

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

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## VOLUME 1 ISSUE 1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 1 ISSUE 2

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 1 ISSUE 3

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 2 ISSUE 1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 2 ISSUE 2

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 2 ISSUE 3

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

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

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

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

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

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

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

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

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

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

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

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

Passive acoustic surveys for cetaceans were carried out from the British Antarctic Survey research vessel James Clark Ross in the region of South Georgia in the austral summer of 1998/99 and also during the IWC/CCAMLR collaborative survey in January/February 2000. The acoustic surveys were conducted concurrently with visual observations. A simple two element hydrophone array, sensitive to frequencies of between 300Hz and 24kHz, was towed on a 400m cable astern of the vessel. The total combined acoustic effort for the two surveys was 569 hours along 11,491km (6,205 n.miles) of trackline. On both surveys, stereo recordings were made for 30 seconds every two minutes. Acoustic detections were made of sperm, killer, pilot and southern bottlenose whales and hourglass dolphins. Reliable density estimates were only possible for sperm whales but the data on other species provide useful indications of relative distribution. A total of 42 individual sperm whales were detected and of these 33 were located by crossing bearings derived acoustically from several points along the trackline. Analysis of perpendicular distances pooled across both surveys gave an estimated strip half width of 8.0km (95% CI 6.4-9.9km) giving an overall density estimate for sperm whales of 0.13 and 0.19 whales per 1,000km<sup>2</sup> from the 1998/99 and 2000 surveys, respectively. The methods supported estimates of sperm whale density using standard line-transect analyses based on perpendicular distances. The need to filter sounds below 300Hz to reduce ship noise largely precluded monitoring for mysticete vocalisations. KEYWORDS: ACOUSTICS; SOUTHERN OCEAN SANCTUARY; SOWER 2000; SPERM WHALE; SURVEY - COMBINED

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 3 ISSUE 1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 3 ISSUE 2

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 4 ISSUE 1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 4 ISSUE 2

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 4 ISSUE 3

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 5 ISSUE 1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DENSITY; FISHERIES; GRAY WHALE; INERTIAL DYNAMICS; MODELLING

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 5 ISSUE 2

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ANTARCTIC; COLOURATION; DISTRIBUTION; KILLER WHALE; TAXONOMY

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

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

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

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

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

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

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

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

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

GRAY WHALE; MIGRATION; TRACKING; TELEMETRY

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

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

MODELLING; PACIFIC; SIGHTINGS-VESSEL; TELEMETRY

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

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

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

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

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

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

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

## VOLUME 5 ISSUE 3

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

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

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

CONSERVATION; GENETICS; MANAGEMENT; STOCK IDENTITY

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

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

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

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

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

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

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

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

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

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

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

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

sperm whales during each of the surveys was estimated to be 2.05, 0.52 and 1.75 whales per 1,000km<sup>2</sup> for the May 2001, October 2001 and May 2002 surveys respectively. Sperm whales were distributed across the majority of the Faroe Shetland Channel. This study has provided the basis for meaningful hypothesis generation in future studies and to gain a better understanding of the factors underlying the spatial and temporal distribution patterns of sperm whales in this area; data on oceanographic, biological and anthropogenic determinants should now be examined.

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 6 ISSUE 1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The Brazilian coast is recognised as a Southern Hemisphere humpback whale (*Megaptera novaeangliae*) wintering ground (IWC breeding stock 'A'). The northeastern coast of Brazil was an important whaling ground in the 20th century. Shipboard sighting surveys were conducted in this area to evaluate large whales' distribution and density in 1999 and 2000. Humpback whale sightings ( $n = 81$ , 153 individuals) were recorded using line transect methodology. Data from the 2000 survey were used to estimate abundance over the continental shelf from 5 to 12°S (20,040km<sup>2</sup>). A total of 872.1km were surveyed on effort. Humpback whales were distributed from nearshore to the 800m isobath, but 93.5% of sightings were recorded shoreward of the 300m isobath. The relatively high density off northeastern Brazil suggests that the species is reoccupying historical areas of distribution and the presence of newborn individuals indicates that calving and nursing occur in the area. The hazard rate model best fit perpendicular distance data. Abundance was estimated

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

### VOLUME 6 ISSUE 3

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 7 ISSUE 1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 7 ISSUE 2

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Estimating the abundance and density of beaked whales is more difficult than for most other cetacean species. Consequently few estimates appear in the published literature. Field identification is problematic, especially for the smaller species, and visual detection rates decrease dramatically with Beaufort sea state; prior experience is very important to an observer's ability to detect beaked whales. Passive acoustics may hold future promise for detecting beaked whales from their vocalisations, especially for the larger species. Most published estimates of abundance or density are based on visual line-transect studies that found narrower effective strip widths and lower trackline detection probabilities for beaked whales than for most other cetaceans. Published density estimates range from 0.4-44 whales per 1,000km<sup>2</sup> for small beaked whales and up to 68 whales per 1,000km<sup>2</sup> for large beaked whales. Mark-recapture methods based on photo-identification have been used to estimate abundance in a few cases in limited geographical areas. Focused research is needed to improve beaked whale abundance and density estimates worldwide. KEYWORDS: ABUNDANCE ESTIMATE;  $g(0)$ ; MARK-RECAPTURE; SURVEY-VESSEL; SURVEY-AERIAL; SURVEY-ACOUSTIC; BEAKED WHALE; MODELLING; DISTRIBUTION; ACOUSTICS; PHOTO-ID

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The ecology and conservation status of river dolphins (*Inia* sp.) distributed in the lowland rivers of Bolivia are poorly understood and only recently have basic studies been conducted to investigate their population size, taxonomic status, distribution, behaviour, environmental threats and ecology in this region. This paper examines the distribution and encounter rates of the bufeo (*Inia* sp.) in the middle reach of the Bolivian Amazon and was conducted in the Mamoré River and four of its tributaries during the low water season. Methods were employed which can be replicated during future surveys of Bolivian river dolphins and the results can be compared with those from surveys of *Inia* throughout its range. Sixty-two hours were spent surveying for dolphins, with 68% of the effort in Mamoré River and 32% in its tributaries. The *Inia* encounter rates reported here (1.6-5.8 dolphins km<sup>21</sup>) are the highest recorded anywhere in its broad geographic range; and indicate the importance of continuing and expanding surveys in this area. The mean group size was greatest in the Tijamuchi River (3.3±2.96) and smallest in the Yacuma River (1.8±0.75) and the maximum group size was 14. The high bufeo encounter rates in the central Bolivian Amazon can be taken as a reflection of the general environmental status of the region; however, a growing human population, associated with an increase in boat traffic and fishing activity, poses a future threat to bufeos and their aquatic habitats. KEYWORDS: BOLIVIA; RIVER DOLPHIN; DISTRIBUTION; ABUNDANCE ESTIMATE; MAMORE RIVER; HABITAT; SURVEY-VESSEL.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 8 ISSUE 3

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 9 ISSUE 1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 9 ISSUE 2

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 9 ISSUE 3

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

An aerial line transect and cue counting survey of large whales in West Greenland was conducted in August and September 2005. The survey covered the area between Cape Farewell and Disko Island on the West Greenland coast out to the 200m depth contour. The surveyed area covered 163,574km<sup>2</sup> and a total of 246 sightings of 9 cetacean species were obtained. Abundance estimates were developed for humpback whales, *Megaptera novaeangliae* (21 sightings), fin whales, *Balaenoptera physalus* (78 sightings) and common minke whales, *B. acutorostrata* (42 sightings). The mean group size of humpback whales was 3.30 but groups as large as 95 animals were seen off effort. The mean group size of fin whales was 2.96 with groups as large as 50 seen. Common minke whale group size was 1.1 with only one sighting of a group of two whales. Humpback whales were found both in offshore and coastal areas of West Greenland with the exception of Store Hellefiske Bank and the Cape Farewell offshore area. The line transect abundance estimate of humpback whales was 1,218 (CV=0.56), uncorrected for submerged whales (availability bias) and whales that were available to be seen but were missed by the observers (perception bias). Fin whales were observed in all areas of the survey and the uncorrected line transect estimate was 1,660 (CV=0.38). When corrected for perception bias the estimates increase to 3,234 fin whales (CV=0.44). Common minke whales were found in almost equal densities in all strata except for the Cape Farewell offshore area, where none were seen. The cue-counting abundance estimate of common minke whales was 4,856 (CV=0.49) for West Greenland using a cue rate of 46.3 cues per hour (CV=10.6). If the estimate is corrected for perception bias the common minke whale abundance is estimated to be 10,792 whales (CV=0.59). Low coverage was attained in the northern area of West Greenland and this should cause an especially large negative bias for the estimates of fin whale and humpback whale abundance because this area is believed to have particularly large densities of these whales. KEYWORDS: FIN WHALE; COMMON MINKE WHALE; HUMPBAC WHALE; SURVEY-AERIAL; SURVEY-VESSEL; NORTHERN HEMISPHERE; ABUNDANCE ESTIMATE; CUE COUNTING; DISTRIBUTION; g(0); SCHOOL SIZE.

