

PROTECTED RESOURCES DIVISION (PRD), PUBLICATIONS

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Week of 11 February 2013

Becker, E. A., K. A. Forney, D. G. Foley, and J. Barlow. 2012. Density and spatial distribution patterns of cetaceans in the central North Pacific based on habitat models. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-490, 34 p.

Abstract - Habitat-based density models were developed for cetaceans in the Central North Pacific based on cetacean survey data collected by the Southwest Fisheries Science Center in 1997-2006. Cetacean sighting data were collected on systematic line-transect surveys in the temperate eastern Pacific, around Hawaii and other Pacific Islands, and in the eastern tropical Pacific west of 120 degrees longitude. Habitat variables, derived from satellite data, included sea surface temperature, sea surface chlorophyll, sea surface height root-mean-square, primary productivity, distance to land, latitude, and longitude. Models were developed for the pantropical spotted dolphin, spinner dolphin, striped dolphin, rough-toothed dolphin, common bottlenose dolphin, false killer whale, short-finned pilot whale, sperm whale, Bryde's whale, and an “other dolphins” group that included the short-beaked common and Pacific white-sided dolphin. Uniform densities were estimated for species/guilds that had insufficient sightings for modeling, including pygmy killer whale, Risso's dolphin, killer whale, a small beaked whale guild (including Cuvier's beaked whale and beaked whales of the genus *Mesoplodon*), and pygmy/dwarf sperm whale. Although validation using an independent survey was not possible, modeled density estimates for the 10 species/species group were compared to previously published line-transect density estimates derived within the U.S. Exclusive Economic Zone around Hawaii. The model-based estimates of abundance fall within the 95% confidence limits of the standard line-transect analyses, and they provide greater spatial resolution of the density estimates based on habitat associations. These new models are intended as baseline density estimates for Navy planning and environmental impact statements, to be updated and improved as additional survey data become available in the future.

Moore, J., and D. Weller. 2013. Probability of taking a western gray whale during the proposed Makah hunt. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-507, 13 p.

Executive Summary - Recent observations of gray whales (*Eschrichtius robustus*) identified in the western North Pacific (WNP) migrating to areas off the coast of North America (Alaska to Mexico) raise concern about the possibility of the small western population being subjected to the gray whale hunt proposed by the Makah Indian Tribe in northern Washington, USA. To address this concern, we estimated the probability of striking (i.e. killing or seriously injuring) a WNP whale during the Makah hunt using six models from 4 model sets that varied based on the assumptions and types of data used for estimation. Model set 1 used WNP and ENP abundance estimates. Model set 2 used these abundance estimates, as well as sightings data from the proposed hunt area. Model sets 3 and 4 used only the sightings data. Within model sets 1 and 2, two models (A and B) differed based upon whether migrating ENP and WNP whales were assumed to be equally available to the hunt per capita (A) or whether this assumption is relaxed (B). We consider Model 2B the most plausible of all models because model set 2 makes use of all available information and 2B contains fewer assumptions than 2A. Based on model 2B, the probability of striking ≥ 1 WNP whale in a single season ranges from 0.007 to 0.036, depending on if the median or upper 95th percentile estimate is used and on which maximum is used for the total number of whales struck. The probability of striking ≥ 1 WNP whale out of 5 seasons ranges from 0.036 to 0.170 across the same scenarios. The expected number to be struck in a single year ranges from 0.01 to 0.04

and from 0.04 to 0.19 across 5 years. For context, these strike estimates were compared to different possible values of Potential Biological Removal (PBR). We also summarized analogous estimates for the number of WNP whales that would be “taken” non-lethally, in terms of the number of attempted but unsuccessful strikes as well as the number of animals approached and pursued during the hunt.

Week of 4 February 2013

Curry, BE, K.Ralls, **R.L. Brownell Jr.** 2013. Prospects for captive breeding of poorly known small cetacean species. *Endangered Species Research* 19:223-243.

Abstract - Because of the precarious condition of small cetacean species and subpopulations listed as Endangered or Critically Endangered by the IUCN, use of captive breeding for conservation has been suggested for some of them, and will likely be suggested for others. A successful captive breeding program for a new species cannot be implemented until reliable capture and husbandry techniques have been developed. Techniques for assisted reproduction and reintroduction may also be needed. We review attempts to capture, maintain, and breed poorly known small cetaceans and discuss assisted reproductive technologies (ART) that have been used to enhance captive breeding efforts for other small cetaceans. We conclude that the techniques required for successful captive breeding of most Endangered or Critically Endangered small cetacean species have not been sufficiently developed. Development of these techniques should begin before a species or population is Critically Endangered. In particular, ARTs tend to be species specific, necessitating considerable time, money, and research to develop for each species of concern. Critically Endangered populations cannot afford to lose the individuals needed for technique development. The fairly large captive population sizes necessary (to avoid loss of genetic diversity, inbreeding, and genetic adaptation to captivity), limited space available in aquariums, and high costs of captive breeding and reintroduction programs make it unlikely that captive breeding will play a major role in the conservation of most small cetaceans. The substantive conservation measures needed to prevent extinction of Critically Endangered small cetaceans is reduction or elimination of their primary threats, which are usually by-catch and habitat loss.

Fiedler, P. C., R. Mendelssohn, D. M. Palacios, and S. J. Bograd. 2013. Pycnocline variations in the eastern tropical and North Pacific, 1958–2008. *J. Climate* 26:583–599.

Abstract - Climatic variability of the pycnocline in the eastern tropical and North Pacific has oceanographic and ecological implications. Gridded monthly profiles of temperature and salinity from the Simple Ocean Data Assimilation (SODA) reanalysis, 1958–2008, were used to derive estimates of four variables related to the density structure of the upper-ocean water column: surface temperature, pycnocline depth, mixed layer depth, and stratification (potential energy anomaly). The pycnocline is primarily a thermal gradient in this region, except in subarctic waters at the northern extreme of the study area, where salinity becomes more important than temperature in determining stratification. Spatial patterns of mean and standard deviation of the four pycnocline variables are presented. Partitioning of variance between seasonal and interannual scales shows the predominance of interannual variability in the tropics and seasonal variability at higher latitudes. Low-frequency variations (trends) in the pycnocline variables were derived by state-space analysis of time series averaged in 5° squares. Regionally coherent trends were either monotonic over 50 years or had decadal-scale changes in sign (± 5 –10-m depth, ± 5 –10% of stratification). For example, in the eastern equatorial Pacific, the pycnocline shoaled by 10 m and weakened by 5% over the 50 years, while in the California Current the pycnocline deepened by ~5 m but showed little net change in stratification, which weakened by 5% to the mid-1970s, strengthened by 8% to the mid-1990s, and then weakened by 4% to 2008. These observed changes in the pycnocline, and future changes resulting from global climate change, may have important biological and ecosystem effects.

Hancock-Hanser, B.L., A. Frey, M.S. Leslie, P.H. Dutton, F.I. Archer, and P.A. Morin. 2013. Targeted multiplex next-generation sequencing: advances in techniques of mitochondrial and nuclear DNA sequencing for population genomics. *Molecular Ecology Resources* doi: 10.1111/1755-0998.12059

Abstract - Next-generation sequencing (NGS) is emerging as an efficient and cost-effective tool in population genomic analyses of nonmodel organisms, allowing simultaneous resequencing of many regions of multi-genomic DNA from multiplexed samples. Here, we detail our synthesis of protocols for targeted resequencing of mitochondrial and nuclear loci by generating indexed genomic libraries for multiplexing up to 100 individuals in a single sequencing pool, and then enriching the pooled library using custom DNA capture arrays. Our use of DNA sequence from one species to capture and enrich the sequencing libraries of another species (i.e. cross-species DNA capture) indicates that efficient enrichment occurs when sequences are up to about 12% divergent, allowing us to take advantage of genomic information in one species to sequence orthologous regions in related species. In addition to a complete mitochondrial genome on each array, we have included between 43 and 118 nuclear loci for low-coverage sequencing of between 18 kb and 87 kb of DNA sequence per individual for single nucleotide polymorphisms discovery from 50 to 100 individuals in a single sequencing lane. Using this method, we have generated a total of over 500 whole mitochondrial genomes from seven cetacean species and green sea turtles. The greater variation detected in mitogenomes relative to short mtDNA sequences is helping to resolve genetic structure ranging from geographic to species-level differences. These NGS and analysis techniques have allowed for simultaneous population genomic studies of mtDNA and nDNA with greater genomic coverage and phylogeographic resolution than has previously been possible in marine mammals and turtles.

Week of 28 January 2013

Pitman, R. L. 2013. Clipperton Island. Pp. 471-473, in Robert Warren Howarth (ed.), *Biomes and Ecosystems: An Encyclopedia*. Salem Press, Ipswich, MA.

Week of 22 January 2013

X. Zhao, D. Wang, S. T. Turvey, **B. Taylor** and T. Akamatsu. Distribution patterns of Yangtze finless porpoises in the Yangtze River: implications for reserve management. *Animal Conservation* doi:10.1111/acv.12019

Abstract - The Yangtze finless porpoise (*Neophocaena asiaeorientalis asiaeorientalis*) is a highly threatened cetacean endemic to the middle and lower reaches of the Yangtze River that has suffered a dramatic decline in recent decades. We characterize and quantify recent distribution patterns of porpoises in the Yangtze River in order to facilitate strategic management of existing *in situ* cetacean reserves and maximize effective utilization of limited conservation resources. We calculated porpoise relative abundance (encounter rate) using a 1-km moving average along the Yangtze main stem based on a combined visual and acoustic survey conducted in 2006. We then evaluated conservation priority areas based on encounter rates along the river. High-porpoise density areas (> 0.20 porpoises km⁻¹) cover approximately one-third (33.9%, 599 km) of the survey area and contain approximately two-thirds of the porpoise population, making them priority areas for porpoise conservation. In contrast, low-porpoise density areas (0.05 porpoises km⁻¹) cover 28.8% (509 km) of the survey area but contain only 4.5% of the porpoise population, and may already be of little value for porpoise conservation. Five high-priority porpoise conservation sites and five sections that now contain few or no surviving porpoises are identified. Proposed spatial modifications to existing reserves and associated conservation recommendations are made for five existing protected areas along the Yangtze main stem, and we emphasize that some additional river sections should urgently be designated as new protected areas given their high porpoise density. Our approach for identifying conservation priorities may provide lessons for reserve design and management in other protected area networks.

Week of 14 January 2013

Allen CD, Lemons GE, Eguchi T, LeRoux RA, Fahy CC, Dutton PH, Peckham SH, Seminoff JA. 2013. Stable isotope analysis reveals migratory origin of loggerhead turtles in the Southern California Bight. *Marine Ecology Progress Series* 472: 275–285.

