

Marine Science Review – 185

Marine mammals



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- A. Recent articles – no abstract available
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A. Recent articles – no abstract available

Vos, D.J., Quakenbush, L.T., and Mahoney, B.A. **Documentation of sea otters and birds as prey for killer whales.** *Marine Mammal Science* 22(1): 201-205, 2006.

Labrada-Martagón, V., Auriolles-Gamboa, D., and Martínez-Díaz, S.F. **Natural and human disturbance in a rookery of the California sea lion (*Zalophus californianus californianus*) in the Gulf of California, Mexico.** *Latin American Journal of Aquatic Mammals* 4(2): 175-186, 2005.

Soto, N.A., Johnson, M., Madsen, P.T., Tyack, P.L., Bocconcelli, A., and Borsani, J.F. **Does intense ship noise disrupt foraging in deep-diving Cuvier's beaked whales (*Ziphius cavirostris*)?** *Marine Mammal Science* 22(3): 690-699, 2006.

Pitman, R.L., van Helden, A.L., Best, P.B., and Pym, A. **Shepherd's beaked whale (*Tasmacetus shepherdi*): Information on appearance and biology based on strandings and at-sea observations.** *Marine Mammal Science* 22(3): 744-755, 2006.

Bell, C., Shaughnessy, P., Morrice, M., and Stanley, B. **Marine mammals and Japanese long-line fishing vessels in Australian waters: operational interactions and sightings.** *Pacific Conservation Biology* 12(1): 31-39, 2006.

B. Recent articles with abstracts

Tabuchi, M., Veldhoen, A., Dangerfield, N., Jeffries, S., Helbing, C.C., and Ross, P.S. **PCB-related alteration of thyroid hormones and thyroid hormone receptor gene expression in free-ranging harbor seals (*Phoca vitulina*).** *Environmental Health Perspectives* 114(7): 1024-1031, 2006.

Notes: Persistent organic pollutants are environmental contaminants that, because of their lipophilic properties and long half-lives, bioaccumulate within aquatic food webs and often reach high concentrations in marine mammals, such as harbor seals (*Phoca vitulina*). Exposure to these contaminants has been associated with developmental abnormalities, immunotoxicity, and reproductive impairment in marine mammals and other high-trophic-level wildlife, mediated via a disruption of endocrine processes. The highly conserved thyroid hormones (THs) represent one vulnerable endocrine endpoint that is critical for metabolism, growth, and development in vertebrates. We characterized the relationship between contaminants and specific TH receptor (*TR*) gene expression in skin/blubber biopsy samples, as well as serum THs, from free-ranging harbor seal pups ($n = 39$) in British Columbia, Canada, and Washington State, USA. We observed a contaminant-related increase in blubber *TR*-a gene expression [total polychlorinated biphenyls (SPCBs); $r = 0.679$; $p < 0.001$] and a concomitant decrease in circulating total thyroxine concentrations (SPCBs; $r = -0.711$; $p < 0.001$). Consistent with results observed in carefully controlled laboratory and captive feeding studies, our findings suggest that the TH system in harbor seals is highly sensitive to disruption by environmental contaminants. Such a disruption not only may lead to adverse effects on growth and development but also could have important ramifications for lipid metabolism and energetics in marine mammals.

Godard, C.A.J., Wise, S.S., Kelly, R.S., Goodale, B., Kraus, S., Romano, T., O'Hara, T., and Wise, J.P. **Benzo[a]pyrene cytotoxicity in right whale (*Eubalaena glacialis*) skin, testis and lung cell lines.** *Marine Environmental Research* 62: S20-S24, 2006.

Notes: The North Atlantic right whale (NARW) is one of the most endangered great whales. The NARW population consists of only about 300 individuals and is reproducing at an insufficient rate. There is growing concern about the potential effects of environmental contaminants on the reproductive and overall health of NARW. High contaminant burdens can accumulate in tissues of great whales but toxicological studies of their effects are limited due to legal, logistical and ethical restrictions and specific in vitro models are critically needed. Cell lines from NARW skin and internal organs were previously created in our laboratory. In this study, skin, testis and lung primary fibroblast cell lines were exposed to benzo[a]pyrene (BP) as part of a multi-chemical toxicity testing project in NARW. Cells were exposed for 24-72 h to 10 nM-10 mM BP dissolved in dimethylsulfoxide. Cytotoxicity was measured with a clonogenic assay using standard methods. Some cytotoxicity was observed after 24 h, the highest concentration (10 mM BP) resulting in 77, 74 and 51 percent relative survival in testis, skin and lung cells, respectively, and indicating a higher cytotoxicity in the lung ($p < 0.05$). After 48 and 72-h exposure, 10 mM BP resulted in 24 and 3, 74 and 27, and 42 and 23 percent relative survival in testis, skin and lung cells, respectively. Cytotoxicity significantly increased with exposure time in all three tissues ($p < 0.05$ for skin and $p < 0.01$ for lung and testis), suggesting metabolic activation of BP in the three organs. Fibro-blast cytotoxicity observed in the testis was higher than that observed either in the skin or lung after 48 h ($p < 0.01$) and was close to 100% after 72 h, warranting further investigation of the potential effects of PAHs on reproductive health.

Morishita, J. **Multiple analysis of the whaling issue: Understanding the dispute by a matrix.** *Marine Policy* 30(6): 802-808, 2006.

Notes: The contentious whaling dispute can be described as a scientific dispute over resource management, the collision between nations that regard whales as food and nations that see whales as special, political game played by politicians who like to be seen as environmentally conscious by opposing whaling, and economic interests of the whaling industry and fundraising anti-whaling organizations. All of these different interpretations are correct, however, none, by themselves, can explain the whole picture of the controversy. This paper, by constructing a matrix, presents a comprehensive picture of this complex dispute and some options for making a progress.

Lopez, B.D. **Interactions between Mediterranean bottlenose dolphins (*Tursiops truncatus*) and gillnets off Sardinia, Italy.** *ICES Journal of Marine Science* 63(5): 946-951, 2006.

