Document titles received for SC/59, Anchorage, USA, May 2007.
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SC/59/AWMP

1. MORITA, J. and GEORGE, J.C. Age classification of bowhead whales using recursive partitioning. 13pp.

An algorithm was derived for using morphometric data to classify bowhead whales, *Balaena mysticetus*, into three age brackets: over 90 years ("very old"), 60-90 years ("old"), and under 60 ("younger"). Recursive partitioning was applied to a subset of the data set from postmortem examinations. This subset consists of whales with higher quality data scores and those with characteristics of "older" animals such as near-maximum body length and baleen length, heavy scarring, ancient weapons imbedded in them, etc. Statistical analysis suggested that for males, body length and peduncle girth provide the most useful information for this age classification. For females, anterior flipper length and body length were the key variables for classifying age. If anterior flipper length is not available for females, then body length, baleen length and peduncle girth may be used to classify age.

2. SIMON, M., KINGSLEY, M. and WITTING, L. Seasonal and spatial distribution and sex ratio of fin whale catches off West Greenland, 1987-2006. 10pp.

Here we present an analysis of the sex ratio and the spatial and temporal distribution of the fin whale catch from 1987 to 2006 based on the catch reports from Greenlandic whale hunters. The fin whales were caught in the area between Nanortalik and Uummannaq, however more than 50 % were caught in the northern most part of this area. The peak catch period was during August and September in the north and during September and October in the centre and south. There was no significant difference in the distribution of males and females in relation to the latitude or the time of the year. There were significantly more years with most females compared to males, caught in the study period.

3. SIMON, M., KINGSLEY, M. and WITTING, L. Biological parameters and the seasonal and spatial distribution of minke whale catch off West Greenland.

4. WITTING, L. Population dynamics of fin whales off West Greenland.

5. WITTING, L. Population dynamics of humpback whales off West Greenland.

6. WITTING, L. and SCHWEDER, T. Sex ratio based assessment for minke whales off West Greenland.

7. HEIDE-JØRGENSEN, M.P., BORCHERS, D., WITTING, L., SIMON, M., LAIDRE, K., ROSING-ASVID, A. and PIKE, D.G. Final estimates of large whale abundance in West Greenland waters from an aerial survey in 2005. 28pp.

An aerial line transect and cue counting survey of large whales in West Greenland was conducted in August and September 2005. The survey covered the area between Cape Farewell and Disko Island on the West Greenland coast out to the 200m depth contour. The surveyed area covered 163,574 km2 and a total of 246 sightings of 9 cetacean species were obtained. Abundance estimates were developed for humpback whales, *Megaptera novaeangliae*, (21 sightings), fin whales, *Balaenoptera physalus*, (78 sigthings) and minke whales, Balaenoptera acutorostrata, (42 sightings). The mean group size of humpback whales was 3.30 but groups as large as 95 animals were seen. The mean group size of fin whales was 2.96 with groups as large as 50 seen. Minke whale group size was 1.1 with only one sighting of a group of 2 whales. Humpback whales were found both in offshore and coastal areas of West Greenland with the exception of Store Hellefiske Bank and the Cape Farewell offshore area. The line transect abundance estimate of humpback whales is 1,218 (cv=0.56), uncorrected for submerged whales and unsubmerged whales on the trackline that were missed by the observers. Fin whales were observed in all areas of the survey and the uncorrected line transect estimate was 1,652 (cv=0.37). When corrected for perception bias (missing animals on the trackline) the estimates increases to 3,218 fin whales (cv=0.43). Minke whales were found in almost equal densities in all strata except for the Cape Farewell offshore area, where none were seen. The cue-counting abundance estimate of minke whales was 4,856 (cv=0.49) for West Greenland using a cue rate of 46.3 cues per hour (cv=10.6). If the estimate is corrected for perception bias the minke whale abundance is estimated to be 10,792 whales (cv=0.59). Low coverage was attained in the northern area of West Greenland and this should cause an especially large negative bias for the estimates of fin whale abundance because the area is believed to have particularly large densities of fin whales.

SC/59/BC

1. ROBBINS, J., LANDRY, MATTILA and ROWLES, T. Scientific information that can be gained through large whale entangling reports.

2. MATTILA, KENNEY, LANDRY, LYMAN and ROBBINS, J. Reliability of eye-witness large whale entanglement reports.

3. SILVA, M.A., DAMASO, C., MACHETE, M., PRIETO, R., REIS, D., SANTOS, M. and SANTOS, R.S. A review of interactions between cetaceans and fisheries in the Azores.

4. LEAPER, R. and COOKE, J.G. Some further simulations of whale meat markets to investigate sensitivity of sampling designs to assumptions about market structure.

5. READ, A.J., CROWDER, L.B., COX, T.M., HALPIN, P., LEWISON, R., NICHOLS, J. and SAFINA, C. Project GloBAL: tackling the global problem of fisheries bycatch.

By-catch is a global conservation problem for cetaceans, but most research on assessment and mitigation has been conducted in only a small number of the world's fisheries. Little information exists about the magnitude or impact of by-catch in many areas, particularly in fisheries of the developing world. Project GloBAL is addressing this information need by synthesizing existing data, coordinating ongoing research efforts and testing novel approaches to data collection. All of these activities are being conducted on a regional (ocean basin) scale. Our objective is to assess the magnitude and impact of by-catch of marine mammals, sea birds and sea turtles across gear types and taxonomic boundaries in areas where such assessments have not yet been conducted. In this brief review, we describe the status of this project and highlight some recent initiatives, including the development and testing of a rapid assessment protocol to assess the magnitude of cetacean by-catch in several fisheries of the developing world..

6. MOORE, J.E. and READ, A.J. A Bayesian uncertainty analysis of cetacean demography and by-catch mortality using strandings data. 32pp.

We are challenged to make the most of sparse information for understanding demography of many species, especially those that are long-lived and difficult to observe. For many odontocete populations, only fertility and age-at-death data are feasibly obtainable. We describe a Bayesian

approach for using fertilities and two types of age-at-death data (age structure of deaths from all mortality sources, and age structure of anthropogenic mortalities) to estimate rate of increase, mortality rates, and impacts of anthropogenic mortality on those rates for a population assumed to be in a stable age structure. We used strandings data from 1977-1993 (n = 96) and observer bycatch data from 1989-1993 (n = 233) for the Gulf of Maine/Bay of Fundy harbor porpoise (*Phocoena phocoena*) population as a case study. Our method combines mortality risk functions from Siler (1979) and Heligman and Pollard (1980) to estimate parameters describing agespecific natural and bycatch mortality rates. Separate functions are simultaneously fit to bycatch and strandings data, the latter of which are described as a mixture of natural and bycatch mortalities. Euler equations and an estimate of longevity are used to constrain parameter estimates. We fit models under multiple scenarios intended to correct for possible data bias due to unequal probabilities of natural deaths and bycatch deaths occurring in a strandings sample, and due to indirect bycatch of calves (i.e.., death following bycatch mortality of mothers) being underrepresented in the bycatch sample. Results from the most plausible scenarios were "model averaged" by sampling from all MCMC chains with uniform probability. The median estimate for potential population growth (rnat) was 0.043 (90% CI = 0.003 – 0.113). The median for actual growth (r) was -0.015 (90% CI = -0.141 – 0.072). The probability of population decline due to added fisheries mortality, prior to management to reduce bycatch, was 0.616. Our approach takes into account multiple sources of uncertainty in data and process, and provides posterior distributions for a rich set of demographic rate parameters that are unknown for most cetaceans. This method should be easily adaptable to other taxa for which fertility and age-atdeath data are available.

7. RITTER, F. A quantification of ferry traffic in the Canary Islands.

The Canary Islands, known for a high cetacean species diversity, have witnessed a rapid expansion of fast ferry traffic during the past few years. At the same time, ship strikes have been repeatedly documented. Here, an overview of the ferry traffic in the archipelago is given. Ferry types in use - both high speed and regular vessels - are described, and the transects on which they operate are identified. To quantify the extent of the inter-island ferry traffic, three parameters were determined: 1. The actual transects from the different ports on the islands, 2. The number of travels made per week on each transect and 3. The length of each transect. Resulting numbers indicate that regular (i.e. slow moving ferries) travel several 100,000 km between islands each year. Fast ferries, i.e. vessels with a travelling speed of 35 knots or more, were calculated to travel roughly the same quantity ammount per annum. Areas of high risk for ship strikes within the archipelago are identified by comparing the location of transects with known areas of high cetacean abundance. It is argued that the Canary Islands are a hot spot for vessel-whale collisions and that a policy to counteract this situation is urgently needed.

8. BALLE, J.D., LARSEN, F., CAÑADAS, A. and SAGARMINAGA, R. Testing potential acoustic deterrent signals, AQ636 and DDD02F devices on bow riding dolphins.

9. BAKER, C.S., FUNAHASHI, N. and STEEL, D. Market surveys of whales 2006 via internet purchases, with reference to genetic identity of fin whale products.

We report on species identification of whale products purchased via the internet from commercial markets of Japan from mid-September to early November 2006. A total of 31 products were identified to species: humpback (n=3), fin (n=15), sei (n=6), North Pacific minke (n=5) and Antarctic minke whales (n=2). The genetic identity of fin whales was considered by comparison to available reference sequences and fin whales products purchases on Japanese markets from 1993 to 2004.

10. SAGARMINAGA, R., BALLE, J.D. and CAÑADAS, A. Developing technologies for the mitigation of cetacean bycatch in fisheries in the SW Mediterranean.

SC/59/BRG

1. RUGH, D., MUTO, M., HOBBS, R., SHELDEN, K., D'VINCENT, C., LAURSEN, I.M., REIF, S., MAHER, S. and NILSON, S. Field report of the 2006/07 census of the Eastern North Pacific stock of gray whales. 9pp.

The southbound migration of the Eastern North Pacific stock of gray whales (*Eschrichtius robustus*) was documented by the National Marine Fisheries Service from 12 December 2006 to 22 February 2007. Research protocol was essentially identical to that used in previous surveys. This involved single observers independently searching for whales and recording data on environmental conditions and the time, location, count and direction of travel for each sighting. The counting system and observer performance were tested through paired, independent observational effort. In addition, in a nearby trailer, a team with two observers (one dedicated to searching, the other both searching and typing in data) rotated through 1.5 hr watches from 2 to 27 January. These counts by the Southwest Fisheries Science Center (SWFSC) will be compared with the standard effort (by the Alaska Fisheries Science Center) because the SWFSC will be conducting the gray whale census in the future. A fix-mounted, high-powered (25x) binocular provided an index (n = 110 pods; 19.7 hr) of the offshore distribution of migrating whales passing within the sighting range of the observers. The timing of the 2006/07 southbound migration seemed to be one week later than in previous years, with the median date close to 21 January instead of 15 January. Most (80%) of the sightings occurred in January, 17 % in February and only 3% in December. Counts of gray whales pods in fair to excellent visibility conditions totaled 1,770 pods during the 73 days (651.6 hr) of the standard census. This summary count compares favorably with similar counts from 2000/01 (1,684 pods in 599.4 hr) and 2001/02 (1,712 pods in 531.5 hr).

2. RUGH, D., KOSKI, W. and GEORGE, J.C. Interyear re-identification of bowhead whales during their spring migration past Barrow, Alaska, 1984-1994. 9pp.

Aerial photography of bowhead whales in the 1900s resulted in >12,000 images, of which 5,600 were taken near Point Barrow during the spring migration. Among the photographs from the Point Barrow area, 40 different whales were seen more than once between years, and of these, two were seen on three different years, making for a total pair-wise sample size of 44 interyear matches. Differences in resighting dates ranged from 1 to 31 days (x = 12 days: SE = 1.2) comparing month and day only, irrespective of year. Most (85%) of the photographs have been taken between 22 April and 26 May, a range of 34 days. Therefore, the resightings are well dispersed across this period. Immature whales appear to have less change in migration dates, but mature whales have a wide range in dates. All of the available evidence indicates that mature bowheads are not restricted to particular dates during the spring migration; instead, on subsequent years they may appear on almost any date within the normal migratory period (mid-April to early June).

3. GEORGE, J.C., MOORE, S. and SUYDAM, R.S. Summary of stock structure research on the Bering-Chukchi-Beaufort Seas stock of bowhead whales: 2003-2007. 15pp.

This paper is a summary of research conducted over the past three years to investigate the stock structure of the Bering-Chukchi-Beaufort (BCB) population of bowhead whales (*Balaena mysticetus*), as requested by the International Whaling Commission Scientific Committee (IWC SC) during its 2004 meeting (Item 9.1.6 of SC.56 report). Research directed towards testing hypotheses concerning the stock structure of BCB bowhead whales was comprised of five elements: (1) Research Planning and Hypothesis Testing; (2) Genetics Sampling and Analysis; (3) Animal Mixing and Abundance; (4) Spatial Distribution and Abundance; and (5) Migration Patterns. Each of these elements was comprised of two to three projects including: photo-identification surveys, collection of tissues from harvested whales, traditional knowledge, biopsy

sampling in Russia and Alaska, stable isotope analysis of baleen plates, analyses of catch data from the Yankee commercial whaling period, development of new microsatellite loci for bowheads, development of new SNPs genetic markers, analyses of the updated genetic datasets (SNPs, microsatellite and mtDNA), development of a models for pairwise microsatellite allele matching probabilities, simulation modeling of genetic and demographic population trajectories for comparison to empirical data, genetic modeling simulations, analyses of photo-identification data related to stock structure, estimation and classification of whale ages, estimation of abundance of whales seen in late spring in waters off Chukotka, collection and analyses of passive acoustic data, and satellite tracking of tagged whales. Collectively, these studies have resulted in over 80 research papers and contributed new information on BCB stock structure, but particularly the genetic structure of the BCB bowhead whale population. It should be recognized that these studies add to the baseline of over 30 years of research (resulting in >300 IWC SC submitted papers), including an intensive program in the 1970-80s when a similar suite of studies (e.g., aerial and ship based surveys, analysis of commercial whaling records, abundance estimation, harvest documentation, local knowledge, etc.) built the foundations of our current knowledge of BCB stock structure. These robust research programs demonstrate that the US has made a major effort to determine if the BCB bowhead whale stock has significant population sub-structuring. Collectively, results of roughly three decades of research have established that while the BCB population is out of genetic equilibrium, there is no compelling evidence of a multi-stock condition within its range, nor compelling evidence of conservation risk under the current single-stock management regime.

4. SUYDAM, R.S., GEORGE, J.C., ROSA, C., PERSON, B., HANNS, C., SHEFFIELD, G. and BACON, J. Subsistence harvests of bowhead whales (*Balaena mysticetus*) by Alaskan Eskimos during 2006. 7pp.

In 2006, 39 bowhead whales (*Balaena mysticetus*) were struck during the Alaskan subsistence hunt resulting in 31 animals landed. The efficiency (# landed / # truck) of the hunt was 79.5%, which is similar to the average during 1996-2005 (mean = 79%, SD = 8%). Of the landed whales, 21 were males and 10 were females. Of the females, only one was presumably mature (>13.4m in length) and she was not discernibly pregnant; however, the animal was harvested in a remote village and was not closely examined by biologists. The average number of whales landed in the 10 previous years was 41.8 (SD = 6.8). Thus, the number of landed whales in 2006 was lower than recent years. Challenging sea ice and weather conditions in the spring precluded 6 of the 8 spring-hunting villages from landing any whales. The spring harvest was the lowest recorded in the last 35 years and only the villages of Wainwright and Barrow were able to land a total of five whales during the spring hunt. Fall harvests in the Beaufort Sea villages (Kaktovik, Nuiqsut and Barrow) were consistent with past years. In the Bering Sea, the St. Lawrence Island villages of Savoonga and Gambell were not able to land any whales during the winter as they have in recent years.

5. GEORGE, J.C., BOCKSTOCE, J.R., PUNT, A.E. and BOTKIN, D.B. Preliminary estimates of bowhead whale body mass and length from Yankee commercial oil yield records. 11pp.

Oil yield-blubber, blubber-weight, and weight-length data are analysed to develop a preliminary approach for estimating the relationship between oil yield (in barrels of oil) and length (in m). This relationship was then used to estimate the length-frequency distribution for whales harvested during the historic period. Parameter uncertainty, estimated using a bootstrap procedure, indicates that considerable uncertainty remains regarding the predicted length-frequencies. It should be possible to reduce this source of uncertainty given additional data. Whalemen were not selective in their catch, however the length-frequencies from oil data suggest that the average size of whales during commercial whaling was somewhat larger than the average size of whales in the B-C-B population today based on photogrammetry. These data also suggest that whales taken early in the fishery were somewhat larger than those taken later. Further refinement of this analysis may help determine if age/lengths structure shifts occurred through the fishery.

6. KOSKI, W., RUGH, D., ZEH, J.E., GEORGE, J.C., SUYDAM, R.S., DAVIS, A.R., MOCKLIN, J. and TRASK, K. A review of bowhead aerial photographic studies in 2003-06. 6pp.

Aerial photographic surveys were conducted near Point Barrow, Alaska, from 12 April to 6 June in 2003, from 18 April to 7 June in 2004, from 6 to 9 September 2005, and 1 to 6 September 2006, and in the Bering Sea, Alaska, from 9 April to 2 May 2005. The 2003 survey was the most complete photographic coverage of the spring migration past Barrow of any survey to date, and the 2004 survey was also thorough except that poor weather resulted in poor coverage of the mother/calf migration late in the season. Approximately 1,157, 1,443 105, 81, and 454 photographs containing 1,606, 1,975, 114, 173 and 967 images were obtained in the respective seasons. The number of different marked whales with acceptable quality photographs to recognise between-year matches was 179 in 2003, 275 in 2004 and 71 in spring 2005. Within-year and between-year matching has been completed for the 2003–2005 spring photographs, and the databases are nearing completion. Eleven whales were matched between the 2003 and 2004 spring migrations, three whales were matched between 2003 and spring 2005, one was matched between spring 2004 and September 2005, and no matches were found between spring 2003 and September 2005. The photographs from these studies will permit calculation of a population estimate required for the AWMP management procedure and comparison with the estimate from icebased counts in 2001 (George et al., 2004) and better precision in the calculation of bowhead whale lifehistory parameters. Stock structure analysis will be applied to resighting rates of bowheads photographed in April 2005 in the Bering Sea (early in the spring migration), through the spring migration near Barrow, during September near Barrow (which is prior to the main fall migration out of the Beaufort Sea), and in late summer in the Beaufort Sea (the primary feeding area).

7. KOSKI, W., GEORGE, J.C. and ZEH, J.E. A calf index for monitoring reproductive success in BCB bowhead whales (*Balaena mysticetus*).

8. MORIN, P.A., HANCOCK, B. and GEORGE, J.C. Development and application of single nucleotide polymorphisms (SNPs) for bowhead whale population structure analysis. 7pp.

We present the preliminary results of efforts to develop new class of nuclear genetic markers, single nucleotide polymorphisms (SNPs), for bowhead whale genetic studies. We have screened over 9000 bp of random bowhead DNA sequence, identifying 67 SNPs. Nineteen SNP assays were optimized initially and used to genotype modern and historical bowhead DNA samples from St. Lawrence Island and Barrow, Alaska. We developed novel methods for genotyping multiple nuclear loci from historical and poor quality samples, demonstrating high efficiency and low estimated error rates. Preliminary population analyses with this limited set of loci show no evidence of population structure for various strata analyzed previously with mtDNA and microsatellite analysis. Future application of additional loci and samples should demonstrate the power of SNPs for population structure analysis, providing a strong alternative to microsatellite loci.

9. LEDUC, R.G., MARTIEN, K.K., MORIN, P.A., HEDRICK, N., ROBERTSON, K.M., TAYLOR, B.L., MUGUE, N.S., BORODIN, R.G., ZELENINA, D.A. and GEORGE, J.C. Mitochondrial genetic variation in bowhead whales in the western Arctic. 11pp.

Bowhead whales in the Western Arctic are managed as a single stock by the IWC. In response to recent concerns about the potential existence of multiple stocks in the region, we examined genetic variation in the mitochondrial control region among various spatial, temporal and age-related strata. Sequences from 380 samples were used in the comparisons. No significant differences were detected in spatial comparisons or in temporal comparisons along Alaska's North Slope. However, in the $\chi 2$ analysis, there was evidence of genetic heterogeneity between some of the age cohorts, specifically between animals born prior to 1918 (n=8) and those born after 1979 (n=34) (p=0.030), between those born 1918-

1949 (n=13) and those born after 1979 (p=0.050), and between the two aforementioned older cohorts and those born after 1979 (p=0.009). There was also a significant Fst difference between fall (n=13) and spring (n=11) whales from St. Lawrence Island (p=0.049). The age data were insufficient to determine if this seasonal difference was due in part to the difference between age cohorts.