Abstract - Loggerhead turtles *Caretta caretta* in the North Pacific are listed as Endangered under the US Endangered Species Act and the IUCN Red List. Due partly to their imperiled status, the US National Marine Fisheries Service established a time-area closure in 2003 for the California drift gillnet (CDGN) fishery operating within the Southern California Bight (SCB) to avoid incidental captures. This closure is triggered when sea surface temperatures are above normal, generally caused by El Niño-derived warm-water conditions, which is the time when loggerheads are thought to enter the SCB. Knowledge of the previous foraging grounds of loggerheads incidentally captured by the CDGN fishery in the SCB will help elucidate the oceanographic mechanisms that may influence turtle movement into this region and can assist in optimizing the environmental triggers for implementation of the SCB fishing closure. Stable carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) isotope analysis was used to determine the previous foraging grounds of loggerheads encountered in the SCB. Skin samples from loggerheads captured in the CDGN fishery were compared with skin from loggerheads in the central North Pacific, incidentally caught in the Hawaii-based longline fishery, as well as skin from turtles sampled during in-water research along the Baja California Peninsula, Mexico. The stable isotope values of CDGN-caught turtles were more similar to those from the central North Pacific than to those from Baja, indicating movements from the central North Pacific to the SCB. We elaborate on potential oceanographic mechanisms by which turtles access the SCB and provide insights that can inform future management decisions for the time-area closure.

Curtis KA, Moore JE. 2013. Calculating reference points for anthropogenic mortality of marine turtles. *Aquatic Conservation: Marine and Freshwater Ecosystems*. DOI:10.1002/aqc.2308
<http://onlinelibrary.wiley.com/doi/10.1002/aqc.2308/abstract>

Abstract - 1. Human-caused mortality threatens many marine turtle populations worldwide, with fisheries interactions being a primary cause for population declines. National and international management of fisheries interactions with marine turtles are rarely tied to turtle population biology. Quantitative tools tied to population-based objectives can provide insight into the effectiveness and urgency of bycatch mitigation. 2. A management approach is proposed based on a bycatch control rule called Reproductive Value Loss Limit (RVLL), generalized from the Potential Biological Removal management model for marine mammal populations. For RVLL, population size is scaled by reproductive value to account for strongly age-structured population dynamics and age-dependent fisheries mortality rates in marine turtle populations. 3. RVLL is an estimate of maximum sustainable mortality for a population, calculated from estimates of maximum population growth rate, total reproductive value in the population, and an uncertainty factor. RVLL estimates correspond to specified management goals and risk tolerances. For demonstration, simultaneous goals of maintaining populations above the maximum net productivity level (analogous to the population size that produces maximum sustainable yield) and preventing a decrease in adults are assumed, both with 95% probability. A management-strategy-evaluation-like process was used to explore parameterization of the RVLL equation for robust performance over a range of plausible life history characteristics and uncertainties in abundance and bycatch mortality estimates for marine turtle populations. 4. The RVLL-based management approach presented here proved robust to several important sources of uncertainty and to violation of several key underlying assumptions, and can be adapted to account for important sources of bias. The architecture presented, including tailored management strategy evaluation, provides a useful basis for further development of reference-point-based management of human-added mortality in populations that experience large changes with age in reproductive value and human-caused mortality rates, as is the case for marine turtles.

Week of 7 January 2013

Staaf, D.J., **J.V. Redfern**, W.F. Gilly, W. Watson, and **L.T. Ballance**. 2013. Distribution of ommastrephid paralarvae in the eastern tropical Pacific. *Fishery Bulletin* 111:78-89.

Abstract—Jumbo squid (*Dosidicus gigas*) and purpleback squid (*Sthenoteuthis oualaniensis*) (Teuthida: Ommastrephidae) are thought to spawn in the eastern tropical Pacific. We used 10 years of plankton tow and oceanographic data collected in this region to examine the reproductive habits of these 2 ecologically important squid. Paralarvae of jumbo squid and purpleback squid were found in 781 of 1438 plankton samples from surface and oblique tows conducted by the Southwest Fisheries Science Center (NOAA) in the eastern tropical Pacific over the 8-year period of 1998–2006. Paralarvae were far more abundant in surface tows (maximum: 1588 individuals) than in oblique tows (maximum: 64 individuals). A generalized linear model analysis revealed sea-surface temperature as the strongest environmental predictor of paralarval presence in both surface and oblique tows; the likelihood of paralarval presence increases with increasing temperature. We used molecular techniques to identify paralarvae from 37 oblique tows to species level and found that the purpleback squid was more abundant than the jumbo squid (81 versus 16 individuals).

Turvey ST, Risly CL, **Moore JE**, Barrett LA, Yujiang H, Xiujiang Z, Kaiya Z, Ding W. 2013. Can local ecological knowledge be used to assess status and extinction drivers in a threatened freshwater cetacean? *Biological Conservation* 157:352-360.

Abstract - Local ecological knowledge constitutes a potentially useful source of information for conservation, but the quality, limitations and biases of this body of knowledge remain largely untested. The Yangtze finless porpoise (*Neophocaena asiaeorientalis asiaeorientalis*) is a highly threatened freshwater cetacean found in one of the world's most densely populated human environments. The dynamics of porpoise decline remain poorly understood, and local ecological knowledge from fishing communities across its range may represent an important conservation tool for monitoring porpoise population status and quantifying levels of human-caused mortality. We used interview data from an extensive survey of fishing communities across the middle-lower Yangtze drainage to investigate spatial and temporal patterns of porpoise abundance, mortality and population change. Interview data on porpoise relative abundance and decline, especially weekly sighting frequencies, show congruent spatial patterns with data collected from boat-based Yangtze cetacean surveys, demonstrating that informant data can provide accurate quantitative information on these two key parameters of species conservation status. Interview-based collection of local ecological knowledge therefore represents a useful monitoring method for assessing population trends in freshwater cetaceans and other charismatic or distinctive aquatic species, and may be particularly appropriate in regions where resources for regular boat-based surveys are limited. Using local ecological knowledge to identify primary threats to the porpoise population is less straightforward due to probable biases in interview data on porpoise mortality. However, interview data are able to demonstrate that the number of porpoises killed annually in the Yangtze mainstem may have doubled, and that annually mortality rate may have quadrupled, over the past two decades, with mortality due to vessel strikes and other factors having increased more in recent years than by-catch mortality. It seems unlikely that fisheries mortality has been the dominant driver of porpoise decline in the Yangtze mainstem, suggesting that regulating regional fisheries may not be sufficient for porpoise conservation.

Week of 17 December 2012

Rankin, S., F. Archer, and J. Barlow. 2012. Vocal activity of tropical dolphins is inhibited by the presence of killer whales, *Orcinus orca*. *Marine Mammal Science* DOI: 10.1111/j.1748-7692.2012.00613.x

Abstract - Research has suggested killer whale (*Orcinus orca*) predation may affect cetacean vocal behavior; however, few data exist to test this hypothesis. Data collected during 40,976 km of visual and acoustic shipboard surveys in the tropical Pacific Ocean, including 1,232 detections of 13 species, were examined to determine if changes in dolphin vocal activity could be attributed to the presence of killer whales. Generalized linear models and Random Forest analyses were used to test the hypothesis that dolphin vocal activity was related to the distance and time to the nearest killer whale sighting. Both results show that dolphin vocalizations were inversely correlated with the temporal proximity of killer

whales ($P < 0.05$). Despite the relative rarity of killer whales in the tropics, they appear to influence vocal behavior of nearby dolphin schools. This disruption in communication may not significantly impact interactions necessary for survival in tropical waters where killer whale density is low. However, in temperate climates, where increased productivity supports a greater abundance of killer whales, this interruption in communication may have a greater impact. The lower incidence of whistling dolphins in temperate waters may be related to the greater abundance of killer whales in these areas.

Morin, P.A., Archer, F.I., Pease, V.L., Hancock-Hanser, B.L., Robertson, K.M., Huebinger, R.M., Martien, K.K., Bickham, J.W., George, J.C., Postma, L.D., Taylor, B.L., 2012. Empirical comparison of single nucleotide polymorphisms and microsatellites for population and demographic analyses of bowhead whales. *Endangered Species Research* 19, 129-147.

Abstract - Interest in bowhead whale stock structure has been high due to the species' extreme historical depletion, differential rates of recovery, the potential effects of climate change, and the need to set appropriate quotas for aboriginal hunts. We present an analysis of 42 linked and unlinked single nucleotide polymorphisms (SNPs) among 3 bowhead whale stocks and within the Bering/Chukchi/Beaufort Seas (BCB) stock, and compare results with previously published results of mtDNA control region sequences and 22 microsatellites. We performed tests of population structure (FST, χ^2 , STRUCTURE), population assignment, and estimates of effective population size (N_e), and evaluated different numbers of loci and samples to estimate the relative statistical power of SNPs and microsatellites. Results indicate that this number of SNPs provides similar power to microsatellites to detect low levels of differentiation (FST = 0.005–0.03) between bowhead populations with sample sizes of at least 20 per population. Neither marker performed well for Bayesian analysis of population structure (STRUCTURE) for the strata that had high diversity coupled with low differentiation. This example is valuable in cautioning against use of STRUCTURE to exclude demographic independence of relatively abundant populations. Microsatellites provided greater precision for estimates of N_e and for assignment tests. All 3 genetic marker types are consistent with the BCB stock being a single population. For microsatellites, differences were found between individuals born before 1949 and those born after 1979. SNPs are continuing to prove valuable as tools for understanding structure and demography of populations, and are likely to prove beneficial for long-term monitoring of bowhead whales.

Week of 19 November 2012

Jackson, A. R. 2012. The tuna-porpoise observer photograph collection and database. SWFSC Admin. Rep., La Jolla, LJ-12-05, 10 p.

Abstract – From 1971 to 1995, the U.S. National Marine Fisheries Service's Tuna-Porpoise Program placed biological technicians ("observers") on U.S. tuna seiners fishing in the eastern tropical Pacific Ocean. In addition to collecting data on fishery-related dolphin kills, these observers opportunistically took photographs of cetaceans in support of life history data and species/stock identification. These photographs, mostly color slides, are indexed and archived with the Protected Resources Division of the Southwest Fisheries Science Center. Information about each photograph is contained in a Microsoft Access database named TVPhotoDB. There are over 13,000 photographs in this collection.

