

# Marine Science Review - 198

## Marine mammals



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## A. Recent articles – no abstract available

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Parsons, E.C.M., Rose, N.A., Bass, C., Perry, C., and Simmonds, M.P. **It's not just poor science - Japan's "scientific" whaling may be a human health risk too.** *Marine Pollution Bulletin* 52(9): 1118-1120, 2006.

Myers, R.A., Boudreau, S.A., Kenney, R.D., Moore, M.J., Rosenberg, A.A., Sherrill-Mix, S.A., and Worm, B. **Saving endangered whales at no cost.** *Current Biology* 17(1): R10-R11, 2007.

## B. Recent articles with abstracts

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Antonelis, G.A., Baker, J.D., Johanos, T.C., Braun, R.C., and Harting, A.L. **Hawaiian monk seal: status and conservation issues.** *Atoll Research Bulletin* 543: 75-101, 2006.

**Notes:** The authors detail pertinent information on the history, current status, and conservation of the endangered Hawaiian monk seal (*Monachus schauinslandi*). The present population is estimated at about 1,200 to 1,300 seals, a decrease of 60% since the 1950s. Counts declined about 5%/yr from 1985 to 1993, remained relatively stable through the year 2000, and then declined again from 2001 to 2003. Population trends have been variable at the six main reproductive subpopulations in the Northwestern Hawaiian Islands (NWHI). Over the last few decades, pup production has averaged about 200, but overall juvenile survival has declined at most sites. The largest subpopulation is at French Frigate Shoals, where counts have dropped by 60% since 1989 and the age distribution has become severely inverted as a result of high juvenile mortality over the last decade. Overall demographic trends and parameters suggest that the total population will likely continue to decline, at least in the short term. Monk seals appear throughout the Hawaiian Archipelago, and although most are found in the NWHI, a small but increasing number haul out and pup in the Main Hawaiian Islands (MHI). Monk seals typically use isolated beaches for resting, molting, parturition, and nursing offspring; and forage on demersal and epibenthic prey. Past and present sources of anthropogenic impacts to monk seals include hunting (during 1800s and early 1900s), disturbance (e.g., prior military activities beginning in WWII), entanglement in marine debris, and fishery interactions. Primary natural factors affecting monk seal recovery include predation by sharks, aggression by adult male monk seals, and reduction of habitat and prey associated with environmental change. Identification and mitigation of these and other possible factors (e.g., disease) limiting population growth represent ongoing challenges and are the primary objectives of the Hawaiian monk seal conservation and recovery effort.

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Sasaki, T., Nikaido, M., Wada, S., Yamada, T.K., Cao, Y., Hasegawa, M., and Okada, N. ***Balaenoptera omurai* is a newly discovered baleen whale that represents an ancient evolutionary lineage.** *Molecular Phylogenetics and Evolution* 41: 40-52, 2006.

**Notes:** *Balaenoptera omurai*, formerly classified as a small form of Bryde's whale, was recently reclassified as a new baleen whale species of the family Balaenopteridae. Although researchers have investigated the evolutionary history of Balaenopteridae and their relatives using molecular phylogenetic methods, the taxonomy of the ordinary Bryde's whale (*Balaenoptera brydei*) and

small-form Bryde's whales (*Balaenoptera edeni* and *B. omurai*) remains unclear. We have used complete mtDNA sequences and short interspersed repetitive element (SINE) insertion patterns to construct the evolutionary history of both *B. omurai* and the taxonomically redefined species, *B. edeni*. The combined results demonstrate that *B. omurai* forms a monophyletic lineage with *B. musculus*, *B. brydei*, *B. edeni* and *B. borealis* and that *B. omurai* and *B. musculus* successively diverged from their common ancestor. In addition, we also showed that *B. edeni* constitutes a sister taxon to *B. brydei*. Our data suggest that *B. omurai* evolved as an ancient independent lineage that diverged much earlier than *B. borealis*, *B. brydei* and *B. edeni*, which were previously believed to be closely related to *B. omurai*.

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Ferguson, S.H. and Higdon, J.W. **How seals divide up the world: environment, life history, and conservation.** *Oecologia* 150(2): 318-329, 2006.

**Notes:** Pinnipeds display a remarkable variation in life history adaptations while successfully inhabiting almost every marine environment. We explore how they have done this by grouping the world's pinniped species according to their environmental conditions, mating systems, lactation strategies, and timing of life histories. Next, we tested whether any of these clusters provide information about risk of extinction (using the International Union for Nature and the Conservation of Natural Resources status ranks). Seals at risk were not characterized by differences in lactation pattern (22% short vs. 46% long), mating system (24% multi-male vs. 35% harems), or timing of life history events (23% fast vs. 42% slow) but did differ based on four environmental groupings. Grouping traits (rather than seals) described two clusters: one that included the environmental trait, primary productivity, and a second one that included all other environmental variables (seasonality, latitude, and temperature). Based on this result and theoretical considerations, we plotted seals according to energy (primary productivity) and variation (seasonality) and found a pattern analogous to that of the same four groups determined by cluster analysis of all environmental variables. Of the two pinniped groups representing low variation (equatorial and high productivity), ten of 21 seal species have been designated at risk, in contrast to none of the 13 seal species adapted to high variation. We conclude that seals appear to be best adapted to seasonal environments and thus, conservation efforts may benefit by concentrating on species inhabiting less variable environments.