10. PUNT, A.E. and BREIWICK, J. Revised age-comparisons for the B-C-B bowhead whales. 7pp.

The method for estimating the age-composition of harvests of bowhead whales developed by Schweder and Ianelli (2000) is applied to updated data on age-at-length and catch-at-length to produce revised age-compositions by sex. The results indicate a smaller proportion of very old (100+) animals and a greater incidence of very old males in catches since 1974 than estimated by Schweder and Ianelli (2000).

11. GIVENS, G., WILLIAMS, M., MORIN, P.A., HANCOCK, B. and GEORGE, J.C. A brief and preliminary look at SNPs data for some Bering-Chukchi-Beaufort Seas bowhead whales. 5pp.

We present preliminary analyses of 18 single nucleotide polymorphism markers (SNPs) for 106 bowhead whales from Barrow and St. Lawrence Island. We find no evidence for disequilibrium, population substructure, or genetic variation associated with temporal spacing of whales in the migration.

12. QUAKENBUSH, L. Preliminary telemetry results for Bering-Chukchi-Beaufort bowhead whales. 2pp.

The Alaska Department of Fish and Game (ADF&G) has begun a cooperative project (with the AEWC and the NSB and funded by the US Minerals Management Service (MMS) to study bowhead whale movements and behavior using satellite telemetry.

13. KNOCHE, M., SUYDAM, R.S., GEORGE, J.C. and MORITA, J. Using stable isotopes in baleen to examine migratory behaviour of Bering-Chukchi-Beaufort Sea bowhead whales (*Balaena mysticetus*): a pilot study. 12pp.

We analyzed stable-carbon (δ13C) and -nitrogen (δ15N) isotopes of baleen from bowhead whales (*Balaena mysticetus*) harvested at St. Lawrence Island (SLI) and Barrow, Alaska, to investigate the possibility of a non-migratory group of whales within the Bering-Chukchi-Beaufort seas (BCBS) stock. The distribution patterns of δ13C and δ15N along the lengths of baleen were grossly similar for the two groups. The mean δ13C values of baleen from SLI and Barrow were significantly different within and between groups. The oscillating pattern of δ13C values in SLI baleen was likely attributed to feeding in both, thus migration between, the Bering/Chukchi and Beaufort Seas. The baleen δ15N values provided little evidence for fasting in either SLI or Barrow whales. When the δ13C and δ15N data were examined in unison, they suggested that feeding and fasting bouts (i.e., by a non-migratory group of bowhead whales) could not produce the patterns of isotope distributions found in the SLI-harvested whales. Therefore, we concluded that stable isotope values of baleen from SLI bowheads examined in this study provided evidence for migratory behavior.

14. GIVENS, G., HUEBINGER, R.M., BICKHAM, J.W., GEORGE, J.C. and SUYDAM, R.S. Patterns of genetic differentiation in bowhead whales (*Balaena mysticetus*) from the western Arctic. 28pp.

Analysis of 33 microsatellite loci for bowhead whales, including 22 new highly reliable markers, suggests present or historical departures from panmixia in Bering-Chukchi-Beaufort Seas bowhead whales. Although these bowheads are clearly genetically distinct from bowheads in the Sea of Okhotsk, we find significant patterns of genetic inhomogeneity among the Bering-Chukchi-Beaufort Seas samples. These samples exhibit strong and widespread departure from Hardy-Weinberg equilibrium, including significant evidence of a historical bottleneck consistent with gene drift after commercial exploitation or thousands of years earlier. There is also significant evidence that whales of detectably different ancestry intermingle during some spatio-temporal portions of the annual migration but partially segregate in other portions. The most notable such pattern is seen in migratory pulses passing Barrow in the fall. Estimates of Fst associated with our findings of genetic structure in Bering-Chukchi-Beaufort Seas bowheads are extremely small compared to values for comparisons with the known separate stock in the Sea of Okhotsk, and are also smaller than values obtained by separating suspected familial lineages within the Bering-Chukchi-Beaufort Seas samples. Furthermore, potential model misspecification provokes skepticism about some detected patterns, notably including the temporal ones. When analysis is limited to the most trusted markers and samples, sensitivity analyses show that most of our findings vanish and that the main sources of genetic signal in these data are scoring errors, familial relations, and birth year. We conclude that Bering-Chukchi-Beaufort Seas bowheads may comprise a complex spatio-temporal aggregation of animals with mixed and variable ancestry with an unknown degree of nonrandom mating, whose degree of genetic inhomogeneity is significantly less than what is seen between spatially isolated stocks. Despite these intriguing and complex biological findings, we have found no convincing evidence that Bering-Chukchi-Beaufort Seas bowheads should be managed as more than one stock.

15. MORIN, P.A., LEDUC, R.G., ARCHER, E., MARTIEN, K.K., TAYLOR, B.L., HUEBINGER, R.M. and BICKHAM, J.W. Estimated genotype error rates from bowhead whale microsatellite data. 10pp.

We calculate genotype error rates using opportunistic replicate samples in the microsatellite data for bowhead whales. The estimated rate (1%/genotype) falls within normal ranges reviewed in this paper. The results of a jackknife analysis identified five individuals that were highly influential on estimates of Hardy-Weinberg equilibrium for four different markers. In each case, the influential individual was homozygous for a rare allele. Although these individuals have not been re-genotyped in the laboratory to determine whether the initial homozygous allele calls were correct, our result demonstrates that Hardy-Weinberg p-values are very sensitive to homozygosity in rare alleles for single individuals. This raises the possibility that even small, normal levels of laboratory errors can result in an overestimate of the degree to which markers are estimated to be out of Hardy-Weinberg equilibrium and hence overestimate the potential to infer stock structure. To avoid such bias, we recommend routine identification of influential individuals and multiple replication of those samples.

16. MARTIEN, K.K., ARCHER, E., RIPLEY, B.J. and TAYLOR, B.L. The genetic consequence of non-equilibrial dynamics in bowhead whales.

17. ARCHER, E., MARTIEN, K.K., TAYLOR, B.L., LEDUC, R.G., GIVENS, G. and GEORGE, J.C. Use of an individual-based simulation of BCB bowhead whale population dynamics to examine empirical genetic data. 28pp.

To better interpret whether genetic data from bowhead whales could have resulted from a single stock, we created an individual-based model of bowhead whale population dynamics and genetics using the R package *rmetasim*. The model re-created as closely as possible all aspects of the demography, genetics, and whaling history of bowheads. Simulated datasets were generated by sampling from the simulated population in a way that matched the age, sex, and geographic distribution of the empirical samples. These simulated datasets were used to generate null distributions for a variety of genetic analyses, against which we compared the empirical bowhead dataset. In most respects, the results of our analysis indicate that the empirical genetic data sampled from BCB bowhead whales are consistent with our model of a single, randomly-mating population. Of the 55 spatial, temporal, and cohort comparisons we examined (11 stratifications for 5 measures of genetic differentiation), only the mitochondrial FST between fall and spring St. Lawrence Island, and the microsatellite FST between Barrow and St. Lawrence Island exhibited a significant difference between the simulated and empirical datasets. Our results show that the empirical STRUCTURE analyses are entirely consistent with a single population that is out of genetic equilibrium due to the effects of commercial whaling.

18. MOORE, S.E., STAFFORD, K.M. and MUNGER, L. Passive acoustic surveys for BCB bowhead whales in the

Beaufort Sea, 2003-2005. 7pp.

Passive acoustic surveys were conducted in support of a comprehensive effort to investigate stock structure in the Bering-Chukchi-Beaufort (BCB) population of bowhead whales (*Balaena mysticetus*). Two types of survey were conducted: (1) an over-winter survey (2003-04) northeast of Barrow, Alaska, using autonomous recorders; and (2) a dipping-hydrophone survey (2005) along a cruise track northwest of Barrow to investigate bowhead occurrence near the Chukchi Borderland in summer. Although provisional reports from both surveys were provided to the IWC Scientific Committee (SC) in 2005 and 2006, this report represents the final summary of results from both acoustic surveys. In neither survey were bowhead calls detected in areas or at times supportive of any of the putative multiple stock hypotheses.

18. WELLER, D.W., BRADFORD, A.L., LANG, A.R., KIM, H.W., TSIDULKO, G.A., BURDIN, A.M. and BROWNELL, R.L. Status of western gray whales off northeastern Sakhalin Island, Russia.

20. SKAUG, H. and GIVENS, G. Relateness among individuals in BCB bowhead microsatellite samples. 5pp.

We analyze 33 microsatellite loci for 282 bowhead samples to identify potentially related individuals. Possible related pairs found include many cases where one individual was caught in Barrow and the other individual was caught at St. Lawrence Island, Chukotka, or whaling villages along the Alaskan coastline.

21. DUECK, L. and POSTMA, L. Update of bowhead whale research in Canada.

22. BRADFORD, A.L., WELLER, D.W., IVASHCHENKO, Y.V., BURDIN, A.M. and BROWNELL, R.L. Seasonal and annual variation in body condition of western gray whales off northeastern Sakhalin Island, Russia.

23. HEIDE-JØRGENSEN, M.P., LAIDRE, K., BORCHERS, D. and SAMARRA, F. Surprising recovery of bowhead whales. 8pp.

The bowhead whale was severely depleted for several decades of commercial whaling when the species was offered worldwide protection in 1931. No signs of population recovery in West Greenland were observed over the course of the 100-year post-whaling period. In April 2006, a dedicated survey for bowhead whales was conducted on the former whaling grounds in efforts to determine the current population status. This effort included a double platform aerial survey design, satellite tracking of the movements of nine whales, and estimation of high resolution surface time from 14 whales instrumented with time-depth recorders. The whales utilized an area of ~25.000 km2 and 32 out of 36 bowhead whale sightings during the survey were within this area. Only 12% of the area used by the tracked whales was not covered by the survey. The aerial survey sampled 125.634 km2 of bowhead whale habitat with 10.500 km flown. After accounting for perception bias, there were estimated to be 295 animals in the survey area (cv=47%). Using data from the instrumented whales, animals were estimated to spend an average of 24% (cv=0.03) of the time at or above 2 m depth,, the maximum depth to which bowhead whales can be seen on the trackline. Applying this availability factor and correcting for sightings missed by observers resulted in a fully corrected abundance estimate of 1229 (95% CI: 495-2939) bowhead whales in West Greenland in April 2006. This surprisingly large population estimate, much larger than any previous estimates for the area, is puzzling given that the change in abundance cannot be explained by a recent or rapid growth in population size given current assumptions about population dynamics and stock identity. One possible explanation is that the population recently has attained a certain threshold size where mature females start to appear abundantly on the feeding ground in West Greenland. This in combination with the latest severe reduction in sea ice might explain why this survey documents the largest number of bowhead whales recorded in the past 100 yrs on the former whaling ground in West Greenland.

24. GOSHO, M.E., GEARIN, P.J., JENKINSON, R., LAAKE, J., KUBIAK, D. and MAZZUCA, L. Research on gray whales off Kodiak Island, Alaska from 2002-2005.

25. LAIDRE, K., HEIDE-JØRGENSEN, M.P. and NIELSEN, T.G. The role of the bowhead whale as a predator in West Greenland. 43pp.

We examined the spatial and temporal linkage between primary production, zooplankton distribution and density, and bowhead whale (*Balaena mysticetus*) foraging behavior in Disko Bay, West Greenland using concurrent ship-based oceanographic and net sampling together with instrumentation of whales with satellite-linked transmitters and dive recorders. Estimates of bowhead whale abundance were used in a bioenergetic model to estimate the potential consumption of zooplankton during their four-month stay in Disko Bay. Between 2001 and 2006, 30 whales were instrumented with satellite transmitters providing information on daily movements and fourteen whales were instrumented with archival Time-Depth or Time-Depth-Fluorescence recorders providing detailed dive data. Simultaneous data were collected on water column structure, phytoplankton and zooplankton density, taxa, and biomass at 25 stations south of Disko Island in 2003, 2005 and 2006. After the retreat of annual winter sea ice, bowhead whales explored a limited area along the south coast of Disko Island and had high interannual site fidelity. Mean dive depths varied between 53 (± 35) to 109 (± 41) m but maximum depths were >400 m. Most dives targeted the bottom and dive durations >40 min were observed for several whales. Available prey for bowhead whales was dominated by calanoid copepods, with *Calanus finmarchicus, C. glacialis*, and *C. hyperboreus* occurring at 90-100% of all stations between 0 and 50 m and contributing 78% ± 25 of the total biomass. Bottom sampling for epizooplankton in 2006 resulted in unprecedented densities of *C. finmarchicus*, several orders of magnitude higher than any other depths. Bioenergetic modeling indicated the population consumes ~220 tons of zooplankton per day or >21,000 tons during the 4-month stay in Disko Bay. Although the total biomass of zooplankton in the upper 50 m of the water column theoretically could support this predation level, benthic zooplankton densities and behavioral data suggest whales target pre-ascension stage epibenthic copepods near the sea bed in high density patches.

26. BRANDON, J.R., PUNT, A.E. and WADE, P.R. Incorporating environmental time series into a population dynamics model for eastern North Pacific gray whales.

27. JORDE, P.E. and SCHWEDER, T. Further analysis of stock structure for BCB bowhead whales using genetic data. 15pp.

An extensive set of microsatellite and mitochondrial DNA data is analysed with the aim of investigating potential population substructure in the Bering-Chukchi-Beaufort stock of bowhead whales. We found no significant temporal pattern in the genetic data from migrating bowheads along the Alaskan coast, as was found previously in a subset of the data. However, different strata of the microsatellite DNA data deviate from Hardy-Weinberg genotype expectations and display significant spatial genetic differentiation. These observations indicate that the BCB stock does not represent a single, randomly mating population, although the precise structure of the stock remains unclear.

28. SCHWEDER, T. and SADYKOVA, D. Event history models for capture-recapture surveys with passively marked individuals. Application to photo-ID for BCB bowheads whales.

29. PASTENE, L.A., KITAKADO, T., GOTO, M. and KANDA, N. Update of mitochondrial DNA analyses on stock structure in the B-C-B stock of bowhead whales. 12pp.

Genetic analyses based on mtDNA control region sequences were conducted on samples of the B-C-B stock of bowhead whale collected from

different villages engaged in aboriginal whaling. Laboratory work on mitochondrial DNA sequencing was carried out by US scientists and access to these data was possible under the Scientific Committee's data access protocol (Procedure A). The total number of sequences available was 399. Approximately 68% of those come from a single locality (Point Barrow). An additional 24 sequences from the Okhotsk Sea bowhead whale stock were used in the analysis for comparative purposes. Same as previously reported, the nucleotide diversity was smaller in whales from the Okhotsk Sea stock than in whales from the different localities of the B-C-B stock. The quantification of the temporal and geographical mtDNA differentiation was carried out using the Fst. In addition the genetic relationship was quantified using the chi-square statistics for heterogeneity of mtDNA haplotype frequencies. First temporal (seasonal) differentiation was examined in those localities with larger sample sizes (St. Lawrence Island and Point Barrow). Subsequently geographical mtDNA differentiation among four localities (Point Barrow, St. Lawrence Island, Chukotka and Okhotsk Sea), was examined. No significant mtDNA heterogeneity was found among B-C-B stock whales, apart from a marginal significant seasonal heterogeneity for Fst found in St. Lawrence Island. In contrast with a previous mtDNA result, no significant heterogeneity was found at Barrow when the samples were grouped into spring and fall. Significant genetic heterogeneity was found between B-C-B stock localities and whales from the Okhotsk Sea stock. In general these mtDNA results provide no strong evidence for genetic population structure within the B-C-B stock. Sample sizes for several localities and months, however, remain low and therefore negative results in some comparison could just reflect the low statistical power of the analysis. Furthermore samples from Chukotka and St. Lawrence Island obtained in summer months, which are essential to investigate some of the multiple stock hypotheses, are not available because they are difficult to collect since there is no whaling at this time of the year. At Barrow nuclear DNA markers have suggested the possibility of additional stock structure and mixing of stocks. It is possible therefore that the mtDNA analysis could not identify structure if two stocks mix to each other in similar proportion when they pass through that locality in spring and autumn.

30. KITAKADO, T., PASTENE, L.A., GOTO, M. and KANDA, N. Updates of the stock structure analyses of B-C-B stock of bowhead whales using microsatellites. 13pp.

We updated our genetic data analyses of the B-C-B stock of bowhead whales using the two reference microsatellite datasets. Samples of the whales were obtained from several different Alaskan villages engaged in aboriginal whaling, Canada and Okhotsk. The two reference datasets included a total of 22 or 33 loci, respectively. In order to describe spatial and temporal population structure of the B-C-B bowhead whales, the analyses were conducted using the computer program Structure (Pritchard et al. 2000, Falush et al. 2003) under two different models: no-admixture with independent allele frequencies and admixture with correlated allele frequencies among stocks. Results of the analysis suggested the possibility of multiple stocks. In particular, individuals passing by Barrow, at both spring and fall migration, probably came from at least two genetically distinct stocks of the bowhead whales. On the comparison between the no-admixture and admixture models, the former was better supported from estimates of the marginal likelihood and the parameter α. The mixing rate of stocks passing by Barrow was estimated based on the results of assignment probabilities under the assumption of no-admixture in each of the seasons, and the results indicated that multiple stocks were well-mixed during migration at that locality. Furthermore, the results showed a clear temporal migration pattern in fall season while no temporal pattern was observed in spring season.

31. WWF RUSSIA. A report on the planning and implementation of the marine protected area for the Western Pacific gray whales.

32. GIVENS, G. A note on interannual variation of Fis for bowhead whales sampled at Barrow. 6pp.

33. LEDUC, R.G., MARTIEN, K.K., MORIN, P.A., HEDRICK, N., ROBERTSON, K.M., TAYLOR, B.L., MUGUE, N.S., BORODIN, R.G., ZELENINA, D.A. and GEORGE, J.C. Sequence variation in bowhead whales: a response to BRG29 and a re-examination of the analyses. 5pp.

We reanalyze comparisons made in LeDuc *et al*. 2007 (SC/59/BRG9) with small corrections to samples included and find no substantive differences in our conclusions. We also provide new analyses for comparisons involving Saint Lawrence Island data, where uncertainty remains regarding linking bone and baleen samples to individual whales. The new analyses bracket the uncertainty by in one case using all sequences and in another decreasing the sample size by excluding sequences of questionable origin. We find that sample choice does not affect the statistical conclusion of significance between fall and spring at Saint Lawrence Island using Fst, significance between age cohorts, and negative results for all other comparisons.

34. MARTIEN, K.K., GIVENS, G. and ARCHER, E. A note on the ability of STRUCTURE to correctly infer the number of populations for Bering-Chukchi-Beaufort Seas bowhead whales. 8pp.

Multiple stocks within the Bering-Chukchi-Beaufort region have been inferred from analyses of microsatellite data from bowhead whales killed on migration using the method STRUCTURE (Kitikado et al. 2007). We show that this conclusion is unwarranted and that STRUCTURE analyses are consistent with a single stock. We discuss model choice for STRUCTURE analyses and conclude that, based on bowhead biology, the appropriate model is one that assumes both recent ancestry and some current gene flow (admixture with correlated allele frequencies). Bowhead biology and history is not consistent with the model used by Kitikado et al. (2007) that assumes strong evolutionary separation and no current gene flow (no admixture and independent allele frequencies). We perform two new analyses to facilitate the appropriate selection of the number of populations (K) suggested by STRUCTURE analyses. The inference method currently recommended by STRUCTURE's authors strongly suggests one stock within the BCB region. This is consistent with results using individual-based simulations of a single stock modeled to recreate BCB bowhead population dynamics and history (described in Archer et al. 2007): simulated datasets generated from a single stock and analyzed using STRUCTURE in the manner employed by Kitikado et al. falsely favored K=2 about 30% of the time. We conclude that in the analysis of the full dataset, including BCB, Okhotsk and Atlantic samples, that STRUCTURE likely makes two errors: 1) it incorrectly fails to identify BCB and Atlantic whales as separate stocks, and 2) it incorrectly identifies two biologically meaningless groups within the pooled BCB-Atlantic samples if selection of K is done in a manner not supported by the current literature.

SC/59/DW

1. OHISHI, K., FUJISE, Y. and MARUYAMA, T. *Brucella* infection in whales in the western North Pacific and Antarctic: a review. 6pp.