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

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

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

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

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

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

was quantified by using typical ICI patterns known from the literature. These were recorded using two T-PODs deployed at a wind farm site (Nysted, Denmark) between 14 June and 12 July 2005 and during the entanglement of a porpoise calf in a gillnet (Clayoquot Sound Canada). It was possible to distinguish between feeding, approach behaviour and communication and known ICI patterns associated with these behaviours were used to categorise acoustic data. During feeding typical click trains start with long ICIs (30-70ms) and end with ICIs down to about 2ms. In a transition phase ICIs rapidly decrease. Click trains attributed to feeding were found in the wind farm data at a rate of 6.3d-1 (n=174) with a patchy distribution. We found 20 to 74s long click train sequences with ICIs decreasing from a median of 72ms (range 34 to 143ms) to 5ms at a rate of 1.6day-1 (n=45). This was interpreted as approach behaviour, in which the animal was acoustically 'locked on' to a reflective structure. Communication signals are built up of click trains with very short ICIs (<7.7ms). During the entanglement of a porpoise calf, three different call types were determined at a rate of 8.9min-1 (n=89). One call with variable duration (100 to 890ms) and relatively stable ICIs as low as 3.6ms resembled 'distress calls' described by Amundin (1991b). Another call type with durations from 780 to 830ms and ICIs ranging from 3.0 to 10 ms and thus different with respect to ICI curve progression was found only three times. These had a U-shaped ICI curve, similar to an 'alarm' or 'fright' call described by Busnel and Dziedzic (1966). A third and previously unreported call is characterised by a long call duration (up to 1,270ms) and sometimes oscillating ICIs with an initial decrease from about 9ms to around 7ms and an increase towards the end. The data presented suggest that the T-POD is a promising tool for behavioural studies. It is possible to recognise certain acoustic behavioural categories described in the literature, but it is important to look at the temporal context with other vocalisations in T-POD data, such as ICIs of preceding click trains. KEYWORDS: COMMUNICATION; ECHOLOCATION; FEEDING, FOOD/PREY; BIOSONAR; HARBOUR PORPOISE; ACOUSTICS; NORTHERN HEMISPHERE.

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

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

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

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

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

Dolphin hunting for fishing bait in Bahía Solano, Chocó, Colombia, was evaluated during eight months, between July 2005 and April 2006. Interviews were conducted with 122 fishermen (18.2% of the registered fishermen in the zone), who cover at most 890km<sup>2</sup> when fishing (approximately 2.3% of the Pacific Territorial Sea of Colombia), and data obtained from landings at a fishing company. Only fishermen using longlines (37.3%) confirmed using dolphins as bait. It was not possible to obtain additional information about date, specific location or dolphin species, but the most probable captured species were common bottlenose dolphin and pantropical spotted dolphin. Nine dolphins were killed during the study period (1.1 dolphins/month) and extrapolating these numbers to all fishermen using longlines in the region (250), 24 dolphins might have been taken during the study period (3 dolphins/month). Fish species caught using dolphin bait include Pacific bearded brotula groupers and smooth-hound. KEYWORDS: PANTROPICAL SPOTTED DOLPHIN; BOTTLENOSE DOLPHIN; PACIFIC OCEAN; SOUTH AMERICA; DIRECT CAPTURE; FISHERIES; PURSE-SEINES; GILLNETS; TRAWLS.

## VOLUME 10 ISSUE 3

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VOLUME 11 ISSUE 1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

# Special Issue 1: Chemical Pollutants and Cetaceans

edited by PJH Reijnders, A. Aguilar and GP Donovan

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## REPORT SECTION

Reijnders, P.J.H., Donovan, G.P., Aguilar, A. and Bjørge, A. 1999. Report of the Workshop on Chemical Pollution and Cetaceans, March 1995, Bergen, Norway. *J. Cetacean Res. Manage.* (special issue) 1:1-42.

KEYWORDS: REVIEW; POLLUTION

Clausen, B. 1999. Practical guidelines for postmortem examination and tissue sampling of cetaceans for ecotoxicological purposes. *J. Cetacean Res. Manage.* (special issue) 1:43-5.

KEYWORDS: CETACEANS - GENERAL; POLLUTION; TOXICOLOGY

Aguilar, A., Bjørge, A., Donovan, G. and Reijnders, P. 1999. Proposal to the IWC on Furthering the Recommendations of the Pollution Workshop. *J. Cetacean Res. Manage.* (special issue) 1:47-53. [Also printed in: *Rep.int.Whal.Comm* 48:425-28].

KEYWORDS: POLLUTION; RESEARCH PROPOSAL

International Whaling Commission. 1999. Planning Workshop to Develop a Research Programme to Investigate Pollutant Cause-Effect Relationships in Cetaceans - 'POLLUTION 2000+'. *J. Cetacean Res. Manage.* (special issue) 1:55-82.

KEYWORDS: POLLUTION; RESEARCH PROPOSAL

Reijnders, P.J.H., Rowles, T., Donovan, G.P., O'Hara, T., Bjørge, A., Larsen, F. and Kock, K.-H. 1999. Planning Workshop to Develop a Programme to investigate Pollutant Cause-effect relationships in Cetaceans: 'POLLUTION 2000+'. Annex C. POLLUTION 2000+: after Barcelona. *J. Cetacean Res. Manage.* (special issue) 1:77-83.

KEYWORDS: POLLUTION; RESEARCH PROPOSAL

## PAPERS

Aguilar, A., Borrell, A. and Pastor, T. 1999. Biological factors affecting variability of persistent pollutant levels in cetaceans. *J. Cetacean Res. Manage.* (special issue) 1:83-116

The main biological factors responsible for the variability of pollutant concentrations in cetaceans are reviewed. Diet is significant because many pollutants are concentrated through food webs. This explains most interspecific differences in pollutant levels and it may also contribute to variation among populations of the same species or even among different components of the same population when diet is subject to age-related or sex-related variations. The effect of body size is complex. Excretion rate and activity of detoxifying enzymes decrease as body weight increases, processes which would lead to higher pollutant concentrations in large animals. In contrast, a high metabolic rate, which is inversely correlated to body size, is associated with high pollutant concentrations. These opposing effects usually result in higher residue levels in smaller individuals. Body composition affects the contribution of each body compartment to the overall pollutant load. Therefore, the body load of lipophilic pollutants will strongly depend on the relative mass of blubber, a variable that shows a threefold variation among cetacean species, or, in seasonal feeders, among individuals. Nutritive condition also affects the dynamics of lipophilic pollutants. Lipid mobilisation results in an increase in residue levels, but this variation is not as large as a purely concentrative model would suggest because of enhancement of detoxification processes following a rise in tissue pollutant concentrations. Disease affects pollutant levels in different ways: impoverishing nutritive condition; altering normal physiological functions; and depressing reproduction therefore reducing reproductive transfer in females. The combined result of these processes is usually an increase in pollutant levels in diseased individuals. The concentration of lipophilic pollutants normally increases with age in males because input exceeds the ability of the organism to excrete pollutants. Variable proportions of the pollutant load are transferred to offspring during gestation and lactation, for which reason tissue concentrations in females decrease or stabilise, thus producing lower residue levels than in males. However, because not all compounds are transferred at the same rate, their relative abundance varies with age and sex. Intensity of reproductive transfer is also associated with the reproductive traits of the species, particularly the length of lactation. With the exception of size, concentrations of heavy metals increase with age in both sexes but by contrast with lipophilic pollutants, concentrations in females are similar or higher than in males. The significance of these factors of variation should be taken into account when designing sampling methodology, comparing sample groups, or evaluating toxicological impact. KEYWORDS: BIOACCUMULATION; BIOMAGNIFICATION; BOTTLENOSE DOLPHIN; BOWHEAD WHALE; CETACEANS - GENERAL; FIN WHALE; HARBOUR PORPOISE; HEAVY METALS; MINKE WHALE; POLLUTION; POLLUTION-ORGANOCHLORINES; REPRODUCTION; RIGHT WHALE; SPERM WHALE; SPOTTED DOLPHIN;

Peakall, D.B. 1999. Biomarkers as pollution indicators with special reference to cetaceans. *J. Cetacean Res. Manage.* (special issue) 1:117-24

The limited information available on biomarkers in cetaceans and pinnipeds is reviewed. The main problems with their application to cetaceans are the difficulties in obtaining suitable tissue material and in carrying out experimental work to relate pollutant levels and effects. A white whale population from the Gulf of St Lawrence has been found to have a high incidence of tumours and the presence of adducts was related to exposure to benzo(a)pyrene (PAH), a well-known carcinogen. Some research has been carried out on induction of Mixed Function Oxidases (MFOs) (mainly cytochrome P450 system) in cetaceans, but the results are not yet conclusive. Studies on other groups of animals suggest that MFOs may be valuable biomarkers, particularly if techniques to measure them in biopsy skin samples are further developed. The goal should be that wild cetaceans are physiologically normal, biomarkers can be used to identify populations whose physiological functions are outside normal limits because of excessive exposure to pollutants. Since no pristine environments currently exist, measurements of biomarkers along gradients of pollutant exposure are needed to establish normality in cetaceans. KEYWORDS: BERGEN; BIOMARKERS; DALL'S PORPOISE; DNA ADDUCTS; FIN WHALE; HAZARD ASSESSMENT; IMMUNOSUPPRESSION; MINKE WHALE; PHYSIOLOGY; PILOT WHALE - SHORT-FINNED; PINNIPED; POLLUTION; POLLUTION-HAHS; POLLUTION-ORGANOCHLORINES; POLLUTION-PESTICIDES; STRIPED DOLPHIN; WHITE WHALE

Bowles, D. 1999. An overview of the concentrations and effects of heavy metals in cetacean species. *J. Cetacean Res. Manage.* (special issue) 1:125-48