Notes: A first attempt at analysing interactions between bottlenose dolphins and gillnets along the northeastern coast of Sardinia (Italy) was conducted between October 1999 and December 2004. A new approach was used: combining interviews with fishers with boat-based direct observations and behavioural and group size analysis. Fishers on monitored boats noted 2556 days on which gillnet damage was caused by bottlenose dolphins, 68.7% of the total fishing days, with no difference between seasons. An annual estimate of the number of bottlenose dolphins caught in the gillnets was 1.47 (0.98 immatures and 0.49 adults). In all, 317 days were spent making observations at sea, of which 330.6 h were spent directly observing the dolphins. There were no changes in the distribution of daily encounter rate among seasons, group size, or number of immatures, in the presence or the absence of gillnets. However, bottlenose dolphins spent more time both in the study area and feeding when gillnets were present. The extent of the estimated bycatch is worrisome in terms of the ability of bottlenose dolphins off Sardinia to sustain such an annual loss.

Laidre, K.L., Estes, J.A., Tinker, M.T., Bodkin, J., Monson, D., and Schneider, K. **Patterns of growth and body condition in sea otters from the Aleutian archipelago before and after the recent population decline.** *Journal of Animal Ecology* 75(4): 978-989, 2006.

Notes: 1. Growth models for body mass and length were fitted to data collected from 1842 sea otters *Enhydra lutris* shot or live-captured throughout south-west Alaska between 1967 and 2004. Growth curves were constructed for each of two main year groups: 1967-71 when the population was at or near carrying capacity and 1992-97 when the population was in steep

decline. Analyses of data collected from animals caught during 2004, when the population density was very low, were precluded by a small sample size and consequently only examined incidentally to the main growth curves. 2. Growth curves demonstrated a significant increase in body mass and body length at age in the 1990s. Asymptotic values of body mass were 12-18% higher in the 1990s than in the 1960s/70s, and asymptotic values for body length were 10-11% higher between the same periods. Data collected in 2004 suggest a continued increase in body size, with nearly all data points for mass and length falling significantly above the 1990s growth curves. 3. In addition to larger asymptotic values for mass and length, the rate of growth towards asymptotic values was more rapid in the 1990s than in the 1960s/70s: sea otters reached 95% of asymptotic body mass and body length 1-2 years earlier in the 1990s. 4. Body condition (as measured by the log mass/log length ratio) was significantly greater in males than in females. There was also an increasing trend from the 1960s/70s through 2004 despite much year-to-year variation. 5. Population age structures differed significantly between the 1960s/70s and the 1990s with the latter distribution skewed toward younger age classes (indicating an altered $l(x)$ function) suggesting almost complete relaxation of age-dependent mortality patterns (i.e. those typical of food-limited populations). 6. This study spanned a period of time over which the population status of sea otters in the Aleutian archipelago declined precipitously from levels at or near equilibrium densities at some islands in the 1960s/70s to < 5% of estimated carrying capacity by the late 1990s. The results of this study indicate an improved overall health of sea otters over the period of decline and suggest that limited nutritional resources were not the cause of the observed reduced population abundance. Our findings are consistent with the hypothesis that the decline was caused by increased killer whale predation.

Costa, A.D., Durbin, E.G., and Mayo, C.A. **Variability in the nutritional value of the major copepods in Cape Cod Bay (Massachusetts, USA) with implications for right whales.** *Marine Ecology: An Evolutionary Perspective* 27(2): 109-123, 2006.

Notes: The North Atlantic right whale, a seriously endangered species, is found in Cape Cod Bay (Massachusetts, USA) during the winter and early spring. During their residency in these waters, these whales are frequently observed feeding. This study evaluated spatial and temporal changes in the chemical composition (carbon weight and C/N ratio) of the food resource targeted by the right whales in Cape Cod Bay. The three taxa measured (*Centropages typicus*, *Pseudocalanus* spp., and *Calanus finmarchicus*) had highly variable chemical compositions resulting from the different life strategies and from fluctuations in their surrounding environment. The impact of seasonal variability in the energy densities of the food resource of right whales was calculated and compared to the energetic requirements of these whales. Calculations indicated that differences in the nutritional content of the zooplankton prey in Cape Cod Bay could have a considerable effect on the nutrition available to the right whales. Therefore, it is likely that using more precise estimates of the energetic densities of the prey of right whales would lead to a re-evaluation of the adequacy of the food resource available to these whales in the North Atlantic.

Hofmeyr, G.J.G., Bester, M.N., Makhado, A.B., and Pistorius, P.A. **Population changes in subantarctic and Antarctic fur seals at Marion Island.** *South African Journal of Wildlife Research* 36(1): 55-68, 2006.

Notes: Counts at Marion Island during the 2003/04 breeding season indicated a pup production of 16 045 for Subantarctic fur seals, *Arctocephalus tropicalis*, and 759 for the sympatric population of Antarctic fur seal, *A. gazella*. While the mean annual rate of increase of 5.2% for the Subantarctic fur seal population at Marion Island for the period 1994/95-2003/04 was approximately half of that recorded between 1951 and the late 1980s, that of the Antarctic fur seal population for the same period continues to be high (17.0%). We suggest that the dissimilarity in population growth between the two species is due to differences in the availability of preferred terrestrial habitat, since their diets are very similar. Together with the neighbouring Prince Edward Island, this archipelago supports a population of approximately 150 000 Subantarctic fur seals, which has grown at a mean annual rate of 5.3% over the past 15 years. The population of Antarctic fur seals numbers approximately 5800, and has grown at a mean annual rate of 14.8% over the past 21 years. While there appears to be limited opportunity for heterospecific mating, low levels of hybridization continue.

Monnett, C. and Gleason, J.S. **Observations of mortality associated with extended open-water swimming by polar bears in the Alaskan Beaufort Sea.** *Polar Biology* 29(8): 681-687, 2006.