Blanco GS, Morreale SJ, **Seminoff JA**, Paladino FV, Piedra R, Spotila JR. 2012. Movements and diving behavior of interesting green turtles along Pacific Costa Rica. *Integrative Zoology*. doi:10.1111/j.1749-4877.2012.00298.x

Abstract – Using satellite transmitters, we determined the interesting movements, spatial ecology and diving behavior of East Pacific green turtles (*Chelonia mydas*) nesting on Nombre de Jesús and Zapotillal beaches along the Pacific coast of northwestern Costa Rica. Kernel density analysis indicated that turtles spent most of their time in a particularly small area in the vicinity of the nesting beaches (50% utilization distribution was an area of 3 km²). Minimum daily distance traveled during a 12 day interesting period was 4.6 ± 3.5 km. Dives were short and primarily occupied the upper 10 m of the water column. Turtles

spent most of their time resting at the surface and conducting U-dives (ranging from 60 to 81% of the total tracking time involved in those activities). Turtles showed a strong diel pattern, U-dives mainly took place during the day and turtles spent a large amount of time resting at the surface at night. The lack of long-distance movements demonstrated that this area was heavily utilized by turtles during the nesting season and, therefore, was a crucial location for conservation of this highly endangered green turtle population. The unique behavior of these turtles in resting at the surface at night might make them particularly vulnerable to fishing activities near the nesting beaches.

Week of 12 November 2012

Barlow, J. 2012. Book Review: Passive Acoustic Monitoring of Cetaceans by Walter M. X. Zimmer. *Marine Mammal Science* 28(4):782-784.

Week of 5 November 2012

Elfes, C.T., S.R. Livingstone, A. Lane, V. Lukoschek, K.L. Sanders, A. Courtney, J. Gatus, M. Guinea, A. Savio Lobo, D. Milton, A. Rasmussen, M. Read, M.-D. White, J. Sanciangco, A. Alcalá, H. Heatwole, D. Karns, **J.A. Seminoff**, H. Voris, K. Carpenter, J.C. Murphy. *In Press*. Fascinating and forgotten: the conservation status of the world's sea snakes. *Herpetological Conservation and Biology*.

Abstract – The conservation status of marine elapid snakes was assessed under the categories and criteria of the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species. The assessment suggests that 9% of marine elapids are threatened with extinction, and an additional 6% are near threatened. A large proportion (34%) are listed as data deficient. An analysis of distributions revealed the greatest species diversity is found in Southeast Asia and northern Australia. Three of the seven threatened species occur at Ashmore and Hibernia Reefs in the Timor Sea, while the remaining threatened taxa occur in the Philippines, Niue, and Solomon Islands. The majority of data deficient species are found in Southeast Asia. Threats to marine snakes include coral reef and coastal habitat loss, incidental bycatch in fisheries, as well as fisheries that target snakes for leather. The presence of two critically endangered and one endangered species in the Timor Sea suggests that this is an area of particular conservation concern. More rigorous, long-term population monitoring is needed in order to evaluate the success of conservation measures for marine snake species, provide scientifically-based guidance for determining harvest quotas, and to assess the populations of many data deficient species.

Week of 29 October 2012

SWFSC publications in:

Conserving cetaceans and manatees in the western African region. 2012. CMS Secretariat, Bonn, Germany. CMS Technical Series No. 26. http://www.cms.int/publications/TechSeries/ts26_watch_e.pdf

Perrin, William F., and Koen Van Waerebeek. 2012. The small-cetacean fauna of the west coast of Africa and Macaronesia: diversity and distribution

Moore, J.E., T.M. Cox, R.L. Lewison, A.J. Read, R. Bjorkland, S.L. McDonald, L.B. Crowder., E. Aruna, I. Ayissi, P. Espeut, C. Joynson-Hicks, N. Pilcher, C. Poonian, B. Solarin and J. Kiszka. 2012. Rapid assessment of marine mammal and sea turtle mortality in small-scale fisheries.

Week of 22 October 2012

S. Elizabeth Alter, Howard C. Rosenbaum, Lianne D. Postma, Peter Whitridge, Cork Gaines, Diana Weber, Mary G. Egan, Melissa Lindsay, George Amato, Larry Dueck, **Robert L. Brownell Jr.**, Mads-Peter Heide-Jørgensen, Kristin L. Laidre, Gisella Caccone & **Brittany L. Hancock**. 2012. Gene flow on ice: the role of sea ice and whaling in shaping Holarctic genetic diversity and population differentiation in bowhead whales (*Balaena mysticetus*). *Ecology and Evolution*. doi: 10.1002/ece3.397

Abstract - Sea ice is believed to be a major factor shaping gene flow for polar marine organisms, but it remains unclear to what extent it represents a true barrier to dispersal for arctic cetaceans. Bowhead whales are highly adapted to polar sea ice and were targeted by commercial whalers throughout Arctic and subarctic seas for at least four centuries, resulting in severe reductions in most areas. Both changing ice conditions and reductions due to whaling may have affected geographic distribution and genetic diversity throughout their range, but little is known about range-wide genetic structure or whether it differed in the past. This study represents the first examination of genetic diversity and differentiation across all five putative stocks, including Baffin Bay-Davis Strait, Hudson Bay-Foxe Basin, Bering-Beaufort-Chukchi, Okhotsk, and Spitsbergen. We also utilized ancient specimens from Prince Regent Inlet (PRI) in the Canadian Arctic and compared them with modern stocks. Results from analysis of molecular variance and demographic simulations are consistent with recent and high gene flow between Atlantic and Pacific stocks in the recent past. Significant genetic differences between ancient and modern populations suggest PRI harbored unique maternal lineages in the past that have been recently lost, possibly due to loss of habitat during the Little Ice Age and/or whaling. Unexpectedly, samples from this location show a closer genetic relationship with modern Pacific stocks than Atlantic, supporting high gene flow between the central Canadian Arctic and Beaufort Sea over the past millennium despite extremely heavy ice cover over much of this period.

Sarah M. E. Fortune*, Andrew W. Trites, **Wayne L. Perryman**, Michael J. Moore, Heather M. Pettis, and **Morgan S. Lynn**. 2012. Growth and rapid early development of North Atlantic right whales (*Eubalaena glacialis*). *Journal of Mammalogy*, 93(5):1342-1354. 2012.

Abstract - Body growth of North Atlantic right whales (*Eubalaena glacialis*) was described from measurements of known age live and dead individuals to gain insights into the nutritional needs and life-history strategies of this endangered species. Body lengths from 154 individuals revealed that calves more than doubled in size and attained three-fourths of asymptotic adult size by the time they had weaned at 12 months. Calves gained on average ~1.7 cm and ~34 kg per day while nursing during this extremely rapid growth phase. Mean predicted lengths and body mass were 4.2 m and 1.1 metric tons (mt) at birth, 10.3 m and 13.5 mt at weaning, and 13.6 m and 29.6 mt when fully grown. Growth of right whales was best described using a 2-phased Gompertz growth model and could not be fit using any of the single continuous growth models commonly used for other mammals. Rapid growth during dependency may minimize the risk of predation and maximize calf survival. Rapid calf growth also may maximize development of the mouth and baleen to optimize foraging efficiency of juveniles at the time of weaning, as well as improve reproductive fitness by reducing the age at which sexual maturity is attained. However, transferring the amount of energy needed to support the rapid postnatal growth of North Atlantic right whales may ultimately affect the intervals between pregnancies (.3 years) of mature females.

Week of 15 October 2012

LeRoux, R.A., Dutton P.H., Abreu-Grobois F.A., et al. 2012. Re-examination of population structure and phylogeography of hawksbill turtles in the Wider Caribbean using longer mtDNA sequences. *Journal of Heredity*. doi:10.1093/jhered/ess055

Abstract - Management of the critically endangered hawksbill turtle in the Wider Caribbean (WC) has been hampered by knowledge gaps regarding stock structure. We carried out a comprehensive stock structure re-assessment of 11 WC hawksbill rookeries using longer mtDNA sequences, larger sample

sizes (N = 647), and additional rookeries compared to previous surveys. Additional variation detected by 740bp sequences between populations allowed us to differentiate populations such as Barbados-Windward and Guadeloupe ($F_{st} = 0.683$, $P < 0.05$) that appeared genetically indistinguishable based on shorter 380bp sequences. POWSIM analysis showed that longer sequences improved power to detect population structure and that when $N < 30$, increasing the variation detected was as effective in increasing power as increasing sample size. Geographic patterns of genetic variation suggest a model of periodic long-distance colonization coupled with region-wide dispersal and subsequent secondary contact within the WC. Mismatch analysis results for individual clades suggest a general population expansion in the WC following a historic bottleneck about 100,000-300,000 years ago. We estimated an effective female population size (N_{ef}) of 6000-9000 for the WC, similar to the current estimated numbers of breeding females, highlighting the importance of these regional rookeries to maintaining genetic diversity in hawksbills. Our results provide a basis for standardizing future work to 740bp sequence reads and establish a more complete baseline for determining stock boundaries in this migratory marine species. Finally, our findings illustrate the value of maintaining an archive of specimens for re-analysis as new markers become available.

West, K.L., S. Sanchez, D. Rotstein, **K.M. Robertson**, S. Dennison, G. Levine, N. Davis, D. Schofield, C.W. Potter And B. Jensen. 2012. A Longman's beaked whale (*Indopacetus pacificus*) strands in Maui, Hawaii, with first case of morbillivirus in the central Pacific. *Marine Mammal Science*, doi: 10.1111/j.1748-7692.2012.00616.x

Abstract - The Longman's beaked whale (*Indopacetus pacificus*) is one of the world's most poorly known whales. Until 1999 this species had not been identified from either a live or a dead whale and was known only from the holotype skull collected from Queensland, Australia in 1882 (Longman 1926) and one additional skull from Somalia (Azzaroli 1968). After a detailed assessment of photographs of an unidentified tropical "bottlenose whale" (Pitman et al. 1999), and later genetic confirmation of species identity from stranded animals (Dalebout et al. 2003), at sea identification of this species became possible and sighting reports are no longer uncommon in subtropical and tropical waters, especially in the Indian Ocean (Pitman et al. 1999, Anderson et al. 2006). In the Pacific, a few sighting reports suggest that Longman's beaked whales inhabit Hawaiian waters in low abundance (Shallenberger 1981, Barlow 2006, McSweeney et al. 2007). However, specimens remain scarce and to date this species is known from less than 10 confirmed strandings world-wide (Pitman 2009). This is the first report on a stranding and necropsy findings from a Longman's beaked whale from the Hawaiian archipelago and confirms the presence of this species in waters of the United States. This is the only case of a Longman's beaked whale stranding world-wide where the response included collection of morphometrics, computed tomography (CT) scanning, gross necropsy, histopathology, genetics, and molecular diagnostics for pathogens.

Week of 1 October 2012

Blanco, G.S., S.J. Morreale, H. Bailey, **J.A. Seminoff**, F.V., Paladino, and J.R. Spotila. 2012. Post-nesting movements and feeding grounds of a resident East Pacific green turtle (*Chelonia mydas*) population from Costa Rica. *Endangered Species Research*. 18:233-245.