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Baker, C.S., Lukoschek, V., Lavery, S., Dalebout, M.L., Yong-un, M., Endo, T., and Funahashi, N. **Incomplete reporting of whale, dolphin and porpoise 'bycatch' revealed by molecular monitoring of Korean markets.** *Animal Conservation* 9(4): 474-482, 2006.

**Notes:** We report the results of molecular monitoring of 'whalemeat' markets in the Republic of (South) Korea based on nine systematic surveys from February 2003 to February 2005. As Korea has no programme of commercial or scientific whaling and there is a closure on the hunting of dolphins and porpoises, the only legal source of these products was assumed to be incidental fisheries mortalities ('bycatch') as reported by the government to the International Whaling Commission. Species identification of 357 products using mitochondrial DNA control region or cytochrome *b* sequences and the web-based programme DNA-surveillance revealed three species of baleen whales (North Pacific minke, common form Bryde's and humpback), three species of beaked whales (Cuvier's, Stejneger's and Blainville's), seven species of dolphins (short-finned pilot, false killer and killer whales; Risso's, bottlenose, common and Pacific white-sided dolphins) and two species of porpoises (harbour and finless). Comparison of market products with official records revealed a number of discrepancies. Of the eight species identified on the markets in 2003, three were not reported in official records for that year. Of the 11 species identified in 2004, five were not reported as bycatch, although one species, a humpback whale, was reported as 'stranded'. We also found significant inconsistencies in the expected frequencies of products from most species, including a large over-representation of finless porpoises and false killer whales. We suggest ways in which market surveys could be improved to provide better information on the magnitude of fisheries bycatch and other illegal, unregulated and unreported (IUU) exploitation of wildlife.

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Cornick, L.A., Neill, W., and Grant, W.E. **Assessing competition between Steller sea lions and the commercial groundfishery in Alaska: A bioenergetics modelling approach.** *Ecological Modelling* 199(1): 107-114, 2006.

**Notes:** In the last three decades the western stock of the Steller sea lion (*Eumetopias jubatus*) has declined by more than 85%. Nutritional stress resulting in increased juvenile mortality is one of the leading hypotheses to account for this decline. Competition between Steller sea lions and the commercial groundfishery for walleye pollock (*Theragra chalcogramma*) has been

proposed as a mechanism underlying the nutritional stress. In order to examine the competition component of the nutritional stress hypothesis, we developed a bioenergetics-based model to project the population trends of Steller sea lions under various scenarios of continued groundfish harvest. Annual energy budgets were calculated for the Gulf of Alaska population of Steller sea lions, and compared with projected available energy from walleye pollock under a variety of harvest scenarios. Model simulations produced 50-year Steller sea lion population projections consistent with current trends, as well as with published projections for stable and increasing populations from stable age distribution life table models. Model simulations were unable to produce energy deficits sufficient to account for the decline in Steller sea lions, but do suggest areas where existing data need supplementing.

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Panigada, S., Pesante, G., Zanardelli, M., Capoulade, F., Gannier, A., and Weinrich, M.T. **Mediterranean fin whales at risk from fatal ship strikes.** *Marine Pollution Bulletin* 52(10): 1287-1298, 2006.

**Notes:** This paper reviews and analyzes ship collision records for the relatively isolated population of fin whales in the Mediterranean Sea from 1972 to 2001. Out of 287 carcasses, 46 individuals (16.0%) were certainly killed by boats. The minimum mean annual fatal collision rate increased from 1 to 1.7 whales/year from the 1970s to the 1990s. Fatal strike events (82.2%) were reported in or adjacent to the Pelagos Sanctuary, characterized by high levels of traffic and whale concentrations. Among 383 photo-identified whales, 9 (2.4%) had marks that were attributed to a ship impact. The reported rates are unusually high for baleen whales. The high likelihood of unreported fatal strikes combined with other anthropogenic threats suggests an urgent need for a comprehensive, basin-wide conservation strategy, including ship strike mitigation requirements, real-time monitoring of whale presence and distribution to re-locate ferry routes to areas of lower cetacean density, and reducing ship speed in high cetacean density areas.

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Carstensen, J., Henriksen, O.D., and Teilmann, J. **Impacts of offshore wind farm construction on harbour porpoises: acoustic monitoring of echolocation activity using porpoise detectors (T-PODs).** *Marine Ecology Progress Series* 321: 295-308, 2006.

**Notes:** Offshore wind farming is a new emerging technology in the field of renewable energies. This study investigates the potential impact of the construction of one of the first major, offshore wind farms (> 100 MW) on harbour porpoises *Phocoena phocoena* by means of acoustic porpoise detectors (T-PODs) monitoring porpoise echolocation activity. The monitoring program was established as a modified BACI (before, after, control, impact) design, with 6 monitoring stations equally distributed between the impact area and a nearby reference area. Mean waiting times, defined as the period between 2 consecutive encounters of echolocation activity, increased from 6 h in the baseline period to 3 d in the wind farm area during the construction. This increase was 6 times larger than changes observed in the reference area. One specific construction activity, involving the ramming and vibration of steel sheet piles into the seabed, was associated with an additional significant increase in waiting time of 4 to 41 h, in both the construction and reference areas. Assuming that echolocation activity is related to harbour porpoise density, the analysis shows that their habitat-use changed substantially, with the porpoises leaving the construction area of the offshore wind farm. Acoustic monitoring from fixed positions provides data with a high temporal resolution, but low spatial resolution, which can be analysed at a variety of scales, and can be applied to harbour porpoises and other echolocating cetaceans.