Notes: During aerial surveys in September 1987-2003, a total of 315 live polar bears were observed with 12 (3.8%) animals in open water, defined for purposes of this analysis as marine waters > 2 km north of the Alaska Beaufort Sea coastline or

associated barrier islands. No polar bear carcasses were observed. During aerial surveys in early September, 2004, 55 polar bears (*Ursus maritimus*) were seen, 51 were alive and of those 10 (19.9%) were in open water. In addition, four polar bear carcasses were seen floating in open water and had, presumably, drowned. Average distance from land and pack ice edge for live polar bears swimming in open water in 2004 ($n = 10$) were 8.3 +/- 3.0 and 177.4 +/- 5.1 km, respectively. We speculate that mortalities due to offshore swimming during late-ice (or mild ice) years may be an important and unaccounted source of natural mortality given energetic demands placed on individual bears engaged in long-distance swimming. We further suggest that drowning-related deaths of polar bears may increase in the future if the observed trend of regression of pack ice and/or longer open water periods continues.

Cronin, M.A., Amstrup, S.C., and Scribner, K.T. **Microsatellite DNA and mitochondrial DNA variation in polar bears (*Ursus maritimus*) from the Beaufort and Chukchi seas, Alaska.** *Canadian Journal of Zoology* 84(5): 655-660, 2006.

Notes: Radiotelemetry data have shown that polar bears (*Ursus maritimus* Phipps, 1774) occur in separate subpopulations in the Chukchi Sea and the southern Beaufort Sea. However, segregation is not absolute, and there is overlap of ranges of animals in each subpopulation. We used genetic variation at eight microsatellite DNA loci and mitochondrial DNA (mtDNA) to further assess the degree of spatial structure of polar bears from the Chukchi and southern Beaufort seas. Microsatellite allele frequencies and mtDNA haplotype frequencies of bears from the southern Beaufort and Chukchi seas did not differ significantly. Lack of differentiation at both maternally inherited mtDNA and bi-parentally inherited microsatellite loci suggests that gene flow between the two areas is mediated by both sexes. The genetic data indicate that polar bears in the southern Beaufort and Chukchi seas compose one interbreeding population. However, there is considerable fidelity to ranges in each area, particularly by adult females. The combined genetic and movement data suggest that polar bears could be managed as Beaufort Sea and Chukchi Sea subpopulations of a combined southern Beaufort Sea and Chukchi Sea population.

Hammond, P. **Whale science—and how (not) to use it.** *Significance* 3(2): 54-58, 2006.

Notes: Few creatures carry more emotion on their broad backs than whales; and few issues arouse as much passion as whaling. Each year around this time the International Whaling Commission comes under pressure to allow the resumption of commercial catching and killing of whales and the Save the Whale lobbyists protest. But how many whales are there? Can the scientists and statisticians tell us - and how much influence do they wield in the real world of whale-politik? Philip Hammond, a former Chairman of the Scientific Committee of the IWC, explains.

Van Bresse, M.F.O., Van Waerebeek, K., Montes, D., Kennedy, S., Reyes, J.C., Garcia-Godos, I.A., Onton-Silva, K., and Alfaro-Shigueto, J. **Diseases, lesions and malformations in the long-beaked common dolphin *Delphinus capensis* from the Southeast Pacific.** *Diseases of Aquatic Organisms* 68(2): 149-165, 2006.

Notes: Miscellaneous lesions of the head, skull, teeth, trunk, appendages, skin and genital tract were observed in 120 of 930 long-beaked common dolphins *Delphinus capensis* taken in fisheries off Peru between 1985 and 2000. Seven subsamples were defined according to the varying field sampling protocols. Forty-two dolphins showed at least 2 types of injuries or diseases affecting 1 or more organs. The majority (5 of 7) of traumas encountered were diagnosed as caused by violent, fisheries-related interactions, and the skin in 20.4% of specimens ($n = 54$) showed healed scars from such interactions. Prevalences of malformations and traumas of crania ($n = 103$) were 2.9 and 1.9%, respectively. Lytic cranial lesions were present in 31.1% of dolphins ($n = 103$) and accounted for 84.2% of all bone injuries. Skull damage diagnostic for *Crassicanda* sp. infestation was encountered in 26.5% of dolphins ($n = 98$) and did not differ among sex and age classes. *Crassicanda* sp. and tooth infections were responsible for, respectively, 78.8 and 6.1% of the lytic lesions. Adult dolphins showed a high prevalence of worn and broken teeth (35%, $n = 20$) as well as damaged alveoli (20%, $n = 70$). Prevalence of 'paired teeth', a congenital condition, was 9.4% ($n = 32$). Lesions of the head, body and appendages were present in 10 dolphins and included traumas, deformations (e.g. scoliosis and brachygnathia) and chronic mastitis. Ovarian cysts suggestive of follicular cysts were observed in 1 of 24 females. Chronic orchitis affected 1 of 78 males. Of 12 dolphins 2 had vesicular lesions of the penis. Prevalence of cutaneous lesions, abnormalities and scars ranged between 1.8% ($n = 56$) and 48.2% ($n = 27$).

Lewis, M., Campagna, C., Marin, M.R., and Fernandez, T. **Southern elephant seals north of the Antarctic Polar Front.** *Antarctic Science* 18(2): 213-221, 2006.

Notes: This paper reports on sightings and dispersion of individual southern elephant seals (*Mirounga leonina*) along the Atlantic and Pacific coasts of South America based on reports of tagged/marked seals from Patagonia and of animals of unknown origin. From 154 sightings, encompassing at least 354 individuals, we found that individuals dispersed to subequatorial latitudes on both sides of the continent, and to more temperate sites, in the Magellanic region of Tierra del Fuego. Nineteen sites were visited by tagged seals from the established colony of Península Valdés (PV, Argentina). PV and the smaller seal population of the Falklands/Malvinas were regularly connected by adults of both sexes. There were more sightings of males than females. No incipient new breeding colonies were found along the Atlantic coast of South America. Some observations coincided with places where elephant seals had been recorded or exploited in the seventeenth and eighteenth centuries. A shortage of suitable habitat for expansion and proximity to predictable food could act as a stabilizing process preventing colonization of new areas from PV. Dispersion data, coherent with population genetics, support a Patagonian elephant seal stock.

Swartz, S.L., Taylor, B.L., and Rugh, D.J. **Gray whale *Eschrichtius robustus* population and stock identity.** *Mammal Review* 36(1): 66-84, 2006.