Data are presented on the biomagnification rates, accumulation and concentrations of metals in cetacean species. Concentrations of metals predominantly occur in the soft tissues, although zinc and lead concentrate in the skin and bones. Rates of uptake are dependent upon metal availability, the species' dietary preference and chemical reactions between contaminants. Differences in concentrations occur according to the sex and age of the animal, with certain metals displaying age-related trends. Mercury is the only metal which shows both biomagnification at all levels of the food chain and a positive correlation with age at all stages during a cetacean's life. Differences in concentrations occur between baleen species and toothed cetaceans. Levels tend to be lower in baleen whales, primarily due to a shorter food chain (resulting in lower bioconcentration factors) and as the principal prey species are taken from lower parts of the food chain. A number of storage and detoxifying mechanisms have been recorded in many species that may alter the effects of high metal concentrations. Data on the effects of metal toxicity in cetacean species are sparse, but tolerance limits have been proposed for mercury and cadmium. These are compared with high concentrations recorded in certain species and possible effects extrapolated. Effects of toxicity may alter depending on the species, age and sex of the animal, but indications of toxic effects have been reported. Finally, the possibility of determining regional hot-spots, where background pollution levels are high, from concentrations of mercury reported in cetacean species, are examined. KEYWORDS: BIOACCUMULATION; BIOMAGNIFICATION; POLLUTION; POLLUTION - HEAVY METALS; REVIEW; TOXICITY

Borrell, A. and Reijnders, P.J.H. 1999. Summary of temporal trends in pollutant levels observed in marine mammals. *J. Cetacean Res. Manage.* (special issue) 1:149-55

The present paper reviews reported time trends in concentrations and relative abundance of pollutants in marine mammals. Available information refers only to pinnipeds and cetaceans, mainly covers the period 1969-1988 and focuses on DDTs, PCBs and mercury. Although data are limited, there are indications that in the Canadian Arctic, mercury levels in marine mammals have increased in recent decades. By contrast, during the late 1970s and the 1980s, concentrations of DDTs and PCBs in marine mammals from highly polluted areas have tended to decrease. While this trend is likely to continue for DDTs in the future, it is foreseen that until at least the first decades of the next century, PCB levels will stabilise as degradation is compensated by new inputs caused by the recycling of the fraction currently present in non-marine compartments. KEYWORDS: CETACEANS - GENERAL; PINNIPED; POLLUTION; POLLUTION-METALS; POLLUTION-ORGANOCHLORINES; POLLUTION-PESTICIDES; REVIEW; TRENDS

Jones, P.D., Hannah, D.J., Buckland, S.J., van Maanen, R., Leathem, S.V., Dawson, S., Slooten, E., van Helden, A. and Donoghue, M. 1999. Polychlorinated dibenzo-p-dioxins, dibenzofurans and polychlorinated biphenyls in New Zealand cetaceans. *J. Cetacean Res. Manage.* (special issue) 1:157-67

Limited information is available on the concentrations of halogenated aromatic hydrocarbons (HAHs) in cetaceans from the Southern Hemisphere. This paper presents data on blubber concentrations of polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) in Hector's dolphins, dusky dolphins, southern right whale dolphins, blue whales, minke whales, Gray's beaked whales, Curvier's beaked whales and pygmy right whales stranded in New Zealand. Both HAH concentrations and toxic equivalents (TEQs) are found to be higher in Hector's dolphins, a species with an inshore distribution, than in other odontocetes, which are more oceanic. Baleen whales, which are oceanic and feed at lower trophic levels, present the lowest levels of pollutants, with PCDD and PCDF concentrations usually below detection limits. The PCB profiles of the various species suggest that they are exposed to different PCB sources. Overall, HAH levels detected are lower than those reported for comparable species in the Northern Hemisphere. The relative abundance of low chlorinated PCB congeners in New Zealand cetaceans, as compared to those from northern waters, suggests that the origin of these compounds is mostly atmospheric deposition. KEYWORDS: BEAKED WHALE-CUVIER'S; BEAKED WHALE-GRAY'S; BLUE WHALE; DUSKY DOLPHIN; HECTOR'S DOLPHIN; MINKE WHALE; POLLUTION; PYGMY RIGHT WHALE; SOUTH PACIFIC; SOUTHERN HEMISPHERE; SOUTHERN RIGHT WHALE DOLPHIN;

Cockcroft, V.G. 1999. Organochlorine levels in cetaceans from South Africa: a review. *J. Cetacean Res. Manage.* (special issue) 1:169-76

Publications on levels of organochlorines in cetaceans from South Africa are reviewed. Organochlorine contamination in cetaceans off South Africa is similar to those in Australian waters, but generally low compared to the Northern Hemisphere. An exception are the coastal dolphins inhabiting the South African east coast waters. In these animals levels are similar to Northern Hemisphere coastal cetaceans. Levels are generally higher in coastal dolphins, compared to dolphins living in deeper waters. It is suggested that these differences are directly related to the levels of industrialisation and cultivation of the surrounding area. Too few samples of either baleen whales or toothed whales are available to investigate the differences in organochlorine levels between these two groups. Similarly, even for species with the highest sample sizes - common and bottlenose dolphins - the data are insufficient to investigate trends in contaminant levels.

KEYWORDS: CETACEANS - GENERAL; INDIAN OCEAN; POLLUTION; POLLUTION-ORGANOCHLORINES; REVIEW; SOUTH ATLANTIC;

Henry, J. and Best, P. 1999. A note on concentrations of heavy metals in cetaceans from Southern Africa. *J. Cetacean Res. Manage.* (special issue) 1:177-94

Concentrations of zinc, copper, cadmium, mercury and lead were measured by atomic absorption spectrophotometry in samples of the brain, kidney, liver and muscle tissue from 178 individuals of 323 different cetacean species (4 right whales - *Eubalaena australis*, 2 pygmy right whales - *Caperea marginata*, 3 minke whales - *Balaenoptera acutorostrata*, 3 Bryde's whales - *B. edeni*, 1 humpback whale - *Megaptera novaeangliae*, 1 sperm whale - *Physeter macrocephalus*, 11 pygmy sperm whale - *Kogia breviceps*, 6 dwarf sperm whales - *K. simus*, 1 southern bottlenose whale - *Hyperoodon planifrons*, 1 Cuvier's beaked whale - *Ziphius cavirostris*, 9 Blainville's beaked whales - *Mesoplodon densirostris*, 5 strap-tooth whales - *M. layardii*, 2 True's beaked whales - *M. mirus*, 3 long-finned pilot whales - *Globicephala melas*, 30 Risso's dolphins - *Grampus griseus*, 12 bottlenose dolphins - *Tursiops truncatus*, 5 striped dolphins - *Stenella coeruleoalba*, 1 pantropical spotted dolphin - *S. attenuata*, 1 hump-backed dolphin - *Sousa chinensis*, 21 dusky dolphins - *Lagenorhynchus obscurus*, 1 hourglass dolphin - *L. cruciger*, 12 Heaviside's dolphins - *Cephalorhynchus heavisidii* and 43 common dolphins - *Delphinus delphis*). All but the hourglass dolphin were strandings or animals taken incidental to fishing operations or under scientific permit in coastal waters of South Africa or Namibia. Highest concentrations of Zn, Cu and Hg were generally found in the liver and of Cd in the kidney. Comparisons of animals pre-and post puberty indicated accumulation of hepatic mercury in the pygmy sperm whale, Risso's dolphin, dusky dolphin and common dolphin. Loss of a metal (zinc) after puberty was only shown in the common dolphin. No individual analyses exceeded proposed (human) tolerance limits for hepatic mercury and hepatic or renal cadmium. KEYWORDS: BEAKED WHALE-BLAINVILLE'S; BEAKED WHALE-CUVIER'S; BEAKED WHALE-TRUE'S; BOTTLENOSE DOLPHIN; BRYDE'S WHALE; COMMON DOLPHIN; DUSKY DOLPHIN; DWARF SPERM WHALE; HEAVISIDE'S DOLPHIN; HOURGLASS DOLPHIN; HUMP-BACKED DOLPHIN; HUMPBACK WHALE; MINKE WHALE; PILOT WHALE - LONG-FINNED; POLLUTION; POLLUTION-METALS; PYGMY RIGHT WHALE; PYGMY SPERM WHALE; RIGHT WHALE; RISSO'S DOLPHIN; SOUTH AFRICA; SOUTHERN BOTTLENOSE WHALE; SPERM WHALE; SPOTTED DOLPHIN; ; STRAP-TOOTHED WHALE; STRIPED DOLPHIN

Borrell, A. and Aguilar, A. 1999. A review of organochlorine and metal pollutants in marine mammals from Central and South America. *J. Cetacean Res. Manage.* (special issue) 1:195-207

Published data on pollutants found in marine mammals from Central and South America are limited. Few species have been studied (18) and sample sizes are usually too small to allow for proper assessment of trends or impacts of pollutants on the populations being studied. The only exceptions to this are the franciscana dolphin from Argentina and the spotted dolphin from the eastern tropical Pacific: the former population studied for organochlorines and the latter for heavy metals. Information on organochlorine levels, mainly on PCBs and DDTs, suggests low levels of exposure when compared to other regions of the world. The ratio DDT/PCB is higher than in other areas, which indicates the predominance of agricultural contamination over that of industrial origin. The generally low DDE/DDT ratio, particularly in southern America, indicates a recent usage of this pesticide in the region. Levels of mercury were moderate overall, although marine mammals from the areas where contamination by this metal is likely to be higher, such as the Amazon river, have not been studied in this regard. In contrast, mean cadmium and zinc concentrations were higher overall than those in the range typical for northern marine mammals, while copper and lead levels were comparatively low, although information on these latter metals is extremely limited. The lack of comprehensive, long-term studies makes a sound evaluation of the impact of pollutants on the marine mammals from the region unfeasible. KEYWORDS: MARINE MAMMALS; POLLUTION; POLLUTION-METALS; POLLUTION-ORGANOCHLORINES; SOUTH ATLANTIC; SOUTH PACIFIC;

Brouwer, A. 1999. Induction of biotransformation enzymes by polyhalogenated aromatic hydrocarbons (PHAHs): potential impact on animal physiology and health. *J. Cetacean Res. Manage.* (special issue) 1:209-1