Abstract - Satellite telemetry has helped reveal migratory movements of sea turtles. We attached satellite transmitters (MK10 Pat Tags) to 10 post-nesting East Pacific green turtles *Chelonia mydas* from Nombre de Jesús, Costa Rica (in 2006, 2007 and 2009) to track their movements, identify their foraging grounds, and elucidate their foraging behavior. Location data were analyzed by applying a switching state-space model to obtain daily position estimates and to differentiate between 2 behavioral modes (migrating and foraging). All post-nesting movements were along coastal routes ranging up to 1086 km from the nesting beach. Of the 10 turtles, 6 remained local residents of Costa Rica foraging in the Gulf of Papagayo (N = 2) and the Gulf of Santa Elena (N = 4). One individual moved southwards to the Gulf of Panama, and 3 other turtles migrated northwards to waters off the Gulf of Fonseca in northern Nicaragua, with one continuing its foraging movements northwards to coastal Guatemala. Home ranges during foraging varied widely among individuals, and the calculated size of feeding grounds ranged from 315 to 18 335

km², the latter being the largest reported for this species. The fact that members of this nesting population inhabit coastal waters makes them vulnerable to human activities along the coasts of Central America. Our findings highlight the importance of Costa Rica and the coastal waters of Central America for the survival of the Endangered Costa Rican green turtles.

Lennert-Cody, C. E., **Rusin, J. D.**, Maunder, M. N., Everett, E. H., Largacha Delgado, E. D. and Tomlinson, P. K. 2012. Studying small purse-seine vessel fishing behavior with tuna catch data: Implications for eastern Pacific Ocean dolphin conservation. *Marine Mammal Science*. doi: 10.1111/j.1748-7692.2012.00608.x
URL: <http://onlinelibrary.wiley.com/doi/10.1111/j.1748-7692.2012.00608.x/full>

Abstract - Despite achievements in dolphin conservation for the tuna purse-seine fishery of the eastern Pacific Ocean, debate continues about the magnitude and importance of dolphin mortality caused by small (unobserved) vessels. In-port sampling of tuna catch size composition is a potentially cost-effective means of identifying unobserved vessels that may be catching tunas associated with dolphins because yellowfin tuna caught in association with dolphins are larger, on average, than those caught in other types of purse-seine sets. A classification algorithm to predict purse-seine set type (“dolphin” vs. “nondolphin”) was built from port-sampling data on yellowfin tuna length-frequencies and the date and location of fishing of large (observed) vessels. This classification algorithm was used to screen the port-sampling data of small vessels collected during 2006-2009, assuming the fishing practices of the two groups resulted in similar catch characteristics. From these results, hypothetical time series of dolphin mortality for small vessels were constructed and incorporated into a population dynamics model, along with mortalities of large vessels. Results suggest that any dolphin mortality of small vessels is unlikely to be substantially affecting trends in dolphin abundance. These results underscore the importance of in-port sampling, in combination with at-sea observation and fishery-independent surveys, to effective management.

Week of 17 September 2012

Robert L. Pitman, Lisa T. Ballance, and Charles A. Bost. 2012. Incidence of Wing Deformities (‘Angel Wing’) Among Masked Boobies at Clipperton Island: Life History Consequences and Insight into Etiology. *The Wilson Journal of Ornithology*, 124(3):597-602. 2012.
DOI: <http://dx.doi.org/10.1676/11-208.1>
URL: <http://www.bioone.org/doi/full/10.1676/11-208.1>

Abstract - ‘Angel wing’ is a developmental wing deformity among birds that can cause flightlessness; it is mostly known from domestic birds, especially waterfowl, and has only rarely been reported among wild bird populations. We estimated that 508 (4.9%) Masked Booby (*Sula dactylatra*) chicks on Clipperton Island (10u 189 N, 109u 139 W) in the eastern tropical Pacific Ocean exhibited angel wing during March 2005. Both hatching-year birds and after-hatching-year birds exhibited the condition; the latter included seven flightless birds in adult plumage (i.e., minimum 2 yrs of age) which were still being fed by their presumed parents. The angel wing outbreak coincided in time with high nestling mortality, apparently related to food shortage, and we speculate on causal linkages.

David W. Weller, Amber Klimek, Amanda L. Bradford, John Calambokidis, **Aimee R. Lang,** Brian Gisborne, Alexander M. Burdin, Wendy Szaniszlo, Jorge Urbán, Alejandro Gómez-Gallardo Unzueta, Steven Swartz, **Robert L. Brownell Jr.** 2012. Movements of gray whales between the western and eastern North Pacific. *Endangered Species Research* 18:193-212.

Abstract - The western North Pacific (WNP) population of gray whales *Eschrichtius robustus* is redlisted by the IUCN as Critically Endangered. As part of a long-term study on whales off Sakhalin Island, Russia, photo-catalog comparisons of gray whales in the western and eastern North Pacific (ENP) were undertaken to assess population mixing. These comparisons involved 2 approaches: (1) a systematic comparison of the WNP ‘Sakhalin Catalog’ to an ENP ‘Pacific Northwest Catalog’ that consisted of

images from the northwest coast of North America and (2) a non-systematic comparison of the WNP ‘Sakhalin Catalog’ to an ENP ‘Laguna San Ignacio Catalog’ that consisted of images from central Baja California, Mexico. The Sakhalin to Pacific Northwest comparison consisted of 181 and 1064 whales, respectively, and resulted in 6 matches (3 males, 2 females, and 1 whale of unknown sex). All sightings of ‘Sakhalin whales’ in the Pacific Northwest occurred off southern Vancouver Island, British Columbia, Canada. The Sakhalin to Laguna San Ignacio comparison consisted of 181 and 2514 whales, respectively, and resulted in 4 matches (2 males and 2 females). As the Pacific Northwest and Laguna San Ignacio catalogs represent only a small fraction of the total estimated number of individuals in the ENP population (~19 000), it is likely that more WNP/ENP exchange has occurred than was detected by these photo-catalog comparisons. Although these matches provide new records of movements between the WNP and ENP, recent observations of gray whales off Japan and China suggest that not all gray whales identified in the WNP share a common wintering ground.

Week of 10 September 2012

Noda T, **Okuyama J**, Koizumi T, Arai N, Kobayashi M. 2012. Monitoring attitude and dynamic acceleration of free-moving aquatic animals using a gyroscope. *Aquatic Biology* 16:265–276.

Abstract - A novel method (the ‘gyro method’) was developed to monitor the attitude and dynamic acceleration of free-moving aquatic animals with high precision and temporal resolution (100 Hz) using a new type of animal-attached data logger with a 3-axis gyroscope, a 3-axis accelerometer, and a 3-axis magnetometer. The gyro method was applied to green sea turtles *Chelonia mydas* in both tank and open-sea experiments, and the data for 2 types of activity (steady swimming and breathing) were compared to those obtained by a conventional method with only an accelerometer and a magnetometer, using low-pass filtering or running mean smoothing to determine gravity-based acceleration. Significant differences (mean \pm SD: 0.034 ± 0.012 g and $1.964 \pm 1.090^\circ$ for steady swimming) were found in the reconstructed gravity-based acceleration and attitude between the gyro method and the conventional method. The gyro method reconstructed the fluctuation in attitude associated with the power stroke of the sea turtles, which was not documented by the conventional method. Additionally, the dynamic acceleration determined by the conventional method differed from the true dynamic acceleration, whereas the gyro method was able to reconstruct any attitude change (and therefore dynamic acceleration) without using the vague criteria involved with low-pass filtering or running mean smoothing in the conventional method. Hence, our new method will be useful for accurately measuring kinematics and movement performance involving complicated changes in motion, such as foraging for prey and escaping from predators, or the interactions of endangered species with fishing gear.

Olson, P.A. 2012. Review of Field Guide to Marine Mammals of the Pacific Coast: Baja, California, Oregon, Washington, British Columbia, by Sarah G. Allen, Joe Mortenson, and Sophie Webb. *Quarterly Review of Biology*. 87(3):273.

Week of 4 September 2012

Jehl, J.R., Jr, **A.E. Henry**, and J.St. Leger. 2012. Waterbird mortality in hypersaline environments: the Wyoming trona ponds. *Hydrobiologia* 697: 23–29.

Abstract - Each year hundreds of salt-encrusted waterbirds, mainly Eared Grebes (*Podiceps nigricollis Brehm*) die at evaporation ponds of the trona (soda ash) industry in southwestern Wyoming. Clinical investigations attributed the mortality to sodium toxicity because high levels of sodium were found in brains of grebes salvaged from the ponds. This was puzzling because natural history information shows that this species resides in saline and hypersaline environments for most of the year. In addition, field observations gave no indication that grebes at the ponds were ingesting salt or salt crystals. Further, the

salt glands were not hypertrophied and gavage experiments showed that healthy birds were able to ingest trona pond water without ill effect. Carcasses immersed in pond water, however, attained brain sodium levels far exceeding those considered toxic within a few hours, indicating that the high levels considered as causal probably resulted from post-mortem events. We attribute the mortality to complications of salt encrustation, notably impaired thermoregulation. Other purported cases of sodium toxicity involving encrusted birds at industrial ponds or hypersaline situations may have a similar etiology.

Week of 20 August 2012

Amaral AR, Beheregaray LB, Bilgmann K, Freitas L, **Robertson KM**, Sequeira M, Stockin KA, Coelho MM, Möller LM. 2012. Influences of past climatic changes on historical population structure and demography of a cosmopolitan marine predator, the common dolphin (genus *Delphinus*). *Molecular Ecology*. doi: 10.1111/j.1365-294X.2012.05728.x

Abstract - Climatic oscillations during the Pleistocene have greatly influenced the distribution and connectivity of many organisms, leading to extinctions but also generating biodiversity. While the effects of such changes have been extensively studied in the terrestrial environment, studies focusing on the marine realm are still scarce. Here we used sequence data from one mitochondrial and five nuclear loci to assess the potential influence of Pleistocene climatic changes on the phylogeography and demographic history of a cosmopolitan marine predator, the common dolphin (genus *Delphinus*). Population samples representing the three major morphotypes of *Delphinus* were obtained from 10 oceanic regions. Our results suggest that short-beaked common dolphins are likely to have originated in the eastern Indo-Pacific Ocean during the Pleistocene and expanded into the Atlantic Ocean through the Indian Ocean. On the other hand, long-beaked common dolphins appear to have evolved more recently and independently in several oceans. Our results also suggest that short-beaked common dolphins had recurrent demographic expansions concomitant with changes in sea surface temperature during the Pleistocene and its associated increases in resource availability, which differed between the North Atlantic and Pacific Ocean basins. By proposing how past environmental changes had an effect on the demography and speciation of a widely distributed marine mammal, we highlight the impacts that climate change may have on the distribution and abundance of marine predators and its ecological consequences for marine ecosystems.