Notes: 1. In response to conservation and management concerns about gray whale *Eschrichtius robustus* population and stock structure, we provide an overview of the life history and ecology of gray whales as a context for discussion of population and stock structure within the species. Historically eastern and western North Pacific gray whales were managed separately because: (i) their ranges do not overlap; (ii) genetic analyses indicate that the two populations are significantly different; and (iii) eastern gray whales have increased in abundance over the past century while western gray whales have not. 2. Here, we review gray whale migration timing and segregation, feeding and prey species, and reproduction and reproductive behaviour. For the eastern and western gray whale, we review their distribution, history of exploitation, abundance and current status, although most of what is known is founded on the better studied eastern gray whale and only implied for the lesser known western gray whale. Methods to investigate population and stock identity are reviewed including genetics, morphology, chemical signatures, carbon isotopes, parasites, photographic identification and trends in abundance. 3. While the evidence indicates that there is at least some degree of mixing within each of the gray whale populations, no stocks or sub-stocks can be defined. Population structure is not evident in nuclear data, and because selection occurs primarily on the nuclear genome, it is unlikely that there is structuring within each population that could result in evolutionary differences. For western gray whales, there are insufficient data to assess the plausibility of stock structure within the population, owing to its extremely depleted state. Research on eastern gray whales has focused mostly on documenting changes in abundance, feeding biology and behaviour, and suggests separate breeding groups to be unlikely. Both males and females are promiscuous breeders lending little opportunity for the nuclear genome to be anything other than well mixed as is suggested by the high haplotypic diversity of the eastern population. 4. The available data strongly indicate that western gray whales represent a population geographically isolated from eastern gray whales and therefore that the western and eastern populations should be treated as separate management units.

Stensland, E., Carlen, I., Sarnblad, A., Bignert, A., and Berggren, P. **Population size, distribution, and behavior of Indo-Pacific bottlenose (*Tursiops aduncus*) and humpback (*Sousa chinensis*) dolphins off the south coast of Zanzibar.** *Marine Mammal Science* 22(3): 667-682, 2006.

Notes: Indo-Pacific bottlenose (*Tursiops aduncus*) and humpback dolphins (*Sousa chinensis*) off the south coast of Zanzibar, East Africa, have been subject to both direct and indirect takes as well as disturbance from local dolphin tourism during the last decade. Meanwhile, little or no information on population parameters exists for these animals. In order to assess the anthropogenic threats, a study was conducted between 1999 and 2002 to determine population sizes, distribution, and behavior of these animals. Population sizes were calculated for each year using mark-recapture methods applied to photo-identification data. The estimates ranged between 136 and 179 for the bottlenose dolphins and between 58 and 65 for the humpback dolphins in the calculated 26 km² study area. Patterns in distribution and behavior were investigated using image and spatial statistic software on data from boat surveys. Analyses of spatial densities showed that both species concentrated their activities to smaller areas (2%-11.5%) within the study area. When the study results were considered in light of the

anthropogenic threats, it was clear that immediate conservation measures were needed. This is critical if the negative impact on the species is to be minimized and the dolphins are to continue to represent a socioeconomic resource in the region.

Siebert, U., Gilles, A., Lucke, K., Ludwig, M., Benke, H., Kock, K.H., and Scheidat, M. **A decade of harbour porpoise occurrence in German waters - Analyses of aerial surveys, incidental sightings and strandings.** *Journal of Sea Research* 56(1): 65-80, 2006.

Notes: Data on the occurrence of harbour porpoises (*Phocoena phocoena*) in German waters from 1988 to 2002 were collected from dedicated aerial surveys, incidental sightings and strandings. Aerial surveys conducted in 1995 and 1996 revealed a mean abundance of 4288 (in 1995) and 7356 harbour porpoises (in 1996) in the German North Sea study area. Mean abundances of harbour porpoises in the German Baltic Sea, divided into two subunits (blocks B and Q, were estimated at 980 and 1830 (in 1995 and 1996 resp.) and at 601 (in 1995; there were no sightings in block C during the 1996 survey). From 1988 to 2002, 791 incidental sightings of harbour porpoise pods were reported in German and partly Danish coastal waters of the North and Baltic Seas. In the period 1990 to 2001, 996 harbour porpoises were found stranded along the German North Sea coast and 17 animals were identified as by-catch. In the same period 229 harbour porpoises were found stranded along the German Baltic Sea coast and 105 animals were incidentally taken in fisheries. The proportion of by-caught harbour porpoises was significantly larger in the Baltic Sea. Different monitoring methods are helpful for different aims and management issues: aerial surveys cover large areas in a short time and provide information on density, abundance, distributional patterns and seasonality. Incidental sighting and stranding networks provide indications of general distribution, seasonal variation in abundance, age distribution, by-catch and of areas which are important in the harbour porpoise's life cycle. Comparison of data from the North and Baltic Seas revealed a higher abundance of harbour porpoises in the North Sea than in the Baltic Sea. Altogether the data sets demonstrated a strong seasonality of harbour porpoise occurrence off the German coast with highest numbers during the summer months. Important habitats for harbour porpoises were detected west of the islands of Sylt and Amrum in the North Sea and around the Schlei estuary, in waters west of Fehmarn and the Fischland-Darss area in the Baltic Sea.

Rosa de Oliveira, L., Arias-Schreiber, M., Meyer, D., and Morgante, J.S. **Effective population size in a bottlenecked fur seal population.** *Biological Conservation* 131(4): 505-509, 2006.

Notes: The census population size (N) is usually the only information available for most threatened species. For evolutionary matters, the effective population size (N_e), not the census number, is a prime concern. Factors such as variation in the sex ratio of breeding individuals, variation of population size in different generations and mating system are important. The South American fur seal, *Arctocephalus australis*, has been exploited in Peru by humans since ca. 2000 BC and now the original population declined 72%, as a result of low food availability during the severe El Niño in 1997-1998. In this sense *A. australis* is now classified as in danger of extinction in Peru. We present the first estimate of N_e of the Peruvian population of *A. australis* that takes into account the effects of mating system and variation in population size caused by the 1997-1998 El Niño. The resulting N_e was 2153 specimens. We believe that the estimated N_e for the Peruvian population is a critical value, because it is significantly lower than the mean minimum viable population for vertebrates (7000 breeding age adults). This estimated N_e is of critical importance because combined with the current El Niño events are reasons of great concern for the survival of the species and should be taken into account in future management plans to ensure the conservation and protection of the species in the Peruvian coast.