Biotransformation and its role in the elimination of polyhalogenated aromatic hydrocarbons (PHAHs) has been the subject of many studies from the late seventies onwards. The notion of specific, high affinity interactions of phenolic PHAH metabolites with the plasma transport proteins of thyroid hormone and vitamin A, both in vitro and in vivo, stimulated further research into the possible role of biotransformation in the toxicity of certain PHAHs such as PCBs. Currently, phenolic metabolites of PCBs and related compounds have been identified as major metabolites in blood plasma of e.g. grey seals (*Halichoerus grypus*) and humans with background environmental exposure to these chemicals. The concentrations of the hydroxy-PCBs were in the same range as the most persistent parent congeners, such as PCB 153, 138 and 180. These phenolic metabolites were found to possess a specific range of biological activities, which differed from the parent compounds. Another potential adverse effect associated with persistent induction of biotransformation enzymes, like UDP-glucuronyl transferases (UGTs) by PHAHs, is a long-term enhanced elimination of several important endogenous ligands such as vitamin A and thyroid hormones. Reduced levels of vitamin A and thyroid hormones have been reported in most experimental animal and wildlife species exposed to PHAHs. The recent observation of the accumulation of high levels of phenolic PCB metabolites in blood and brain of late gestational rat foetuses, in parallel with reductions in both vitamin A and thyroid hormone levels, suggests that these metabolites may play an important role in the observed developmental toxicity of PHAHs. KEYWORDS: BIOMARKERS; DISEASE; HAZARD ASSESSMENT; PHYSIOLOGY; POLLUTION; POLLUTION-HAHS; POLLUTION-ORGANOCHLORINES; REPRODUCTION;

Busbee, D., Tizard, I., Stott, J., Ferrick, D. and Ott-Reeves, E. 1999. Environmental pollutants and marine mammal health: the potential impact of hydrocarbons and halogenated hydrocarbons on immune system dysfunction. *J. Cetacean Res. Manage.* (special issue) 1:223-48

This paper provides a detailed review of the immunotoxicological effects of environmental pollutants on the health of marine mammals, particularly in relation to their impact on the immune system and mechanisms of toxicity. Environmental pollutants are increasingly implicated (both directly and indirectly) with the onset of infectious disease and related mortality incidents in marine mammals. The release of chemicals into the marine environment and the subsequent bioaccumulation up the food chain may pose a serious threat to marine mammals inhabiting contaminated areas; this has been documented in various studies of pollutant concentrations in tissue samples and large scale mass mortalities. Data correlating pollutant residues with altered reproductive/developmental states, and immune system dysfunction in particular, are reported for terrestrial mammals and suggest a similar association in marine mammals. Immunology is

emphasised as a tool for assessing marine mammal health using quantitative and qualitative techniques to establish the effects of chemical pollutants. This has become increasingly important in relation to the subsequent dangers that may be posed to humans through any indirect exposure via the food chain. KEYWORDS: DISEASE; IMMUNOSUPPRESSION; POLLUTANTS; POLLUTION; POLLUTION-ORGANOCHLORINES; REVIEW;

Martineau, D., Lair, S., De Guise, S., Lipscomb, T.P. and Béland, P. 1999. Cancer in beluga whales from the St Lawrence Estuary, Quebec, Canada: a potential biomarker of environmental contamination. *J. Cetacean Res. Manage.* (special issue) 1:249-65

A population of approximately 500 white whales (*Delphinapterus leucas*) inhabits a short stretch of the St Lawrence Estuary which drains one of the most industrialised areas of the world. Over a 12-year period (1983-1994), 73 carcasses out of 175 beluga\* whales reported stranded on the St Lawrence Estuary shoreline have been examined. Of these 73 carcasses, 14 (19%) were affected by 15 different malignant tumours (cancers), one animal being affected by two different types of cancer. Overall, 23% of necropsied sexually mature animals were affected by cancer. Forty percent of the 35 cancer cases reported worldwide in cetaceans occurred in this population. The estimated annual incidence rate (AIR) of cancer in St Lawrence beluga whales, a minimum figure of 233/100,000 animals, is much higher than that reported for any other population of cetaceans, and is similar to that of man, and of hospitalised cats and cattle. More specifically, the AIR of small intestinal cancers in the studied population, a minimum figure of 83/100,000 animals, is much higher than that observed in man and all animals, except in sheep in certain parts of the world, where an environmental carcinogen is believed to be etiologically involved. \*The official IWC common name for *Delphinapterus leucas* is the white whale. However, as the common name used in previous papers relating to this population is the alternative 'beluga whale', this has been retained for this paper. KEYWORDS: BERGEN; BIOMARKERS; DISEASE; PATHOLOGY; POLLUTION; POLLUTION-PAHS; WHITE WHALE

Kennedy, S. 1999. Morbilliviral infections in marine mammals. *J. Cetacean Res. Manage.* (special issue) 1:267-73

Epizootics of infectious disease were unknown in cetaceans prior to 1987. However, since then there have been at least three epizootics in dolphins and two in pinniped species. Many of the clinical, pathological and epidemiological features of these events were similar to those of morbilliviral infections in terrestrial mammals. There has been speculation that contaminants may have predisposed marine mammals to these and this is discussed. Morbilliviruses are highly pathogenic viruses and caused epizootics in terrestrial mammals long before the advent of anthropogenic contaminants. KEYWORDS: BOTTLENOSE DOLPHIN; DISEASE; EPIZOOTIC; HARBOUR PORPOISE; IMMUNOSUPPRESSION; PATHOLOGY; PINNIPED; POLLUTION; POLLUTION-ORGANOCHLORINES; REVIEW; STRIPED DOLPHIN; WHITE WHALE

# Special Issue 2: Right Whales: worldwide status

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## REPORT SECTION

International Whaling Commission. 2001. Report of the Workshop on the Comprehensive Assessment of Right Whales: A worldwide comparison. *J. Cetacean Res. Manage.* (special issue) 2:1-60.

International Whaling Commission. 2001. Report of the Workshop on Status and Trends of Western North Atlantic Right Whales. *J. Cetacean Res. Manage.* (special issue) 2:61-87.

## PAPERS

Burnell, S.R. 2001. Aspects of the reproductive biology, movements and site fidelity of right whales off Australia. *J. Cetacean Res. Manage.* (special issue) 2:89-102

Between 1991 and 1997 right whales were studied on their wintering grounds on the southern coastline of Australia, predominantly at the Head of the Great Australian Bight, where over 350 individuals have been identified. The observed mean inter-calf interval for females was  $3.33 \pm 0.10$  years ( $\pm$ SE,  $n=57$ ) at the Head of the Bight and  $3.64 \pm 0.13$  years ( $\pm$ SE,  $n=117$ ) in the wider Australian population. When inter-calf intervals of six or more years were excluded, the mean intervals became  $3.28 \pm 0.09$  years ( $\pm$ SE,  $n=56$ ) and  $3.28 \pm 0.06$  years ( $\pm$ SE,  $n=107$ ), respectively. Inter-calf intervals of two years were recorded following the early death of a neonate on two separate occasions and the implications of these 'shortened' intervals and of calvings that were not observed are discussed. The mean age at which yearlings were observed to be fully weaned was calculated to be  $365 \pm 8$  days ( $\pm$ SE,  $n=18$ ) from the estimated birth dates of individual calves and subsequent associations, or lack of them, between the yearlings and their cows the following year. A total of 108 movements greater than 200km in length were made by individual whales. The mean within-year movement was  $730 \pm 84$  km, made over  $34 \pm 4$  days ( $\pm$ SE,  $n=18$ ), whilst the mean between-year movement was  $1,036 \pm 45$  km ( $\pm$ SE,  $n=87$ ), made over a mean interval of  $3.3 \pm 0.3$  years ( $\pm$ SE,  $n=90$ ). The number and direction of coastal movements observed suggest that the right whales off southern Australia comprise a single population which may undertake an almost circular, anti-clockwise migration to the south of the Australian continent. A significantly greater proportion of females displayed a level of between-year fidelity to the Head of the Bight aggregation area (92%,  $n=61$ ) than did males (68%,  $n=19$ ) or whales of unknown sex (63%,  $n=8$ ). KEYWORDS: AREA-AUSTRALIA; MOVEMENT; REPRODUCTION; RIGHT WHALE; RWI; SITE-FIDELITY; SOUTHERN HEMISPHERE

Bannister, J. 2001. Status of southern right whales (*Eubalaena australis*) off Australia. *J. Cetacean Res. Manage.* (special issue) 2:103-10

The history of Australian right whaling is briefly reviewed. Most catching took place in the first half of the 19th century, with a peak in the 1830s, involving bay whaling by locals and visiting whaleships in winter and whaling offshore in the summer. In the early 20th century, right whales were regarded as at least very rare, if not extinct. The first published scientific record for Australian waters in the 20th century was a sighting near Albany, Western Australia, in 1955. Increasing sightings close to the coast in winter and spring led to annual aerial surveys off southern Western Australia from 1976. To allow for possible effects of coastwise movements, coverage was extended into South Australian waters from 1993. Evidence from 19th century pelagic catch locations, recent sightings surveys, 1960s Soviet catch data and photographically-identified individuals is beginning to confirm earlier views about likely seasonal movements to and from warm water coastal breeding grounds and colder water feeding grounds. Increase rates of ca 7-13% have been observed since 1983. Some effects of different breeding female cohort strength are now beginning to appear. A minimum population size of ca 700 for the period 1995-97 is suggested for the bulk of the 'Australian' population, i.e. animals approaching the ca 2,000km of coast between Cape Leeuwin, Western Australia and Ceduna, South Australia. KEYWORDS: ABUNDANCE; ABUNDANCE ESTIMATE; AREA-AUSTRALIA; DISTRIBUTION; RIGHT WHALE; RWI; SOUTHERN HEMISPHERE; SURVEY - AERIAL; TRENDS