Gaos AR, Lewison RL, Wallace BP, Yañez IL, Liles MJ, Baquero A, **Seminoff JA**. 2012. Dive behaviour of adult hawksbills (*Eretmochelys imbricata*, Linnaeus 1766) in the eastern Pacific Ocean highlights shallow depth use by the species. *Journal of Experimental Marine Biology and Ecology* 432:171-178.

Abstract - Understanding movement and dive behaviour of marine turtles directly informs spatial management strategies. Hawksbill turtles (*Eretmochelys imbricata*, Linnaeus 1766) are a globally endangered marine turtle species, with populations in the eastern Pacific Ocean identified as particularly threatened. To date, very little research on dive behavior of hawksbills has been conducted. Most studies have focused on juveniles in the Wider Caribbean region, and no dive behaviour has been described for hawksbills the eastern Pacific. Using satellite-relayed dive loggers attached to five adult hawksbills, we analyzed dive trends and differences among individuals, movement phases and diel time periods, and compared our findings with those from hawksbills in other regions of the world. Our research indicates that adult hawksbills in the eastern Pacific predominantly use shallow waters (i.e. $\leq 10\text{m}$), with dives rarely occurring to depths $>20\text{m}$. Additionally, in contrast to previous research, we found similar dive behavior across diel time periods, suggesting nocturnal activity may be more prevalent than previously believed. Despite some similarities in dive behavior across individuals, individual variability was also evident. More research on adult hawksbills is urgently needed to increase our understanding of basic hawksbill ecology and behaviour, and improve management of this species in the eastern Pacific Ocean.

Komoroske LK, Lewison RL, **Seminoff JA**, Deustchman DD, Deheyn DD. 2012. Trace metals in an urbanized estuarine sea turtle food web in San Diego Bay, CA. *Science of the Total Environment* 418:108-116.

Abstract - San Diego Bay is an anthropogenically impacted waterway that is also a critical habitat for many sensitive species such as the green sea turtle (*Chelonia mydas*). In this study, we quantified trace metal concentrations in sediment and organisms composing the green sea turtle diet, and identified bioaccumulation patterns for a suite of trace metals. We found Ag, Cd, Cu, Mn, Se, and Zn exhibited the highest bioaccumulation levels in this food web. Cu and Mn concentrations in resident biota displayed a strong spatial gradient from the mouth to the head of the Bay, which was different from the patterns found in the sediment itself. Sediment median concentrations followed a general pattern across the bay of Al>Mn>Cu>Zn>Pb>As>Cd>Ag>Se>Hg. In contrast, eelgrass displayed differential patterns in the mouth versus the back of the Bay (three front Bay sites: Al>Mn>Zn> Cu>Pb>Se>Cd>Ag>As; vs. back Bay sites: Mn>Al>Zn>Cu>Pb>Se>Cd>Ag>Hg>As) with the exception of Shelter Island where levels of Zn and Cu were elevated as a result of anti-fouling paint pollution. Observed differences between sediment and biota metal patterns are likely due to complex processes related to trace metals input and bioavailability, habitat characteristics and specific metabolic functioning of the trace metals for each member of the food web. These data highlight the fact that for the San Diego Bay ecosystem, the current use of toxicity reference values scaled up from sediment and invertebrate testing ex-situ is likely to be inaccurate when transposed to the green sea turtle. Here, we illustrate how identifying spatial variability in metal exposure can improve our understanding of habitat utilization by sea turtles in highly urbanized estuaries. Monitoring contaminants directly in food webs of sensitive vertebrates may greatly improve our understanding of their direct and indirect exposure to potentially deleterious contamination, and should be considered in the future to improve traditional risk assessment approaches.

Week of 13 August 2012

Burrows JA, Harvey JT, Newton KM, Croll DA, **Benson SR**. 2012. Marine mammal response to interannual variability in Monterey Bay, California. *Marine Ecology Progress Series* 461:257–271.

Abstract - The coastal upwelling ecosystem near Monterey Bay, California, is a productive yet variable ecosystem and an important foraging area for many mobile apex predators, such as marine mammals. Long-term studies are necessary to better understand how wide-ranging predators respond to temporal environmental variability; however, few of these studies exist. We conducted monthly shipboard line-transect surveys in Monterey Bay from 1997 to 2007. We identified 22 species of marine mammals, and calculated monthly and annual densities for the 12 most commonly sighted (focal) species. Species richness remained relatively constant (mean richness \pm SE: 13.7 ± 0.396 species yr⁻¹) from 1997 to 2006. Focal species were most evenly distributed (Shannon's equitability, EH = 0.820) but least dense (mean density \pm SE: 0.0598 ± 0.0141) during the anomalous upwelling conditions of 2005, and least even (1997 EH = 0.413; 1998 EH = 0.407) but dense (mean density \pm SE: 1997: 0.433 ± 0.177 ; 1998: 0.438 ± 0.169 ind. km⁻²) during the 1997/1998 El Niño event. There were no statistically significant differences in the densities of marine mammal species between warmer and cooler years. The community and species-specific responses of marine mammals to warm-water years differed depending on the mechanism of oceanographic variability. During the 1997/1998 El Niño (a basin-wide event), marine mammals aggregated in nearshore areas, such as Monterey Bay, with relatively greater productivity than offshore regions, whereas during anomalous upwelling conditions of 2005 (a more localized oceanographic event), marine mammals redistributed away from Monterey Bay to areas less affected by the anomaly.

Fearnbach, H., Durban, J. W., Parsons, K. M., Claridge, D. 2012. Photographic mark-recapture analysis of local dynamics within an open population of dolphins. *Ecological Applications*, 22(5): 1689–1700.

Abstract - Identifying demographic changes is important for understanding population dynamics. However, this requires long-term studies of definable populations of distinct individuals, which can be particularly challenging when studying mobile cetaceans in the marine environment. We collected photo-identification data from 19 years (1992-2010) to assess the dynamics of a population of bottlenose dolphins (*Tursiops truncatus*) restricted to the shallow (<7m) waters of Little Bahama Bank. This

population was known to range beyond our study area, so we adopted a Bayesian mixture modeling approach to mark-recapture to identify clusters of individuals that used the area to different extents, and specifically estimated trends in survival, recruitment and abundance of a “resident” population with high probabilities of identification. There was a high probability ($p = 0.97$) of a long-term decrease in the size of this resident population from a maximum of 47 dolphins (95% Highest Posterior Density Intervals, HPDI = 29-61) in 1996, to a minimum of just 24 dolphins (95% HPDI = 14 - 37) in 2009; a decline of 49% (95% HPDI = -5% to -75%). This was driven by low per-capita recruitment (average ~ 0.02) that could not compensate for relatively low apparent survival rates (average ~ 0.94). Notably, there was a significant increase in apparent mortality (~ 5 apparent mortalities vs. ~ 2 on average) in 1999 when two intense hurricanes passed over the study area, with a high probability ($p = 0.83$) of a drop below the average survival probability (~ 0.91 in 1999; ~ 0.94 on average). As such, our mark-recapture approach enabled useful inference about local dynamics within an open population of bottlenose dolphins; this should be applicable to other studies challenged by sampling highly mobile individuals with heterogeneous space-use.

MacDonald BD, Lewison RL, Madrak SV, Seminoff JA, Eguchi T. 2012. Home ranges of East Pacific green turtles *Chelonia mydas* in a highly urbanized temperate foraging ground. 461: 211–221.

Abstract - Green sea turtles *Chelonia mydas* use coastal areas as foraging grounds for the majority of their lives. Human development of coastlines is increasing, but the effects of urban development of foraging grounds on green turtles are poorly understood. We used acoustic telemetry to determine home ranges of green turtles during 2009 to 2011 in San Diego Bay, California, USA, which is a highly urbanized temperate foraging area. Adult and juvenile turtles ($n = 25$, straight carapace length = 54.9 to 102.5 cm) were tracked for up to 370 d. Based on the fixed kernel densities of 15 turtles, we found individual home range areas (95% utilization distribution) were 2.09 to 8.70 km² (mean \pm SE = 5.51 ± 0.57 km²), where each turtle used 1 or 2 core activity areas (50% utilization distribution). The home ranges of all turtles were exclusively in the southern portion of San Diego Bay, where eelgrass *Zostera marina* is abundant and where human activity is the lowest within the bay. Core activity areas coincided with eelgrass distribution or occurred adjacent to the warm water-effluent outfall of a power plant. Results from our study suggest that south San Diego Bay serves as important turtle habitat within the bay. Future monitoring is required to document the potential effects of changing environmental conditions, including closure of the power plant, on green turtles residing in San Diego Bay.

Ruiz-Cooley, R. I., and T. Gerrodette. 2012. Tracking large-scale latitudinal patterns of d13C and d15N along the E Pacific using epi-mesopelagic squid as indicators. *Ecosphere* 3(7):1-17.

Abstract - Because consumers integrate components of their habitat through diet over time and space, stable isotope ratios from animal tissues can track spatial variation in baseline values across marine systems. To understand large-scale geographic patterns in the eastern Pacific ocean, muscle d13C and d15N from epi-mesopelagic squid ($n = 404$) were collected from 398 S to 538 N and analyzed in relation to hemisphere, latitude, geographic area and current systems. Geographic patterns were controlled for effects of secondary factors such as squid size, species (*Dosidicus gigas* and *Sthenoteuthis oualaniensis*), tissue and year of collection. Joint latitudinal variation of d13C and d15N was also described for the first time. Both d13C and d15N, as well as the standardized difference between them, had distinct patterns by latitude. d13C was the highest at 228S and decreased north and south of that latitude, with lower values at mid-northern latitudes than near the equator. d15N had the lowest values near the equator and gradually increased towards mid-latitudes. The standardized difference between d13C and d15N was highest (C was higher relative to N) near the equator and declined to mid-latitudes. Overall, the d13C and d15N geographic patterns agreed with previous studies for d15N from surface NO₃, but not for d13C in plankton, POM and squid. We suggest that the biochemical processes for carbon and nitrogen are spatially more variable than what has previously been reported because squid isotope ratios varied also among current systems and geographic areas. These geographic patterns in d13C and d15N, indicated by consumers such as cephalopods, could improve our understanding about the interaction between the carbon and nitrogen cycle and the heterogeneity in biochemical cycling processes in marine systems.

Week of 6 August 2012

Lanci, A.K.J., S.E. Roden, A. Bowman, E.L. LaCasella, A. Frey and P.H. Dutton. 2012 Evaluating Buccal and Cloacal Swabs for Ease of Collection and Use in Genetic Analyses of Marine Turtles. *Chelonian Conservation and Biology*. 11(1):144-148.