Moore, S.E. and Laidre, K.L. **Trends in sea ice cover within habitats used by bowhead whales in the western Arctic.** *Ecological Applications* 16(3): 932-944, 2006.

Notes: We examined trends in sea ice cover between 1979 and 2002 in four months (March, June, September, and November) for four large (~ 100 000 km²) and 12 small (~ 10 000 km²) regions of the western Arctic in habitats used by bowhead whales (*Balaena mysticetus*). Variation in open water with year was significant in all months except March, but interactions between region and year were not. Open water increased in both large and small regions, but trends were weak with least-squares regression accounting for ≤ 34% of the total variation. In large regions, positive trends in open water were strongest in September. Linear fits were poor, however, even in the East Siberian, Chukchi, and Beaufort seas, where basin-scale analyses have emphasized dramatic sea ice loss. Small regions also showed weak positive trends in open water and strong interannual

variability. Open water increased consistently in five small regions where bowhead whales have been observed feeding or where oceanographic models predict prey entrainment, including: (1) June, along the northern Chukotka coast, near Wrangel Island, and along the Beaufort slope; (2) September, near Wrangel Island, the Barrow Arc, and the Chukchi Borderland; and (3) November, along the Barrow Arc. Conversely, there was very little consistent change in sea ice cover in four small regions considered winter refugia for bowhead whales in the northern Bering Sea, nor in two small regions that include the primary springtime migration corridor in the Chukchi Sea. The effects of sea ice cover on bowhead whale prey availability are unknown but can be modeled via production and advection pathways. Our conceptual model suggests that reductions in sea ice cover will increase prey availability along both pathways for this population. This analysis elucidates the variability inherent in the western Arctic marine ecosystem at scales relevant to bowhead whales and contrasts basin-scale depictions of extreme sea ice retreats, thinning, and wind-driven movements.

Loomis, J. **Estimating recreation and existence values of sea otter expansion in California using benefit transfer.** *Coastal Management* 34(4): 387-404, 2006.

Notes: This article demonstrates how benefit transfer can quantify tourism and existence values. Existing literature values of sea otters and a meta analysis yield benefit estimates of several million dollars for the increased number of sea otters expected by USFWS in the next decade if the "no otter zone" is eliminated and otters allowed to expand along the Santa Barbara coast. These benefit estimates of sea otter expansion exceed the costs to commercial fishing. Thus the benefit transfer approach can contribute to a more complete economic analysis of endangered species recovery or critical habitat efforts than the current USFWS approach.

Laidre, K.L. and Jameson, R.J. **Foraging patterns and prey selection in an increasing and expanding sea otter population.** *Journal of Mammalogy* 87(4): 799-807, 2006.

Notes: Focal observations of sea otter (*Enhydra lutris kenyoni*) foraging patterns and prey selection were collected in coastal Washington between 1993 and 1999. Records consisted of 13,847 individual dives from 841 feeding bouts ranging from 1 min to > 4 h. Average dive time was 55 s +/- 0.9 SE and average surface time was 45 s +/- 2.3 SE, irrespective of dive success. At least 77% of all dives ($n = 10,636$) were successful prey captures (dives in low light or of undetermined success were excluded). Prey capture success was significantly lower for subadults (63% +/- 5 SE) than adults (82% +/- 1 SE; $P < 0.001$). Sea otters occupying the established population range on the outer coast of Washington fed heavily on bivalves (63%) and had a diverse diet consisting of several prey groups ($n = 10$). In contrast, sea otters occupying new habitat in the Strait of Juan de Fuca had a restricted diet dominated by > 60% red urchins (*Strongylocentrotus franciscanus*), with only 2 other prey species comprising > 10% of their diet. Prey size and prey category were dominant predictor variables in generalized linear models of dive duration and postdive surface duration on successful dives. Significant increases in areal extent of surface canopy of giant kelp (*Macrocystis integrifolia*) and bull kelp (*Nereocystis leutkeana*) were found both in the outer coast and the Strait of Juan de Fuca (0.4-0.5 km² per year, $P < 0.05$) and suggest increasing suitable habitat for a growing population. The growth and expansion of a small and isolated sea otter population provides a unique opportunity to examine the relationship between dietary diversity and population status and explore similarities and differences between trophic paradigms established for sea otter populations at other localities.

Kannan, K., Perrotta, E., and Thomas, N.J. **Association between perfluorinated compounds and pathological conditions in southern sea otters.** *Environmental Science and Technology* 40(16): 4943-4948, 2006.

Notes: Concentrations of four perfluorinated contaminants, including perfluorooctanesulfonate (PFOS) and perfluorooctanoic acid (PFOA), were measured in liver tissue from 80 adult female sea otters collected from the California coast during 1992-2002. Concentrations of PFOS and PFOA were in the ranges of < 1-884 and < 5-147 ng/g, wet wt, respectively. Concentrations of PFOA in the livers of these sea otters were among the highest values reported for marine mammals to date. Liver tissue from 6 male sea otters also was analyzed and contained significantly higher concentrations of PFOS than did tissues from female otters. To examine the association between exposures and potential effects, concentrations of PFOS and PFOA were compared among the adult female otters that died from infectious diseases, noninfectious causes, and from apparent emaciation. Concentrations of both PFOA and PFOS were significantly higher in sea otters in the

infectious disease category than in the noninfectious category. Concentrations of PFOS and PFOA were not significantly different between noninfectious and emaciated otters, suggesting that the poor nutritive (body) status of emaciated otters did not affect the concentrations of perfluorochemicals in livers. Concentrations of PFOA increased significantly from 1992 to 2002, whereas PFOS concentrations increased from 1992 to 1998 and then decreased after 2000. Significant association between infectious diseases and elevated concentrations of PFOS/PFOA in the livers of sea otters is a cause for concern and suggests the need for further studies.