Patenaude, N.J. and Baker, C.S. 2001. Population status and habitat use of southern right whales in the sub-Antarctic Auckland Islands of New Zealand. *J. Cetacean Res. Manage.* (special issue) 2:111-6

In the winters of 1995, 1996 and 1997, research was conducted in the Auckland Islands to evaluate the status of southern right whales in the New Zealand sub-Antarctic. Whales were present in high concentrations each year (maximum count of 146 whales) in a small area on the northeast side of the main island. Cow-calf pairs averaged 12% (range 9% to 14%) of the total population. Most cow-calf pairs were sighted resting at the surface (60%) or travelling (36%) and showed a strong preference for shallow (<20m depth) nearshore waters. The ratio of females to males, as determined by molecular sexing using biopsy samples, varied from 54% to 39% over the three years but did not differ significantly from 1:1 in any year. Both males and females were found in varying group sizes, with the occurrence of

social/sexual activity predominant (85%) in groups of three or more whales. Most single whales were found resting (59%) and occasionally approached the research vessel (19%). A total of 217 individual whales have been photo-identified over the three years of this study, 24% of which were resighted more than once in a season and approximately 15% of which are resighted in more than one year. The high density of whales in Port Ross during winter months, the presence of cow-calf pairs, including newborns, and the frequency of social and sexual activity indicates that the Auckland Islands are a primary wintering habitat for southern right whales in New Zealand waters. However, the low resighting rates within season and documented movement to nearby Campbell Island (290km) suggest that some whales are not resident in the Auckland Islands throughout the season. The rarity of right whales along the main islands of New Zealand and their apparent increase in numbers in the Auckland Islands suggests a major shift in habitat use from pre-exploitation times or the loss of a component of a historically subdivided stock. KEYWORDS: ABUNDANCE ESTIMATE; AREA NEW ZEALAND; BEHAVIOUR; BREEDING GROUNDS; HABITAT; POPULATIONS-STATUS; REPRODUCTION; RIGHT WHALE; RWI; SEX RATIO; SOUTHERN HEMISPHERE; SUB-ANTARCTIC

Stewart, R. and Todd, B. 2001. A note on observations of southern right whales at Campbell Island, New Zealand. *J. Cetacean Res. Manage.* (special issue) 2:117-20

Southern right whales were observed at Campbell Island, in New Zealand's sub-Antarctic ocean, over four field seasons (1983, 1994, 1995 and 1997). Whales were present in both the winter and autumn of 1994. An average of 7-21 whales were seen each season, with a maximum of 44 whales per day in July 1995. Individual whales were resighted in the area over periods of several days to two months. A change to shorter residence periods occurred between the early 1980s and 1990s. Some interchange occurs between Campbell Island and the Auckland Islands, with a recent decrease in number at the former and an increase at the latter. KEYWORDS: AREA NEW ZEALAND; BEHAVIOUR; CENSUS; PHOTO-ID; RIGHT WHALE; RWI; SOUTHERN HEMISPHERE

Patenaude, N., Todd, B. and Stewart, R. 2001. A note on movements of southern right whales between the sub-Antarctic Auckland and Campbell Islands, New Zealand. *J. Cetacean Res. Manage.* (special issue) 2:121-3

To investigate the interchange of southern right whales between wintering grounds of the New Zealand sub-Antarctic, photographs of 31 individuals from Campbell Island were compared to 244 individuals from the Auckland Islands. Three whales first identified at the Auckland Islands in 1995 or 1996 were found at Campbell Island in 1997. One whale identified at Campbell Island in 1995 was seen later that same winter at the Auckland Islands. This provides the first evidence of both within and between year movements of whales between the two New Zealand sub-Antarctic aggregations, suggesting that they are part of one intermingling population. KEYWORDS: AREA NEW ZEALAND; BREEDING GROUNDS; MOVEMENT; PHOTO-ID; RIGHT WHALE; RWI; SOUTHERN HEMISPHERE; SUB-ANTARCTIC

Cooke, J.G., Rowntree, V. and Payne, R.S. 2001. Estimates of demographic parameters for southern right whales (*Eubalaena australis*) observed off Península Valdés, Argentina. *J. Cetacean Res. Manage.* (special issue) 2:125-32

Photographs of the right whales which occur between June and December in the waters surrounding Peninsula Valdes, Argentina, have been obtained from aerial surveys conducted each year from 1971 to the present. Resightings of previously catalogued individuals enable various demographic parameters to be estimated. From analyses of multiple resightings of females accompanied by calves, estimates of the following demographic parameters were obtained, based on the data collected during 1971-90: mean calving interval 3.35 yr (SE=0.05 yr); mean age at first calving 9.1 yr (SE=0.3 yr); adult female annual mortality rate 0.019 (SE=0.005); annual percentage rate of population increase 6.9% (SE=0.7%); reproductive female population size in 1990: 328 animals (SE=21). No evidence of any trend with time in mean calving interval, mortality rate or rate of population increase was found. KEYWORDS: BIOLOGICAL PARAMETERS; INDIVIDUAL RECOGNITION; PHOTO-ID; RIGHT WHALE; RWI; SOUTH ATLANTIC

Rowntree, V.J., Payne, R. and Schell, D.M. 2001. Changing patterns of habitat use by southern right whales (*Eubalaena australis*) on their nursery ground at Península Valdés, Argentina, and in their long-range movements. *J. Cetacean Res. Manage.* (special issue) 2:133-43

Southern right whales (*Eubalaena australis*) have been studied on their nursery ground at Península Valdés, Argentina, every year since 1970. Since 1990, 1,208 individuals have been identified from photographs taken during annual aerial surveys; 618 whales were seen in two or more years. Patterns of habitat use have changed during the study in ways which suggest that right whales may be capable of substantial behavioral and ecological flexibility. One male and three females from Península Valdés have been sighted on other nursery grounds (Tristan da Cunha and southern Brazil). Three individuals from Península Valdés were sighted on feeding grounds off Shag Rocks and South Georgia. Some right whales from Península Valdés showed carbon and nitrogen isotope ratios very similar to those seen in right whales off South Africa, while others showed distinctive isotope ratios indicating that they fed in a different area. Whales of all ages and both sexes moved frequently between three major regions of concentration on the Peninsula Valdés nursery ground. Subadults and adult females with calves were resighted at higher rates than adult males and females in non-calf years. Changes in the geographic distribution of whales at the Peninsula include: (1) abandonment of a major region of concentration; (2) establishment of a nursery area adjacent to the centre of a growing whalewatching industry; and (3) small-scale shifts in distribution, possibly in response to natural and human disturbances. KEYWORDS: BREEDING GROUNDS; DISTRIBUTION; FEEDING; HABITAT; MIGRATION; MOVEMENT; RIGHT WHALE; RWI; SITE-FIDELITY; SOUTH AMERICA; SOUTH ATLANTIC; SOUTHERN HEMISPHERE; SURVEY - AERIAL

Rivarola, M., Campagna, C. and Tagliorette, A. 2001. Demand-driven commercial whalewatching in Península Valdés (Patagonia): conservation implications for right whales. *J. Cetacean Res. Manage.* (special issue) 2:145-51

One of the largest remaining populations of the southern right whale, *Eubalaena australis*, (ca 1,200 individuals in 1986) breeds along the coast of Península Valdés, in Argentine Patagonia. The area offers excellent opportunities for whalewatching because it is possible, with predictability, to have close-up views of animals of all ages. During 11 years, from 1987 to 1997, more than 337,000 tourists took part in boat excursions to watch right whales. The demand increased during this period over 14 times from 5,214 tourists in 1987 to 73,726 in 1997. From 1991 to 1994, more than 8,000 boat trips were required to satisfy a demand of 125,000 people. Most whalewatching involved pregnant animals or mothers and calves that often attempted to avoid the boats. In 1997, whalewatching generated direct revenues of at

least \$US 1 million in boat fees, and direct plus indirect revenues of over \$US 15 million (not including travel costs to Patagonia). The rapid growth of tourism in relation to whales has undisputed economic and public-awareness benefits but it is also raising concern about potentially detrimental effects on the animals. The lack of a management plan and of estimates of a tourist 'carrying capacity' allows customer demand to be the main driving force behind a commercial activity based on a vulnerable species. KEYWORDS: AREA-SOUTH AMERICA; BEHAVIOUR; BREEDING GROUNDS; CONSERVATION; RIGHT WHALE; RWI; SOUTH ATLANTIC; SOUTHERN HEMISPHERE; SUSTAINABILITY; WHALEWATCHING

de Oliveira Santos, M.C., Siciliano, S., de Souza, S.P. and Altmayer Pizzorno, J.L. 2001. Occurrence of southern right whales (*Eubalaena australis*) along southeastern Brazil. *J. Cetacean Res. Manage.* (special issue) 2:153-6

This paper reports on the occurrence of southern right whales (*Eubalaena australis*) in southeastern Brazilian waters (18°S-25°S), with evidence of their use of the region as an important calving area. Only in recent years have right whale sightings and strandings been reported regularly within the surveyed area. Of 71 distinct sightings reported since 1936, 39 (54.9%) were mother-calf pairs observed close to the shore. Most of these sightings (91.5%) were reported from early July to late October. Eight confirmed strandings of this species were observed within the surveyed area, six of which were between July and October. Stranded calves represented 62.5% of these records. Two calves showed evidence of incidental capture. The increasing number of sightings, and recent reports of stranded calves and one adult female could be indicative of an increase in cetacean research efforts in the region. However, it also suggests use of the southeastern Brazilian coast as an important right whale calving area. KEYWORDS: ABUNDANCE; DISTRIBUTION; INCIDENTAL SIGHTINGS; RIGHT WHALE; RWI; SOUTH ATLANTIC; STRANDINGS