Infection of *Brucella*, Gram-negative, pathogenic bacteria, has been reported in a variety of marine mammals in worldwide oceans. We have conducted serological and pathological studies on *Brucella* infection in the western North Pacific using whale serum samples collected in 2000 under Japan's Whale Research Program in the Western North Pacific (JARPNII). Serum samples from 40 common minke whales (*Balaenoptera acutorostrata*), 43 Bryde's whales (*Balaenoptera edeni*), and 4 sperm whales (*Physeter macrocephalus*) were examined by agglutination test using inactivated *B. abortus*. *Brucella*-specific antibodies were detected in 38% of common minke whale samples. Low prevalence (9%) of the antibody was observed in Bryde's whale samples, whereas no antibody against *Brucella* was observed in the examined four sperm whales. However, no antibodies were detected in the serum samples from 104 Antarctic minke whales (*Balaenoptera bonaerensis*) collected under Japan's Whale Research Program under Special Permit in the Antarctic (JARPA). We found abnormal gonads in 35% (13

males and one female) of 40 minke whales in the western North Pacific. They were granular lesions with caseation and calcification. Similar lesions were also observed in the gonads of two Bryde's whales. Histopathological studies showed that the lesions were characterized by consisting of epithelioid cells, multinucleated giant cells and infiltration of lymphocytes. Such a gonad abnormality was not observed in the examined 440 Antarctic minke whales and five sperm whales. These results suggested the followings, (i) *Brucella* infection occurred in the examined whale species in the western North Pacific. (ii) Relatively higher infection rate was observed in common minke whales than other whale species in the North Pacific. (iii) *Brucella* infection does not seem to occur in the Antarctic minke whales. By PCR using specific primers, specific DNA fragments were produced in ten among 22 abnormal testis tissues from examined common minke whales. They have IS711 transposable elements downstream of bp26, which is unique to marine *Brucella* strains. Gene structure of omp2, and the specific PCR product for seal strain, indicated that the *Brucella* strain in the western North Pacific minke whale, is similar to the Atlantic seal strains. So far, neither crews nor researchers who have frequently contacted with whales, have shown no sign of the *Brucella* infection. No *Brucella* specific antibody was detected in the sera from 51 persons examined in 2001, nor from 103 in 2003. .

2. ROWLES, T., BRADFORD, A.L., CALAMBOKIDIS, FALCONE, GABRIELE, GAYDOS, KRAHN, M.M., MATTILA, NORBERG, RAVERTY, ROBBINS, J., ROJAS-BRACHO, L., ROLLAND, ROSA, C., ROTSTEIN, STEIGER, URBAN, WELLER, D.W., WILKINSON and YAMAGUCHI. Report of the Large Whale Health Assessment Workshop, Olympia, Washington, 8-9 December 2006.

3. FLORES, P.A.C., BAZZALO, M., ZAGO, L. and WELLS, R.S. Epidermal disorders and insights on residency in free-ranging bottlenose dolphins (*Tursiops truncatus*) off southern Brazil.

Differently from other regions, bottlenose dolphin is poorly known in Brazil. Skin diseases have been investigated and are common in several bottlenose dolphin popupations worldwide, being suggested to result from anthropogenic and environmental factors. In Baía Norte (27°30'S, 48°31'W), southern Brazil, since 1993 boat based studies have been conducted on ecological and conservation aspects of bottlenose dolphin and marine tucuxi dolphins. Herein residence and site fidelity of bottlenose dolphins as well as the description and occurrence of skin disorders were investigated using photo-identification. Thirty-nine individuals were photo-identified from 67 groups sighted (n = 251 individuals), being resighted on up to seven different days over six years. Only 12.8% (n=5) of photoidentified dolphins (all large/adult animals) have epidermal disorders. These disorders ranged from small de-pigmented areas to white or cream star-like patches to extensive multi colored botches, wrinkles, lumps, abcesses and skin eruptions. One animal showed intense evolution of skin disorders over 20 months while another developed disorders during the study period. The percentage of individuals with epidermal diseases is low while residence and site fidelity patterns are similar to in other bottlenose dolphin populations worldwide. It has not yet been possible to diagnosis the type(s) of disease related to the cases reported here, while some are consistent with the mycotic Lobo's Disease, already recorded in a stranded bottlenose found dead 150km to the South. On the other hand, skin disorders have not been seen in marine tucuxis from Baía Norte, were individuals are resident from up to 13 years. Depending on the epidemiology and infectious power of this(these) diseases, bottlenose dolphins could then be vectors of diseases to tucuxis. These information on skin lesions also shed light on the almost completely unknown pathological and health status of marine mammals in Brazil. Sampling of skin from health and infected individuals are needed together with comparisons to other populations, mainly in southern Brazil.

4. VAN BRESSEM, M.F., VAN WAEREBEEK, K., REYES, J., FÉLIX, F., ECHEGARAY, M., SICILIANO, S., DI BENEDITTO, A.P., FLACH, L., VIDDI, F., AVILA, I.C., BOLAÑOS, J., CASTINEIRA, E., MONTES, D., CRESPO, E., FLORES, P.A.C., HAASE, B., MENDONCA DE SOUZA, S.M.F., LAETA, M. and FRAGOSO, A.B. A preliminary overview of skin and skeletal diseases and traumata in small cetaceans from South American waters. 27pp.

Miscellaneous lesions of the skin and skeletal system, and external traumata were observed in 558 of 7,400 specimens of 12 odontocete species from the waters of Colombia, Ecuador, Peru, Chile, Argentina, Uruguay, Brazil and Venezuela examined in 1984-2007. Tattoo skin disease (TSD), lobomycosis-like and cutaneous diseases of unknown aetiology seem to be emerging in several populations and, in some cases, may be associated with chemical and organic water pollution. TSD was observed in eight species from the SE Pacific and SW Atlantic. Lobomycosis-like disease was found only in coastal *Tursiops truncatus* but in four countries (Colombia, Ecuador, Peru and Brazil). All affected specimens were encountered in the vicinity of major ports, cities or shrimp farms. Whitish velvety cutaneous marks associated with scars occurred in coastal *T. truncatus* (Peru), *Sotalia guianensis* (Brazil) and a *Pseudorca crassidens* (Ecuador). Large, rounded lesions were seen in a calf *Cephalorhynchus eutropia* (Chile) and a *Cephalorynchus commersonii* (Argentina). Cutaneous wounds and scars as well as body traumata related to net entanglements and boat collisions were observed in 62 dolphins and porpoises from both oceans. Traumata resulted in deformations as well as in the partial or complete amputation of the dorsal fin, flippers and flukes in 14 cases. Fractures of the skull, ribs and vertebrae thought to be caused by violent, fisheries-related interactions or boat collisions were seen in single individuals of *Delphinus capensis* (Peru), *Lagenorhynchus obscurus* (Peru), *Ziphius cavirostris* (Uruguay) and *S. guianensis* (Venezuela). Prevalence of osteopathology in dolphins and porpoises from Peru and Brazil ranged widely, from 5.4% to 69.1%. In four small cetacean species from Peru cranial lytic lesions were the most frequently observed disease (5.4%-40.5%), followed by hyperostosis and ankylosing spondylitis in offshore (31%) and inshore (15.4%) *T. truncatus*. Fractures and other bone traumata were seen in 47.2% of the axial skeletons of S. *guianensis* collected along the northern coast of Rio de Janeiro State in 1987-1998. A high prevalence (48.4%, N=31) of, apparently congenital, malformations of the cervical vertebrae observed in a 2001-2006 sample may be linked to a hypothetical genetic bottleneck in this population. Malformations with deficient ossification would increase susceptibility to fractures of vertebrae. This study demonstrates the need for focussed research on the effects of human activities on the spread of infectious and other diseases in small cetaceans, particularly in near-shore populations that inhabit a highly degraded coastal environment.

5. MAZZARIOL, S., DI GUARDO, G., PODESTA, M. and BRUNO, C. Post-mortem examination on a young fin whale (*Balaenoptera physalus*). 2pp.

On 2006, the Italian Large Cetacean Necropsy Team, funded from the Italian Ministry of the Environment within the ACCOBAMS agreement, performed the post-mortem examination of two animals stranded along Italian coastlines. The first intervention was an unidentified, badly preserved beaked whale carcass. On the second animal, a young male fin whale, 5.40 mt long in lenght, a complete necropsy was carried out one day after stranding. Main gross findings were granulomatous parasitic myocarditis, parasite cysts in urinary bladder ligaments and a large haemorrhagic area on the soft tissue of the dorsal neck region. Cardiac failure due to parasitic granulomas was the likely cause of death.

6. MAZZARIOL, S., MARRUCCHELLA, G., DI GUARDO, G., PODESTA, M., OLIVIERI, V., COLANGELO, P., KENNEDY, S., CASTAGNARO, M. and COZZI, B. Post-mortem findings in cetaceans stranded along Italian Adriatic Sea coastline (2000-2006). 8pp.

Stranded cetaceans offer a unique opportunity for collecting data on the health status of dolphin and whale free-living populations. Between 2000 and 2006, the National Stranding Networks described 163 stranded marine mammals along the Italian coastline of the Adriatic Sea. A complete post-mortem examination was possible on 13 entire and well preserved animals. Pneumonia was one of the most commonly

encountered lesion, especially *Halocercus lagenorhynchi*-associated bronchopneumonia. Additional findings were nephritits, hepatitis and *Pholeter gastrophilus*-associated gastritis. Parasites were often found in most of the examined organs and tissues and in many cases. Granulomatous meningoencephalitis by *Cladosporium* spp. was observed in a female bottlenose dolphin, while papilloma-like lesions were observed on the rostrum and in the oral cavity of other two female bottlenose dolphins. Other peculiar findings were heterotopic renal tissue in the lung parenchyma of the common dolphin. In a few cases, putative zoonotic agents, such as *Vibrio alginolyticus*, were isolated from these stranded dolphins. In agreement with other authors, parasites were the most frequently encountered pathogens but, despite noticeable tissue damage, they were not life-threatening organisms. Pneumonia was a very common disease condition also in the cetaceans included in this study.

7. COZZI, B., DI GUARDO, G., PODESTA, M. and MAZZARIOL, S. Presence of cetacean species and relative cause of death in the Italian waters (2001-2006). 4pp.

The Mediterranean Marine Mammals Tissue Bank (MMTB) was established in Padova with the official recognition of the Italian Ministry of the Environment within the ACCOBAMS agreement. It cooperates with National Stranding Networks and other Institution, as the Museum of Natural History of Milan, to collect tissue samples from cetacean stranded along Italian coastlines and close Mediterranean Sea, performing complete post-mortem examination whenever it was possible. Between 2001 and 2006, samples from 109 animals were collected and stored on 712 registered strandings. Data on species, animals and pathological findings are herein discussed.

8. VAN BRESSEM, M.F., RAGA, J.A., BARRETT, T., SICILIANO, S., DI BENEDITTO, A.P., CRESPO, E. and VAN WAEREBEEK, K. Microparasites and their potential impact on the population dynamics of small cetaceans from South America: a brief review. 9pp.

We briefly review the pathology, epidemiology and molecular biology of cetacean viruses (including morbilli, papilloma and pox) and *Brucella* spp. encountered in South America. Antibodies against cetacean morbillivirus were detected (by iELISAs and virus neutralisation tests) in SE Pacific and SW Atlantic delphinids. Morbilliviruses are possibly enzootic in *Lagenorhynchus obscurus* and offshore *Tursiops truncatus* from Peru and in *Lagenodelphis hosei* from Brazil and Argentina, but no morbillivirus antibodies were found in inshore small cetaceans. Papillomaviruses cause genital warts in at least three odontocete species in Peru. Two Phocoena spinipinnis papillomaviruses (PsPVs) were found in warts of Burmeister's porpoises; one (PsPV-1) was cloned and characterized. Half of porpoises had developed genital warts, while in 10% of males the lesions were sufficiently numerous and severe to at least hamper, if not impede, copulation. High titers of cowpox virus neutralising antibodies were detected in Peruvian *D. capensis, T. truncatus, L. obscurus* and *P. spinipinnis* in 1993-1995. The high prevalence of orthopoxvirus neutralising antibodies with high titres indicates common infection by poxviruses antigenically related to cowpox virus, the probable causative agents of tattoo skin disease. Cetacean poxviruses may cause significant mortaliy among neonates and calves unprotected by maternal immunity. In Peru, *Brucella* spp. antibodies were detected (competitive ELISA) in *D. capensis, T. truncatus, L. obscurus* and *P. spinipinnis*. Brucellosis is likely enzootic in the latter two species, and may lead to orchitis and bone lesions in *L. obscurus* and *D. capensis*. The enzootic circulation of brucellae in *L. obscurus* and *P. spinipinnis* may constitute a measurable limiting factor among the environmental variables affecting population dynamics. Also, widespread *Brucella* spp. infection in several Peruvian odontocetes has public health implications (zoonosis), considering frequent manipulation of carcases and consumption of meat. Extrinsic anthropogenic factors may not only exacerbate the consequences of viral infections on the health of a particular individual, but also operate at the population level.

9. KIRK, C., SWOR, R., HOLCOMB, D. and O'HARA, T.M. Assessing Beaufort Sea polar bear health: associations between hematological and serological endpoints. 8pp.

A study of free ranging populations of polar bears in northern Alaska has been initiated to establish clinical (health) baseline data to monitor potential change in health status using multiple hematologic endpoints and infectious agents exposure measures (e.g., serology). Total plasma protein, percent hematocrit, and total leukocyte counts and leukocyte differential means determined for animals captured in Spring 2005 off the Beaufort Sea, fall within one standard deviation of those values reported for captive polar bears in the International Species Database. Statistical analyses revealed differences between genders for mean percent hematocrit, mean total leukocyte as well as mean neutrophil, monocyte, and lymphocyte counts with males having greater values for all parameters. Reproductive status (eg.lactation) or body condition when tested, did not account for these observed differences. In addition, there was a 7.7% increase in mean neutrophil count ($p = 0.012$) and a 17.6% decrease in mean lymphocyte count ($p < 0.001$) with increasing age as determined via simple linear regression. As part of this study; a relatively high prevalence of serum antibodies to four morbilliviral species [canine distemper (CDV), dolphin morbillivirus (DMV), phocine distemper (PDV), and porpoise morbillivirus (PMV)] were identified. This group of viruses has been documented to cause significant disease and mortality in populations of some marine mammals and has been demonstrated to interfere with differentiation and specialization of lymphocytes /in vitro/ (Heaney et al. 2002). Preliminary serological data indicates 48% of the animals tested (n=64) were positive for antibodies to CDV, DMV, PDV, and/or PMV via differential serum neutralization. In addition, antibodies to Toxoplasma gondii were found in 13% of animals tested with titers as high as 1:1064. Associations between antibody titers and hematological parameters were examined revealing a 7% decrease in total leukocyte count ($p = 0.004$), an 8% decrease in mean neutrophils ($p = 0.033$), a 10% decrease in mean monocytes ($p = 0.03$), and a 23% decrease in mean eosinophils ($p = 0.014$) with increasing CDV titer. In addition, eosinophils and monocytes increased 22% ($p = 0.016$) and 11% ($p = 0.03$) with increasing toxoplasma titer. Functional assays (eg. blastogenesis) and further sample collection (Spring 2006) will assist in evaluating the biological significance of these observed changes.

SC/59/E

1. KOSKI, W., ALLEN, T., IRELAND, D., G., B., SMITH, P.R., MACRANDER, A.M., HALICK, M., RUSHING, C., SLIWA, D.J. and MCDONALD, T.L. Evaluation of an unmanned airborne system for monitoring marine mammals.

2. BUCK, G.B., IRELAND, D., SLIWA, D.J., ALLEN, T., RUSHING, C. and KOSKI, W. Strategies to improve UAS performance for marine mammal detection.

3. STACHOWITSCH, M., PARSONS, E.C.M. and ROSE, N.A. State of the Cetacean Environment Report (SOCER) 2007.

4. MOORE, S.E. and KRAHN, M.M. Overview of Arctic research and assessment activities: cetacean-relevant updates on IPY, IPCC, ACIA, PAME, AMAP, CAFF and recent publications. 9pp.

5. MOORE, S.E., ANGLISS, R.P. and HARWOOD, L.A. Summary of seismic surveys conducted offshore northern Alaska and western Canada, July-October 2006, with an overview of plans for 2007.

6. NO PAPER.

7. ROSA, C., O'HARA, T.M., GRAY, M.J. and BLAKE, J.E. Renal interstitial fibrosis, pulmonary firbomuscular hyperplasia and other findings from a histological assessment of the bowhead whale (*Balaena mysticetus*).

We performed gross examinations and collected tissues for histological assessment during the Inuit subsistence harvest of bowhead whales

(*Balaena mysticetus*) in Northern Alaska. Tissue samples were collected for histological analyses from bowhead whales (n=64) hunted during the spring and fall in Barrow and Kaktovik, Alaska (1998-2002). Our objectives were to describe the range of normal histological findings in the species and to define the prevalence of disease in the Bering-Beaufort-Chukchi Sea stock of bowhead whale. We identified and discriminated abnormalities that could be attributed to heavy metal/mineral toxicity, specific disease entities, age, reproductive status or capture. Overall, few pathological changes were observed during gross necropsy or histological assessment. Qualitative observations were made more quantitative through the use of histological staining, digital imaging/measurement and rating profiles, which allowed the assignment of histological observations to a clearly-defined scoring system. Abnormalities were few, consisting mainly of hepatic and renal fibrosis and pulmonary fibromuscular hyperplasia. Additionally, pigment was observed in the liver (25/58 whales examined) and extra-medullary hematopoeisis was noted in the spleen (17/45 whales examined). The putative effects of seasonal feeding and fasting on the pancreas and liver were assessed through the evaluation of pancreatic zymogen stores and the degree of hepatic lipidosis observed. Minimal parasitism was noted.

8. WORBY, N.S. and LEAPER, R. Changes in the Antarctic sea ice ecosystem: potential effects on krill and baleen whales.

9. APLIN, D. Conservation concerns for cetaceans in the Bering Sea and adjacent waters: offshore oil development and other threats. 14pp.

The North Aleutian Basin Planning Area (i.e. the Bristol Bay region is situated in the eastern Bering Sea, which is known for its high biological productivity. There are a number of endangered whale populations utilizing the area as habitat; they include the North Pacific right whale, bowhead whale, blue whale, fin whale, sei whale, humpback whale and sperm whale. The Minerals Management Service, the federal regulatory agency responsible for leasing offshore federal lands for oil and gas resource development, proposes scheduling two lease sales in the North Aleutian Basin in 2010 and 2012. There are currently a variety of lethal and sublethal threats posed by climate change, commercial fishing, maritime commercial shipping, naval activities, pollution, and others. Compounding these threats would be those greater threats posed by offshore oil and gas exploration and production activities associated with leasing OCS lands in the North Aleutian Basin Planning Area (e.g., noise pollution, oil spills and other forms of chemical pollution, vessel collisions, entanglement with or ingestion of marine debris, trophic modifications resulting from the introduction of non-native species, burning of fossil fuels used to extract more sequestered hydrocarbons that subsequently are made available as energy and ultimately contributes to global climate warming and in turn modifies wildlife and human habtitats). The synergistic interactions are vast and threatening to endangered whale populations attempting to rebuild from past human imprudence. The best available information holds that the loss or injury of any individuals of the eastern North Pacific right whale population (the most endangered large whale population) due directly or indirectly to offshore oil and gas leasing, exploration, or production is unacceptable, as is the degradation of their habitat, if conservation of this population and species is to succeed. Therefore, it is prudent and sagacious to forego leasing OCS lands in the North Aleutian Basin Planning Area until endangered whale populations, such as the eastern North Pacific right whale population, rebuilds and is delisted.

10. DOLMAN, S.J., GREEN, M. and SIMMONDS, M.P. Marine renewables and cetaceans. 9pp.

There is an ongoing development of offshore renewable energy projects worldwide. Marine wind power technology is the most advanced and tidal and wave power projects are creating increasing interest. Marine renewable energy projects to date have been focused in northern Europe, yet developments are also planned and underway in other parts of the world. Whilst these offshore renewable energy developments are typically characterised as environmentally desirable, there are some associated adverse impacts that deserve careful consideration. Furthermore, the renewable energy industry is in some ways still in its infancy and, as such, not all of its impacts are clear or fully assessed. This paper outlines the global development of this sector, identifies particular concerns, and some of the possible effects from renewable energy developments on cetaceans, and identifies some research and monitoring needs to address important knowledge gaps.

11. TUNESI, L., DI NORA, T. and AGNESI, S. Human activities in the Pelagos Sanctuary: the methodology used to describe the most relevant issues.

In 2006 ICRAM finalized the preliminary study of the available data on the main human activities present in the area of the Mediterranean Pelagos Sanctuary (87,500 km2), analysing their typology and their spatial fields of interest. The project, founded by the Italian Ministry of Environment, was devoted to defining the framework of a specific multidisciplinary analysis done on GIS basis, to identify the typologies of information essential to start-up the management and the main lack of information. This study allowed the identification of areas where human uses are more intensive (hot spots) and research activities specifically devoted to supporting the management of this Mediterranean Sanctuary.

12. NO PAPER.

13. NO PAPER.

14. FOSSI, M.C., MARSILI, L., CASINI, S. and BUCALOSSI, D. First detection of CP1A1 and CYP2B induction in Mediterranean cetacean skin biopsies and fibroblast cell cultures using western blotting analysis.