Sonne, C., Leifsson, P.S., Dietz, R., Born, E.W., Letcher, R.J., Hyldstrup, L., Riget, F.F., Kirkegaard, M., and Muir, D.C.G. **Xenoendocrine pollutants may reduce size of sexual organs in East Greenland polar bears (*Ursus maritimus*).** *Environmental Science and Technology* 40(18): 5668-5674, 2006.

Notes: Reproductive organs from 55 male and 44 female East Greenland polar bears were examined to investigate the potential negative impact from organohalogen pollutants (OHCs). Multiple regressions normalizing for age showed a significant inverse relationship between OHCs and testis length and baculum length and weight, respectively, and was found in both subadults (dichlorodiphenyl trichloroethanes, dieldrin, chlordanes, hexachlorohexanes, polychlorinated biphenyls (PCBs), and polybrominated diphenyl ethers (PBDEs)) and adults (hexachlorobenzene [HCB]) (all $p < 0.05$). Baculum bone mineral densities decreased with increasing chlordanes, DDTs, and HCB in subadults and adults, respectively (all $p < 0.05$). In females, a significant inverse relationship was found between ovary length and SPCB ($p = 0.03$) and SCHL ($p < 0.01$), respectively, and between ovary weight and SPBDE ($p < 0.01$) and uterine horn length and HCB ($p = 0.02$). The study suggests that there is an impact from xenoendocrine pollutants on the size of East Greenland polar bear genitalia. This may pose a risk to this polar bear subpopulation in the future because of reduced sperm and egg quality/quantity and uterus and penis size/robustness.

Soto, K.H., Trites, A.W., and Arias-Schreiber, M. **Changes in diet and maternal attendance of South American sea lions indicate changes in the marine environment and prey abundance.** *Marine Ecology Progress Series* 312: 277-290, 2006.

Notes: Behavioural observations were made of South American sea lions *Otaria flavescens* in Peru to determine whether changes in their diet and maternal attendance patterns reflected physical changes in the marine environment and alterations in the abundance and distribution of prey. The study was conducted during the breeding season between 1998 and 2002, which was a period that encompassed a strong El Nino (1997 to 1998) and a moderate La Nina (1999 to 2001). Observations revealed strong linkages between maternal attendance patterns and the abundance of prey and oceanographic features close to the rookeries. Acute prey shortage during El Nino resulted in females increasing the length of their foraging trips and decreasing the time they spent onshore with their pups. In contrast, shorter times at sea and longer times onshore were observed during the favourable conditions of La Nina when preferred prey (anchovy and squat lobster) were more abundant near the rookeries. Pup mortalities increased when females spent more time at sea searching for prey and did not return frequently enough to nurse their pups. A larger diversity of prey species (particularly of demersal fishes) was consumed during El Nino when anchovy and lobster were less available. Females appeared to adjust their diets and maternal attendance patterns in response to annual changes in the abundance and distribution of prey. These observations suggested that diet and maternal responses reflect interannual fluctuations of the unpredictable Peruvian upwelling ecosystem, and implied that South American sea lions may be good indicators of relative changes in the distribution and abundance of marine resources.

Frid, A., Baker, G.G., and Dill, L.M. **Do resource declines increase predation rates on North Pacific harbor seals? A behavior-based plausibility model.** *Marine Ecology Progress Series* 312: 265-275, 2006.

Notes: Harbor seals *Phoca vitulina* and other pinnipeds in the Gulf of Alaska have declined since the 1980s. The search for causation has considered top-down and bottom-up influences as 14 independent factors. Research on other systems, however, has revealed that resource availability and predator densities synergistically determine the predation rates experienced by intermediate consumers. From this premise we developed a dynamic state variable model of behavior for the declining harbor seal population of Prince William Sound, Alaska. We modeled separate scenarios in which seals were prey to (1) transient killer whales *Orcinus orca* at and near the surface and Pacific sleeper sharks *Somniosus pacificus* throughout the water column, or (2) killer whales only. In both scenarios, resource decrements reduced the time spent by seals at the haulout (a refuge lacking food), increased the time spent at foraging areas, and lengthened surface intervals and dive durations. Because of this

behavioral compensation, per capita fish consumption remained relatively constant, but predation rates increased as resources declined, despite fixed predator densities. Foraging effort and predation rates increased further when energy stores were lower at the onset of simulation periods, but in all scenarios seals not killed by predators had achieved a high level of energy stores by the reproductive season. These behavioral mechanisms proposed by the model potentially explain - at least partially - why the population has been declining while seals have maintained good energy stores throughout temporal shifts in resource availability. More generally, simulations suggest that overfishing and other factors that reduce fish populations indirectly increase predation rates on seals, but data are needed to test this hypothesis. Our model also encompasses a broader ecosystem perspective by predicting how resource level determines the relative strength of trait- and density-mediated interactions, whereby predators of seals indirectly affect fish populations by influencing the foraging behavior and density of seals. The behavioral modeling approach presented here is an additional tool for resource managers attempting to optimize fisheries exploitation and pinniped conservation.

Bradford, A.L., Wade, P.R., Weller, D.W., Burdin, A.M., Ivashchenko, Y.V., Tsidulko, G.A., VanBlaricom, G.R., and Brownell, R.L. **Survival estimates of western gray whales *Eschrichtius robustus* incorporating individual heterogeneity and temporary emigration.** *Marine Ecology Progress Series* 315: 293-307, 2006.