Greig, A.B., Secchi, E.R., Zerbini, A.N. and Dalla Rosa, L. 2001. Stranding events of southern right whales, *Eubalaena australis*, in southern Brazil. *J. Cetacean Res. Manage.* (special issue) 2:157-60

Although international protection has been granted since 1935, southern right whales have only recently shown signs of recovery, possibly due to anthropogenic factors. Off Brazil, illegal hunting of right whales occurred until 1973. This paper reports on surveys conducted along the southern Brazilian coast and the information recovered on right whale strandings for this area from 1977-1995. In the first 10 years of this period only four cases were registered. However, in contrast, 20 cases were counted during the last nine years. These results are discussed in relation to marine traffic and the fisheries in the area that produce risks of collision and entanglement. Further, the possibility of storm surges being a preponderant factor in the mortality in this area is presented. These yearly rates are compared with neighbouring areas that are also inhabited by the right whales. Both possibilities fit the hypothesis that the right whales using the Brazilian coast for breeding may finally be showing signs of recovery. KEYWORDS: AREA-BRAZIL; ATLANTIC OCEAN; RIGHT WHALE; RWI; SOUTH AMERICA; SOUTHERN HEMISPHERE; STRANDINGS; SURVEY - SHORE-BASED

Best, P.B., Brandão, A. and Butterworth, D.S. 2001. Demographic parameters of southern right whales off South Africa. *J. Cetacean Res. Manage.* (special issue) 2:161-9

Aerial counts of right whale cow-calf pairs on the south coast of South Africa between 1971 and 1998 indicate an annual instantaneous population increase rate of 0.068 per year (SE=0.004) over this period. Annual photographic surveys since 1979 have resulted in 901 resightings of 550 individual cows. Observed calving intervals ranged from 2-15 years, with a principal mode at 3 years and secondary modes at 6, 9 and 12 years, but these make no allowance for missed calvings. Using the model of Payne et al. (1990), a maximum calving interval of 5 years produces the best fit to the data giving a mean calving interval of 3.12 years (95% confidence interval: 3.07, 3.17). The same model produces an estimate for adult female survival rate of 0.983 (95% CI: 0.972, 0.994). The Payne et al. (1990) model is extended to incorporate information on the observed ages of first reproduction of grey-blazed calves, which are known to be female. This allows the estimation of age at first parturition (median 7.88 years 95% CI 7.17, 9.29). Updates of estimates and confidence intervals for the other demographic parameters are: adult female survival rate 0.986 (0.976, 0.999); first year survival rate 0.913 (0.601, 0.994) and instantaneous population increase rate 0.071 (0.059, 0.082). These biological parameter estimates are shown to be compatible with the observed increase rate of the population without the need to postulate immigration. KEYWORDS: MATURATION; MODELLING; POPULATION PARAMETERS; REPRODUCTION; RIGHT WHALE; RWI; SOUTH AFRICA; SOUTHERN HEMISPHERE; SURVEY - AERIAL; SURVIVAL; TRENDS

Best, P.B., Peddemors, V.M., Cockcroft, V.G. and Rice, N. 2001. Mortalities of right whales and related anthropogenic factors in South African waters, 1963-1998. *J. Cetacean Res. Manage.* (special issue) 2:171-6

Between 1963 and 1998, 55 mortalities of southern right whales and a further three 'possible right whale' mortalities were recorded on the South African coastline. Of the known right whale mortalities, 31 could be classified as 'calves of the year', 8 as juveniles and 14 as adults. Relatively few (6.5-16.1%) of the calf mortalities could be attributed to anthropogenic factors, compared to juveniles (25-50%) and adults (35.7-57.1%). Apparent causes of death included ship strikes (4 definite, 7 possible) and entanglement (4 definite, 1 possible), with one harpooning incident. Five non-fatal ship strikes and 16 instances of non-fatal entanglement were also recorded. Whilst the gear most commonly involved in non-fatal entanglement was crayfish trap lines, three of the four entanglement fatalities involved longline gear. The incidence of scars attributable to previous entanglement remained constant amongst mature females from 1979-1997, at 3-4%. Recorded mortalities increased over the period 1963-1997 at a rate no different from that of population growth over the same period. The current level of anthropogenic mortality does not seem to be affecting population recovery. KEYWORDS: CAPTURE; FISHERIES; HUMAN IMPACT; MORTALITY; RIGHT WHALE; RWI; SHIP STRIKE; SOUTH AFRICA; SOUTHERN HEMISPHERE; STRANDINGS

Rosenbaum, H.C., Razafindrakoto, Y., Vahoavy, J. and Pomilla, C. 2001. A note on recent sightings of southern right whales (*Eubalaena australis*) along the east coast of Madagascar. *J. Cetacean Res. Manage.* (special issue) 2:177-80

Southern right whales (*Eubalaena australis*) are distributed throughout the Southern Hemisphere, where they seasonally migrate between high latitude feeding grounds and low latitude breeding grounds. While there are detailed records of historical and recent whaling off the southern, southwestern and southeastern African coasts, historical catches in Madagascar's waters are poorly documented. There have also been no recent, documented sightings of southern right whales off the east coast of Madagascar. Here we report two sightings, one of a single individual in Antongil Bay in northeastern Madagascar and the other of a mother and calf pair near Fort Dauphin on the southeastern

coast. DNA obtained from a biopsy sample of the single animal showed it was a male possessing one of the common South Atlantic right whale mitochondrial haplotypes. The available DNA data provide limited suggestive evidence that the individuals documented off Madagascar represent long-distance migrants from the well-documented South African population. However, the possibility that these southern right whales are members of a small or remnant population from the historical whaling grounds of Delagoa Bay, Sofala Bay or the Crozet Island feeding grounds cannot be excluded. Regardless of population assignment for these individuals, it appears that some southern right whales may be using different parts of Madagascar's east coast during the wintering season. KEYWORDS: 54-JAPAN; BREEDING GROUNDS; ELECTRONIC; GENETICS; INDIAN OCEAN; RIGHT WHALE; RWI; SIGHTINGS-GENERAL

Roux, J.-P., Best, P.B. and Stander, P.E. 2001. Sightings of southern right whales (*Eubalaena australis*) in Namibian waters, 1971-1999. *J. Cetacean Res. Manage.* (special issue) 2:181-5

Southern right whales were originally abundant in Namibian waters in winter and spring. They were either eradicated from the region or driven to extremely low numbers more than a century ago. Since 1971, 36 incidental sightings and three aerial surveys confirm the regular presence of the species within its historical calving range, between June and December. Calving has been recorded in four successive years and at least 10 calves were born in the area between 1996 and 1999, confirming the existence of a small established breeding population. This represents a northward extension of the hitherto known modern regular calving range in the South East Atlantic Ocean by more than 1,000km. KEYWORDS: AREA-AFRICA; DISTRIBUTION; INCIDENTAL SIGHTINGS; REPRODUCTION; RIGHT WHALE; RWI; SIGHTINGS-GENERAL; SOUTHERN HEMISPHERE; SURVEY - AERIAL

Reeves, R.R. 2001. Overview of catch history, historic abundance and distribution of right whales in the western North Atlantic and in Cintra Bay, West Africa. *J. Cetacean Res. Manage.* (special issue) 2:187-92

The catch history of right whales (*Eubalaena glacialis*) in the western North Atlantic has been studied in a series of projects. Data from European archives on early Basque whaling, centred in the Strait of Belle Isle, showed that there were at least a few thousand right whales in the northern part of the range in the sixteenth century. Data from shore whaling in the eastern United States supplemented by British customs data indicated that there were still more than a thousand right whales in the southern part of the range (i.e. south from Nova Scotia) in the late seventeenth century. Right whales were depleted throughout the western North Atlantic by the middle of the eighteenth century, but small shore whaling enterprises persisted in some areas and pelagic whalers continued to kill right whales opportunistically. An increase in alongshore whaling occurred at Long Island (New York) beginning in the 1850s and in North and South Carolina, Georgia and northern Florida in the 1870s-1880s. By the start of the twentieth century only a few crews of shore whalers remained active in Long Island and North Carolina, and their whaling efforts were desultory. All evidence points to stock depletion as the primary reason for the demise of organised whaling for right whales in eastern North America. Recent sightings indicate that some right whales travel from the Bay of Fundy and Scotian Shelf far to the north and east, at least occasionally reaching the historic Cape Farewell Ground. Areas known to have been used regularly by right whales in the past (e.g. Gulf of St Lawrence, Delaware Bay) are now visited seasonally by only a few individuals. Recent surveys of Cintra Bay, a historic right whale wintering ground in the eastern North Atlantic, provided no evidence of continued use by right whales. KEYWORDS: ABUNDANCE; ABUNDANCE ESTIMATE; AREA-AFRICA; DISTRIBUTION; NORTH ATLANTIC; RIGHT WHALE; RWI; WHALING - HISTORICAL

Knowlton, A. and Kraus, S. 2001. Mortality and serious injury of northern right whales (*Eubalaena glacialis*) in the western North Atlantic Ocean. *J. Cetacean Res. Manage.* (special issue) 2:193-208