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Das, K., Vossen, A., Tolley, K., Vikingsson, G., Thron, K., Muller, G., Baumgartner, W., and Siebert, U. **Interfollicular fibrosis in the thyroid of the harbour porpoise: An endocrine disruption?** *Archives of Environmental Contamination and Toxicology* 51(4): 720-729, 2006.

**Notes:** Previous studies have described high levels of polychlorobiphenyls (PCB), polybrominated diphenylether (PBDE), toxaphene, p,p'-dichlorodiphenyl-trichloroethane (DDT), and p,p'-dichlorodiphenyldichloroethylene (DDE) in the blubber of the harbour porpoise from the North Sea raising the question of a potential endocrine disruption in this species. In the present study, the thyroids of 57 harbour porpoises from the German and Danish (North and Baltic Seas), Norwegian, and Icelandic coasts have been collected for histological and immunohistological investigations. The number of follicles and the relative distribution of follicles, connective, and solid tissues (%) were quantified in the thyroid of each individual. Then, the potential relationship between the thyroid morphometry data and previously described organic compounds (namely, PCB, PBDE,

toxaphene, DDT, and DDE) was investigated using factor analysis and multiple regressions. Thyroid morphology differed strongly between sampling sites. Porpoises from the German (North and Baltic Seas) and Norwegian coasts displayed a high percentage of connective tissues between 30 and 38% revealing severe interfollicular fibrosis and a high number of large follicles (diameter > 200  $\mu\text{m}$ ). A correlation-based principal component analysis (PCA) revealed two principal components explaining 85.9% of the total variance. The variables PCB, PBDE, DDT, and DDE compounds loaded highest on PC1 whereas toxaphene compound loaded most on PC2. Our results pointed out a relationship between PC1 (PCBs, PBDE, DDE, and DDT compounds) and interfollicular fibrosis in the harbour porpoise thyroids. Such an association is not alone sufficient for a cause-effect relationship but supports the hypothesis of a contaminant-induced thyroid fibrosis in harbour porpoises raising the question of the long-term viability in highly polluted areas.

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Lancaster, M.L., Gemmell, N.J., Negro, S., Goldsworthy, S., and Sunnucks, P. **Ménage à trois on Macquarie Island: hybridization among three species of fur seal (*Arctocephalus* spp.) following historical population extinction.** *Molecular Ecology* 15(12): 3681-3692, 2006.

**Notes:** Human-induced changes to natural systems can cause major disturbances to fundamental ecological and population processes and result in local extinctions and secondary contacts between formerly isolated species. Extensive fur seal harvesting during the nineteenth century on Macquarie Island (subantarctic) resulted in extinction of the original population. Recolonization by three species has been slow and complex, characterized by the establishment of breeding groups of Antarctic and subantarctic fur seals (*Arctocephalus gazella* and *Arctocephalus tropicalis*) and presumed nonbreeding (itinerant) male New Zealand fur seals (*Arctocephalus forsteri*). One thousand and seven pups from eight annual cohorts (1992-2003) were analysed using mitochondrial control region data (RFLP) and 10 microsatellite loci to estimate species composition and hybridization. Antarctic fur seals predominated, but hybridization occurred between all three species (17-30% of all pups). Involvement of New Zealand fur seals was unexpected as females are absent and males are not observed to hold territories during the breeding season. The proportion of hybrids in the population has fallen over time, apparently owing to substantial influxes of pure Antarctic and subantarctic individuals and non-random mating. Over 50% of New Zealand hybrids and 43% of Antarctic-subantarctic hybrids were not F<sub>1</sub>, which indicates some degree of hybrid reproductive success, and this may be underestimated: simulations showed that hybrids become virtually undetectable by the third generation of backcrossing. While human impacts seem to have driven novel hybridization in this population, the present 'time slices' analysis suggests some biological resistance to complete homogenization.

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Teuten, E.L., Pedler, B.E., Hangsterfer, A.N., and Reddy, C.M. **Identification of highly brominated analogues of Q1 in marine mammals.** *Environmental Pollution* 144(1): 336-344, 2006.

**Notes:** Three novel halogenated organic compounds (HOCs) have been identified in the blubber of marine mammals from coastal New England with the molecular formulae C<sub>9</sub>H<sub>3</sub>N<sub>2</sub>Br<sub>6</sub>Cl, C<sub>9</sub>H<sub>3</sub>N<sub>2</sub>Br<sub>7</sub>, and C<sub>9</sub>H<sub>4</sub>N<sub>2</sub>Br<sub>5</sub>Cl. They were identified using high and low resolution gas chromatography mass spectrometry (GCMS) and appear to be highly brominated analogues of Q1, a heptachlorinated HOC suspected to be naturally produced. These compounds were found in Atlantic white sided dolphin (*Lagenorhynchus acutus*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), harbor porpoise (*Phocoena phocoena*), beluga whale (*Delphinapterus leucas*), fin whale (*Balaenoptera physalus*), grey seal (*Halichoerus grypus*), harp seal (*Phoca groenlandica*) and a potential food source (*Loligo pealei*) with concentrations as high as 2.7  $\mu\text{g/g}$  (lipid weight). The regiospecificity of C<sub>9</sub>H<sub>3</sub>N<sub>2</sub>Br<sub>6</sub>Cl is suggestive of a biogenic origin. Debromination of C<sub>9</sub>H<sub>3</sub>N<sub>2</sub>Br<sub>6</sub>Cl may be significant in the formation of C<sub>9</sub>H<sub>4</sub>N<sub>2</sub>Br<sub>5</sub>Cl.