Notes: Gray whales *Eschrichtius robustus* exist as 2 geographically and genetically distinct populations in the eastern and western North Pacific. Subjected to intensive commercial whaling during the 19th and 20th centuries, the western population presently numbers approximately 100 individuals and is regarded as one of the most endangered baleen whale populations in the world. Since 1997, ongoing studies of western gray whales have resulted in a photographic dataset that can be used for mark-recapture survival estimation. Pollock's robust design was applied to 129 individual whale encounter histories spanning 25 monthly capture occasions from 1997 to 2003. Using Akaike's Information Criterion (AICc) model selection, models incorporating individual heterogeneity in residency patterns and higher temporary emigration probabilities for younger whales provided better fits to the data. Non-calf and calf (1st year post-weaning) survival were estimated as 0.951 (SE = 0.0135, 95% CI = 0.917 to 0.972) and 0.701 (SE = 0.0944, 95% CI = 0.492 to 0.850), respectively, averaging across the best models ($n = 13$) in order to account for model uncertainty. The non-calf survival point estimate is similar to mark-recapture estimates for Gulf of Maine humpback whales, but lower than an indirect estimate for the eastern gray whale population. Although no statistically robust direct estimates of baleen whale calf survival exist for comparison to the current study, the calf survival estimate is markedly lower than a value suggested for Gulf of Maine humpback whales. Estimation of survival is necessary for assessing the status of western gray whales, which can contribute to increased protection, conservation, and management planning for this critically endangered population.

Hoffman, J.I., Forcada, J., and Amos, W. **No relationship between microsatellite variation and neonatal fitness in Antarctic fur seals, *Arctocephalus gazella*.** *Molecular Ecology* 15(7): 1995-2005, 2006.

Notes: Published studies of wild vertebrate populations have almost universally reported positive associations between genetic variation measured at microsatellite loci and fitness, creating the impression of ubiquity both in terms of the species and the traits involved. However, there is concern that this picture may be misleading because negative results frequently go unpublished. Here, we analyse the relationship between genotypic variation at nine highly variable microsatellite loci and neonatal fitness in 1070 Antarctic fur seal pups born at Bird Island, South Georgia. Despite our relatively large sample size, we find no significant association between three different measures of heterozygosity and two fitness traits, birth weight and survival. Furthermore, increasing genetic resolution by calculating parental relatedness also yields no association between genetic variation and fitness. Our findings are consistent with necropsy data showing that most pups die from starvation or trauma, conditions that are unlikely to be influenced strongly by genetic factors, particularly if the benefits of high heterozygosity are linked to immune-related genes.

Hoffman, J.I., Matson, C.W., Amos, W., Loughlin, T.R., and Bickham, J.W. **Deep genetic subdivision within a continuously distributed and highly vagile marine mammal, the Steller's sea lion (*Eumetopias jubatus*).** *Molecular Ecology* 15(10): 2821-2832, 2006.

Notes: The Steller's sea lion *Eumetopias jubatus* is an endangered marine mammal that has experienced dramatic population declines over much of its range during the past five decades. Studies using mitochondrial DNA (mtDNA) have shown that an apparently continuous population includes a strong division, yielding two discrete stocks, western and eastern. Based on a weaker split within the western stock, a third Asian stock has also been defined. While these findings indicate strong female philopatry, a recent study using nuclear microsatellite markers found little evidence of any genetic structure, implying extensive paternal gene flow. However, this result was at odds with mark-recapture data, and both sample sizes and genetic resolution were limited. To address these concerns, we increased analytical power by genotyping over 700 individuals from across the species' range at 13 highly polymorphic microsatellite loci. We found a clear phylogenetic break between populations of the eastern stock and those of the western and Asian stocks. However, our data provide little support for the classification of a separate Asian stock. Our findings show that mtDNA structuring is not due simply to female philopatry, but instead reflects a genuine discontinuity within the range, with implications for both the phylogeography and conservation of this important marine mammal.

Dalebout, M.L., Ruzzante, D.E., Whitehead, H., and Oien, N.I. **Nuclear and mitochondrial markers reveal distinctiveness of a small population of bottlenose whales (*Hyperoodon ampullatus*) in the western North Atlantic.** *Molecular Ecology* 15(11): 3115-3129, 2006.

Notes: Small populations at the edge of a species' distribution can represent evolutionary relics left behind after range contractions due to climate change or human exploitation. The distinctiveness and genetic diversity of a small population of bottlenose whales in the Gully, a submarine canyon off Nova Scotia, was quantified by comparison to other North Atlantic populations using 10 microsatellites and mitochondrial DNA (mtDNA) control region sequences (434 bp). Both markers confirmed the distinctiveness of the Gully ($n = 34$) from the next nearest population, off Labrador ($n = 127$; microsatellites - $F_{ST} = 0.0243$, $P < 0.0001$; mtDNA - $\Phi_{ST} = 0.0456$, $P < 0.05$). Maximum likelihood microsatellite estimates suggest that less than two individuals per generation move between these areas, refuting the hypothesis of population links through seasonal migration. Both males and females appear to be philopatric, based on significant differentiation at both genomes and similar levels of structuring among the sexes for microsatellites. MtDNA diversity was very low in all populations ($h = 0.51$, $\pi = 0.14\%$), a pattern which may be due to selective sweeps associated with this species' extreme deep-diving ecology. Whaling had a substantial impact on bottlenose whale abundance, with over 65 000 animals killed before the hunt ceased in the early 1970s. Genetic diversity was similar among all populations, however, and no signal for bottlenecks was detected, suggesting that the Gully is not a relic of a historically wider distribution. Instead, this unique ecosystem appears to have long provided a stable year-round habitat for a distinct population of bottlenose whales.

McKinney, M.A., DeGuise, S., Martineau, D., Beland, P., Lebeuf, M., and Letcher, R.J. **Organohalogen contaminants and metabolites in beluga whale (*Delphinapterus leucas*) liver from two Canadian populations.** *Environmental Toxicology and Chemistry* 25(5): 1246-1257, 2006.