Abstract - Buccal and cloacal swabs have been used for genetic sampling for a variety of reptiles but not for marine turtles to date. We evaluated whether this method offers a simple and quick way to sample cells from live marine turtles in the wild when it is not feasible to obtain blood or skin. Good-quality DNA was obtained for genetic analyses from both buccal and cloacal swabs. Although we recommend blood and skin sampling whenever possible to collect the highest quality DNA, buccal and cloacal swabs do represent a useful alternative for genetic sampling when these preferred methods are not feasible.

Wade, P. R., Reeves, R.R. and **Mesnick, S.L.** 2012. Social and Behavioural Factors in Cetacean Responses to Overexploitation: Are Odontocetes Less “Resilient” Than Mysticetes? *Journal of Marine Biology*, Volume 2012 Article ID 567276, doi:10.1155/2012/567276.

Abstract - Many severely depleted populations of baleen whales (Mysticeti) have exhibited clear signs of recovery whereas there are few examples in toothed whales (Odontoceti). We hypothesize that this difference is due, at least in part, to social and behavioural factors. Clearly, a part of the lack of resilience to exploitation is explained by odontocete life history. However, an additional factor may be the highly social nature of many odontocetes in which survival and reproductive success may depend on: (a) social cohesion and organization, (b) mutual defence against predators and possible alloparental care, (c) inter-generational transfer of “knowledge”, and (d) leadership by older individuals. We found little evidence of strong recovery in any of the depleted populations examined. Their relatively low potential rates of increase mean that odontocete populations can be over-exploited with take rates of only a few percent per year. Exploitation can have effects beyond the dynamics of individual removals. Four species showed evidence of a decrease in birth rates following exploitation; potential mechanisms include a deficit of adult females, a deficit of adult males, and disruption of mating systems. The evidence for a lack of strong recovery in heavily exploited odontocete populations indicates that management should be more precautionary.

Week of 30 July 2012

Alfaro-Shigueto, J., J.C. Mangel, **P.H. Dutton, J.A. Seminoff**, and B.J. Godley. 2012. Trading information for conservation: a novel use of radio broadcasting to reduce turtle bycatch. *Oryx* 46:332–339.

Abstract - Bycatch of non-target animals in small-scale fisheries poses a major threat to seabirds and marine mammals and turtles. This is also a problem for small-scale fisheries in Peru because of the magnitude of these fisheries and the important marine biodiversity in Peruvian waters. Here we describe how we implemented a novel approach to mitigate bycatch impacts on marine turtles in Peru. We used high-frequency (HF) two-way radio communication to exchange information with fishers. We sought data that would afford insights into fishing patterns and levels of turtle bycatch so that we could identify areas of high-density bycatch in real time and warn other fishers. In return we provided oceanographic and atmospheric information useful for the fishers. Radio communication also served as a platform to promote the use of safe handling and release techniques for incidentally caught animals. During the 24 months of the programme we communicated with over 200 vessels and with 200–1,400 fishers, who used primarily longlines, gillnets, jiggers, purse seiners and trawlers. Our findings suggest that HF radio communication is a useful tool (low cost and widely used by fishers, with extensive spatial coverage), helps build links with fishers that potentially reduces fishery impacts on marine turtles, and can also provide information

on poorly documented fisheries and the relevant bycatch data associated with small-scale fishing practices.

John Ford, **John Durban**, Graeme Ellis, Jared Towers, James Pilkington, Lance Barrett-Lennard and Russel Andrews. 2012. New insights into the northward migration route of gray whales between Vancouver Island, British Columbia, and southeastern Alaska. *Marine Mammal Science*. Available online at [http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1748-7692/earlyview](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1748-7692/earlyview)

Abstract - The route taken by northward migrating gray whales during spring between Vancouver Island and southeastern Alaska, a distance of about 575 km, has long been uncertain. It is generally believed that the whales closely follow the western, outer coastline of Haida Gwaii (formerly the Queen Charlotte Islands), an archipelago lying between Vancouver Island and southeastern Alaska, consistent with their pattern of migrating close to shore over the majority of their northward migratory corridor. By tracking satellite-tagged individuals and surveying whales from shore bases, we provide evidence that this is not the primary migratory corridor, but instead that most whales migrate through Hecate Strait and Dixon Entrance, broad waterways that lie to the east and north of Haida Gwaii. By using this route, northbound gray whales potentially face a wider range of industrial activities and developments than they would by migrating along the outer coast.

Week of 23 July 2012

Duchene, S., **A. Frey**, A. Alfaro-Núñez, **P.H. Dutton**, M. T.P. Gilbert, and **P.A. Morin**. 2012. Marine turtle mitogenome phylogenetics and evolution. *Molecular phylogenetics and evolution*. doi:10.1016/j.ympev.2012.06.010. <http://www.ncbi.nlm.nih.gov/pubmed/22750111>.

Abstract - The sea turtles are a group of cretaceous origin containing seven recognized living species: leatherback, hawksbill, Kemp's ridley, olive ridley, loggerhead, green, and flatback. The leatherback is the single member of the Dermochelidae family, whereas all other sea turtles belong in family Cheloniidae. Analyses of partial mitochondrial sequences and some nuclear markers have revealed phylogenetic inconsistencies within Cheloniidae, especially regarding the placement of the flatback. Population genetic studies based on D-Loop sequences have shown considerable structuring in species with broad geographic distributions, shedding light on complex migration patterns and possible geographic or climatic events as driving forces of sea-turtle distribution. We have sequenced complete mitogenomes for all sea-turtle species, including samples from their geographic range extremes, and performed phylogenetic analyses to assess sea-turtle evolution with a large molecular dataset. We found variation in the length of the ATP8 gene and a highly variable site in ND4 near a proton translocation channel in the resulting protein. Complete mitogenomes show strong support and resolution for phylogenetic relationships among all sea turtles, and reveal phylogeographic patterns within globally-distributed species. Although there was clear concordance between phylogenies and geographic origin of samples in most taxa, we found evidence of more recent dispersal events in the loggerhead and olive ridley turtles, suggesting more recent migrations (<1Myr) in these species. Overall, our results demonstrate the complexity of sea-turtle diversity, and indicate the need for further research in phylogeography and molecular evolution.

Moore, J.E. 2012. Management reference points to account for direct and indirect impacts of fishing on marine mammals. *Marine Mammal Science* DOI: 10.1111/j.1748-7692.2012.00586.x

Abstract - Reference points can help implement an ecosystem approach to fisheries management (EAF), by establishing precautionary removal limits for nontarget species and target species of ecological importance. PBR (Potential Biological Removal), developed under the U.S. Marine Mammal Protection Act (MMPA), is a limit for direct mortality for marine mammals, but it does not account for indirect effects of fishing due to prey depletion. I propose a generalization of PBR (called PBR*) to account for plausible changes in marine mammal carrying capacity (K) from

prey biomass decline relative to two example benchmarks: SSBMSY (maximum sustainable yield biomass for all known prey species) or SSBK (unfished prey biomass). PBR* can help identify when indirect fishing effects (alone, or combination with direct mortality estimates) may stymie MMPA objectives, and could inform catch limit estimates for target species that are also important as marine mammal prey. As a case study, I applied PBR* estimates to evaluate the possible combined direct + indirect effects of fishing on cetaceans in northeastern U.S. waters. Estimated distributions for K were based on fish stock assessments and meta-analysis of predator-prey relationships from the mammalian literature. Based on this analysis, increased risk of marine mammal depletion due to indirect fishing effects was not evident, although this result must be interpreted cautiously given our limited understanding of cetacean diets and marine trophic dynamics. This study is intended to illustrate a possible practical approach for incorporating indirect fisheries impacts on marine mammals into a comprehensive management framework, and it raises several scientific and policy issues that merit further investigation.

Week of 16 July 2012

Miller, C.A., P.B. Best, **W.L. Perryman**, M.F. Baumgartner, M.J. Moore. 2012. Body shape changes associated with reproductive status, nutritive condition and growth in right whales *Eubalaena glacialis* and *E. australis*. Marine Ecology Progress Series 459:135-156.

Abstract - Mammalian reproduction is metabolically regulated; therefore, the endangered status and high variability in reproduction of North Atlantic right whales *Eubalaena glacialis* necessitate accurate assessments at sea of the nutritional condition of living individuals. Aerial photogrammetry was used to measure dorsal body width at multiple locations along the bodies of free-swimming right whales at different stages of the female reproductive cycle (*E. glacialis*) and during the initial months of lactation (mother and calf *Eubalaena australis*) to quantify changes in nutritional condition during energetically demanding events. Principal components analyses indicated that body width was most variable at 60% of the body length from the snout. Thoracic, abdominal and caudal body width of *E. australis* thinned significantly during the initial months of lactation, especially at 60% of body length from the snout, while their calves' widths and width to length ratios increased. The body shape of *E. glacialis* that had been lactating for 8 mo was significantly thinner than non-lactating, non-pregnant *E. glacialis*. Body shape of *E. glacialis* measured in the eighth month of lactation was significantly thinner than that of *E. australis* in the first month, but did not differ from that of *E. australis* in the third and fourth months. Body width was comparable with diameter calculated from girth of carcasses. These results indicate that mother right whales rely on endogenous nutrient reserves to support the considerable energy expenditure during the initial months of lactation; therefore, photogrammetric measurements of body width, particularly at 60% of body length from the snout, are an effective way to quantitatively and remotely assess nutritional condition of living right whales.

Week of 9 July 2012

Palacios, D.M., Herrera, J.C., Gerrodette, T., García, C., Soler, G.A., Avila, I.C., Bessudo, S., Hernández, E., Trujillo, F., Flórez-González, L., Kerr, I. 2012. Cetacean distribution and relative abundance in Colombia's Pacific EEZ from survey cruises and platforms of opportunity. Journal of Cetacean Research and Management 12(1):45-60.