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Houde, M., Pacepavicius, G., Wells, R.S., Fair, P.A., Letcher, R.J., Alae, M., Bossart, G.D., Hohn, A.A., Sweeney, J., Solomon, K.R., and Muir, D.C.G. **Polychlorinated biphenyls and hydroxylated polychlorinated biphenyls in plasma of bottlenose dolphins (*Tursiops truncatus*) from the Western Atlantic and the Gulf of Mexico.** *Environmental Science and Technology* 40(19): 5860-5866, 2006.

**Notes:** Polychlorinated biphenyls (PCBs) and hydroxylated metabolic products (OH-PCBs) were measured in plasma collected from live-captured and released bottlenose dolphins (*Tursiops truncatus*) from five different locations in the Western Atlantic and the Gulf of Mexico in 2003 and 2004. In 2004, the sum ( $\Sigma$ ) of concentration of PCBs in plasma of dolphins

sampled off Charleston, SC [geometric mean: 223 ng/g of wet weight (w.w.)] was significantly higher ( $p < 0.05$ ) than concentrations detected in animals from the Indian River Lagoon, FL ( $\Sigma$ PCBs: 122 ng/g w.w.) and the Sarasota Bay, FL ( $\Sigma$ PCBs: 111 ng/g w.w.). The PCB homolog profiles were similar among locations. Concentrations of OH-PCBs were significantly higher ( $p < 0.05$ ) in plasma of dolphins from Charleston, SC ( $\Sigma$ OH-PCBs for 2003: 126 ng/g w.w.; 2004: 138 ng/g w.w.) than animals from Florida ( $\Sigma$ OH-PCBs ranged from 6 to 47 ng/g w.w.) and Bermuda (8.3 ng/g w.w.); however, concentrations in the Charleston samples did not differ from animals captured in Delaware Bay, NJ (57 ng/g w.w.). The  $\Sigma$ OH-PCBs constituted 2-68% of the total PCB concentrations in plasma. Dichloro- to nonachloro-OH-PCBs were quantified using high-resolution gas chromatography mass spectrometry, but only around 20% of OH-PCBs could be identified by comparison to authentic standards. Results from this study show that OH-PCB are important environmental contaminants in dolphins and suggest that PCBs, decades after their ban, may still constitute a threat to wildlife.

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Amstrup, S.C., Stirling, I., Smith, T.S., Perham, C., and Thiemann, G.W. **Recent observations of intraspecific predation and cannibalism among polar bears in the southern Beaufort Sea.** *Polar Biology* 29(11): 997-1002, 2006.

**Notes:** Intraspecific killing has been reported among polar bears (*Ursus maritimus*), brown bears (*U. arctos*), and black bears (*U. americanus*). Although cannibalism is one motivation for such killings, the ecological factors mediating such events are poorly understood. Between 24 January and 10 April 2004, we confirmed three instances of intraspecific predation and cannibalism in the Beaufort Sea. One of these, the first of this type ever reported for polar bears, was a parturient female killed at her maternal den. The predating bear was hunting in a known maternal denning area and apparently discovered the den by scent. A second predation event involved an adult female and cub recently emerged from their den, and the third involved a yearling male. During 24 years of research on polar bears in the southern Beaufort Sea region of northern Alaska and 34 years in northwestern Canada, we have not seen other incidents of polar bears stalking, killing, and eating other polar bears. We hypothesize that nutritional stresses related to the longer ice-free seasons that have occurred in the Beaufort Sea in recent years may have led to the cannibalism incidents we observed in 2004.

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Stirling, I. and Parkinson, C.L. **Possible effects of climate warming on selected populations of polar bears (*Ursus maritimus*) in the Canadian Arctic.** *Arctic* 59(3): 261-275, 2006.

**Notes:** Polar bears depend on sea ice for survival. Climate warming in the Arctic has caused significant declines in total cover and thickness of sea ice in the polar basin and progressively earlier breakup in some areas. Inuit hunters in the areas of four polar bear populations in the eastern Canadian Arctic (including Western Hudson Bay) have reported seeing more bears near settlements during the open-water period in recent years. In a fifth ecologically similar population, no changes have yet been reported by Inuit hunters. These observations, interpreted as evidence of increasing population size, have resulted in increases in hunting quotas. However, long-term data on the population size and body condition of polar bears in Western Hudson Bay, as well as population and harvest data from Baffin Bay, make it clear that those two populations at least are more likely to be declining, not increasing. While the ecological details vary in the regions occupied by the five different populations discussed in this paper, analysis of passive-microwave satellite imagery beginning in the late 1970s indicates that the sea ice is breaking up at progressively earlier dates, so that bears must fast for longer periods during the open-water season. Thus, at least part of the explanation for the appearance of more bears near coastal communities and hunting camps is likely that they are searching for alternative food sources in years when their stored body fat depots may be depleted before freeze-up, when they can return to the sea ice to hunt seals again. We hypothesize that, if the climate continues to warm as projected by the Intergovernmental Panel on Climate Change (IPCC), then polar bears in all five populations discussed in this paper will be increasingly food-stressed, and their numbers are likely to decline eventually, probably significantly so. As these populations decline, problem interactions between bears and humans will likely continue, and possibly increase, as the bears seek alternative food sources. Taken together, the data reported in this paper suggest that a precautionary approach be taken to the harvesting of polar bears and that the potential effects of climate warming be incorporated into planning for the management and conservation of this species throughout the Arctic.