In the last decades there is a growing concern about the potential risk of Mediterranean cetaceans related to high bioaccumulations of organochlorine (OCs) and emerging contaminants such as Polybrominated diphenyl ethers (PBDEs). While levels or organochlorine compounds are decreasing, concentrations of PBDEs seem to be increasing in the environment including Mediterranean Sea. The need to developed a new powerful tool to detect exposure and effects of old and emerging contaminants in Mediterranean cetaceans, led us to developed a suite of sensitive non-lethal investigation tool (WB, ELISA, RT-PCR, fibroblast cell culture) using skin biopsies of free-ranging animals. In order to propose the induction of CYP1A1 and CYP2B, detected by Western Blotting analysis, as a suitable biomarker of exposure to OCs and PBDEs, a three phase experimental design was performed. In a first phase (*in vitro* experiments) we applied the western blot technique to detect CYP1A1 and CYP2B inductions produced by PBDEs and OCs experimental treatment in cultured cetaceans fibroblasts (*Stenella coeruleoalba* and *Tursiops truncatus*). In a second phase (*in vivo* experiments) we validated the WB analysis of CYP1A1 and CYP2B as a semi-quantitative detection tool in a series of calibration curves of CYP450 obtained by liver and skin of stranded specimens of *Tursiops truncatus*. Finally in a third phase (field applications) we applied the WB analysies of CYP1A1 and CYP2B as a semi-quantitative detection tool to explore the different exposure to OCs and PBDEs in three different sub-populations of Mediterranean *Stenella coeruleoalba*. These data represent a first attempt to propose the induction of CYP1A1 and CYP2B, detected by Western Blotting analysis, as a suitable biomarker of exposure to OCs and PBDEs in free-ranging cetaceans. The future application of this methodology will be discussed in the Pollution 2000+ IWC-Workshop held in Barcelona (11-12 April 2007). This project was supported by the Italian Ministry for Environment and Territory .

SC/59/EM

1. NO PAPER.

2. NICOL, S., CROXALL, J., TRATHAN, P., GALES, N. and MURPHY, E. Paradigm misplaced: Antarctic marine ecosystems are affected by climate change as well as biological process and harvesting

3. NO PAPER.

4. NO PAPER.
5. NO PAPER.
6. NO PAPER.
7. SC-CCAMLR STEERING COMMITTEE and SC-IWC STEERING COMMITTEE FOR THE CCAMLR-IWC WORKSHOP. CCAMLR-IWC Workshop on Antarctic Ecosystem Model Inputs.

SC/59/IA

1. ENSOR, P., KOMIYA, H., BEASLEY, I., FUKUTOME, K., OLSON, P. and TSUDA, Y. 2006-2007 International Whaling Commission-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) Cruise. 58pp.

We conducted the 29th annual IWC-SOWER (formerly IDCR) Cruise in the western part of Antarctic Area III (000°-020°E) aboard the Japanese Research Vessel Shonan Maru No.2. The cruise departed Cape Town, South Africa on 21 December 2006 and returned to Cape Town on 23 February 2007. The cruise had two primary research components: fin whale population research in latitudes north of 60°S; and survey experiments designed to improve and interpret estimates of minke whale abundance from previous cruises. After departing Cape Town, the ship first transited south to the research area for fin whales, located between latitudes 55°S and 61°S. From 27 December to 2 January a visual survey for fin whales was conducted in Closing Mode. A total of 100.29 nmiles of trackline were covered in primary searching and 16 groups of fin whales (comprising 43 animals) were detected. Humpback whales were the most frequently sighted species in the fin whale research area with 53 groups/102 animals detected. Minke whale research was carried out from 4 January to 13 February in the vicinity of the ice edge. The focus of this research component was to evaluate BT mode (Buckland and Turnock, 1992) survey methodology and to conduct school size estimation experiments. 2,258 nmiles of trackline were surveyed during the minke whale research, including 1,482 nmiles in two BT modes and 634 nmiles during two school size estimation experiments. Minke whales were the most frequently sighted species in this research area, totaling 651 groups/2,174 animals. During the cruise, additional research was carried out on blue whales and humpback whales. 55 groups of 125 blue whales were sighted (121 individuals were identified as true blue whales). Of these, biopsies were collected from 72 whales and photo-id images collected from 114 whales. Acoustics recording was conducted at a total of 55 stations using sonobuoys. Sounds attributed to blue whales were recorded at 40 of 45 stations conducted in the vicinity of blue whale sightings. During the cruise, biopsy samples were collected from 15 fin whales. All of the biopsied fin whales but one, were photographed. Biopsy samples were also collected from 72 humpback whales and photo-id images from 160 including all the biopsied whales but three. Other notable sightings during the cruise were a group of six Layard's beaked whales including one calf, and seven sightings of killer whales. Five of the killer whale groups were identified as Type B. One group could not be identified to type because of unique pigmentation including very small eyepatches. During SOWER 2006-2007 the Estimated Angle and Distance Training Exercise and Experiment was completed as in previous years.

2. HEDLEY, S., BRAVINGTON, M., GALES, N., KELLY, N. and PEEL, D. Aerial survey for minke whales off eastern Antarctica.
3. HEDLEY, S., BRAVINGTON, M. and PEEL, D. Design of future SOWER cruises.
4. PUNT, A.E. and POLACHECK, T. Further development of statistical catch-at-age models for southern hemisphere minke whales.
5. BURT, M.L. and HUGHES, M.S. Analysis of the BT mode experiments from the 2005/2006 IWC-SOWER cruise. 13pp.

IWC sightings surveys which have taken place in the Antarctic since 1978/79. In order to interpret the minke whale abundance estimates obtained from data collected on these surveys and to improve the survey design of future cruises, BT mode experiments were conducted during the IWC-SOWER 2005/06 cruise. The BT mode survey method combines mark-recapture and line transect methods to overcome difficulties associated with conventional distance sampling survey methods (i.e. ensuring that animals on the trackline are certain to be seen and that they are seen before they have moved in response to the vessel). The data was divided according to the type of binoculars used (either 7x50 binoculars or higher powered big eye binoculars) and separate analyses were conducted. The results suggested that there were differences between these two sets of analyses but it was not clear why. Further BT mode experiments and analysis of previous sighting survey data would be required to better understand these results.

6. BURT, M.L. Abundance estimates of minke whales by 10° longitudinal sectors from IDCR-SOWER surveys. 10pp.

The Antarctic has been divided into thirty-six 10° longitudinal sectors. For each IDCR-SOWER survey the sighting rate, school size, school density, whale density and whale abundance have been estimated for each sector. Estimates of whale density are presented here.

7. BRANCH, T.A. Possible reasons for the appreciable decrease in abundance estimates for Antarctic minke whales from the IDCR/SOWER surveys between the second and third circumpolar sets of cruises.
8. LEAPER, R. A note on stomach contents analysis from JARPA. 4pp.

The diurnal variation of weight of stomach contents of Antarctic minke whales taken under JARPA in the Southern Ocean have been used to estimate mean daily prey consumption (Tamura and Konishi, 2006). They estimated mean daily consumption of krill of 4.39-4.95% of whale body mass. These estimates are particularly sensitive to assumptions about digestion rates for which few data are available. They are also complicated by the lack of night time data between 22:00 and 03:00 which may include the peak feeding period. The diurnal patterns in stomach weight contents reported by Tamura and Konishi (2006) would appear consistent with no feeding during the period 03:00 to 18:00 or alternatively a prey consumption of 2.8% of whale body mass over the same period if it is assumed that 20% of prey remains undigested after four hours. The resulting range of estimates for mean daily consumption is around 1.5% – 7%. This range covers what might be considered the plausible range of values. However, despite large sample sizes (6777 whales), the current data set does not appear able to narrow this range.

9. OLSON, P.A. Report of blue whale photo-identification from IWC-SOWER 2006/2007, Area IIIW.

Blue whale photographs were collected from the *Shonan Maru No. 2* during the IWC-SOWER Antarctic cruise conducted in Area IIIW, December 2006 to February 2007. 114 individual blue whales were photo-identified from 47 groups. Photographs of whales were compared between days to determine the number of re-sightings of individual whales over space and time during the cruise. The time interval and distance between re-sightings is presented. The proportion of re-sights is compared with the proportion from the 2005/2006 IWC-SOWER cruise (11%), also conducted in Area IIIW. The movement of whales in Area IIIW during both research seasons is examined. Photo-identification data from IWC-SOWER cruises contributes, *inter alia*, toward the assessment of blue whales in the Southern Ocean.

10. OLSON, P.A. Status of the archival and analysis of blue whale photographs from IWC IDCR-SOWER cruises.

Archiving and analysis of blue whale photographs collected during IWC IDCR-SOWER cruises has been undertaken to aid, *inter alia*, in the assessment of Southern Hemisphere blue whales. Over 21,000 identification photographs of blue whales were collected during 18 IWC IDCR-SOWER Antarctic cruises conducted from 1987/88 to 2006/07. Photographs were obtained from all six IWC Management Areas and represent

308 individuals. Available film from the 1987/1988 to 2002/2003 cruises has been gathered at SWFSC in combination with the digital images of blue whales collected during the four most recent cruises. The film is being digitized to facilitate archiving, analysis and the creation of a photo-ID catalogue. Photographs from Area III have been cross-referenced to identify re-sighted individuals, locations and re-sighting rates for that region.

11. HAKAMADA, T., MATSUOKA, K. and NISHIWAKI, S. Progress on the abundance estimation of Antarctic minke whales from JARPA sighting surveys.

12. MURASE, H. and KITAKADO, T. Exploration of GAM based abundance estimation method of Antarctic minke whales to take into account environmental effects.

13. MORI, M., BUTTERWORTH, D.S. and KITAKADO, T. Further progress on ADAPT-VPA to Antarctic minke whales. 32pp.

The ADAPT-VPA assessment methodology originally developed by Butterworth *et al*. (1999) has been appreciably advanced by taking into account various comments made during a series of IWC-SC meetings and is applied here to abundance estimates (from both IDCR/SOWER and JARPA surveys) as well as catch at age data (both commercial and scientific) for the I and P-stocks of Antarctic minke whales. The improvements to the methodology allow account to be taken of various further aspects, primarily: 1) inter-annual differences in the distribution of the population between different management Areas, 2) a stock-recruitment relationship, 3) the effects of possible ageing-error, and 4) the effects of possible change in age-at-sexual maturity over time as indicated by analyses of readings of transition phases in ear plugs. Furthermore sensitivities to various functional forms for selectivity and natural mortality with age are explored. The general pattern shown by analysis for both stocks is of a minke whale abundance trend that increased over the middle decades of the 20th Century to peak at about 1970, and then stabilized or declined somewhat for the next three decades. The recruitment trend is similar, though with its peak slightly earlier. The annual natural mortality rate, *M*, is estimated to be 0.056 with a CV of 0.16 for the I-stock, and 0.069 with a CV of 0.15 for the P-stock for the "Reference case" assessments. When only the JARPA abundance estimates are used for tuning, *M* is estimated as 0.037 and 0.060 for the I- and P-stocks, respectively. The estimation of *M* is fairly robust to the various assumptions of the model. This analysis is considered preliminary, as conclusions relating to estimates of *M* and trends in abundance and recruitment obtained using this approach await further revisions of 1) abundance estimates obtained from IDCR and JARPA surveys, and 2) error-models for the catch-at-age data, particularly those obtained from the commercial harvests.

14. OKAMURA, H. and KITAKADO, T. Abundance estimates of Southern Hemisphere minke whales from the IDCR-SOWER surveys using a hazard probability model.

15. OKAMURA, H. and KITAKADO, T. Simulation results of Southern Hemisphere minke whale abundance surveys using a hazard probability model.

16. SHIMADA, H., BURT, M.L. and KATO, A. Population assessment of the Antarctic minke whale within and out of the ice field using a sighting data on the Ice Breaker and the IWC SOWER vessels in 2004/2005.

17. SHIMADA, H. Relationship between minke whale abundance and pack ice extent examined by 10° longitudinal slices.

18. POLACHECK, T. Summary of responses to a length-meausrement and age-reading questionnaire on Southern Hemisphere minke whales. 8pp.

A summary is provided of responses from experienced researchers to a questionnaire on minke whale aging and length measuring. Such a questionnaire was identified as a high priority for inter-sessional work at last year's IWC SC meeting, and was prepared by the e-mail intersessional group on VPA analysis related to Southern Hemisphere minke whales. Although the sample size was small, the responses confirm that there are still unresolved issues in the age reading of earplugs from Southern Hemisphere minke whales. The two most significant issues based on the questionnaire are: (1) the assessment of the readability of individual earplugs, and (2) undercounting of bands in older animals as the result of tight packing of growth layers. The consequence of nonmigration on the formation of growth layers is also a potentially a source of bias in age estimates. Resolution of these issues remains a high priority for the completion of the minke whale catch-at-age analyses. Their resolution will most likely require further collaborative and comparative earplug readings and analyses among readers with different assessments of the extent to which both non-readability and tight packing occur.

19. WADE, P.R. A review of the coverage of strata and the sequence relative to the ice edge during JARPA.

20. SCHEIDAT, M., KOCK, K.H., FRIEDLAENDER, A., LEHNERT, L. and WILLIAMS, R. Using helicopters to survey Antarctic minke whale abundance in the ice. 10pp.

During the ANT XXIII/8 cruise (November 26th 2006 to January 29th 2007) the German research vessel 'Polarstern' surveyed waters of the Weddell Sea. The helicopters on board were used to conduct surveys for minke whales in the pack ice as well as areas around the Antarctic Peninsula (Antarctic Sound, around James Ross Island, Larsen A and B). Helicopter surveys followed line transect distance sampling protocol flying 'ad hoc' survey patterns as well as pre-designed tracklines covering a total of 8619km. Environmental information was collected continuously during the surveys and included percent ice coverage. A total of 71 sightings of 155 minke whales were recorded. The mean group size was 2.18 with a maximum group size of 7 animals. Sighting rates were lowest in the surveys in the pack-ice with a mean of 0.0021 sightings per km. Sighting rates were 0.0034 for the Larsen A area, 0.006 in Larsen B and 0.026 in the Antarctic Sound. The highest sighting rates were found in the area around James Ross Island (0.074 sightings/km). The helicopter work off the Polarstern showed that helicopters can be a useful survey platform for cetacean surveys. They cover large distances effectively and, in comparison to ship surveys, they are especially well suited to survey areas with higher ice coverage.

21. SCHEIDAT, M., KOCK, K.H., FRIEDLAENDER, A., LEHNERT, L. and WILLIAMS, R. Preliminary results of aerial surveys around Elephant Island and the South Shetland Islands. 7pp.

From 19 December 2006 to 6 January 2007 Germany carried out a CCAMLR – dedicated fish programme from board RV 'Polarstern' (Polarstern ANT 23-8) in the Elephant Island, the South Shetland Islands and Joinville – D'Urville Islands region. This allowed for the opportunity to conduct a helicopter based cetacean survey in the same area parallel to the fish work. A total of 2570nm were covered on survey effort with the helicopter. During this time a total of 39 sightings with 91 animals were recorded. The sightings included four different baleen whale species: humpback whale (*Megeptera novaeangliae*), fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*) and Antarctic minke whale (*Balaenoptera bonaerensis*). Using the helicopter in addition with digital photography allowed the identification of three different beaked whale species: southern bottlenose whale (*Hyperoodon planifrons*), strap-toothed whale (*Mesoplodon layardii*) and Gray's beaked whale (*Mesoplodon grayi*). The different cetacean species showed a clear spatial segregation in the study area. Humpback whales occurred in a mean water depth of 254m, whereas fin whales occurred on the outer shelf and on the slope at a mean depth of 1106. Beaked whales were sighted in much deeper waters with a mean depth of 3198m.

22. BUTTERWORTH, D.S. and MORI, M. On the compatibility of results from ADAPT-VPA and transition-phase-based trends in age-at-maturity for the I stock of Antarctic minke whales. 5pp.

A counter example is provided to show that inferences of incompatibility between population trends from ADAPT-VPA and independently estimated changes in the age-at-sexual-maturity of Antarctic minke whales over the late 1940s to late 1960s are not robust to plausible variants of the ADAPT-VPA assessment (specifically in this case admitting the possibility of a small negative slope in selectivity at larger ages). Final conclusions on this matter should await fuller investigations on the ability to the ADAPT-VPA estimator to reliably estimate the shape of the time-trend in carrying capacity over this period, upon which inferences of compatibility or otherwise are critically dependent.

SC/59/NPM

1. PARK, K.J., AN, Y.R., CHOI, S.G. and KIM, Z.G. Abundance estimation of northwest Pacific minke whales using the Korean sighting survey in 2006.
2. AN, Y.R., CHOI, S.G. and KIM, Z.G. Plan for the Korean sighting surveys in the North Pacific in 2007.
3. MIYASHITA, T. Cruise report of the IO sighting survey in the Northern Sea of Japan in 2006. 7pp.

From 18 May to 28 June in 2006, the IO passing mode sighting survey using a research vessel *Kaiko-maru* was conducted in the northern Sea of Japan to get the information on distribution and abundance of common minke whales. The permission to enter the Russian 200 n.miles EEZ from the Russian Federation was issued and the survey was firstly conducted in the continental side of the Sea. During the research distance of 1,421.6 n.miles, a total of 51 schools (55 animals) of common minke whales were primarily sighted and the IO sighting data was obtained. This suggests that there is enormous biomass of common minke whales in the continental side of the Sea. The vessel also observed fin whales and humpback whales in the research area.

4. MIYASHITA, T. and OKAMURA, H. Abundance estimate of common minke whales in the Russian EEZ of the Sea of Japan.
5. GOVERNMENT OF JAPAN. Proposed Schedule amendment to permit the catching of minke whales from the Okhotsk Sea-West Pacific stock by small-type coastal whaling vessels. Includes appendices. 50pp.

SC/59/O

1. SKAUG, H.J., BÉRUBÉ, M., REW, M.B. and PALSBØLL, P. Genetic analyses reveal promiscuous mating in female minke whales, *Balaenoptera acutorostrata*. 8pp.
2. OHSUMI, S., GOTO, M. and OTANI, S. Application of lethal and non-lethal research methods for JARPA.
3. GOVERNMENT OF JAPAN. Evaluation of 2005/06 and 2006/07 feasibility study of the Second Phase of the Japanese Whale Research Program under Special Permit in the Antarctic (JARPA II).
4. NISHIWAKI, S. Cruise report of the Second Phase of the Japanese Whale Research Program under Special Permit in the Antarctic (JARPA II) in 2006/07 - Feasibility study.
5. TAMURA, T. Cruise report of the Second Phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPN II) in 2006 (part 1) - offshore component.
6. GOTO, M. Cruise report of the Second Phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPN II) in 2006 - coastal component off Sanriku.
7. GOTO, M. Cruise report of the Second Phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPN II) in 2006 - coastal component off Kushiro.
8. KATO, H. and ZENITANI, R. Current status and future plan of age reading in baleen whales by earplugs in Japan.
9. TAMURA, T. and KONISHI, K. Additional analysis on the stomach contents weight of the Antarctic minke whale *Balaenoptera bonaerensis* in the Southern Ocean.
10. KONISHI, K., TAMURA, T. and WALLØE, L. Decline in energy storage in the Antarctic minke whale *Balaenoptera bonaerensis* in the Southern Ocean.
11. KAWAHARA, H. Concept of the ecosystem models developed in JARPN II program.
12. KAWAHARA, H. Multspec-type ecosystem modelling in the JARPN II offshore survey area.
13. MORI, M. and HAKAMADA, T. Some initial progress on the ecosystem modeling of the JARPN II survey area using Ecopath-with-Ecosim.
14. OKAMURA, H. A Bayesian assessment model of the effects on consumption by marine mammals on sandlances.
15. PERRIN, W.F. and BROWNELL, R.L. Proposed updates to the list of recognised species of cetaceans. 4pp.

Addition of three species to the list is recommended based on recent literature. (*Orcaella brevirostris*) has been split into the Irrawaddy dolphin (*O. brevirostris*) and the Australian snubfin dolphin (*O. heinsohni*). *Sotalia fluviatilis* has been split into the riverine tucuxi (*S. fluviatilis*) and the marine "costero" (*S. guianensis*). Evidence to support both of these splits is convincing, and we recommend that they be recognized in the list. The existence of the Bryde's-whale-like species described in 2003 as *Balaenoptera omurai* has been confirmed with additional genetic (nuclear) data. While the species clearly exists, the nomenclature is still unsettled because the genetic identity of the holotype specimen of *Balaenoptera edeni* has not yet been determined. However, the name *B. omurai* is gaining wide usage in application to the new species, and we propose that it be used provisionally by the Scientific Committee pending the genetic identification of the *B. edeni* holotype. We recommend that India be urged to facilitate the identification. We recommend continued use of the name *Balaenoptera edeni* provisionally for both the "ordinary" large form and the small coastal form, recognising that further genetic and morphological research may justify recognition of two species: *B. brydei* and *B. edeni*. We also recommend that any new specimen be referred to *B. omurai* only after its mtDNA has been sequenced and found to support the identification.