Northern right whales in the western North Atlantic number about 300 animals and have shown little sign of recovery in recent decades. Mortality and serious injury due to human activities, particularly commercial fishing and shipping, are thought to be significant factors limiting their recovery. From 1970-1999, 45 right whale deaths were reliably documented. Sixteen of these fatalities (35.5%) were due to ship collisions, and three (6.7%) were due to entanglement in fishing gear. The remainder were neonates (13; 28.9%) and 'unknown cause' mortalities (13; 28.9%). Criteria for defining serious injuries and mortalities from entanglement or ship strikes were developed and include any animal carrying fishing gear, cuts from entanglement or ship strike deeper than 8cm, swelling or necrosis, evidence of poor health from such interactions, and, in carcasses, evidence of haematoma, haemorrhaging or broken bones. A total of 56 animals fitting the defined criteria were documented from 1970-1999: 31 (55.4%) from entanglement and 25 (44.6%) from ship strikes. Nineteen were fatal (16 ship strikes, 3 entanglements), 10 were possibly fatal (2 ship strikes, 8 entanglements) and 27 were non-fatal (7 ship strikes, 20 entanglements). The breakdown of potentially serious injuries by age and sex reveals no difference in levels between sexes but shows a 3.3:1 higher level of interaction in juveniles and calves versus adults. The data show that ship strikes are more immediately lethal, but entanglements can result in long term deterioration of an animal and may be responsible for higher levels of mortality than previously thought. Considering that some animals become entangled, drown and never return to the surface, even these levels may be underestimated. Between 1986 and 1999, 84 animals were presumed dead based on a lack of resightings for six years. There were 32 confirmed deaths during this time period suggesting that at least as many unreported deaths occurred as carcasses were reported. Definitive actions need to be taken to reduce the level and severity of anthropogenic injuries and deaths. Actions could include continued disentanglement efforts, gear modifications, seasonal closures for fisheries, mandatory ship reporting, ships' routing measures and speed restrictions for commercial shipping. KEYWORDS: ENTANGLEMENT; FISHERIES; HUMAN IMPACT; MORTALITY; NORTH ATLANTIC; NORTHERN HEMISPHERE; RIGHT WHALE; RWI; SHIP STRIKE; STRANDINGS

Kenney, R.D. 2001. Anomalous 1992 spring and summer right whale (*Eubalaena glacialis*) distributions in the Gulf of Maine. *J. Cetacean Res. Manage.* (special issue) 2:209-23

No right whales (*Eubalaena glacialis*) were sighted during aerial surveys in May-July 1992 in the Great South Channel region of the South-western Gulf of Maine. This was the first year that spring surveys failed to detect right whales in this region. During the late spring/early summer season when right whales would normally be expected in the Great South Channel, a few were sighted in the central Gulf of Maine, none were found in their usual late summer/early autumn feeding area near Nova Scotia and a few were seen in Massachusetts Bay. The absence of right whales in the Great South Channel in 1992 can be attributed to a shift in the regional zooplankton community. The usual spring zooplankton of the region is strongly dominated by the calanoid copepod *Calanus finmarchicus*, vertically and horizontally aggregated into dense patches which are the preferred foraging areas of right whales. The 1992 zooplankton was dominated by pteropods, distributed evenly throughout the water column. It is possible, although unlikely, that pteropods are unacceptable prey for right whales. A more likely explanation is that their local densities within the small-scale patches were below the energetic threshold required for

successful right whale feeding. The shift in zooplankton dominance in 1992 is likely related to significantly reduced water temperatures and a delay in the development of the usual hydrographic structure of the region. The 1992 temperature and hydrographic anomalies, in turn, can be attributed principally to an unusually large influx of colder and fresher Scotian Shelf Water, and may have been enhanced by widespread cooling of the Northern Hemisphere caused by sulphuric acid haze in the atmosphere from the June 1991 eruption of Pinatubo volcano in the Philippines. KEYWORDS: CLIMATE CHANGE; DISTRIBUTION; ECOSYSTEM; FEEDING GROUNDS; NORTH ATLANTIC; OCEANOGRAPHY; PATCHES; PREY; RIGHT WHALE; RWI

Mayo, C.A., Letcher, B.H. and Scott, S. 2001. Zooplankton filtering efficiency of the baleen of a North Atlantic right whale, *Eubalaena glacialis*. *J. Cetacean Res. Manage.* (special issue) 2:225-9

In order to define the trophic requirements of the North Atlantic right whale, a series of experiments were designed to examine the food capture characteristics of the species. The food filtering efficiency of the baleen of an immature right whale was tested in a flume using graded samples of zooplankton, primarily calanoid copepods, collected in the path of surface-feeding whales. The filtering capacity decreased with decreasing prey organism size, so that greater than 95% of the available caloric content of the zooplankton samples was captured in size fractions collected on 333µm mesh nets. The experiments demonstrate that the filtering efficiency of the baleen narrowly focuses the right whale's feeding on an energy-rich, yet spatially and temporally variable, portion of the mid-water food resource. KEYWORDS: COPEPODS; DIET; EUPHASIIDS; FEEDING; NORTH ATLANTIC; NUTRITION; PREY; RIGHT WHALE; RWI

Kraus, S., Hamilton, P., Kenney, R., Knowlton, A. and Slay, C. 2001. Reproductive parameters of the North Atlantic right whale. *J. Cetacean Res. Manage.* (special issue) 2:231-6

North Atlantic right whale reproduction was assessed for the period 1980 through 1998. At the end of this period, we estimated there were between 299 and 437 right whales alive, including 70 mature females. Using maximum and minimum population estimates for the entire period, mean values for gross annual reproductive rate were 0.36 and 0.49 respectively, and the mean value for calves per mature female per year was 0.25. There is a significant decreasing trend in calves per mature female per year over the entire study period. The mean age at first calving is 9.53 years. The mean number of cows recruited annually since 1985 is 3.8. Mean annual calving intervals have increased significantly during the study period from 3.67 years (1980-1992) to over 5 years (1993-1998). Although the North Atlantic population is affected by significant anthropogenic mortality, diminishing reproductive rates are probably also responsible for the plight of this species. KEYWORDS: NORTH ATLANTIC; REPRODUCTION; RIGHT WHALE; RWI; TRENDS

Kraus, S.D. and Hatch, J.J. 2001. Mating strategies in the North Atlantic right whale (*Eubalaena glacialis*). *J. Cetacean Res. Manage.* (special issue) 2:237-44

Data from 210 groups of right whales engaged in apparent courtship behaviour were examined. Photo-identification of individual whales, videotapes and underwater recordings were used to analyse the composition and function of these groups. Most groups were composed of one female and several males involved in sexual activity. Underwater recordings made of eight groups indicated that females within the groups emitted calls, probably to attract males. Except to breathe, females remained inverted at the surface, making copulation difficult. Females did not actively select mates, but instead created conditions that incited competition among males. Males used agility, strength, stamina and large callosities to compete for mating opportunities when the female rolled over to breathe. Males also probably competed through sperm competition. Maintaining favourable positions next to a female appeared to provide males with the most opportunities to copulate, and repeated copulations with the same female may have increased the probability of displacing competing male's sperm. KEYWORDS: BEHAVIOUR; COMPETITION; NORTH ATLANTIC; PHOTO-ID; REPRODUCTION; RIGHT WHALE; RWI; SOCIAL; VOCALISATION

Brown, M.W., Brault, S., Hamilton, P.K., Kenney, R.D., Knowlton, A.R., Marx, K., Mayo, C.A., Slay, C.K. and Kraus, S.D. 2001. Sighting heterogeneity of right whales in the western North Atlantic: 1980-1992. *J. Cetacean Res. Manage.* (special issue) 2:245-50

The population of western North Atlantic right whales (*Eubalaena glacialis*) is distributed primarily between Florida, USA and Nova Scotia, Canada, aggregating seasonally in five geographically distinct, high-use areas. To test the effectiveness of monitoring all demographic classes (juveniles, adult males and females) of the population in these five habitat areas, an evaluation was carried out of the identification records of catalogued right whales collected between 1980 and 1992, for which the age, sex and reproductive status (for adult females) were known. The mean annual identification frequency of adult females was significantly lower than that of adult males, juvenile females and juvenile males. Among adult females, reproductively active females were seen significantly more often than expected when lactating (with a calf) than during their pregnancy or resting years. These data suggest that, while research efforts in the five high-use habitat areas have had relatively equal success at monitoring juvenile males and females and adult males, many adult females are segregated at times from the rest of the population. Lower variability in annual identification frequencies of adult females indicates that they may be more site specific in their distribution than males, particularly during the years when they are pregnant or resting from a previous pregnancy. Re-running these analyses using sighting records updated through 2000 will help determine if the trends continue to be documented regardless of changes in survey effort and patterns of habitat use of some animals. KEYWORDS: MONITORING; NORTH ATLANTIC; NORTHERN HEMISPHERE; POPULATION ASSESSMENT; RIGHT WHALE; RWI; SIGHTINGS-GENERAL

Kenney, R.D., Mayo, C.A. and Winn, H. 2001. Migration and foraging strategies at varying spatial scales in western North Atlantic right whales. *J. Cetacean Res. Manage.* (special issue) 2:251-60

Western North Atlantic right whales (*Eubalaena glacialis*) utilise several important foraging habitats off the northeastern United States and eastern Canada, where they feed on dense patches of zooplankton. At a fundamental level, a right whale's optimal strategy should be to locate and exploit the prey patches with the highest net energetic return from foraging. There remain many questions, however, concerning their migration and foraging strategies and the environmental cues and sensory modalities involved in migration and foraging, all of which are likely to vary at different spatial scales. For example, a right whale most likely uses different mechanisms and strategies for location of primary feeding grounds than those used for detection of optimum prey patches within a feeding area. This paper proposes a multi-scaled, hierarchical, conceptual model of right whale migratory and foraging strategies and presents a variety of hypotheses concerning the

mechanisms involved. Right whales may return to the general area of their feeding grounds based on prior experience. The locations of successful foraging in the immediately preceding years are likely to be re-visited, as are habitats to which an animal was exposed while accompanying its mother during its first year of life. It is also possible that the whales utilise large- or medium-scale environmental cues, such as currents, temperature discontinuities, or salinity signals indicating coastal plumes, to locate likely areas of high zooplankton patch density. Whilst on their feeding grounds, right whales tend to be aggregated, but there are usually outliers which may represent occasional excursions in search of other prey patches, though there is currently no evidence to address whether they communicate information about prey to other individuals. Their behaviour whilst actively feeding indicates that they can detect differences in patch density and adjust their behaviour accordingly. A likely sensory mechanism for quantification of patch density and triggering of feeding behaviour would be the vibrissae around the anterior opening of the mouth. KEYWORDS: BEHAVIOUR; DISTRIBUTION; FEEDING GROUNDS; FORAGING; HABITAT; MIGRATION; MOVEMENT; NORTH ATLANTIC; PATCHES; RIGHT WHALE; RWI; SITE-FIDELITY