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Rojas-Bracho, L., Reeves, R.R., and Jaramillo-Legorreta, A. **Conservation of the vaquita *Phocoena sinus*.** *Mammal Review* 36(3): 179-216, 2006.

**Notes:** 1. The vaquita *Phocoena sinus* is a small porpoise that is endemic to the northern Gulf of California, Mexico. It is the most critically endangered marine small cetacean in the world. The most precise estimate of global abundance based on a 1997 survey is 567 (95% CI 177-1073). 2. Vaquitas mainly live north of 30°45'N and west of 114°20'W. Their 'core area' consists of about 2235 km<sup>2</sup> centred around Rocas Consag, 40 km east of San Felipe, Baja California. Genetic analyses and population simulations suggest that the vaquita has always been rare, and that its extreme loss of genomic variability occurred over evolutionary time rather than being caused by human activities. 3. Gill nets for fish and shrimp cause very high rates of by-catch (entanglement) of vaquitas. Estimates of bycatch rates are from 1993-94 and refer to one of three main fishing ports: 84 per year (95% CI 14-155) using only data collected by observers and 39 per year (95% CI 14-93) using combined data from observers and interviews with fishermen. Boats from other ports may experience similar rates, and the total is probably well above what would be sustainable. 4. Other less well-characterized and longer-term risk factors include the potential for disturbance by trawling to affect vaquita behaviour, and the uncertain effects of dam construction on the Colorado River and the resultant loss of freshwater input to the upper Gulf. However, entanglement is the clearest and most immediate concern. 5. Progress towards reducing entanglement has been slow in spite of efforts to phase out gill nets in the vaquita's core range, and the development of schemes involving compensation for fishermen. The Biosphere Reserve in the northern Gulf has fallen far short of its potential for vaquita conservation. On 29 December 2005, the Mexican Ministry of Environment declared a Vaquita Refuge that contains within its borders the positions of approximately 80% of verified vaquita sightings. In the same decree, the state governments of Sonora and Baja California were offered \$1 million to compensate affected fishermen. The effectiveness of this major initiative remains to be seen. 6. The vaquita's survival does not depend on more or better science but on improved management. As a funding priority, implementation of conservation measures and evaluation of their effectiveness should come ahead of more surveys or improved estimation of by-catch.

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Mos, L., Morsey, B., Jeffries, S.J., Yunker, M.B., Raverty, S., De Guise, S., and Ross, P.S. **Chemical and biological pollution contribute to the immunological profiles of free-ranging harbor seals.** *Environmental Toxicology and Chemistry* 25(12): 3110-3117, 2006.

**Notes:** Polychlorinated biphenyls and other persistent organic pollutants have been associated with immunotoxicity and outbreaks of (infectious) disease in marine mammals by rendering them vulnerable to infection by pathogens such as viruses and bacteria. In an immunotoxicological study of free-ranging harbor seals (*Phoca vitulina*), we obtained samples of blood and blubber from seal pups that were live-captured from two remote and two near-urban sites in British Columbia, Canada, and Washington state, USA. Using these samples, we quantified hematology, innate immune function, adaptive immune function, and polychlorinated biphenyl accumulation. While controlling for confounding factors (age, sex, and condition), univariate correlations between phagocytosis ( $r^2 = 0.30, p = 0.002$ ), respiratory burst ( $r^2 = 0.45, p = 0.000$ ), T-lymphocyte function ( $r^2 = 0.16, p = 0.028$ ), lymphocyte signaling ( $r^2 = 0.17, p = 0.025$ ), and lymphocyte counts ( $r^2 = 0.29, p = 0.002$ ), and polychlorinated biphenyl concentrations suggested chemical-associated immunotoxicity. Principal component analysis of immunological endpoints provided additional evidence of immunotoxic effects in seals. However, principal component analysis also identified a noncontaminant-related factor by distinguishing between seals inhabiting urban versus remote sites, with results being consistent with increased pathogen exposure. Elevated fecal coliform concentrations in water, and observations of terrestrial spill-over pathogens in local seals, further support the notion of biological pollution at these sites. Although our study highlights the role that environmental contaminants might play in rendering marine mammal populations vulnerable to disease through immunotoxicity, it also suggests that biological pollution represents an emerging conservation concern.

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Wade, P., Heide-Jorgensen, M.P., Shelden, K., Barlow, J., Carretta, J., Durban, J., Leduc, R., Munger, L., Rankin, S., Sauter, A., and Stinchcomb, C. **Acoustic detection and satellite-tracking leads to discovery of rare concentration of endangered North Pacific right whales.** *Biology Letters* 2(3): 417-419, 2006.

**Notes:** The North Pacific right whale, *Eubalaena japonica*, is one of the most endangered species of whale in the world. On 10 August 2004, two right whales were located in the Bering Sea using headings to right whale calls provided by directional sonobuoys. A satellite-monitored radio tag attached to one of these whales functioned for 40 days. Over the 40-day period, this whale moved throughout a large part of the southeast Bering Sea shelf, including areas of the outer-shelf where right whales have not been seen in decades. In September, multiple right whales were acoustically located and subsequently sighted by another survey vessel approaching a near-real-time position from the tag. An analysis of photographs confirmed at least 17 individual whales (not including the tagged whales). Genetic analysis of biopsy samples identified 17 individuals: 10 males and 7 females. The discovery of seven females was significant, as only one female had been identified in the past. Genetics also

confirmed the presence of at least two calves. Although the future of this population is highly uncertain, the discovery of additional females and calves gives some hope that this most critically endangered of all whale populations may still possess the capacity to recover.