16. VÍKINGSSON, G., ÓLAFSDOTTIR, D., GUNNLAUGSSON, T., HALLDORSSON, S.D., GALAN, A., SVANSSON, V., KJELD, M., DANIELSDOTTIR, A.K., GISLASON, D., AUDUNSSON, G.A., PALMADOTTIR, H., GUNNLAUGSDOTTIR, H., STEFANSSON, M., HJARTARSDOTTIR, S. and PIKE, D.G. Research programme on

common minke whales (*Balaenoptera acutorostrata*) in Icelandic waters - a progress report May 2007
17. AGUILAR, A., BORRELL, A. and GOMEZ-CAMPOS, E. The reliability of blubber thickness as a measure of body condition in cetaceans.

SC/59/PFI
1. ROBBINS, J. Photo-ID studies on North Atlantic fin whales.
2. PASTENE, L.A., KAWAHARA, S. and HATANAKA, H. Concepts for a research programme on North Pacific Bryde's whale - RMP Variant 2 with research. 5pp.

During the Second Intersessional Workshop on western North Pacific Bryde's whale RMP *Implementation* the conservation performance of each trial and RMP variant was examined. In reviewing trials results the Workshop agreed that Variants 1, 3 and 4 were 'acceptable without research' (conservation performance was acceptable for both 'high' and 'medium' weight trials) while Variant 2 had acceptable performance for all 'high' weight trials but it was 'unacceptable' for three 'medium' weight trials, therefore this variant could not be ranked 'accepted without research'. All these trials are related to stock structure hypothesis 4, which involve sub-stock structure within sub-area 1. This paper presents the concepts for a research program on western North Pacific Bryde's whale focused to elucidate the possibility of sub-stock structure in sub-area 1.

3. SHIMADA, H. Population abundance of the western North Pacific Bryde's whales for CLA of RMP using sighting data from 1998 to 2002 under the RMS guidelines.

SC/59/RMP
1. PUNT, A.E. and ALLISON, C. Results of additional Bryde's whale *Implementation Simulation Trials*.
2. PUNT, A.E. and BREIWICK, J. The implications of different tunings of the *CLA* for single stock and NE Atlantic minke trials. 8pp.

A semi-automatic approach for selecting the values for the tuning parameters of the Catch Limit Algorithm (CLA) is outlined. It appears that tuning the CLA re-seeding the andom number seed after each simulation leads to more stable behaviour. The implications of applying alternative tunings of the CLA to the multi-stock scenarios represented by management of the minke whales in the North Atlantic (with particular focus on the North East Atlantic) are explored. As expected, the 0.66 tuning of the CLA leads to performance that is 'borderline' according to the criteria evaluated by Punt and Allison (2006), while the 0.72 tuning of the CLA satisfies the criteria for 'acceptable' performance and the 0.6 tuning of the CLA leads to performance that would be deemed to be 'unacceptable'.

3. ØIEN, N. and SCHWEDER, T. On the surfacing rate in minke whales in the northeastern Atlantic.
4. ALDRIN, M. and HUSEBY, R.B. Simulation trials 2007 for a re-tuned Catch Limit Algorithm.
5. ØIEN, N. Report of the Norwegian 2006 survey for minke whales in the Small Management Area EW in the northeast Atlantic.

As part of a six-year program over the period 2002-2007 with the aim to get a new estimate of minke whale abundance in the Northeast Atlantic, the eastern Norwegian Sea including the coastal areas off northern Norway, comprising the Small Management Area EW, was surveyed with two vessels during the summer 2006. There were four planned blocks with a planned basic coverage of about 2,150 nautical miles. In total about 2,300 nautical miles were searched with primary effort. The most common species sighted were minke whales (69 groups seen from the primary platform), sperm whales (55 groups), Lagenorhynchus dolphins (49 groups), killer whales (32 groups), harbour porpoises (26 groups) and fin whales (12 groups). Opportunistic collections were made of biopsy samples from 11 minke whales, one fin whale, one humpback whale and three sperm whales, and photo IDs were collected from two humpback whales and 14 minke whales.

6. ØIEN, N., BØTHUN, G. and KLEIVANE, L. Update on available data on surfacing rates of northeastern Atlantic minke whales.

We present results from radio tagging of five minke whales in the Norwegian Sea and Svalbard areas and compare them to earlier radio-tagging and visual experiments to determine surfacing rates for use in estimation of abundance of minke whales in the Northeast Atlantic. While one of the whales was followed for less than 3 hours, the other four were followed over periods of 19-40 hours. They showed large individual variation in hourly blow rates which is of the same order as variation between individuals which spans the range 33-72 blows/whale/hour. The mean intersurfacing interval of 18 minke whales radio-tagged in Norwegian waters is 77.31 s, corresponding to a blow rate of 46.6 blows/whale/hour.

7. ØIEN, N. Planning of annual partial sighting surveys over the six-year period 2008-2013 to estimates abundance of minke whales in the northeastern Atlantic.

SC/59/SD
1. CIPRIANO, F. New methods developed for human forensics used for identifying cetacean products in commercially-available non-food items.

DNA analysis methods used for whale product identification are dependent on extraction and PCR amplification of cetacean nucleic acids, but certain product types and intensive processing may restrict the amount of DNA recovered or degrade the DNA and inhibit amplification. Newly developed methods used for human forensic analysis provide more robust extraction and amplification from cetacean products, including: (1) bone demineralization procedures which can release 10X more DNA than standard methods, (2) a series of purification steps that can purify degraded and chemically treated DNA from "processed" samples, and (3) hemi-nested PCR amplification uses hierarchical PCR to amplify cetacean DNA with high specificity, even in a background containing degradation products and other inhibitors and DNA from other species. Initial trials using these new approaches were much better able to amplify, and in some cases precisely identify, DNA sequences from highly processed materials of several types.

2. HAALAND, O. and SKAUG, H. Preliminary estimates of error rates in the Norwegian minke whale DNA-register based on mother-fetus pairs.
3. MARTIEN, K.K., ARCHER, E., GREGOVICH, D. and TAYLOR, B.L. Simulation-based performance testing of the Bayesian clustering program STRUCTURE.
4. MARTIEN, K.K. and GREGOVICH, D. A champion's guide to the TOSSM package.

SC/59/SH

1. VERNAZZANI, B.G., CARLSON, C.A., CABRERA, E. and BROWNELL, R.L. Status of blue whales off Isla de Chiloe, Chile, during 2007 field season.

2. JOHNSTON, S.J. and BUTTERWORTH, D.S. Corrected assessment results for the Southern Hemisphere humpback whale breeding stocks D and G. 5pp.

Corrected Bayesian stock assessment results for breeding stocks D and G which take into account trend information from the IDCR/SOWER survey results are presented.

3. JOHNSTON, S.J. and BUTTERWORTH, D.S. Further stock assessment results of the Southern Hemisphere humpback whale breeding stock B.

4. JOHNSTON, S.J. and BUTTERWORTH, D.S. Further stock assessment results of the Southern Hemisphere humpback whale breeding stock C.

5. GEDAMKE, J., GALES, N., HILDEBRANDE, J. and WIGGINS, S. Seasonal occurrence of low frequency whale vocalizations across eastern Antarctic and southern Australian waters, February 2004 to February 2007.

6. GEDAMKE, J. A first attempt at estimating blue whale abundance from a systematic sonobuoy survey in Eastern Antarctic waters.

7. BRANCH, T.A. and MIKHALEV, Y. Female length at sexual maturity for pygmy and Antarctic blue whales based on Soviet ovarian corpora, 1961-72. 14pp.

Female blue whale ovarian corpora data were translated and encoded from the USSR's *Slava* (1961/62–1965/66) and *Sovietskaya Ukraina* (1961/62–1971/72) expeditions. Complete ovarian data were available for 1,425 blue whales (1,272 pygmy, 153 Antarctic). Catches north of 52°S were assumed to be pygmy blue whales (*Balaenoptera musculus brevicauda*), while those south of 56°S were assumed to be Antarctic (true) blue whales (*B. m. intermedia*), although there was some evidence for a small proportion (<1%) of both Antarctic blue whales north of 52°S and pygmy blue whales south of 56°S. A small proportion of lengths were rounded to the nearest metre, and many whales shorter than 18.0 were recorded as 18.0 m or greater (whale stretching). A Bayesian logistic model fitted to the data provided estimates of 50 L and 95 L (the lengths at which 50% and 95% of females are sexually mature). For pygmy blue whales 50 L was 19.2 m (95% interval 19.1–19.3 m) and 95 L was 20.5 m (95% interval 20.4–20.7 m). These estimates are more precise than those from Japanese data because the Soviet vessels recorded 32 times more pygmy blue whales shorter than the legal minimum length (21.3 m). Among small areas, 50 L varied from 18.4 to 19.9 m for pygmy blue whales; all estimates were much shorter than the 23.4 m from the Antarctic. The status of northern Indian Ocean pygmy blue whales is unclear: 50 L for these blue whales was statistically significantly shorter than 50 L for both the southern Indian Ocean and around Australia, but the magnitude of the differences was small: 0.5–0.6 m.

8. BRANCH, T.A. and FINDLAY, K. Blue whale abundance in offshore Chilean waters from the 1997/98 SOWER survey.

9. BRANCH, T.A. Abundance of Antarctic blue whales south of 60°S from three complete circumpolar sets of surveys. 17pp.

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

10. KATO. Distribution and abundance of pygmy blue whales and southern right whales from materials obtained through the 1995/96 Japan and IWC JV blue whale cruise.

11. FÉLIX, F., CABALLERO, S. and OLAVARRÍA, C. A preliminary assessment of the genetic diversity in humpback whales (*Megaptera novaeangliae*) from Ecuador and population differentiation with other Southern Hemisphere breeding grounds and feeding areas. 11pp.

Information on the genetic characterization of humpback whales (*Megaptera novaeangliae*) breeding off Ecuador (2º10'S; 81º00'W; Stock G) is presented. Mitochondrial DNA was extracted and sequenced from forty three skin samples collected between 1994 and 2006 to establish the genetic diversity of Ecuadorian humpback whales. Samples were obtained either from beached animals (n=6), biopsies (n=1) or sloughed skin (n=38). Haplotype diversity (h±SD) was estimated to be 0.884 ± 0.042% and the nucleotide diversity (π±SD) 1.84 ± 0.96%. When compared with six Southern Hemisphere breeding grounds and two Stock G feeding areas, five new unique haplotypes were observed. One of the shared haplotypes was only recorded in the Western Australian breeding ground. The phylogenetic analysis showed that Ecuadorian haplotypes were distributed in three of the four described clades in the Southern Hemisphere AE, CD and IJ, being absent from the SH clade. A pairwise Analysis of Molecular Variance (AMOVA) showed significant differentiation at both haplotype and nucleotide levels with all the Southern Pacific breeding grounds, except with Colombia. When compared with feeding areas, there were significant differences with Magellan Strait, but not with the Antarctic Peninsula. The AMOVA analysis suggests panmixia in the Stock G, but a larger sample is needed for a definitive conclusion.

12. ENGEL, M.H., MARCONDES, M.C.C., CASTRO, C., FORRESTELL, P., LLANO, M.E., GARITA, F., GARCIA-GODOS, I., SANTOS, M.R., NEVES, M., FERREIRA, S. and FONTES, F. Humpback whale photo-identification newteork in the south and central American breeding grounds.

A photoidentification workshop was held in Ubatuba, Brazil from March 09th to 13th 2007 with the aim of facilitate the collaboration of humpback whale researchers using photoidentification techniques within South and Central America waters. The group started a collaboration working towards a stardization of catalogues and a posterior matching of humpback whale fluke catalogues from all the breeding grounds in South and Central America including Brazil, Colombia, Ecuador, Panama, Costa Rica and Peru. The workshop participants agreed to form a a

humpback whale research working group to provide a forum to facilitate collaborative working partnerships among researchers from these humpback whale breeding grounds. This group is known as "Humpback Whale Photoidentification Network in the South and Central America Breeding Grounds". The Network will identify, prioritise and complete research on humpback whales to support management, develop a common format for exchange of data and key information, provide a forum for sharing skills and enhancing research techniques, and will facilitate peer-reviewed publications of humpback whale research. The group members will further develop the specific aims and objectives of the group, and define the structure, membership, operating guidelines, ethics and arrangements for sharing intellectual property. The current status of the six main humpback whale photo-identification datasets from South and Central Pacific and South Atlantic was defined. Improved protocols for managing humpback whale photo-identification datasets and databases will be developed by the Network. The workshop succeeded in meeting its objectives, and the formation of the Humpback Whale Photoidentification Network in the South and Central America Breeding Grounds represents an important initiative for developing future collaborative working relationships between humpback whale researchers in the region.

13. BELGRANO, J., MASELLO, J., GRIBAUDO, C., ARCUCCI, D., KROHLING, F., FAILLA, M. and IÑIGUEZ, M. Sightings of sei whales (*Balaenoptera borealis*) on the south western Atlantic. 3pp.

The sei whale, *Balaenoptera borealis* (Lesson, 1828) is distributed worldwide but favour temperate and oceanic waters. This note summarizes the results of 16 sightings of sei whales on the South Western Atlantic. .

14. GARRIGUE, C., BAKER, C.S., CONSTANTINE, R., POOLE, M., HAUSER, N., CLAPHAM, P., DONOGHUE, M., RUSSELL, K., PATON, D., MATTILA, D.K. and ROBBINS, J. Interchange of humpback whales in Oceania (South Pacific) 1999-2004 (SC/A06/HW55 revised).

15. GARRIGUE, C., FRANKLIN, T., RUSSELL, K., BURNS, D., POOLE, M., PATON, D., HAUSER, N., OREMUS, M., CONSTANTINE, R., CHILDERHOUSE, S., MATTILA, D.K., GIBBS, N., FRANKLIN, W., ROBBINS, J. and BAKER, C.S. First assessment of interchange of humpback whales between Oceania and the east coast of Australia.

16. HAUSER, N. Migratory destination of a satellite-tagged humpback whale in the Cook Islands.

17. ALLEN, J.M., CARLSON, C.A., HOLM, B. and STEVICK, P. Interim report: IWC Research Contract 16, Antarctic Humpback Whale Catalogue. 7pp.

SC/59/SM

1. CHOU, L.S., YU, H.Y. and BROWNELL, R.L. Killer whales in Taiwanese waters: population identity, biology and conservation status.

2. LARSEN, F. and KROG, C. Fishery trials with increased pinger spacing.

3. HERMAN, D.P., YLITALO, G.L., MATKIN, C.O., DURBAN, J.W., BRADLEY HANSON, M., DAHLHEIM, M.E., STRALEY, J.M., TILBURY, K.L. and KRAHN, M.M. Assessing the age-distributions of killer whale (*Orcinus orca*) populations from the composition of endogenous fatty acids in their outer-blubber layers.

Knowledge of the age distributions of endangered killer whale populations is a critical element in assessing the current health and long-term viability of these top-level predators. Currently, there is no reliable method to determine the specific age of live animals, particularly for remote populations that have not been continuously observed (i.e., historical photographic records maintained to track individuals beginning shortly after birth). Whereas allometric relationships (e.g., total length, dorsal fin height/width) enable individuals to be grouped into various age classes, they lack sufficient specificity to determine exact numerical ages, particularly for full-grown adult whales. To fill this gap in our knowledge of age structure, we describe methods by which their age can be deduced with varying degrees of precision from measurements of specific lipids (wax/sterol esters), specific endogenous fatty acids (short-chain mono-unsaturated, branched-chain, and odd-chain) and fatty acid ratios present in their outer-blubber layers. Whereas the correlation of wax/sterol esters with age was reasonably good for female resident killer whales, this correlation was much less pronounced for males and for transients. In contrast, individual short-, branched-, and odd-chain fatty acids correlated better with age for transients and residents of both sexes but these single parameter relationships were population specific, moderately scattered and seemingly varied with long-term diet. However, a simple, multi-linear equation model derived from the combination of two specific fatty acid ratios enables the ages of individual whales to be predicted with good precision (s = +3.8 years). This simple killer whale (age)-fatty acid ratio model appears to be independent of individual diet and should therefore be applicable to eastern North Pacific killer whale populations of both genders and ecotypes. The model was applied to several less well-studied resident and transient killer whale populations to predict their age distributions from their blubber fatty acid compositions and these distributions compared to a population of known age structure (i.e., West Coast Southern Residents). Most interestingly, these results provide some evidence for the first time that adult male transient killer whales appear to have a lower life expectancy than their resident counter-parts. Finally, a description of potential future research aimed at improving the precision of the killer whale (age)-fatty acid model is discussed.

4. BURDIN, A.M., HOYT, E., FILATOVA, O., IVKOVICH, T., TARASYAN, K. and SATO, H. Status of killer whales, *Orcinus orca*, in Eastern Kamchatka, Russia, based on photo-identification and acoustic studies. Preliminary results. 11pp.

From 1999-2006, a long-term study of killer whales (Orcinus orca) off eastern Kamchatka has conducted photoidentification and acoustic studies from a field station in Avacha Gulf. From 2002-2005, wide-area large ship surveys have expanded the study to other regions in the Russian Far East (RFE) including: northeast Kamchatka, Commander Islands, Chukotka, Kuril Islands and northeast Sakhalin. In this paper we mainly discuss the killer whale status on the eastern coast of Kamchatka, and give a brief review of available information regarding the killer whale status in other areas of the RFE. During the field seasons 2005-2006, a total of 434 individuals were identified in Avacha Gulf in at least three acoustic clans with different dialects. Most are resident-type fish-eating whales. Some transient-type marine mammal eating whales have also been recorded in Avacha Gulf and in other areas of the RFE. Transients as well as some residents show bites from the cookie cutter shark (Isistius brasiliensis) which may indicate long distance travel along the Asian coast or out to sea. To date, live captures have removed at least two subadult females from the Avacha Gulf residents. A live-capture quota of 6-10 killer whales in the RFE has been granted every year since 2002 (8 for 2007) although data remain inadequate to support this. The conflict between whales and fishermen in the Sea of Okhotsk due to killer whale depredation merits further study.

5. FOOTE, A.D., VÍKINGSSON, G., GUNNLAUGSSON, T., ØIEN, N., DAVIES, C.G., DUNN, T.E., HARVEY, P., WHOOLEY, P. and THOMPSON, P.M. Distribution and density of killer whales in the North East Atlantic. 10pp.

We present a review of sightings from across the NE Atlantic. In light of a large migration shift in the late 1960's by the Norwegian spring spawning herring *Clupea harengus* stock, a key prey species, we compare sightings from 1970 to present with whaling catch data from 1938 to

1967. Data from several large-scale line transect North Atlantic Sighting Surveys (NASS) in 1987, 1989, 1995 and 2001 are presented to show effort based sightings across this area and are analysed to assess the ability of this dataset to estimate any trend in abundance or density.

6. HOELZEL, A.R. and HEY, J. Multiple management units among con-specific populations of the killer whale in the North Pacific.

The killer whale as currently defined is a polytypic species, enough so that some have questioned its classification, suggesting that it may become appropriate to name new species. In the North Pacific behavioural distinctions define two ecotypes, the marine-mammal-eating 'transient' type, and the fish-eating 'resident' type. In this paper we discuss the available genetic data and show evidence for significant differentiation among geographic populations, and among populations in sympatry of different ecotype. At the same time, we show evidence for ongoing gene flow among all populations, including among ecotypes. We conclude that both ecotype and geographic distance are important factors defining population structure, and that management units should be defined both within and among ecotypes. We find no evidence in support of the designation of separate species among the putative populations studied.

7. MORRICE, M. Killer whales (*Orcinus orca*) in Australian territorial waters. 2pp.

8. FORTUNA, C.M., VACCHI, M. and LAURIANO, G. Occurrence and distribution of cetaceans in Terra Nova Bay (Ross Sea, Antarctica).