Abstract - Cetacean sighting data collected under various programmes in Colombian Pacific waters were collated with the goal of assessing the distribution and abundance patterns of all species occurring in the exclusive economic zone (EEZ). Distribution maps are presented for 19 species and one genus based on 603 sightings collected between 1986 and 2008. Ordered by sighting frequency, these species were: humpback whale (*Megaptera novaeangliae*); striped dolphin (*Stenella coeruleoalba*); common bottlenose dolphin (*Tursiops truncatus*); pantropical spotted dolphin (*Stenella attenuata*); common dolphin

(*Delphinus delphis*); Risso's dolphin (*Grampus griseus*); sperm whale (*Physeter macrocephalus*); rough-toothed dolphin (*Steno bredanensis*); short-finned pilot whale (*Globicephala macrorhynchus*); mesoplodont whales (*Mesoplodon* spp.); Cuvier's beaked whale (*Ziphius cavirostris*); melon-headed whale (*Peponocephala electra*); false killer whale (*Pseudorca crassidens*); killer whale (*Orcinus orca*); spinner dolphin (*Stenella longirostris*); dwarf sperm whale (*Kogia sima*); Bryde's whale (*Balaenoptera edeni*); pygmy killer whale (*Feresa attenuata*); minke whale (*Balaenoptera acutorostrata*) and fin whale (*Balaenoptera physalus*). Concentrations of sightings were observed in three geographic areas: (1) the continental shelf (depths <200m) and the contiguous continental slope (200–2,000m); (2) over the Malpelo Ridge, an offshore bathymetric feature and (3) the northeast corner of the EEZ between Golfo de Cupica and the border with Panamá, although we do not rule out that these patterns could be an artefact of non-random effort. In inshore waters, the most frequently seen species were pantropical spotted dolphin, common bottlenose dolphin and humpback whale. For several of the data sets we provide encounter rates as indices of relative abundance, but urge caution in their interpretation because of methodological limitations and because several factors that affect sightability could not be accounted for in these estimates. Our results provide useful information for ongoing regional research and conservation initiatives aimed at determining occurrence, population status and connectivity within adjacent EEZs in the eastern tropical Pacific. Suggested research priorities include conducting dedicated surveys designed for estimating abundance and monitoring trends throughout the EEZ and focused studies in areas of special interest like the continental shelf, the Malpelo Ridge and the vicinity of Cupica and Cabo Marzo. More research is also needed in terms of quantifying the sources and impact of anthropogenic mortality on population size. Studies characterizing genetic diversity and stock discreteness in coastal species (pantropical spotted dolphin and common bottlenose dolphin) would help inform local management strategies.

Scott, M.D., **S.J. Chivers**, R.O. Olson, **P.C. Fiedler**, and K. Holland. 2012. Pelagic predator associations: tuna and dolphins in the eastern tropical Pacific Ocean. *Marine Ecology Progress Series* 458:283-302 (doi 10.3354/meps09740.) Link to the full text pdf: http://www.int-res.com/articles/meps_oa/m458p283.pdf

Abstract - The association of yellowfin tuna and pantropical spotted dolphins in the eastern tropical Pacific Ocean (ETP) has been exploited by tuna fishermen and has intrigued scientists for decades, yet we still have questions about what the benefits of the association are—whether the association is obligatory or facultative, why the tuna are most often found with spotted dolphins, and why the species associate most strongly in the ETP. We review the hypotheses that have been proposed to explain the bond and present results from 3 studies conducted to address these hypotheses: a simultaneous tracking study of spotted dolphins and yellowfin tuna, a trophic interactions study comparing their prey and daily foraging patterns, and a spatial study of oceanographic features correlated with the tuna–dolphin association. These studies demonstrate that the association is neither permanent nor obligatory and that the benefits of the association are not based on feeding advantages. These studies do support the hypothesis that one or both species reduce the risk of predation by forming large, mixed-species groups. The association is most prevalent where the habitat of the tuna is compressed to the warm, shallow, surface waters of the mixed layer by the oxygen minimum zone, a thick layer of oxygen-poor waters underlying the mixed layer. The association has been observed in other oceans with similar oceanographic conditions, but it is most prevalent and consistent in the ETP, where the oxygen minimum zone is the most hypoxic and extensive in the world.

Week of 25 June 2012

Gaspar P, **Benson SR**, **Dutton PH**, Réveillère A, Jacob G, Meeto C, Amaury Dehecq, Sabrina Fossette. 2012. Oceanic dispersal of juvenile leatherback turtles: going beyond passive drift modeling. *Marine Ecology Progress Series* 457:265–284. Available at <http://www.int-res.com/articles/theme/m457p265.pdf>

Abstract - The current paper presents the first detailed investigation of open-ocean dispersal of hatchlings and juveniles of the critically endangered western Pacific leatherback turtle *Dermochelys coriacea*

populations nesting in New Guinea. Dispersal patterns were simulated by releasing particles drifting passively, or almost passively, into a state-of-the-art World Ocean circulation model. Analysis of the simulation results combined with sighting, genetic, bycatch, and adult satellite tracking information reveals that: (1) Hatchlings emerging from the main New Guinea nesting beaches are likely to be entrained by highly variable oceanic currents into the North Pacific, South Pacific, or Indian Oceans. Those drifting into the Indian Ocean likely suffer very high mortality. This suggests that, as ocean current variability determines the partition of hatchlings into different dispersal areas, it also largely influences juvenile survival rate at the population level. (2) Within 1 to 2 yr, most passively drifting juveniles reach temperate oceanic regions where the water temperature in winter drops well below the minimum temperature likely tolerated by such small individuals. This leads us to hypothesize that, after an initial period of mostly passive drift, juveniles initiate active swimming towards lower (warmer) latitudes before winter and back again towards higher latitudes, where food abounds, during spring. Such seasonal migrations would significantly slow the eastward progression of individuals circulating in the North Pacific current. This slower drift scenario better explains the size distribution of leatherbacks observed, or incidentally caught by pelagic fisheries, in the North Pacific. This dispersal mechanism combining passive drift with active habitat-driven seasonal migrations might well apply to many other sea turtle populations and deserves further study.

Week of 18 June 2012

Okuyama J., Kataoka K., Kobayashi M., Abe O., Yoseda K., Arai N. 2012. The regularity of dive performance in sea turtles: a new perspective from precise activity data. *Animal Behavior* doi: 10.1016/j.anbehav.2012.04.033.

Abstract - Air-breathing divers are assumed to dive and surface in a way that maximizes their realized benefit. Dive duration in diving animals seems to depend on the purpose of the dive. Although the purpose of dives in most marine mammals and birds is undoubtedly foraging, this is not always true for so-called "surfacers" that spend most of their time underwater for various purposes (e.g., foraging, resting, mating, and migration). In this study, we investigated the relationships among dive duration, the amount of activity per unit time, the air volume in the lungs, and post-dive surface duration of four hawksbill turtles *Eretmochelys imbricata*, which are surfacers, using multi-sensor data loggers. Our results demonstrated that hawksbills generally perform dives with consistent relationships between dive duration, the amount of activity per unit time, and the air volume in the lungs, and that dives are followed by short periods at the surface, indicating that hawksbills rarely perform anaerobic dives. This longer dive duration compared to the length of surface resting indicates that the diving strategy of hawksbill turtles maximizes their time spent submerged. This strategy seems unique to sea turtles and surfacers in general.

Olson, P.A., Ensor, P., and Kuningas, S. 2012. Observations of killer whales off East Antarctica, 82°-95°E, in 2009. *J. Cetacean Res. Manage.* 12(1): 61-64.

Abstract - Observations of killer whales (*Orcinus orca*) during a survey off east Antarctica, 082° - 095°E revealed previously undescribed variations in pigmentation and group associations. During the survey 24 killer whale groups were sighted south of 60°S and classified, when possible, to Types A, B, or C (Pitman and Ensor 2003) based on their external morphology. Sufficient observation was available for nine groups to be classified: 2 groups of Type A; 1 mixed group of Type A and Type B; 3 groups of Type C; and 3 groups with eyepatch pigmentation intermediate in size between Types B and C. These whales may represent an intergrade between Types B and C or a previously unrecognized form. One of the 'intermediate' groups was observed feeding in a multi-species aggregation with other cetaceans in deep water. Clearly distinguishable Type A and Type B whales were observed feeding together in a mixed aggregation, the first time that this has been documented.

Week of 11 June 2012

Bradford, A. L., **K. A. Forney**, E. M. Oleson, and **J. Barlow**. 2012. Line-transect abundance estimates of false killer whales (*Pseudorca crassidens*) in the pelagic region of the Hawaiian Exclusive Economic Zone and in the insular waters of the Northwestern Hawaiian Islands. PIFSC, NMFS, NOAA. Admin. Rep. H-12-02, 23 p.

Abstract: Three stocks of false killer whales (*Pseudorca crassidens*) can be differentiated within the U.S. Exclusive Economic Zone of the Hawaiian Islands (Hawaiian EEZ): an insular main Hawaiian Islands stock, a dispersed pelagic stock, and a newly recognized Northwestern Hawaiian Islands stock. Current abundance estimates are needed for the pelagic and Northwestern Hawaiian Islands stocks. To this end, a ship-based line-transect survey of the Hawaiian EEZ was conducted in the summer–fall of 2010, resulting in 6 systematic-effort visual sightings of pelagic (n = 5) and Northwestern Hawaiian Islands (n = 1) false killer whale groups. These sightings were combined with data from multiple sources and analyzed within the conventional line-transect estimation framework, although the detection function, mean cluster size, and encounter rate were estimated separately so as to appropriately incorporate data collected using different methods. Unlike previous line-transect analyses of false killer whales, subgroups were treated as the analytical unit instead of groups because subgroups better conform to the specifications of line-transect theory. Bootstrap values (n = 5000) of the line-transect parameters were randomly combined to estimate the variance of stock-specific abundance estimates. Hawaii pelagic and Northwestern Hawaiian Islands false killer whales were estimated to number 1503 (CV = 0.66) and 552 (CV = 1.09) individuals, respectively. These estimates can be considered positively biased to an unknown extent due to the effect of vessel attraction.

Week of 4 June 2012

Seminoff JA, Benson SR, Arthur KE, Eguchi T, Dutton PH, Tapilatu RF, Popp BN. 2012. Stable isotope tracking of endangered sea turtles: validation with satellite telemetry and d15N analysis of amino acids. PLoS ONE 7(5): e37403. doi:10.1371/journal.pone.0037403

Abstract. - Effective conservation strategies for highly migratory species must incorporate information about long-distance movements and locations of high-use foraging areas. However, the inherent challenges of directly monitoring these factors call for creative research approaches and innovative application of existing tools. Highly migratory marine species, such as marine turtles, regularly travel hundreds or thousands of kilometers between breeding and feeding areas, but identification of migratory routes and habitat use patterns remains elusive. Here we use satellite telemetry in combination with compound-specific isotope analysis of amino acids to confirm that insights from bulk tissue stable isotope analysis can reveal divergent migratory strategies and within-population segregation of foraging groups of critically endangered leatherback sea turtles (*Dermochelys coriacea*) across the Pacific Ocean. Among the 78 turtles studied, we found a distinct dichotomy in d15N values of bulk skin, with distinct “low d15N” and “high d15N” groups. d15N analysis of amino acids confirmed that this disparity resulted from isotopic differences at the base of the food chain and not from differences in trophic position between the two groups. Satellite tracking of 13 individuals indicated that their bulk skin d15N value was linked to the particular foraging region of each turtle. These findings confirm that prevailing marine isoscapes of foraging areas can be reflected in the isotopic compositions of marine turtle body tissues sampled at nesting beaches. We use a Bayesian mixture model to show that between 82 and 100% of the 78 skin-sampled turtles could be assigned with confidence to either the eastern Pacific or western Pacific, with 33 to 66% of all turtles foraging in the eastern Pacific. Our forensic approach validates the use of stable isotopes to depict leatherback turtle movements over broad spatial ranges and is timely for establishing wise conservation efforts in light of this species’ imminent risk of extinction in the Pacific.