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Learmonth, J.A., MacLeod, C.D., Santos, M.B., Pierce, G.J., and Crick, H.Q.P. **Potential effects of climate change on marine mammals.** *Oceanography and Marine Biology: An Annual Review* 44: 431-464, 2006.

**Notes:** Predicted impacts of climate change on the marine environment include an increase in temperature, a rise in sea levels and a decrease in sea-ice cover. These impacts will occur at local, regional and larger scales. The potential impacts of climate change on marine mammals can be direct, such as the effects of reduced sea ice and rising sea levels on seal haul-out sites, or species tracking a specific range of water temperatures in which they can physically survive. Indirect effects of climate change include changes in prey availability affecting distribution, abundance and migration patterns, community structure, susceptibility to disease and contaminants. Ultimately, these will impact on the reproductive success and survival of marine mammals and, hence, have consequences for populations. Marine mammal species, which have restricted geographical distributions with little or no opportunity for range expansion in response to climate change, may be particularly vulnerable to the effects of climate change. The potential effects of climate change on marine mammals have a number of implications for their conservation and highlight several areas requiring further research.

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Guenette, S., Heymans, S.J.J., Christensen, V., and Trites, A.W. **Ecosystem models show combined effects of fishing, predation, competition, and ocean productivity on Steller sea lions (*Eumetopias jubatus*) in Alaska.** *Canadian Journal of Fisheries and Aquatic Sciences* 63(11): 2495-2517, 2006.

**Notes:** Steller sea lions (*Eumetopias jubatus*) increased in the eastern portion of their range while declining in the Gulf of Alaska and Aleutian Islands from the late 1970s to late 1990s. We constructed ecosystem models of the central and western Aleutians and of southeast Alaska to simultaneously evaluate four hypotheses explaining sea lion dynamics: killer whale (*Orcinus orca*) predation, ocean productivity, fisheries, and competition with other species. Comparisons of model predictions with historical time series data indicate that all four factors likely contributed to the trends observed in sea lion numbers in both ecosystems. Changes in ocean productivity conveyed by the Pacific Decadal Oscillation influenced the abundance trajectory of several species. Fishing could have affected the ecosystem structure by influencing the abundance of Atka mackerel (*Pleurogrammus monopterygius*) in the Aleutians and Pacific herring (*Clupea pallasii*) in southeast Alaska. Pacific halibut (*Hippoglossus stenolepis*) in the Aleutians and arrowtooth flounder (*Atheresthes stomias*) in southeast Alaska appear to impede sea lion population growth through competitive interactions. Predation by killer whales was important when sea lions were less abundant in the 1990s in the Aleutians and in the 1960s in Southeast Alaska, but appear to have little effect when sea lion numbers were high.

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Tyack, P.L., Johnson, M., Soto, N.A., Sturlese, A., and Madsen, P.T. **Extreme diving of beaked whales.** *Journal of Experimental Biology* 209(21): 4238-4253, 2006.

**Notes:** Sound-and-orientation recording tags (DTAGs) were used to study 10 beaked whales of two poorly known species, *Ziphius cavirostris* (Zc) and *Mesoplodon densirostris* (Md). Acoustic behaviour in the deep foraging dives performed by both species (Zc: 28 dives by seven individuals; Md: 16 dives by three individuals) shows that they hunt by echolocation in deep water between 222 and 1885 m, attempting to capture about 30 prey/dive. This food source is so deep that the average foraging dives were deeper (Zc: 1070 m; Md: 835 m) and longer (Zc: 58 min; Md: 47 min) than reported for any other air-breathing species. A series of shallower dives, containing no indications of foraging, followed most deep foraging dives. The average interval between deep foraging dives was 63 min for Zc and 92 min for Md. This long an interval may be required for beaked whales to recover from an oxygen debt accrued in the deep foraging dives, which last about twice the estimated aerobic dive limit. Recent reports of gas emboli in beaked whales stranded during naval sonar exercises have led to the hypothesis that their deep-diving may make them especially vulnerable to decompression. Using current models of breath-hold diving, we infer that their natural diving behaviour is inconsistent with known problems of acute nitrogen supersaturation and embolism. If the assumptions of these models are correct for beaked whales, then possible decompression problems are more likely to result from an abnormal behavioural response to sonar.

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Thomsen, F., Laczny, M., and Piper, W. **A recovery of harbour porpoises (*Phocoena phocoena*) in the southern North Sea? A case study off Eastern Frisia, Germany.** *Helgoland Marine Research* 60(3): 189-195, 2006.

**Notes:** Detailed information on year-round distribution, seasonal abundance and inter-annual trends of a given species is essential for any conservation effort. However, for most odontocetes this knowledge is rather limited. Therefore, area-specific management or conservation plans are often difficult to argue for. This is also true for the harbour porpoise (*Phocoena phocoena*), although it is the most common cetacean species in the North Sea. Knowledge of the current status of local stocks as well as fine scale information on the temporal use of certain areas by the species is incomplete. One area of concern is the southern North Sea where the abundance of harbour porpoises has declined in the twentieth century. Recent studies using stranding data and observations from seabird surveys indicate a comeback of the species along the Dutch and Belgian coast. However, data on other regions of the southern North Sea is sparse. Between 2002 and 2004, we undertook 25 aerial line transect surveys (11,000 km on effort; altitude = 250 and 600 ft) in a 2,500 km<sup>2</sup> coastal area off Eastern Frisia, Germany including a small portion of Dutch coastal waters. The data were  $g(0)$  corrected using a double platform approach and analysed with distance sampling software. A total of 426 harbour porpoises were sighted, including eight calves. Densities ranged between < 0.1 and 1.62 individuals/km<sup>2</sup> with peaks in February and July 2003 as well as February and May 2004. The results of our study show that harbour porpoises are present in the coastal part of the southern North Sea even during their reproductive period. However, they seem to appear in lower numbers and much more irregular than in other areas, for example off Northern Frisia. The results of this study support the recent findings that despite a decline in the mid-twentieth century, harbour porpoises are now at times quite abundant in the southern North Sea. The underlying factors of this 'return' should be investigated using a combination of surveys and satellite telemetry.