Cetacean presence around Terra Nova Bay (Ross Sea, Antarctica) has been anecdotally reported since early Italian scientific explorations. During 2003-2004 austral summer, data on presence and distribution of cetaceans were routinely collected from helicopter- and boat-based surveys along the coast, the perennial fast ice edge, and the seasonal fast ice, a core area of about 200 linear km around the "Mario Zucchelli" Italian Base. In addition to this data, information on opportunistic sightings of cetaceans, confirmed by videos and photographs, were collected (fourteen since 2001). These included a group of 8 Arnouxi's beaked whales (*Berardius arnuxii*), killer whales (*Orcinus orca*) and Antarctic minke whales (*Balaenoptera bonaerensis*). We present here a summary on 71 observations on cetaceans - 39 on killer whales, 17 on Antarctic minke whales, 9 on *Balaenoptera* spp., 2 on Arnouxi's beaked whales, and 4 on undetermined species. Group size of killer whale ranged between 1 and 30 individuals, with a median of 8 individuals. Calves were observed in all occasions of groups larger then 2 individuals. Most of the encounters were with type C killer whales; but on three occasions type B killer whales were recorded. The observed behaviour of these two types was very different, and consideration on the use of this area by both B and C form killer whales and observations on their feeding strategies will also be presented. Five killer whales were photo-identified and a certain number of re-sightings occurred. Group size of minke whales ranged between 1 and 3 individuals. Arnouxi's beaked whales were always solitary. Based on this pilot study it was possible to highlight different use patterns of the core area by killer whales, with a clear significant preference for an area (a sector) of about a 60 km along the ice shelf edge, between the Campbell glacier tongue and Cape Washington, an area with a water depth of around 200-500m. This part of the study area is characterised, and extended, by the perennial fast ice shelf, with seasonal fast ice and pack-ice at its edge. It hosts several species of top predator, including *Hydrurga leptonyx, Leptonychotes weddelli, Lobodon carcinophagus, Aptenodytes forsteri,* and *Pygoscelis adeliae*. The presence of such a high number of top predators appears to be a natural consequence of high local productivity in terms of phyto-, zooplankton and pelagic fishes abundances.

9. WADE, P.R., PARSONS, K. and BALCOMB, K. Population dynamics of southern resident killer whales.

10. DALLA ROSA, L. Occurrence and distribution of killer whales in waters of the Antarctic peninsula.

11. DALLA ROSA, L., SECCHI, E.R., LAILSON-BRITO, J. and AZEVEDO, A.F. Status of killer whales in Brazilian waters.

12. YAMADA, T.K., UNI, Y., AMANO, M., BROWNELL, J., R.L., SATO, H., ISHIKAWA, S., EZAKII, I., SASAMORI, K., TAKAHASHI, T., MASUDA, Y., YOSHIDA, T., TAJIMA, Y., MAKARA, M., ARAI, K., KAKUDA, T., HAYANO, A., SONE, E., NISHIDA, S., KOIKE, H., YATABE, A., KUBODERA, T., OMATA, Y., UMESHITA, Y., WATARAI, M., TACHIBANA, M., SASAKI, M., MURATA, K., SAKAI, Y., ASAKAWA, M., MIYOSHI, K., MIHARA, S., ANAN, Y., IKEMOTO, T., KAJIWARA, N., KUNISUE, T., KAMIKAWA, S., OCHI, Y., YANO, S. and S.TANABE. Biological indices obtained from a pod of killer whales entrapped by sea ice.

In February 2005, we experienced a tragic event of mass entrapment of killer whales by sea ice and their subsequent deaths in Rausu, Hokkaido northern Japan. There are killer whales in the seas around Japan. Ancient people left a variety of icons and figures representing killer whale figures. There were direct catches of killer whales during the mid 20th Century (Matsuura, 1938; Nishiwaki and Handa, 1958). Our knowledge of the killer whales in Japanese waters, however, is very limited. Only recently, Sato, et al, 2006 listed sighting records of killer whales in the coastal waters of Hokkaido. Few samples have been collected in the past for various reasons so the AKW tragedy turned out to be valuable opportunity to collect samples for various analyses that increased our understanding of these whales. Although we tried to undertake the investigation quickly, unfavourable climate conditions, financial difficulties, and other conditions prevented prompt action and we were not able to initiate the actual necropsies until about one week after the event. Although the temperature was between -5 to -15°C, most individuals were severely decomposed and detailed investigations such as analyses on pathology, reproductive biology, etc were not as successful as we had hoped. Stomach contents, tissue samples for molecular biology and contaminant analyses, teeth for age determination, and skeletons for exhibit were successfully collected with less influences of decomposition. Together with previously collected data and samples from sporadic fishery catches and stranding events, the AKW stranding was a very important event. The specimens and data collected will serve as a significant resource for future scientists.

13. KUNINGAS, S.M., SIMILÄ, T. and HAMMOND, P.S. Population dynamics of killer whales (*Orcinus orca*) off northern Norway.

14. GUERRERO-RUIZ, M., URBAN-R, J., GENDRON, D. and RODRIGUEZ, M.E. Prey items of killer whales in the Mexican Pacific.

15. URBAN-R, J., GUERRERO-RUIZ, M., CÁDENAS, G., GENDRON, D. and ROJAS-BRACHO, L. Current knowledge of killer whales in the Gulf of California.

SC/59/WW

1. PARSONS, E.C.M., LEWANDOWSKI, J. and LÜCK, M. Recent advances in whalewatching research: 2006-2007.

2. BEJDER, L., WHITEHEAD, H., SAMUELS, A. and ALLEN, S. An ethological framework for defining habituation, sensitisation and tolerance to anthropogenic stimuli. 12pp.

An important goal of scientific inquiry into effects of anthropogenic activity on wildlife is to provide a sound foundation for wildlife

conservation and management efforts. This objective, however, is often jeopardized by misinterpretation of the very science that professes to safeguard wildlife. In particular, imprecise or lax use of the terms, habituation, sensitisation and tolerance can lead to misinterpretation of research findings with unintended and potentially dire consequences for wildlife communities. The most noticeable example is colloquial use of the term behavioural habituation, to refer to any form of moderation in wildlife response to human disturbance. Because habituation is widely assumed to be a positive outcome for wildlife, such a misclassification can lead to inappropriate management decisions including an easing of conservation efforts. Clear definitions of terms, and rigorous methods for distinguishing among them are provided, thereby demonstrating that most cases of presumed habituation or sensitisation actually represent differences in the tolerance levels of wildlife to anthropogenic activity. This distinction is important because there are various mechanisms by which different tolerance levels can arise and by which habituation- and sensitisation-type responses can be explained. By characterizing explanatory mechanisms as learning, physiology, selection or ecology, it is shown that only one mechanism will result in true behavioural habituation (or sensitisation), while others will have detrimental outcomes for targeted animals. A framework is provided for literal and standardized use of terminology, and an empirical technique for discerning among explanatory mechanisms to detect true habituation and sensitisation responses is offered.

3. HIGHAM, J.E.S. and BEJDER, L. Wildlife-based tourism: edging slowly towards sustainability? 7pp.

4. HIGHAM, J.E.S., BEJDER, L. and LUSSEAU, D. Developing the marine mammal viewing industry: an integrated framework to address issues of long-term sustainability. 11pp.

5. ROSE, N.A. Development of sustainable cetacean watching in Peru. 2pp.

In an effort to reduce demand for black market dolphin meat, Mundo Azul, a Peruvian non-governmental organization (NGO), international NGOs, Peruvian government agencies, and the U.S. State Department are sponsoring a project to foster the development of sustainable cetacean watching in coastal communities, as a viable economic alternative to hunting and an incentive to protect coastal habitat. In 2006 and 2007, numerous workshops took place in various municipalities and an international conference was held in Lima, to address various aspects of cetacean watching. Two documents, one a national strategy for developing sustainable cetacean watching in Peru and one a generic plan for developing sustainable cetacean watching world-wide, have been produced as part of this project. Base-line research on bottlenose dolphins is on-going and dolphin watching pilot projects will be undertaken in the near future. Cetacean watching guidelines and monitoring programs will be established as soon as possible.

6. ROSE, N.A., PARSONS, E.C.M., SELLARES, R. and WEINRICH, M. Swim-with-whale tourism: an update on development of a questionnaire.

7. OLIVEIRA, C., GONCALVES, J.G., MAGALHAES, S., PRIETO, R., SILVA, M.A. and SANTOS, R.S. Whalewatching management in the Azores: an updated review of the regulations.

8. OLIVEIRA, C., GONCALVES, J.G., MAGALHAES, S., PRIETO, R., SILVA, M.A. and SANTOS, R.S. A social-economic perspective of the whalewatching activity in the Azores.

9. MAGALHAES, S., OLIVEIRA, C., PRIETO, R., SILVA, M.A. and SANTOS, R.S. Impact of whalewatching on cetaceans: assessing the appropriateness of existing regulations.

10. SIMMONDS, M.P. and STANSFIELD, L. Solitary sociable dolphins - an update from the UK. 7pp.

To date, at least 70 sociable and solitary cetaceans have been recorded worldwide and they seem to be part of a growing phenomenon of individual cetaceans that live in isolation from their societies and which actively seek contact with people. Such animals are very vulnerable to being injured or killed as a result of human actions. In a previous submission to the IWC Scientific Committee we provided an overview of the situation in UK waters (SC/58/WW5). Subsequent to this, one of the solitary bottlenose dolphins, *Tursiops truncatus*, previously reported on has died and another appears increasingly at risk. This paper provides a short update about this perplexing situation.

11. BENHAM, D. An update on the Dolphin Space Programme training and accreditation scheme for wildlife tour boat operators in the Moray Firth, Scotland. 10pp.

Provided here is a summary of progress made by the Dolphin Space Programme (DSP) training and accreditation scheme for wildlife tour operators in the Moray Firth, Scotland. In May 2005 a new DSP project officer was employed with support from Scottish Natural Heritage (SNH) and the Whale and Dolphin Conservation Society (WDCS), for a period of two years. Since then the DSP scheme has been reviewed and a number of significant changes and improvements made. These include increasing the benefits of membership for tour operators; leading to increased support for the scheme, development of a new DSP website (www.dolphinspace.org), regular meetings and workshops between DSP operators and steering group members, collaboration with the national WiSe (www.wisescheme.org) accreditation scheme to offer increased training and marketing opportunities for DSP members, development of new interpretation materials for DSP boats and training in interpretive and guiding skills, increased marketing and promotion of the DSP scheme and input into the new Scottish Marine Wildlife Watching Code (SMWWC). In addition, a new research project is planned for summer 2007 to investigate how successful the DSP is currently in protecting marine wildlife from disturbance due to tourism activities. SNH and WDCS have recently awarded the DSP further funding which will support the running costs of the DSP and project officer salary for a further two years. .

12. BARADELL, M.G. and RITTER, F. Swim-with-dolphin activities in the Azores - steps towards sustainability.

Swim-with-dolphin tourism is increasing worldwide, and with the success of this industry detrimental effects on the animals are feared. Here, we describe the swim-with activities based on wild dolphins carried out in the Azores to date. A distinction is made between On-the-day swim-with-trips, where tourists are taken out to sea on a day to day basis, with genrally little instruction given; and Guided swim-with tours, which last several days and give profound instruction about snorkelling in general and the swim-with dolphins attempt itself. We argue that the concept of Guided swim-with tours is a practicable way to minimize the disturbance of dolphins in their natural habitat, as well as to cope with safety risks when placing - sometimes unexperienced - swimmers in open water cetacean habitats. .

13. RITTER, F. Cetacean sightings in the northwest Atlantic Ocean during a commercial Arctic cruise, summer 2006.

Platforms of opportunity have proven to contribute to the body of knowledge about cetaceans, especially when data is collected by trained personnel following standard procedures. Here, cetacean sightings made during a journey on the Northwest Atlantic Ocean on board of a commercial cruise ship are reported. Date, time, species, groups size and geographical position were recorded, and photographs were taken opportunistically. Moreover, the responsive behaviour of cetaceans to the presence of the vessel was categorized. 60 sightings were made, comprising nine species from seven cetacean families. The behavioural observations showed that a greater proportion of animals showed no obvious response to the vessel. In two cases, the vessel passed at close range of large whales. The information collected resulted in valuable information on the distribution of several species and also may serve as an preliminary assessment of cetaceans' reactions towards large vessels. A proposal for the development of a standard protocol for cetacean sighting data collected on cruise ships is made.

14. TRITES, A.W., HOCHACHKA, W.M., CARTER, S.K., WONG, M.M. and WILLIAMS, R. Boats displace killer whales from a marine protected area. 25pp.

Movements of vessels and killer whales (*Orcinus orca*) were monitored during summer daylight hours from July to September (1991-94) to determine whether vessels affected killer whales in the Robson Bight - Michael Bigg Ecological Reserve, British Columbia. Killer whales were seen in all parts of the Reserve, but spent significantly more time near the rubbing beaches than anywhere else. Overall, killer whales partitioned their time in the Reserve among resting (12%), rubbing (25%) and other activities (63%). Vessels, primarily commercial fishing vessels, were observed entering the Reserve over 12,000 times during the 4-year study. They did not appear to have marked effects on the numbers of whales in the Reserve. However, vessels did appear to affect the movements of the whales in this near-shore habitat. Whales were more likely to move to another area of the Reserve or to leave the Reserve entirely when vessels were present than when they were absent, and were more sensitive to vessels near the rubbing beaches than anywhere else in the Reserve. Our findings suggest that boats can displace whales from areas that might be designated as critical habitat. However, the possible long-term consequences of such short-term effects are not known and require further study.

15. NO PAPER.

16. NO PAPER.

17. LUSSEAU, D., BEJDER, L., CARLSON, C.A., FORTUNA, C.M., PARSONS, E.C.M., ROBBINS, J., SIMMONDS, M.P., WEINRICH, M. and WILLIAMS, R. Workshop for strategic planning of large-scale whalewatching research. 3pp.

18. ASHE, E. and WILLIAMS, R. Feeding hotspots and whalewatching 'not-spots': using killer whale behaviour to prioritize vessel exclusion zones. 20pp.

Among other factors, vessel traffic has been implicated in the decline of the Endangered "southern resident" killer whales in the northeast Pacific. Notwithstanding recreational and industrial traffic, commercial whalewatching alone comprises more boats than there are killer whales to be watched. Requiem or refuge reserves present an obvious impact mitigation option, but they run the risk of tokenism if arbitrarily placed. Recent studies reported that resident killer whales were most vulnerable to vessel disturbance while feeding; therefore targeting foraging hotspots for protection should confer greater conservation benefit to whales than protecting their habitat generically. We present new results from two analyses of killer whale habitat use, using classification trees and spatial models, from data collected during May-September 2006 in the inshore waters near San Juan Island, Washington State (USA) and adjacent Canadian waters. The spatial resolution of our prediction grid was influenced by interviews with on-the-water boater education coordinators, which yielded a practical grid cell size within which boats could feasibly be excluded with existing financial resources and reasonable boater compliance. Our results showed that fairly minor adjustments to the boundaries of existing no-go zones would encompass greater portions of killer whale feeding areas. A recurring theme in the use of MPAs to protect cetaceans is the need to identify areas that are large enough to be biologically meaningful while being small enough to allow real management of human activities within those boundaries. Our approach, identifying areas that whales use primarily for activities in which they are particularly sensitive to anthropogenic disturbance, balances pragmatism and conservation benefit by identifying small, but important areas to prioritize for protection.

19. BOLAÑOS-JIMÉNEZ, J., HERRERA, O.L., PANZA, R. and VILLARROEL-MARIN, A. Preliminary assessment of marketing-related aspects on dolphin-watching in the Mochima National Park, northeastern Venezuela.

A good strategy for promoting dolphin-watching programs includes a proper approach for marketing-related issues. During the last 15 years, dolphin-watching has been made in the Mochima National Park (MNP) with no scientific support or legal authorization by relevant authorities. Marketing includes all of the activities involved in the conceptualizing, pricing and promoting of services like this. Here, we present the preliminary results of a marketing study designed to understand how people perceive dolphin-watching in the MNP, with the purpose of help environmental managers and business owners to best promote dolphinwatching in this protected area, in search for sustainability. A questionnaire was designed to elicit information about personal profile of passengers, accommodation, and their perception of both the quality of service and the effect of boats on the dolphin groups. The questionnaires were pilot tested on 21 representatives of family groups who had just arr ived from a watching trip. On the basis of this sample, our results indicate that – on average - these passengers are: professionals (62%) and businessmen (30%), Venezuelan (76%), married (52%), aged 20-40 (47%) , older than 40 (47%). On the other side, 52% of groups were accommodated in hotels or guests houses and 24% with f riends or relatives. Number of days in the hotel or guest house averaged 2.73. Regarding the service, 62% of passengers came to dolphin-watching because of personal recommendation from former passengers; on a scale of 1 (very deficient) to 5 (excellent) aspects related to quality of service were all ranked over 4. In opinion of responders, the interaction was beneficial for both the dolphins and people (62%) and neutral (29%) . Nobody perceived interactions as a threat for dolphins. 100% of responders would repeat and would recommend the experience. Scientific research on marketing, possible impacts and biological aspects of dolphins is strongly recommended in order to achieve sustainability.

20. YAZDI, P. Impact of tour boats on the behaviour and energetics of bottlenose dolphins (*Tursiops truncatus*) off Choros Island, Chile. 9pp.

The aim of this study was to examine how the activities and energetics of bottlenose dolphins off Choros Island, Chile, are affected by boats. Swimming speeds and movements of dolphins were recorded via theodolite tracking (n=21.3 observation hours). The results show that close boats (<100 m) affect the behaviour of bottlenose dolphins more strongly than boats further away (>100 m). The activity budget of dolphins did not change significantly with distant boats compared to controls. Close boats, however, induced a decrease of feeding (from 6% to 0%), resting (15% to 5%) and social behaviour (15% to 5%). The proportions of high-speed swimming (5% to 11%) and slow swimming (20% to 38%) increased. In the presence of close boats, dolphins were observed 6 times more frequently to leap and 3.6 times more frequently to tail-slap than under control conditions – an indication of disturbance. Dolphins responded to close boats with evasive manoeuvres similar to predator avoidance. With more than two close boats, animals swam approx. 37% faster than without close boats – a horizontal avoidance strategy. Diving as a vertical avoidance strategy constituted 16% of dolphin reactions towards close boats. In 14% of the cases, there was a simultaneous occurrence of horizontal and vertical avoidance behaviour. That was mostly the case, when several boats stayed a long time in the proximity of the dolphins. An energy consumption of 2.93 W kg-1 was calculated. This corresponds to a daily energy demand of 50.6 MJ per dolphin assuming 200 kg body mass. With boats at close range, the mean power requirement of dolphins was around 15.4% higher than during controls. With close boats, dolphins used a third of their energy budget to avoid boats by swimming at high speed. In the light of these findings, recommendations for dolphin-watching guidelines are given.

21. RITTER, F. Cetacean sightings in the North Atlantic Ocean during a commercial Arctic Cruise, summer 2006. 6pp.

Platforms of opportunity have been proven to contribute to the body of knowledge about cetaceans, especially when data is collected by trained personnel following standard procedures. Here, cetacean sightings made during a journey on the North Atlantic Ocean on board a commercial cruise ship are reported. Date, time, species, group size and position were recorded, and photographs were taken opportunistically. Moreover, the responsive behaviour of cetaceans to the presence of the vessel was categorized. 60 sightings were made, comprising nine species from five cetacean families. The behavioural observations showed that a greater proportion of animals showed no obvious response to the vessel. In two cases, the vessel passed within close range of large whales. The information collected resulted in valuable information on the distribution of several species and also may serve as an initial assessment of cetaceans' reactions towards large vessels. A proposal for the development of a

standard protocol for cetacean sighting data collected on cruise ships is made.

22. WILEY, D.N., MOLLER, J.C., PACE, R.M. and CARLSON, C.A. Are voluntary agreements an effective conservation tool? A case study using endangered whales and commercial whale watching in the Stellwagen Bank National Marine Sanctuary.

23. WEINRICH, M. and CORBELLI, C. Whale-watching in southern New England does not affect humpback whale (*Megaptera novaeangliae*) calving rates or calf survival.

24. CORBELLI, C. An evaluation of the impact of commercial whale watching on humpback whales (*Megaptera novaeangliae*) in Newfoundland and Labrador, and of the effectiveness of a voluntary code of conduct as a management strategy.

SC/59/Rep

1. Report of the Intersessional Workshop to Review Data and Results from Special Permit Research on Minke Whales in the Antarctic, Tokyo, 4-8 December 2006.

SC/59/ProgRep

Argentina. 11pp.
Australia. 28pp.
Belgium. 5pp.
Denmark. 5pp.
Germany. 12pp.
Norway. 8pp.
Portugal. 24pp.
Spain. 12pp.
USA. 43pp.

SC/59/Forinfo

1. MARTIEN, K.K., ARCHER, E. and TAYLOR, B.L. Genesis of simulated genetic data and sampling to emulate empirical bowhead whale samples. 6pp.

2. ANON. The Ross Sea, Antarctica, where all ecosystem processes still remain for study. CCAMLR Document WG-EMM-02/60. 22pp.

