public access to ENL's MMP for the period of tugboat operations near and in the mouth of Piltun Lagoon, b) ensure that the plan is evaluated promptly by an independent panel of experts, c) ensure that the MMP includes, at a minimum, real-time (or near-real-time) acoustic monitoring of the Piltun area (possibly under Ministry of Natural Resources/RPN control) with triggers to initiate mitigation, and d) insist that ENL follows the example of Sakhalin Energy in accepting an Independent Observer nominated by IUCN or another qualified organisation to monitor and evaluate implementation of the MMP.