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Clapham, P.J., Childerhouse, S., Gales, N.J., Rojas-Bracho, L., Tillman, M.F., and Brownell, R.L. **The whaling issue: Conservation, confusion, and casuistry.** *Marine Policy* 31(3): 314-319, 2007.

**Notes:** Morishita's "multiple analysis" of the whaling issue [Morishita J. Multiple analysis of the whaling issue: Understanding the dispute by a matrix. *Marine Policy* 2006;30:802-8] is essentially a restatement of the Government of Japan's whaling policy, which confuses the issue through selective use of data, unsubstantiated facts, and the vilification of opposing perspectives. Here, we deconstruct the major problems with Morishita's article and provide an alternative view of the whaling dispute. For many people in this debate, the issue is not that some whales are not abundant, but that the whaling industry cannot be trusted to regulate itself or to honestly assess the status of potentially exploitable populations. This suspicion has its origin in Japan's poor use of science, its often implausible stock assessments, its insistence that culling is an appropriate way to manage marine mammal populations, and its relatively recent falsification of whaling and fisheries catch data combined with a refusal to accept true transparency in catch and market monitoring. Japanese policy on whaling cannot be viewed in isolation, but is part of a larger framework involving a perceived right to secure unlimited access to global marine resources. Whaling is inextricably tied to the international fisheries agreements on which Japan is strongly dependent; thus, concessions made at the IWC would have potentially serious ramifications in other fora.

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Hodgson, A.J. and Marsh, H. **Response of dugongs to boat traffic: The risk of disturbance and displacement.** *Journal of Experimental Marine Biology and Ecology* 340(1): 50-61, 2007.

**Notes:** Disturbance from boats has been documented for many species of marine mammals, especially cetaceans, but has never been quantified for dugongs. Dugongs depend on seagrass for food. This food mostly occurs in shallow coastal areas where boat traffic is high. Thus there is potential for boats to alienate dugongs from critical habitat areas. Using an overhead video observation system ('blimp-cam'), we observed the behaviour of focal dugongs during controlled boat pass experiments and while no boats were present. The percentage of time focal dugongs spent feeding and travelling was unaffected by boat presence, the number of boat passes and whether a pass included a stop and restart (pass continuity). The duration, distance and direction of a focal dugong's subsurface behaviour were unaffected by number, continuity or distance of boat passes. However, focal dugongs were less likely to continue feeding if the boat passed within 50 m, than if the boat passed at a greater distance. Mass movements of dugong feeding herds in response to experimental and opportunistically observed boats were timed on 42 occasions but only lasted an average of 122 s. These movements occurred in response to boats passing at a range of speeds, and at distances of less than 50 m to over 500 m. The levels of boat traffic we observed may reduce dugongs'

feeding time budget by a maximum of 0.8-6%. Thus at present boats appear unlikely to be having a substantive effect on the energy intake of dugong populations at our study site on the Moreton Banks near Brisbane, Australia. However, boat traffic is likely to increase in this fast growing region, raising concern about the future impact of boats on this and other dugong populations.

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Weise, M.J., Costa, D.P., and Kudela, R.M. **Movement and diving behavior of male California sea lion (*Zalophus californianus*) during anomalous oceanographic conditions of 2005 compared to those of 2004.** *Geophysical Research Letters* 33(22): art. L22S10, 2006.

**Notes:** During the highly anomalous conditions in early 2005, characterized by increased water temperatures and decreased productivity, male California sea lions adopted previously undocumented foraging behaviors. We investigated the movement and spatially explicit foraging behavior of males using satellite-linked data loggers and compared foraging behavior and effort between 2003-2004 and 2004-2005. Males foraged almost exclusively over the continental shelf during short trips in 2003-2004, while during anomalous conditions in 2004-2005 they altered their foraging effort by spending more time at sea and venturing up to 450 km offshore. Foraging trips in 2004-2005 were more than twice the distance and three times the duration of trips during 2003-2004. Our data indicated that the effects of climatic shifts during 2005 extended beyond the physical oceanography and lower trophic levels, to an apex predator; providing insight into the plasticity of foraging behavior and movement patterns of sea lions as they respond to environmental perturbations.

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Newell, C.L. and Cowles, T.J. **Unusual gray whale *Eschrichtius robustus* feeding in the summer of 2005 off the central Oregon Coast.** *Geophysical Research Letters* 33(22): art. L22S11, 2006.

**Notes:** The climate of the North Pacific underwent an unusual event in the summer of 2005 with a very late spring transition. This event had profound effects on both resident gray whales (*Eschrichtius robustus*) and their food source, mysids, off Depoe Bay, Oregon. Near bottom swarms of gray whales' major prey item, *Holmesimysis sculpta*, were sparse until August, a marked contrast to normal years when mysid swarms are abundant all summer. A large percentage of mysid females had empty brood pouches in 2005 while in 2003 and 2004 all observed females had full brood pouches. Gray whales spent little time foraging and spent fewer days in residence than in earlier years. The 2005 resident whales also showed signs of poor body condition, reflecting a nutritional deficit.