Scarff, J.E. 2001. Preliminary estimates of whaling-induced mortality in the 19th century North Pacific right whale (*Eubalaena japonicus*) fishery, adjusting for struck-but-lost whales and non-American whaling. *J. Cetacean Res. Manage.* (special issue) 2:261-8

This study develops preliminary estimates of total whaling-induced mortality of northern right whales in the 19th century North Pacific pelagic whale fishery. Best's (1987) study of American whaling returns resulted in estimates of the total American catch of 14,480 and 15,374 northern right whales during the period 1839-1909. The present study offers adjustment factors to estimate the total mortality from these catch data. Quantitative data from 14 pelagic expeditions for northern right whales in the North Pacific from 1838-1860 and additional anecdotal information about struck-but-lost animals is reviewed. On 12 voyages, 327 northern right whales were struck with harpoons, but only 133 landed. Adjusted for the subsequent recovery of struck whales, this implies a ratio of 2.43 whales struck for each whale eventually secured and flensed by whaleships. Data from four voyages show that of 148 northern right whales struck with harpoons, 14 sank before they could be processed. From a sample of five voyages, 80 northern right whales were landed and 31 carcasses sank without being secured. During the height of pelagic whaling in the North Pacific, approximately 10% of the fleet was non-American, primarily French. Adjusting recorded catch estimates for struck-but-lost mortality and non-American whaling yields preliminary estimates of total mortality in this fishery in the range of 26,500-37,000 animals during the period 1839-1909. In the single decade of 1840-49, between 21,000-30,000 northern right whales may have been killed in the North Pacific, Sea of Okhotsk and Bering Sea, representing about 80% of the northern right whales killed in this region during the period 1839-1909. KEYWORDS: ABUNDANCE ESTIMATE; NORTH PACIFIC; NORTHERN HEMISPHERE; RIGHT WHALE; RWI; WHALING - HISTORICAL

Brownell, R.L., Clapham, P.J., Miyashita, T. and Kasuya, T. 2001. Conservation status of North Pacific right whales. *J. Cetacean Res. Manage.* (special issue) 2:269-86

The North Pacific right whale (*Eubalaena japonica*) is among the most endangered of all great whales, having been subject to intensive commercial whaling in the 19th century. All available 20th century records of this species in the North Pacific were reviewed. There has been a total of 1,956 recorded sightings since 1900; of these, 991 came from the western North Pacific, 690 from the eastern North Pacific and 284 had no location specified. Thirteen strandings (all but one from the western North Pacific) were recorded. Known catches for commercial or scientific purposes totalled 738 (327 in the western North Pacific, 411 in the eastern North Pacific). Most of the reported Soviet 'sightings' in the eastern North Pacific were actually catches, as may be the case for Soviet sightings in the Okhotsk Sea. In addition, the impact of known Soviet illegal catches in the Okhotsk Sea may be reflected in an apparent decline in sightings after the 1960s (although this may be partly explained by low observer effort). Overall, the data support the hypothesis that at least two stocks of right whales exist in the North Pacific. Any recovery in the western North Pacific population was compromised by the Soviet catches in the Okhotsk region, although recent sightings suggest that this population is still large enough to sustain reproduction. By contrast, Soviet catches in the now-smaller eastern North Pacific population have probably irreversibly damaged any recovery. The extreme paucity of sightings and virtual absence of reproduction in the eastern North Pacific region suggest that this population may become extinct when its remaining members die in the 21st century. Although the prognosis for this population is poor, a long-term monitoring programme is required to better understand its conservation status and to determine whether it may be affected by human-related problems that would require mitigation. KEYWORDS: CONSERVATION; DISTRIBUTION; NORTH PACIFIC; NORTHERN HEMISPHERE; PACIFIC OCEAN; RIGHT WHALE; RWI; WHALING - HISTORICAL; WHALING - MODERN

LeDuc, R.G., Perryman, W.L., Gilpatrick, J.W.J., Hyde, J., Stinchcomb, C., Carretta, J.V. and Brownell, R.L., Jr. 2001. A note on recent surveys for right whales in the southeastern Bering Sea. *J. Cetacean Res. Manage.* (special issue) 2:287-9

Research vessel and aerial platforms were used between 1997 and 2000 to collect genetic and photographic data from a small population of right whales that summers in the southeastern Bering Sea. Totals of 11 and six unique individuals were identified using photographic and genetic methods, respectively. Single matches between years occurred using both methods, and all genetic samples turned out to be from male whales. Long-term research is needed to estimate the size of this population and to determine what threats the whales may be facing. KEYWORDS: GENETICS; NORTH PACIFIC; PHOTO-ID; RIGHT WHALE; RWI; SURVEY - AERIAL; SURVEY-VESSEL

Hiby, L. and Lovell, P. 2001. A note on an automated system for matching the callosity patterns on aerial photographs of southern right whales. *J. Cetacean Res. Manage.* (special issue) 2:291-5

Photographs showing the callosity patterns of southern right whales (*Eubalaena australis*) are currently compared by eye to identify individuals and monitor their occurrence within certain areas. This paper describes software designed to reduce the number of by eye comparisons required to maintain each of the existing local photo-identification catalogues. The software is used to extract, from each photograph, a viewpoint-independent description of the shape and location of each callosity which generates a parallel catalogue of extracts. This is then compared with the description extracted from each new photograph to generate a list of similarity scores and thus highlight likely matches. The software can also be used to compare the different catalogues of extracts with each other. Using a test set of 67 photographs of 23 whales taken from 1974 to 1986, the software reduced the number of by eye comparisons required to identify all individuals by 93% when compared with a purely random search. KEYWORDS: PHOTO-ID; RIGHT WHALE; RWI; SOUTHERN HEMISPHERE

Burnell, S. and Shanahan, D. 2001. A note on a prototype system for simple computer-assisted matching of individually identified southern right whales, *Eubalaena australis*. *J. Cetacean Res. Manage.* (special issue) 2:297-300

A system using computer assistance in the matching of the callosity patterns of individual southern right whales is described. When provided with a digitised representation of an individual whale's callosity pattern, the prototype system produces a hierarchical output of the most similar patterns in the database with relatively high accuracy. A trial database of binary images of the callosity patterns of 165 individually identified southern right whales was created. A further two replicates each of nine different individual whales within the trial database, were then created by two different operators, producing a test set of 18 images. A software program, utilising a pattern recognition algorithm and incorporating a mouse driven user interface, was developed so that when provided with a binary bitmap of an individual whale from the test set, the program compares it against a trial database of previously saved bitmaps and produces a hierarchical output of the most similar whales, or nearest 'matches'. For 15 of the 18 test images (83%), the system returned the correct whale as the top match out of the 165 in the trial database. For the remaining three test images the correct whale was the second, sixth and sixteenth ranked whale in the trial database containing 165 whales. The program was successful in reducing the number of individuals required for manual comparison to a small percentage of the total catalogue, with a high degree of accuracy, and with a significant associated time saving. It is envisaged that the final matching will continue to be done visually by an experienced operator using the original photographs. Further refinement of the system with the aim of streamlining and simplifying the input process and incorporating partial pattern recognition is intended. KEYWORDS: PHOTO-ID; RIGHT WHALE; RWI; SOUTHERN HEMISPHERE; TECHNIQUES

Moore, M.J., Miller, C.A., Morss, M.S., Arthur, R., Lange, W.A., Prada, K.G., Marx, M.K. and Frey, E.A. 2001. Ultrasonic measurement of blubber thickness in right whales. *J. Cetacean Res. Manage.* (special issue) 2:301-9

The right whale population in the northwestern Atlantic appears to face the risk of extinction: ship and fishing gear trauma are significant mortality factors, but calving rates are also depressed compared to southern right whales. A major factor in calving success in many species is body condition. Knowledge of the dynamics of body condition is also important in studies of juvenile and sub-adult growth and seasonal changes in adults. This paper describes a method to assess body condition in live right whales. To characterise the acoustic properties of the blubber/muscle interface we first studied samples of Atlantic white-sided dolphin and right whale in the laboratory. Tissue heterogeneity was examined grossly and in histological sections. Acoustic echoes were strong from the sub-dermal connective tissue sheath(s). Echo strengths did not appear to vary with lipid content. We then used a 0.5MHz ultrasound transducer on a cantilevered 12m pole to touch the back of surfacing right whales briefly. Multiple laboratory and field measurements on individual animals suggest repeated measures of blubber thickness at a single location are reasonably consistent. Data will be normalised to both sampling position on the body and to length of the animal, estimated by mensuration from stereo video images of the animal during sampling. In this way, using a long-term consistent database of blubber thickness measurements, and catalogued reproductive histories from on-going photographic identification studies, we plan to assess the significance of changing body condition in right whale population dynamics. KEYWORDS: BLUBBER; NORTH ATLANTIC; NUTRITION; REPRODUCTION; RIGHT WHALE; RWI; ULTRASOUND TECHNIQUES