The Ross Sea is a well-defined embayment of Antarctica about the size of southern Europe, bounded by Victoria Land to the west; King Edward VII Peninsula, Marie Byrd Land, to the east; the Ross Ice Shelf to the south; and the Southern Ocean, Pacific Sector, to the north. Its waters are composed of two related biotic systems: the Ross Sea Shelf Ecosystem (RSShelfE) and the Ross Sea Slope Ecosystem (RSSlopeE). The RSShelfE is the last Large Marine Ecosystem on Earth (except the Weddell Sea) that has escaped direct anthropogenic alteration; the RSSlopeE, similar to all of Earth's other marine ecosystems, has lost its large baleen whales but otherwise is intact. A huge multidisciplinary, international scientific effort has been invested in studies of the geology, physics and biology of the Ross Sea over the past 45 years. In particular the activities of the US, NZ and Italian Antarctic programs have been a model of international scientific cooperation and collaboration. The successful result is an incredible wealth of knowledge, including long-term biological data sets, not available anywhere else in the Antarctic, which has documented clear signals of climate forcing, as well as top-down influences not confused by human exploitation or activity. Ironically, much remains unknown about how these ecosystems function. The Ross Sea is off limits to mineral extraction, but pressures on its biological resources are growing. The economic value of the resources should be weighed against the value of the system as a unique scientific resource. The Ross Sea represents an unparalleled natural laboratory in which the results of different fishery management strategies can be modeled in the context of short-term and decadal variation in biological populations, with these models applied elsewhere in the Southern Ocean and the World.

3. ANON. Acquiring a 'base datum of normality' for a marine ecosystem: the Ross Sea, Antarctica. CCAMLR Document WG-EMM-04/20. 18pp.

The Ross Sea Shelf Ecosystem (RSShelfE) offers the last chance to understand ecological processes in a system where both top-down and bottom-up forcing are still intact. Elsewhere in Earth's oceans the systems used for understanding ecological processes and fishery effects all have lacked significant, natural top-down forcing for such a long time that it is a concept rarely considered by researchers who currently investigate open-ocean systems. Herein, the importance of top-down forcing in pelagic and neritic marine ecosystems is reviewed with concrete evidence given for its existence in the current functioning of the RSShelfE. In spite of this unique evidence for the Antarctic region, much remains to be learned about cross-component interactions in the Ross Sea system. Should the RSShelfE be un-naturally altered, an easy accomplishment given increasing fishery pressure, we will have lost the last opportunity to understand the processes that take place in a healthy, complete marine ecosystem.

4. AINLEY, D., BALLARD, G., ACKLEY, S., BLIGHT, L.K., EASTMAN, J.T., EMSLIE, S.D., LESCROEL, A., OLAMASTRONI, S., TOWNSEND, S.E., TYNAN, C.T., WILSON, P. and WOEHLER, E. Paradigm lost, or is top-down forcing no longer significant in the Antarctic marine ecosystem? *Arctic Science*: in press. 15pp.

Investigations of the ecological structure and processes of the Southern Ocean in recent years almost exclusively have taken a bottom-up, forcing-by-physical-processes approach relating various species' population trends to climate change. Just 20 years ago, however, researchers focused on a broader set of hypotheses, in part formed around a paradigm positing interspecific interactions as central to structuring the ecosystem (forcing by biotic processes, top-down), and particularly on a "krill surplus" caused by the removal from the system of more than a million baleen whales. Since then, this latter idea has disappeared from favor with little debate. Moreover, it recently has been shown that concurrent with whaling was a massive depletion of finfish in the Southern Ocean, a finding also ignored in deference to climate-related explanations of ecosystem change. We present two examples from the literature, one involving gelatinous organisms and the other involving penguins, in which climate has been used to explain species' population trends but which could better be explained by including species

interactions in the modelling. We conclude by questioning the almost complete shift in paradigms that has occurred and discuss whether it is leading Southern Ocean marine ecological science in an instructive direction.

5. AINLEY, D., TONIOLO, V., BALLARD, G., BARTON, K., EASTMAN, J., KARL, B., FOCARDI, S., KOOYMAN, G., LYVER, P., OLMASTRONI, S., STEWART, B.S., TESTA, J.W. and WILSON, P. Managing ecosystem uncertainty: critical habitat and dietary overlap of top-predators in the Ross Sea. CCAMLR Document WG-EMM-06/29. 15pp.

We summarize three types of data in order to increase appreciation among fishery managers of the close spatial and temporal ecological overlaps among top predators in the Ross Sea Shelf Ecosystem (RSShE). This includes data on diet, foraging behavior, and habitat use. Murphy (1995) demonstrated that space-time overlap is critical to predicting the degree to which a fishery might affect a food web. The fisheries that we contemplate are those for Antarctic toothfish and the Antarctic minke whale, though other species might also soon be exploited in the Ross Sea region. In addition to those two predators we also include other trophic competitors and (and in two cases predatory species): killer whale (type C), Weddell seal, Emperor penguin, Adélie penguin, and 4 species of flighted birds. Using data from satellite tags attached to top predators that occur at colonies and haul outs along the coast of Victoria Land from 1990 through 2004, we summarize the foraging ranges from these sites and the habitats used for foraging. We also summarize data on diet and overlaps in foraging behavior among these predators from analyses of scats and stomach contents and time-depth-recorders collected from 1976 through 2002. Finally, we present results of ship-based surveys of birds and cetaceans made from 1976 through 1981. Though many of those species have not yet been studied using satellite telemetry, their diets have been investigated. Most top predators in the Ross Sea feed at relatively great depths, perhaps because this affords them access to waters under sea ice, which persists in this region except for late summer. Three of them are able to exploit the entire water column of the shelf, with others foraging from near surface to mid-depths. The major geographic habitats used include waters that are or were part of the marginal ice zone that rings the Ross Sea Polynya during spring and summer when primary production is in full swing. Waters over shallow banks, especially in the western region, also appear to be important habitats. Even for colonies of these predators that are near the shelfbreak, their foraging efforts appear to be restricted to waters overlying the upper slope and shelf although deeper waters are well within range. In the RSShE, the main prey species eaten by most of the listed predators is the Antarctic silverfish, which is a major predator of ice krill. Based on frequency of occurrence in the diet, the prevalence of silverfish among diving predators averages 70% (range 45-95%) and among near-to-surface predators averages 31% (range 4-53%). The other main prey species of RSShE top predators is ice krill. Antarctic krill replaces ice krill in the predators' diets over the Ross Sea continental slope and outer shelf waters. The key, and perhaps critical, foraging habitats of the seals and penguins from the colonies and haul-outs studied so far along the Victoria Land coast occur almost entirely within CCAMLR statistical area SSRU 88.1J and the southern third of 88.1H, one of the main SSRUs for harvests of Antarctic toothfish. We make recommendations for research needs related to top predators, including further assessments of population size and diet (including studies of fatty acid composition) from autumn through early spring when sea ice is most extensive, and simultaneous tracking of toothfish and cetaceans, especially the toothfish-eating killer whale.

6. AINLEY, D., BALLARD, G. and DUGGER, K.M. Competition among penguins and cetaceans reveals trophic cascades in the western Ross Sea, Antarctica. *Ecology* 87(8). 2080-93.

An apparent trophic cascade that appears during summer in the western Ross Sea, Antarctica, explains why the Antarctic silverfish (*Pleuragramma antarcticum*) there becomes cannibalistic; its principal prey, crystal krill (*Euphausia crystallorophias*) becomes scarce; and the diatom community is minimally grazed compared to adjacent areas. The krill is the major grazer of diatoms. On the basis of fieldwork at Ross Island, we suggest that the cascade results from foraging by unusually numerous Adelie Penguins (*Pygoscelis adeliae*), minke whales (*Balaenoptera bonaerensis*), and fish-eating killer whales (*Orcinus orca*). These species and other top predators apparently deplete the krill and silverfish. In drawing our conclusions, we were aided by two ''natural experiments.'' In one ''experiment,'' large, grounded icebergs altered the seasonal pattern of change in regional sea-ice cover, but not the seasonal change in penguin diet and foraging behavior that was also detected during the preiceberg era. In the other ''experiment,'' a short-term polynya (opening in the ice) brought penguins and whales together in a confined area, this time altering both penguin diet and foraging behavior. We conclude that the foraging of penguins and whales, and not a formerly hypothesized seasonal decrease in sea-ice cover, explains (1) the annual switch in the penguins' prey from krill to silverfish, (2) the subsequent lengthening of penguin foraging trips, and (3) a marked decline of cetaceans in the area later in the season. Reduction in the middle-trophiclevel prey is expressed in the relaxed grazing pressure on phytoplankton.

7. AINLEY, D., DUGGER, K.M., TONIOLO, V. and GAFFNEY, I. Cetacean occurrence patterns in the Amundsen and Southern Bellingshausen Sea sector, Southern Ocean. *Marine Mammal Science*. In press. 19pp.

We conducted 239.5 h and 3,494 km of cetacean surveys in the Amundsen and Bellingshausen seas, 15 February to 31 March 1994; most of the area, the large portion of which was ice covered, had never before nor has it since been surveyed for cetaceans, even to the date when this paper was prepared (2006). Logistic regression and an information-theoretic approach related the occurrence of Antarctic minke whales Balaenoptera bonaerensis (the most abundant species) to whether we were in open- or pack-ice-covered, pelagic or neritic waters, in or out of the marginal ice zone (MIZ), and north or south of the Antarctic Circumpolar Current southern boundary. Other variables included date and distance to the MIZ and shelf-break front. Statistical analysis showed that the probability of sighting a minke, as well as killer whale — but not the case for an index to whale density — was related to the proximity of coastal polynyas in early autumn, switching offshore to the MIZ once waters within the pack began to freeze persistently later in the season. Probability of detection was higher with distance into the MIZ. Supporting these findings, the density index was strongly related to ice concentration in an inverse relationship. The strong relationship to polynyas and the MIZ indicate that sea-ice divergence altered by decadal or longer-term climate change, as described in the recent literature, could well affect any apparent, long-term trends evident in this species' abundance if surveyed only in open or near-to-ice waters. We speculate on how the minke whale's pagophilic nature 1) could have been encouraged by largescale industrial whaling and by competition with species more characteristic of open waters and the outer MIZ; and 2) may have protected the population somewhat during industrial whaling resulting in the much greater abundance of this species now compared to other targeted species.

8. MELNIKOV, V.V. and ZEH, J.E. Chukotka Peninsula counts and estimates of the number of migrating bowhead whales. *J. Cetacean Res. Manage.* Submitted. 10pp.

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

9. ROJAS-BRACHO, L., REEVES, R.R. and JARAMILLO-LEGORRETA, A. Conservation of the vaquita *Phocoena sinus*. *Mammal Review* 36(3). 179-216.

1. The vaquita *Phocoena sinus* is a small porpoise that is endemic to the northern Gulf of California, Mexico. It is the most critically endangered marine small cetacean in the world. The most precise estimate of global abundance based on a 1997 survey is 567 (95% CI 177–1073).

2. Vaquitas mainly live north of 30°45′N and west of 114°20′W. Their 'core area' consists of about 2235 km2 centred around Rocas Consag, 40 km east of San Felipe, Baja California. Genetic analyses and population simulations suggest that the vaquita has always been rare, and that its extreme loss of genomic variability occurred over evolutionary time rather than being caused by human activities.

3. Gill nets for fish and shrimp cause very high rates of by-catch (entanglement) of vaquitas. Estimates of bycatch rates are from 1993–94 and refer to one of three main fishing ports: 84 per year (95% CI 14–155) using only data collected by observers and 39 per year (95% CI 14–93) using combined data from observers and interviews with fishermen. Boats from other ports may experience similar rates, and the total is probably well above what would be sustainable.

4. Other less well-characterized and longer-term risk factors include the potential for disturbance by trawling to affect vaquita behaviour, and the uncertain effects of dam construction on the Colorado River and the resultant loss of freshwater input to the upper Gulf. However, entanglement is the clearest and most immediate concern.

5. Progress towards reducing entanglement has been slow in spite of efforts to phase out gill nets in the vaquita's core range, and the development of schemes involving compensation for fishermen. The Biosphere Reserve in the northern Gulf has fallen far short of its potential for vaquita conservation. On 29 December 2005, the Mexican Ministry of Environment declared a Vaquita Refuge that contains within its borders the positions of approximately 80% of verified vaquita sightings. In the same decree, the state governments of Sonora and Baja California were offered $1 million to compensate affected fishermen. The effectiveness of this major initiative remains to be seen.

6. The vaquita's survival does not depend on more or better science but on improved management. As a funding priority, implementation of conservation measures and evaluation of their effectiveness should come ahead of more surveys or improved estimation of by-catch.

10. PITMAN, R.L., PERRYMAN, W.L., LEROI, D. and EILERS, E. A dwarf form of killer whale in Antarctica. *Journal of Mammalogy* 88(1). 43-48.

In the early 1980s, 2 groups of Soviet scientists independently described 1, possibly 2 new dwarf species of killer whales (*Orcinus*) from Antarctica. We used aerial photogrammetry to determine total length (TL) of 221 individual Type C killer whales—a fish-eating ecotype that inhabits dense pack ice—in the southern Ross Sea in January 2005. We confirmed it as one of the smallest killer whales known: TL of adult females (with calves) averaged 5.2 m 6 0.23 SD (n ¼ 33); adult males averaged 5.6 6 0.32 m (n ¼ 65), with the largest measuring 6.1 m. Female Type A killer whales—offshore mammal-eaters—from Soviet whaling data in the Southern Ocean were approximately 1–2 m longer, and males were 2–3 m (up to 50%) longer (maximum length 9.2 m). Killer whale communities from the North Atlantic and in waters around Japan also appear to support both a smaller, inshore, fish-eating form and a larger, offshore, mammal-eating form. We suggest that, at least in Antarctica, this degree of size dimorphism could result in reproductive isolation between sympatric ecotypes, which is consistent with hypotheses of multiple species of killer whales in the Southern Ocean.

11. SIMMONDS, M.P. and ISAAC, S.J. Review: the impacts of climate change on marine mammals: early signs of significant problems. *Oryx* 41(1). 19-26.

Climate change is now known to be affecting the oceans. It is widely anticipated that impacts on marine mammals will be mediated primarily via changes in prey distribution and abundance and that the more mobile (or otherwise adaptable) species may be able to respond to this to some extent. However, the extent of this adaptability is largely unknown. Meanwhile, within the last few years direct observations have been made of several marine mammal populations that illustrate reactions to climate change. These observations indicate that certain species and populations may be especially vulnerable, including those with a limited habitat range, such as the vaquita *Phocoena sinus*, or those for which sea ice provides an important part of their habitat, such as narwhals *Monodon monoceros*, bowhead *Balaena mysticetus* and beluga *Delphinapterus leucas* whales and polar bears *Ursus maritimus*. Similarly, there are concerns about those species that migrate to feeding grounds in polar regions because of rapidly changing conditions there, and this includes many baleen whale populations. This review highlights the need to take projected impacts into account in future conservation and management plans, including species assessments. How this should be done in an adequately precautionary manner offers a significant challenge to those involved in such processes, although it is possible to identify at this time at least some species and populations that may be regarded as especially vulnerable. Marine ecosystems modellers and marine mammal experts will need to work together to make such assessments and conservation plans as robust as possible. .

12. HEIDE-JØRGENSEN, M.P. and SIMON, M. Cue rates for common minke, fin and humpback whales in West Greenland. *J. Cetacean Res. Manage.* Submitted. 10pp.

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

13. HEIDE-JØRGENSEN, M.P., SIMON, M. and LAIDRE, K. Estimates of large whale abundance in Greenland waters from a ship-based survey in 2005. *J. Cetacean Res. Manage.* Submitted. 30pp.

A ship-based line transect survey of large whales in East and West Greenland was conducted in September 2005. The survey platform primarily targeted capelin, *Mallotus villosus*, using acoustic methods and systematically covered the east and west coasts of Greenland from the coast to the shelf break (approximately 200 m). The surveyed area comprised 81000 km2 in East Greenland and 225000 km2 in West Greenland. A total of 194 sightings of 13 cetacean species were obtained and standard line transect methods were used to derive abundance estimates of the four most commonly encountered large cetaceans. Fin whales, *Balaenoptera physalus*, were most abundant in East Greenland (3214, 95% CI 980-10547) with lower abundances estimated for West Greenland (1980, 95% CI 913-4296). Sei whales, *Balaenoptera borealis*, were frequently encountered in the same areas as the fin whale, but the estimated abundance in East Greenland (763, 95% CI 236-2465) was lower than in West Greenland (1599, 95% CI 690-3705). Humpback whales, *Megaptera novaeangliae*, were found both in offshore and coastal areas of West Greenland (1306, 95% CI 570-2989) and in low numbers in East Greenland (347, 95% CI 48-2515). Finally, minke whale, *Balaenoptera acutorostrata*, abundance was estimated at 1848 (95% CI 197-17348) for East Greenland and 4479 (95% CI 1760-11394) for West Greenland.

Inclusion of sightings of unidentified large baleen whales in West Greenland distributed in proportion to species and strata increased abundance estimates for fin, sei, and humpback whales to 2824 (95% CI 1346-5925), 2009 (95% CI 948-4260), and 1514 (95% CI 560-4089), respectively. Despite good conditions and considerable effort, few cetaceans were observed in the northernmost strata in West Greenland. This suggests that the southbound fall migration of large whales from Northwest Greenland had already started by the time the survey was initiated. The abundance estimates presented in this study are negatively biased. No corrections were applied for whales missed by observers or for whales submerged during the passage of the survey platform, which should cause a particularly large negative bias, 35 for the estimates of minke whale abundance.

14. LUBETKIN, S.C., ZEH, J.E., ROSA, C. and GEORGE, J.C. Age estimation for young bowhead whales (*Balaena mysticetus*) using baleen growth increments and their rates of change. 28pp.

We compiled age estimates and baleen plate δ13C data from 86 bowhead whales (*Balaena mysticetus*, L., 1758). We used previous whale age estimates based on aspartic acid racemization (AAR) and corpora counts to extend the use of δ13C data for age determination from cycle counting to a modified exponential model using annual baleen growth increments and their rate of change with age. Our two-fold approach used the growth increment data from individual whales in a non-linear mixed effects model to assess both population level and whale specific growth parameters, and used the rate of change in the annual baleen growth rate to check the model for internal consistency and effectively estimate standard errors for whales that we estimated ages for. Although age estimates from baleen based models become less precise as the whales age, and baleen growth and length near steady state, the growth increment and rate of change models show promise in estimating bowhead whale ages, especially in bowhead length ranges where other techniques are less precise or the data are scarce.

15. ROSA, C., O'HARA, T.M., HOEKSTRA, P.F., REFSAL, K.R. and BLAKE, J.E. Serum thyroid hormone concentrations and thyroid histomorphology as biomarkers in bowhead whales (*Balaena mysticetus*). *Canadian Journal of Zoology*. Accepted. 15pp.

Serum thyroid hormone (TH) concentrations have been used alone or with other measurements to assess health status or effects of toxicant exposure in marine mammals. Histological sections from thyroid glands of the bowhead whale (*Balaena mysticetus* L., 1758) were examined in conjunction with serological TH analyses. Serum was assayed for total and free triiodothyronine and total and free thyroxine via radioimmunoassay. Histomorphology of thyroid tissue was assessed via light microscopy and the utilization of an epithelial-follicular index (EFI). Age, sex or season did not significantly affect serum TH levels. However, TH concentrations in pregnant/lactating females were found to be significantly lower than other sex/reproductive groups investigated. The EFI and epithelial height (EH) were greater in spring subadult and adult whales than those landed in the fall. No correlation was found between serum TH concentrations and serum, blubber or liver levels of select polychlorinated biphenyl metabolites and organochlorine congeners examined. Low variability in concentrations of the serum THs across age, season and sex/reproductive groups supports the existence of strong homeostatic mechanisms for maintenance of TH concentrations in these presumably healthy animals. Departures from these ranges may indicate a disturbance in these regulatory mechanisms and may be a useful indication of toxicity or other health disorders.

16. HEIDE-JØRGENSEN, M.P. and LAIDRE, K. Autumn space-use patterns of humpback whales (*Megaptera novaeangliae*) in West Greenland. *J. Cetacean Res. Manage.* Submitted. 18pp.

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

17. HUGHES-HANKS, J.M., RICKARD, L.G., PANUSKA, C., SAUCIER, J.R., O'HARA, T.M., DEHN, L. and ROLLAND, R.M. Prevalence of *Cryptosporidium* spp. and *Giardia* spp. in five marine mammal species. *J. Parasitol.* 91(5). 1225-28.