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McLeod, B.A., Frasier, T.R., and White, B.N. **Reply to the comment by Romero and Kannada on "Genetic analysis of 16th-century whale bones prompts a revision of the impact of Basque whaling on right and bowhead whales in the western North Atlantic".** *Canadian Journal of Zoology* 84(7): 1066-1069, 2006.

**Notes:** The comment by Romero and Kannada is presented as a critique of our previous work and suggests that our conclusions are in direct conflict with the historic whaling information reviewed in their paper. However, the critique is based on a misinterpretation of the geographical, temporal, and taxonomic focus of our previous work. The source of the putative conflict appears to stem from the misinterpretation that our results, focused solely on the impact of Basque whaling in the 16th and 17th centuries on the western North Atlantic right whale, were intended to be representative of all whaling of both right and bowhead whales throughout the North Atlantic. To demonstrate this, we briefly review our original results and conclusions and show that the information reviewed by Romero and Kannada does not challenge any aspect of our original work. As such, their comment is not a critique of our paper, but rather a brief review of the history of whaling in the North Atlantic.

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Romero, A. and Kannada, S. **Comment on "Genetic analysis of 16th-century whale bones prompts a revision of the impact of Basque whaling on right and bowhead whales in the western North Atlantic".** *Canadian Journal of Zoology* 84(7): 1059-1065, 2006.

**Notes:** Rastogi et al. presented their genetic analysis of 16th-century whale bones found on a Basque whaling ship excavated from Red Bay, Labrador Peninsula, Canada. Based on the results from a very small sample, these authors concluded that whaling populations were already depleted before the onset of whaling. This is in direct contradiction to historical data. They also implied that the Basques were the only Europeans whaling in the North Atlantic before the onset of Yankee whaling and that there was a belief that Basque whalers historically killed equal numbers of right and bowhead whales. Here we present data based on historical and archaeological records generated by several authors using different methodologies, which clearly show that (i) Basques were not the only whalers that impacted cetacean populations in the North Atlantic; (ii) the number of whales killed by different peoples for approximately two centuries indicates that both right and bowhead whale population levels were much higher than typically assumed; and (iii) for many years there have been records published indicating that the Basques and others killed more bowhead whales than right whales, at least in the western North Atlantic.

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Pendleton, G.W., Pitcher, K.W., Fritz, L.W., York, A.E., Raum-Suryan, K.L., Loughlin, T.R., Calkins, D.G., Hastings, K.K., and Gelatt, T.S. **Survival of Steller sea lions in Alaska: a comparison of increasing and decreasing populations.** *Canadian Journal of Zoology* 84(8): 1163-1172, 2006.

**Notes:** Steller sea lion (*Eumetopias jubatus* (Schreber, 1776)) populations have had differing dynamics in different regions of Alaska over the past 30 years. The western population (west of 144°W, near Cape Suckling) declined by approximately 85% between the 1970s and 2000, while the eastern population has increased at a rate of over 3%/year. Past research has indicated that the decline in the western population likely resulted from decreased juvenile survival and smaller declines in adult female survival and reproduction. Based on repeated observations (1987-2003) of sea lions branded as pups at Marmot Island (58.216°N, 151.840°W; western population; branded in 1987-1988) and at the Forrester Island rookery complex (54.859°N, 133.539°W; eastern population; branded in 1994-1995), we used mark-resight analyses to estimate age-specific survival probabilities. Juvenile sea lion survival probability at Marmot Island from 1988 to 1991 was lower than survival estimates at that location in the 1970s (assumed stable population) and lower than juvenile survival at Forrester Island from 1995 to 1998 (increasing population). Adult female survival at Marmot Island from 1992 to 2003 was only slightly reduced compared with that in the 1970s but was substantially lower than that at Forrester Island (1999-2003). In addition, and contrary to the typical pattern (e.g., Forrester Island), adult female survival probabilities at Marmot Island were indistinguishable from adult male survival probabilities. This suggests that regardless of which factors altered the dynamics of the western Steller sea lion population, they differentially affected females.

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Parks, E.K., Derocher, A.E., and Lunn, N.J. **Seasonal and annual movement patterns of polar bears on the sea ice of Hudson Bay.** *Canadian Journal of Zoology* 84(9): 1281-1294, 2006.

**Notes:** Polar bears (*Ursus maritimus* Phipps, 1774) move thousands of kilometres over sea ice searching for mates and hunting for seals, which are their primary prey. Recently, decreased sea ice extent and earlier ice break-up have been linked to shifts in seal distribution and abundance and to declines in polar bear condition and numbers in the western Hudson Bay polar bear population. We used geographic positioning system and satellite collars deployed between 1991 and 2004 to quantify movement patterns of adult female polar bears on the sea ice of Hudson Bay in relation to reproductive class and temporal variations in sea ice patterns. We tested whether reproductive status and season affected movement and whether temporal changes in movement were correlated with temporal changes in sea ice patterns in Hudson Bay. Movement patterns were not dependent on reproductive status but did change significantly with season. Annual distances moved and areas covered by bears in Hudson Bay have decreased since 1991, which suggests that measured declines in bear condition and numbers are due to reduced prey intake as opposed to increased energy output. These declines in bear movement are correlated with progressively earlier ice break-up in western Hudson Bay.

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