Notes: Contaminants described as organochlorines (OCs; e.g., polychlorinated biphenyls [PCBs]) are present in tissues of marine mammals, including beluga whales (*Delphinapterus leucas*), but the complexity of contaminant exposure often is not fully known. The PCBs, OC pesticides, polybrominated diphenyl ether (PBDE) flame retardants, methylsulfonyl (MeSO₂)- and hydroxy (OH)-PCB metabolites, and OH-PBDEs and methoxylated (MeO)-PBDEs were determined in the liver of beluga whales from two Canadian populations: the St. Lawrence Estuary (SLB; $n = 6$), and western Hudson Bay in the Canadian Arctic (CAB; $n = 11$). The SPCB, SDDT, and SPBDE concentrations were higher ($p < 0.05$) in SLB versus CAB. Of 18 detectable OH-PCBs in SLB (mainly 4-OH-CB107, 4-OH-CB112, and 4'-OH-CB120), only 4'-OH-CB120 was found in CAB. The SOH-PCB concentrations were less than 0.2% of the YPCBs in both populations but were higher ($p < 0.05$) in SLB (65 +/- 22 ng/g lipid wt) than in CAB (3.1 +/- 0.5 ng/g lipid wt). The SMeSO₂-PCB concentrations were higher in SLB (3,801 +/- 1,322 ng/g lipid wt) relative to CAB (77 +/- 23 ng/g lipid wt) and were 11 and 4%, respectively, of the SPCB concentrations. Of the 15 OH-PBDEs, only two congeners were detectable, but not quantifiable (notably 2'-OH-BDE 68 and 6-OH-BDE 47), in animals from both populations. Of the 15 MeO-PBDEs, 4'-MeO-BDE 17 and 6-MeO-BDE 47 in the SLB ($n = 2$) and 2'-MeO-BDE 68 and 6-MeO-BDE 47 in the CAB ($n = 2$) had concentrations from 20 to 100 ng/g lipid weight. The OH-PBDEs and MeO-PBDEs most likely are of natural origin and accumulated in beluga whales, whereas the OH-PCBs and MeSO₂-PCBs are metabolites derived from accumulated PCBs. Canadian beluga whale liver contains previously unidentified organohalogen contaminants and metabolites and, thus, a complexity of contaminant exposure that may be impacting the health of Canadian beluga whale populations.

Sonne, C., Dietz, R., Leifsson, P.S., Born, E.W., Kirkegaard, M., Letcher, R.J., Muir, D.C.G., Riget, F.F., and Hyldstrup, L. **Are organohalogen contaminants a cofactor in the development of renal lesions in East Greenland polar bears (*Ursus maritimus*)?** *Environmental Toxicology and Chemistry* 25(6): 1551-1557, 2006.

Notes: Tissues of polar bears (*Ursus maritimus*) from East Greenland contain the highest concentrations of organohalogen contaminants (OHCs) among subpopulations of any mammalian species in the Arctic. Negative associations also have been found between OHC concentrations and bone mineral density and liver histology parameters for this subpopulation of polar bears. The present study examined the OHC concentrations and adverse effects on renal tissue for 75 polar bears collected during 1999 to 2002. Specific lesions were diffuse glomerular capillary wall thickening, mesangial glomerular deposits, tubular epithelial cell hyperplasia, hyalinization of the tubular basement membrane, tubular dilatation, atrophy and necrosis, tubular medullary hyalin casts, interstitial fibrosis, and mononuclear cell infiltration. With the exception of mononuclear cell infiltrations, all these parameters were correlated with age, whereas none was associated with the sex of the animals. In an age-controlled statistical analysis of covariance, increases in glomerular mesangial deposits and interstitial fibrosis were significantly ($p < 0.05$) correlated with polybrominated diphenyl ether (SPBDE) concentrations in subadults. In adult males, statistically significant ($p < 0.05$) positive correlations were found for tubular epithelial cell hyperplasia and dieldrin concentration; diffuse glomerular capillary wall thickening and chlordane (SCHL) concentrations, and tubular medullary hyalin casts and SCHL, SPBDE, polychlorinated biphenyl, and hexachlorocyclohexane concentrations. The lesions were consistent with those reported previously in highly OHC-contaminated Baltic seal populations and exposed laboratory animals. The renal lesions were a result of aging. However, based on the above statistical findings as well as the nature of the findings, we suggest that long-term exposure to OHCs may be a cofactor in renal lesion occurrence, although other cofactors, such as exposure to heavy metals and recurrent infections from microorganisms, cannot be ruled out. This is new and important knowledge in the assessment of health status among wildlife populations and humans relying on food resources that are contaminated with OHCs.

Houde, M., Balmer, B.C., Brandsma, S., Wells, R.S., Rowles, T.K., Solomon, K.R., and Muir, D.C.G. **Perfluoroalkyl compounds in relation to life-history and reproductive parameters in bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay, Florida, USA.** *Environmental Toxicology and Chemistry* 25(9): 2405-2412, 2006.

Notes: Perfluoroalkyl compounds (PFCs) were determined in plasma, milk, and urine of free-ranging bottlenose dolphins (*Tursiops truncatus*) from Sarasota Bay (FL, USA) during three winter and two summer capture-and-release programs (2002-2005). Plasma and urine samples were extracted using an ion-pairing method. Perfluoroalkyl compounds were extracted from milk samples using acetonitrile, and extracts were cleaned with graphitized nonporous carbon. All extracts were analyzed by high-performance liquid chromatography-tandem mass spectrometry. Mean seasonal sum of PFCs (SPFCs) detected in dolphin plasma ranged from 530 to 927 ng/g wet weight. No significant differences ($p > 0.05$) were found in concentrations between seasons, suggesting a constant exposure to PFCs. Overall, blubber thickness of dolphins did not correlate with PFC concentrations in plasma, suggesting an absence of PFC sequestration in blubber. Sexually immature calves (age, < 10 years; mean SPFCs, 1,410 +/- 780 ng/g wet wt) were significantly more contaminated ($p < 0.001$) than their mothers (mean SPFCs, 366 +/- 351 ng/g wet wt). The reproductive history of females had a significant role in the burden of PFC contamination; PFC concentrations in nulliparous females (females that have not been observed with calves) were significantly greater than those detected in uniparous females (females that have been observed with one calf), suggesting an off-loading of PFCs during or after parturition. To investigate this hypothesis, PFCs were analyzed in milk samples ($n = 10$; mean SPFCs, 134 +/- 76.1 ng/g wet wt), confirming a maternal transfer of PFCs through lactation in dolphins. Results from the present study showed that young and developing bottlenose dolphins are highly exposed to PFCs. These chemicals also were detected in urine (mean SPFCs, 26.6 +/- 79 ng/g wet wt), indicating that the urinary system is an important pathway of PFC depuration in dolphins.