Cryptosporidium spp. and *Giardia* spp. are protozoan parasites that are often associated with severe diarrheal disease in a variety of mammals. Although these parasites have been extensively studied in terrestrial ecosystems, little is known about either parasite in the marine environment. Therefore, the objective of this study was to determine the prevalence of both *Cryptosporidium* spp. and *Giardia* spp. in 5 marine mammal species. Fecal samples were collected from 39 bowhead whales (*Balaena mysticetus*), 49 North Atlantic right whales (*Eubalaena glacialis*), 31 ringed seals (*Phoca hispida*), 22 bearded seals (*Erignathus barbatus*), and 18 beluga whales (*Delphinapterus leucas*) between 1998 and 2003. Using an immunofluorescent assay, parasites were detected in the feces of bowhead whales, right whales, and ringed seals, while neither parasite was detected in samples from bearded seals or beluga whales. Overall, prevalences were highest in ringed seals (*Cryptosporidium* spp., 22.6%; *Giardia* spp., 64.5%) and right whales (*Cryptosporidium* spp., 24.5%; *Giardia* spp., 71.4%) and lowest in bowhead whales (*Cryptosporidium* spp., 5.1%; *Giardia* spp., 33.3%). To our knowledge, this is the first report of *Cryptosporidium* spp. and *Giardia* spp. in either whale species and of *Cryptosporidium* spp. in the ringed seal.

17 add. RICKARD, L.G., PANUSKA, C., O'HARA, T.M., PHARR, G.T. and ROLLAND, R.M. Genotypic analysis of *Giardia* from two whale species. 4pp.

18. RITTER, F. Behavioral responses of rough-toothed dolphins to a dead newborn calf. *Marine Mammal Science* 23(2). 429-33.

19. JOERGENSEN, M. First photographed observation of the harbour porpoise (*Phocoena phocoena*) in Svalbard. 2pp.

20. GUIMARAES, P.R., DE MENEZES, M.A., BAIRD, R.W., LUSSEAU, D., GUIMARAES, P. and DOS REIS, S.F. Vulnerability of a killer whale social network to disease outbreaks. *Physics Review E*. Submitted. 7pp.

Emerging infectious diseases are among the main threats to conservation of biodiversity. A crucial task facing epidemiologists is to predict the vulnerability of populations of endangered animals to disease outbreaks. In this context, the network structure of social interactions within animal populations may affect disease spreading. Using network theory, we show that the social structure of an endangered population of mammal-eating killer whales is vulnerable to disease outbreaks. This feature was found to be a consequence of the combined effects of the topology and strength of social links among individuals. Our results uncover a serious challenge for conservation of the species and its ecosystem. In addition, this study shows that network approach can be useful to study dynamical processes in very small networks.

21. SMITH, E., LUSSEAU, D. and WHITEHEAD, H. The effects of whalewatching in Pleasant Bay, Cape Breton, Nova

Scotia: balancing long-term benefits to whalewatchers and immediate behavioural changes in long-finned pilot whales (*Globicephala melas*). *Tourism Management*. Submitted. 15pp.

Whalewatching has dramatically increased since the 1950's. There are now concerns about the increased exposure of cetaceans to noise and the presence of tour boats. In some areas, whalewatching has significantly altered behavioral and energetic budgets and has had detrimental impacts on reproductive success and habitat use of the targeted populations. Whalewatching in Pleasant Bay, Nova Scotia is a relatively new industry that focuses on the long-finned pilot whale (*Globicephala melas*) population that spends the summer months in the Gulf of St Lawrence. We examined the satisfaction of the passengers aboard a whalewatching cruise, as well as the behavioral changes of the long-finned pilot whales when in the presence of the whalewatching boat. The most significant variables affecting customer satisfaction were the number and length of pilot whale encounters and the amount of cloud cover. The variables that most significantly influenced pilot whale direction of travel were the encounter, the time into the encounter and number of boats present. As encounters increased in duration, customer satisfaction increased, but pilot whale satisfaction appeared to decrease. To sustain this industry in Pleasant Bay, we suggest that encounters are limited to 20 minutes, a period which appears to limit negative reactions from pilot whales, but also maintains a highly satisfying tour for the passengers.

22. DALLA ROSA, L. and SECCHI, E.R. Killer whale (*Orcinus orca*) interactions with the tuna and swordfish longline fishery off southern and south-eastern Brazil: a comparison with shark interactions. *J. Mar. Biol. Ass. UK.* 87. 135-40.

Depredation by cetaceans and sharks on longline fisheries is a global issue that can have negative impacts on both animals and fisheries and has concerned researchers, managers and the fishing industry. Nevertheless, detailed information on depredation is only available for a few regions where the problem exists. With the purpose of evaluating killer whale depredation on longline-caught tuna (*Thunnus* spp.) and swordfish (*Xiphias gladius*) in the waters off southern and south-eastern Brazil and comparing it to shark depredation, data sheets were distributed to the captains of tuna vessels in Santos, south-eastern Brazil, between 1993 and 1995. Data on the catch per unit effort (CPUE) of tuna and swordfish and some records of interactions were also obtained from fishing vessel logbooks. Dockside interviews with fishermen and with researchers on board tuna vessels provided additional information. Killer whale and shark interactions were analysed per longline set and per trip. Killer whale interactions occurred from June to February, mainly between June and October, while shark interactions occurred year round. The number of sets and trips involving shark interactions was significantly higher than the number of sets and trips involving killer whale interactions. However, when depredation occurred, the proportion of fish damaged by killer whales was significantly higher than by sharks. Furthermore, killer whales removed or damaged significantly more hooked swordfish than hooked tuna, whereas sharks damaged significantly more hooked tuna than swordfish. This study also shows that cetacean by-catch is experienced by the tuna and swordfish longline fishery in Brazilian waters.

23. MATE, B., MESECAR, R. and LAGERQUIST, B. The evolution of satellite-monitored radio tages for large whales: one laboratory's experience. Deep-Sea Research Part II. 54. 224-46.

Despite several centuries of whaling and directed research, there are only a few whale stocks whose year-round whereabouts are reasonably well known. For the vast majority of depleted populations, the link between seasonal feeding and breeding concentrations remains unknown. This lack of information on range, seasonal distribution, stock structure, and migration routes makes it difficult to design and implement effective conservation measures to promote recovery. The use of such information would have been valuable to develop stock-specific quotas for whaling, but now it may be even more important for recovery of depleted stocks and identifying anthropogenic threats throughout a depleted stock's range. Building upon the preliminary findings of Discovery tags and more recent photo identification studies, satellite-monitored radio tags are now providing range and seasonal distribution information for many stocks of depleted large whales. These parameters are important to better estimate population abundance, characterize habitats, identify threats to recovery, and design effective protection measures when needed. This paper traces one laboratory's experience with the development of satellite-monitored radio tag technology for large whales, including attachment mechanisms and delivery systems, in the hope that others will profit from our successes and our mistakes. Selected examples are used to demonstrate how such tags contribute to new insights about whales' habitats, migrations, behaviour, and management.

24. BRANCH, T.A., ABUBAKER, E.M.N., MKANGO, S. and BUTTERWORTH, D.S. Separating southern blue whale subspecies based on length frequencies of sexually mature females. *Marine Mammal Science.* Accepted. 20pp.

When sexually mature, Antarctic (true) blue whales are substantially longer than pygmy blue whales. To estimate the proportions of these two subspecies in various regions, Bayesian mixture models were fitted to catch length frequencies of sexually mature females. The extent of rounding to 5-ft intervals was also estimated. Antarctic blue whales dominated (99.2%) pelagic catches south of 52°S, while pygmy blue whales dominated (99.9%) north of 52°S and in 35°–180°E. South of 60°S only 0.7% (95% credibility interval 0.5–1.0%) were pygmy blue whales, lower than the 7% upper bound currently assumed. Shore-based catches from SW Africa and those before 1937 from South Georgia and the South Shetlands were estimated to contain 90–92% Antarctic blue whales. Actual proportions were probably higher, but these data show evidence of rounding (up to 19% of records), poor length estimation methods and other problems. The mean length of sexually mature female Chilean blue whales (77.1 ft, 23.5 m) was intermediate between pygmy (68.9 ft, 21.0 m) and Antarctic blue whales (83.4–86.3 ft, 25.4–26.6 m). A good fit to these data was obtained only by assuming that the Chilean whales are a separate subspecies or distinctive population. This finding is also consistent with their discrete distribution, and genetic and call type differences compared to Antarctic and pygmy blue whales.

25. BRANCH, T.A. Humpback whale abundance south of 60°S from three complete circumpolar sets of surveys. *Journal of Cetacean Research and Management*. Submitted. 25pp.

Austral summer estimates of abundance are obtained for humpback whales (*Megaptera novaeangliae*) in the Southern Ocean from the IWC's IDCR and SOWER circumpolar programmes. These surveys have encircled the Antarctic three times: 1978/79–1983/84 (CPI), 1985/86–1990/91 (CPII) and 1991/92–2003/04 (CPIII), criss-crossing strata totalling respectively 64.3%, 79.5% and 99.7% of the open-ocean area south of 60°S. Humpback whales were absent from the Ross Sea, but were sighted in all other regions, and in particularly high densities around the Antarctic Peninsula, in Management Area IV and north of the Ross Sea. Abundance estimates are presented for each CP, for Management Areas, and for assumed summer feeding regions of each breeding stock. Abundance estimates are negatively biased because some whales on the trackline are missed and because some humpback whales are outside the survey region. Circumpolar estimates with approximate midpoints of 1980/81, 1987/88 and 1997/98 are 7,100 (CV=0.36), 10,200 (CV=0.30) and 41,500 (CV=0.11). When these are adjusted simply for unsurveyed northern areas, the estimated annual rate of increase is 9.6% (95% CI 5.8–13.4%), near the maximum possible for humpback whales. All breeding stocks are estimated to be increasing but increase rates are significantly greater than zero only for breeding stocks D and E. If the rate of increase is >5%, total abundance in the Southern Hemisphere is greater than 50,000 and is similar to the summed northern breeding ground estimates (~53,000 from 1999–2005). Some breeding ground abundance estimates are far greater, and others far lower, than the corresponding IDCR/SOWER estimates, in a pattern apparently related to the latitudinal position of the Antarctic Polar Front.

26. BRANCH, T.A., STAFFORD, K.M., PALACIOS, D.M., ALLISON, C., BANNISTER, J.L., BURTON, C.L.K., CABRERA, E., CARLSON, C.A., GALLETTI VERNAZZANI, B., GILL, P.C., HUCKE-GAETE, R., JENNER, K.C.S., JENNER, M., MATSUOKA, K., MIKHALEV, Y., MIYASHITA, T., MORRICE, M., NISHIWAKI, S., STURROCK, V.J., TORMOSOV, D., ANDERSON, R.C., BAKER, A.N., BEST, P.B., BORSA, P., BROWNELL, R.L.,

CHILDERHOUSE, S., FINDLAY, K., GERRODETTE, T., ILANGAKOON, A.D., JOERGENSEN, M., KAHN, D.K., LJUNGBLAD, B., MAUGHAN, B., MCCAULEY, R.D., MCKAY, S., NORRIS, T.F., OMAN WHALE AND DOLPHIN RESEARCH GROUP, RANKIN, S., SAMARAN, F., THIELE, D., VAN WAEREBEEK, K. and WARNEKE, R.M. Past and present distribution, densities and movements of blue whales in the Southern Hemisphere and adjacent waters. *Mammal Review*. Accepted. 43pp.

1. Blue whale locations in the Southern Hemisphere and northern Indian Ocean were obtained from catches (303,239), sightings (4,383 records of ≥8,058 whales), strandings (103), Discovery marks (2,191) and recoveries (95), and acoustic recordings.
2. Sighting surveys included 7,480,450 km of effort plus 14,676 days with unmeasured effort.
3. Groups usually consisted of solitary whales (65.2%) or pairs (24.6%); larger feeding aggregations of unassociated individuals were only rarely observed.
4. Sighting rates (groups per 1,000 km from many platform types) varied by four orders of magnitude and were lowest in the waters of Brazil, South Africa, the eastern tropical Pacific, Antarctica and South Georgia; higher in the Subantarctic and Peru; and highest around Indonesia, Sri Lanka, Chile, southern Australia and south of Madagascar.
5. Blue whales avoid the oligotrophic central gyres of the Indian, Pacific, and Atlantic Oceans, but are more common where phytoplankton densities are high, and where there are dynamic oceanographic processes like upwelling and frontal meandering.
6. Compared to historical catches, the Antarctic ("true") subspecies is exceedingly rare and usually concentrated closer to the summer pack ice. In summer they are found throughout the Antarctic; in winter they migrate to southern Africa (although recent sightings there are rare) and to other northerly locations (based on acoustics), although some overwinter in the Antarctic.
7. Pygmy blue whales are found around the Indian Ocean and from southern Australia to New Zealand. At least four groupings are evident: northern Indian Ocean, from Madagascar to the Subantarctic, Indonesia to western and southern Australia, and from New Zealand northwards to the equator. Sighting rates are typically much higher than for Antarctic blue whales.
8. South-east Pacific blue whales have a discrete distribution and high sighting rates compared to the Antarctic. Further work is needed to clarify their subspecific status given their distinctive genetics, acoustics, and length frequencies.
9. Antarctic blue whales numbered 1,700 (95% Bayesian interval 860–2,900) in 1996 (less than 1% of original levels), but are increasing at 7.3% per annum (95% Bayesian interval 1.4–11.6%). The status of other populations in the Southern Hemisphere and northern Indian Ocean is unknown because few abundance
estimates are available, but higher recent sighting rates suggest that they are less depleted than Antarctic blue whales.

27. ASOC. The Antarctic and Climate Change. 7pp.

28. BAIN, D.E., LUSSEAU, D., WILLIAMS, R. and SMITH, J.C. Vessel traffic disrupts the foraging behaviour of southern resident killer whales (*Orcinus* spp.). Marine Ecology Progress Series. Submitted. 26pp.

Vessel traffic may have contributed to Southern Resident killer whales becoming endangered. To determine the importance of this threat, we measured behavior of Southern Residents in the presence and absence of vessels in 2003-2005 at two different sites along San Juan Island. We observed activity states of killer whale schools using scan sampling and collected information on the number of vessels present at various distances from each school. Transitions between activity states were significantly affected by vessel traffic, indicating a reduction in time spent foraging as was observed in Northern Resident killer whales in a previous study. If reduced foraging effort results in reduced prey capture, this would result in decreased energy acquisition. Each school was within 400m of a vessel most of the time during daylight hours from May through September. The high proportion of time Southern Resident killer whales spend in proximity to vessels raises the possibility that the short-term behavioral changes reported here can lead to biologically significant consequences.

29. ABALLERO, S., TRUJILLO, F., VIANNA, J.A., BARRIOS-GARRIDO, H., MONTIEL, M.G., BELTRAN-PEDREROS, MARMONTEL, M., SANTOS, M.C., ROSSI-SANTOS, M. and BAKER, C.S. Taxonomic status of the genus *Sotalia*: species level ranking for the 'tucuxi' (*Sotalia fluviatilis*) and 'costero' (*Sotalia guianensis*). *Marine Mammal Science*. In press. 29pp.

Dolphins of the genus *Sotalia* are found along the Caribbean and Atlantic coasts of Central and South America and in the Amazon River and most of its tributaries. At present, the taxonomy of these dolphins remains unresolved. Although five species were described in the late 1800s, only one species is recognized currently (*Sotalia fluviatilis*) with two ecotypes or subspecies, the coastal subspecies (*Sotalia fluviatilis guianensis*) and the riverine subspecies (*Sotalia fluviatilis fluviatilis*). Recent morphometric analyses, as well as mitochondrial DNA analysis, suggested recognition of each subspecies as separate species. Here we review the history of the classification of this genus and present new genetic evidence from ten nuclear and three mitochondrial genes supporting the elevation of each subspecies to the species level under the Genealogical/Lineage Concordance Species Concept and the criterion of irreversible divergence. We also review additional evidence for this taxonomic revision from previously published and unpublished genetic, morphological, and ecological studies. We propose the common name "costero" for the coastal species, (Van B´en´eden 1864), and accept the previously proposed "tucuxi" dolphin, *Sotalia fluviatilis* (Gervais, 1853), for the riverine species.

30. BAIN, D.E., WILLIAMS, R., SMITH, J.C. and LUSSEAU, D. Effects of vessels on behavior of individual southern resident killer whales (*Orcinus* sp.). 29pp.

Southern resident killer whales numbered only 84 individuals in 2004. Disturbance by vessels may be a factor in the population's endangered status. To determine the importance of this factor, we compared behavior in the presence and absence of vessels in 2003-2005 at two different sites along San Juan Island, Washington State, USA. Theodolite tracks were summarized in terms of swimming path directness and deviation indices, travel speed, and rates of respiration and surface active display behaviors. Vessel number and distance were used in a generalized additive modelling framework as candidate explanatory variables for differences in whale behavior, along with natural factors such as sex, age, pod membership, time of day, time of year, geographic location, current and tide height. Path directness varied with number of vessels and distance to vessels. Increased distance travelled in the presence of vessels could result in increased energy expenditure relative to whales that could rest while waiting for affected whales to catch up. The likelihood and rate of surface active behavior varied with number of vessels. Number and proximity of vessels were also related to variability in respiratory intervals, path deviation index and swimming speed. The high proportion of time that southern resident killer whales spend in proximity to vessels raises the possibility that the short-term behavioral changes reported here may lead to biologically significant consequences.

31. JACKSON, J.A., PATENAUDE, N.J., CARROLL, E.L. and BAKER, C.S. How few whales were there after whaling? Inference from contemporary mtDNA diversity. 33pp.

Reconstructing the history of exploited populations of whales requires fitting a trajectory through at least three points in time: 1) prior to exploitation, when abundance is assumed to be at the maximum allowed by environmental carrying capacity; 2) the point of minimum

abundance or 'bottleneck', usually near the time of protection or the abandonment of the hunt; and, 3) near the present, when protected populations are assumed to have undergone some recovery. As historical abundance is usually unknown, this trajectory must be extrapolated according to a population dynamic model using catch records, an assumed rate of increase and an estimate of current abundance, all of which have received considerable attention by the International Whaling Commission (IWC). Relatively little attention has been given to estimating minimum abundance (Nmin), although it is clear that genetic and demographic forces at this point are critical to the potential for recovery or extinction of a local population. We present a general analytical framework to improve estimates of Nmin using the number of mtDNA haplotypes (unique sequences) surviving in a contemporary population of whales or other exploited species. We demonstrate the informative potential of this parameter as an a posteriori constraint on Bayesian logistic population dynamic models based on the Comprehensive Assessment of the intensively exploited southern right whales(Eubalaena australis) by the IWC and published surveys of mtDNA diversity for this species. Estimated historical trajectories from all demographic scenarios suggested a substantial loss of mtDNA haplotype richness as a result of 19th century commercial whaling and 20th century illegal whaling by the Soviet Union. However, the relatively high rates of population increase used by the IWC assessment predicted a bottleneck that was implausible narrow (median, 67 mature females), given our corrected estimates of Nmin. Further, high levels of remnant sequence diversity (theta) suggested that pre-exploitation abundance was larger than predicted by the logistic model given the catch record, which is known to be incomplete. Our results point to a need to better integrate evolutionary processes into population dynamic models, to account for uncertainty in catch records, the influence of maternal fidelity on metapopulation dynamics and the potential for inverse density dependence (an 'Allee effect') in severely depleted populations.

32. BAKER, C.S., COOKE, J.G., LAVERY, S., DALEBOUT, M.L., MA, Y.U., FUNAHASHI, N., CARRAHER, C. and BROWNELL, J., R.L. Estimating the number of whales entering trade using DNA profiling and capture-recapture analysis of market produce. *Molecular Ecology*. In press. 10pp.

Surveys of commercial markets combined with molecular taxonomy (i.e. molecular monitoring) provide a means to detect products from illegal, unregulated and/or unreported (IUU) exploitation, including the sale of fisheries bycatch and wild meat (bushmeat). Capture-recapture analyses of market products using DNA profiling have the potential to estimate the total number of individuals entering the market. However, these analyses are not directly analogous to those of living individuals because a 'market individual' does not die suddenly but, instead, remains available for a time in decreasing quantities, rather like the exponential decay of a radioactive isotope. Here we use mitochondrial DNA (mtDNA) sequences and microsatellite genotypes to individually identify products from North Pacific minke whales (*Balaenoptera acutorostrata* ssp.) purchased in 12 surveys of markets in the Republic of (South) Korea from 1999 to 2003. By applying a novel capture-recapture model with a decay rate parameter to the 205 unique DNA profiles found among 289 products, we estimated that the total number of whales entering trade across the five-year survey period was 827 (SE, 164; CV, 0.20) and that the average 'half-life' of products from an individual whale on the market was 1.82 months (SE, 0.24; CV, 0.13). Our estimate of whales in trade (reflecting the true numbers killed) was significantly greater than the officially reported bycatch of 458 whales for this period. This unregulated exploitation has serious implications for the survival of this genetically distinct coastal population. Although our capture-recapture model was developed for specific application to the Korean whale-meat markets, the exponential decay function could be modified to improve the estimates of trade in other wildmeat or fisheries markets or abundance of living populations by noninvasive genotyping.