Week of 28 May 2012

The final NMFS Marine Mammal Stock Assessments for 2011 are now published and available at <http://swfsc.noaa.gov/textblock.aspx?Division=PRD&ParentMenuId=148&id=1247>

Week of 14 May 2012

Benson S.R., Dutton P.H. 2012. Sea Turtles of the U.S. West Coast: Life in the Higher Latitudes. In: Seminoff, J.A., Wallace, B.P. (editors). *Sea Turtles of the Eastern Pacific Ocean: Advances in Research and Conservation*. University of Arizona Press, Tucson, Arizona. pp. 88-112.

Summary - Sea turtles are typically associated with tropical sandy beaches or coral reef habitat, not with the cool and dynamic waters off the U.S. West Coast. Although some sea turtle species are indeed rare, wayward visitors during warm water events in temperate high latitudes of the eastern North Pacific, leatherbacks (*Dermochelys coriacea*) and green turtles (*Chelonia mydas*) are regularly found in this region. The California Current is known to contain some of the most productive marine habitats in the world, but little has been known about the movements and ecology of green and leatherback turtles within this ecosystem. Using a variety of research techniques, including genetic studies, satellite telemetry, aerial surveys, boat-based capture operations, and analysis of blood and tissue samples, scientists have recently uncovered some of the mysteries of these ancient mariners. Endangered leatherbacks perform trans-Pacific movements from tropical western Pacific nesting beaches to forage in offshore and neritic waters off the North American west coast during summer and fall. Drawn by dense aggregations of brown sea nettles (*Chrysaora fuscescens*) and other sea jellies, leatherbacks are rarely seen at sea, and their cryptic behavior beneath the dense fog that often blankets the west coast adds to their intrigue. In contrast with the seasonal presence of leatherbacks in the cool open sea, green turtles occur year-round in estuarine and coastal marine ecosystems within the warmer Southern California Bight. Although evidence of the occurrence of green turtles has been available since the late 1800s, scientists have only recently learned that their long-term residence in coastal embayments, most notably San Diego Bay, is a natural behavior and part of their normal life history. Aided by a warm-water effluent from a nearby power plant, the thriving population in San Diego Bay includes the largest eastern Pacific green turtle on record and exhibits the fastest growth rates among Pacific green turtles. Large populations of whales and seabirds and important fisheries are also well-known components of the California Current ecosystem. Recent revelations about leatherback and green turtle populations in this high-latitude, temperate region have enhanced our knowledge of the diverse assemblage of marine vertebrates.

Seminoff J.A., Alfaro-Shigueto J., Amorocho D., Arauz R., Baquero Gallegos A., Chacón Chaverri A., Gaos A.R., Kelez S., Mangel J.C., Urteaga J., Wallace B.P. 2012. Biology and conservation of sea turtles in the Eastern Pacific Ocean: a general overview, In: Seminoff, J.A., Wallace, B.P. (editors). *Sea Turtles of the Eastern Pacific Ocean: Advances in Research and Conservation*. University of Arizona Press, Tucson, Arizona. pp. 11-38.

Summary - The waters of the eastern Pacific Ocean (hereafter EP) host important feeding and nesting areas for four sea turtle species: the leatherback (*Dermochelys coriacea*), the green turtle (*Chelonia mydas*), the hawksbill (*Eretmochelys imbricata*), and the olive ridley (*Lepidochelys olivacea*) (see plates 1–10). In addition, a fifth species, the loggerhead turtle (*Caretta caretta*), feeds in the northern- and southernmost latitudes of the EP but nests on distant beaches in the western Pacific. While green turtles and hawksbills depend on shallow coastal habitats for food resources, leatherbacks, loggerheads, and olive ridleys are more generally tied to offshore pelagic waters for foraging. Because of the unique oceanography of these habitats in the EP, sea turtles in this region have evolved distinct biology, morphology, and behavior compared with their counterparts in other parts of the world. Through the exploitation of eggs and turtles as food, as well as incidental mortality in fishing gear, sea turtle populations have been subjected to human impacts throughout the EP (plates 11 and 12). While some remote nesting rookeries have withstood these threats and remain relatively intact, most populations have declined to some extent, many severely so. Efforts to recover populations started in the mid-1960s with the initiation of nesting beach conservation camps at a few major nesting beaches in México. By the late 1990s, sea turtle conservation camps were established at hundreds of beaches throughout the EP, and the number of similar operations increases every year. Over the last decade, national and regional sea

turtle conservation strategies and action plans have been developed and enacted, and grass-roots sea turtle conservation has prospered through increased networking and coordination among various stakeholders (e.g., biologists, wildlife managers, and local communities) throughout the region (plates 13–16). These efforts have contributed to significant recoveries of olive ridley nesting rookeries in the EP and the partial restoration of green turtle rookeries in México. However, in some cases—particularly with leatherbacks and hawksbills—the outlook remains grim. Recovery of these nesting assemblages will require prompt, broad-based action on the part of countries on whose beaches these turtles nest (plates 3 and 7), and a redoubling of efforts to mitigate the impacts of industrial and artisanal fisheries bycatch in the near-shore and offshore waters within which they forage.

Week of 7 May 2012

Keller J.M., L. Ngai, J.B. McNeill, L.D. Wood, **Kelly R. Stewart**, S.G. O'Connell, And J.R. Kucklick. 2012. Perfluoroalkyl contaminants in plasma of five sea turtle species: Comparisons in concentration and potential health risks. *Environmental Toxicology and Chemistry* DOI: 10.1002/etc.1818

Abstract - The authors compared blood plasma concentrations of 13 perfluoroalkyl contaminants (PFCs) in five sea turtle species with differing trophic levels. Wild sea turtles were blood sampled from the southeastern region of the United States, and plasma was analyzed using liquid chromatography tandem mass spectrometry. Mean concentrations of perfluorooctane sulfonate (PFOS), the predominant PFC, increased with trophic level from herbivorous greens (2.41 ng/g), jellyfish-eating leatherbacks (3.95 ng/g), omnivorous loggerheads (6.47 ng/g), to crab-eating Kemp's ridleys (15.7 ng/g). However, spongivorous hawksbills had surprisingly high concentrations of PFOS (11.9 ng/g) and other PFCs based on their trophic level. These baseline concentrations of biomagnifying PFCs demonstrate interesting species and geographical differences. The measured PFOS concentrations were compared with concentrations known to cause toxic effects in laboratory animals, and estimated margins of safety (EMOS) were calculated. Small EMOS (<100), suggestive of potential risk of adverse health effects, were observed for all five sea turtle species for immunosuppression. Estimated margins of safety less than 100 were also observed for liver, thyroid, and neurobehavioral effects for the more highly exposed species. These baseline concentrations and the preliminary EMOS exercise provide a better understanding of the potential health risks of PFCs for conservation managers to protect these threatened and endangered species. *Environ. Toxicol. Chem.* © 2012 SETAC

Week of 30 April 2012

Gerrodette, T., and L. Rojas-Bracho. 2012. Inference from limited data: A response to Lonergan. *Marine Mammal Science*. (<http://onlinelibrary.wiley.com/doi/10.1111/j.1748-7692.2012.00569.x/pdf>)

Summary: Lonergan misinterpreted some parts of the vaquita population model of Gerrodette and Rojas-Bracho 2011. In another aspects he seems to have a different philosophy about how data should be analyzed. The conclusions of Gerrodette and Rojas-Bracho about the probable success of several proposed vaquita protection areas are supported.

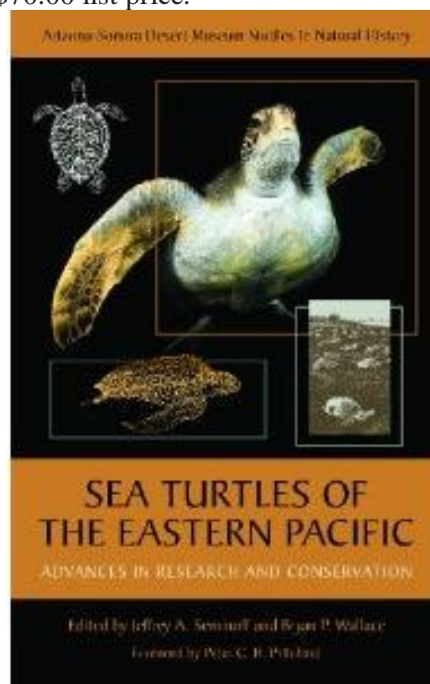
Bailey H, **Benson SR**, Shillinger GI, **Bograd SJ**, **Dutton PH**, Eckert SE, Morreale SJ, Paladino FV, **Eguchi T**, **Foley D**, Block BA, Piedra R, Hitipeuw C, Tapilatu RF, Spotila JR (2012) Identification of distinct movement patterns in Pacific leatherback turtle populations influenced by ocean conditions. *Ecological Applications* 22(3):735–747

Abstract: Interactions with fisheries are believed to be a major cause of mortality for adult leatherback turtles (*Dermochelys coriacea*), which is of particular concern in the Pacific Ocean, where they have been rapidly declining. In order to identify where these interactions are occurring and how they may be reduced, it is essential first to understand the movements and behavior of leatherback turtles. There are

two regional nesting populations in the East Pacific (EP) and West Pacific (WP), comprising multiple nesting sites. We synthesized tracking data from the two populations and compared their movement patterns. A switching state-space model was applied to 135 Argos satellite tracks to account for observation error, and to distinguish between migratory and area-restricted search behaviors. The tracking data, from the largest leatherback data set ever assembled, indicated that there was a high degree of spatial segregation between EP and WP leatherbacks. Area-restricted search behavior mainly occurred in the southeast Pacific for the EP leatherbacks, whereas the WP leatherbacks had several different search areas in the California Current, central North Pacific, South China Sea, off eastern Indonesia, and off southeastern Australia. We also extracted remotely sensed oceanographic data and applied a generalized linear mixed model to determine if leatherbacks exhibited different behavior in relation to environmental variables. For the WP population, the probability of area-restricted search behavior was positively correlated with chlorophyll-a concentration. This response was less strong in the EP population, but these turtles had a higher probability of search behavior where there was greater Ekman upwelling, which may increase the transport of nutrients and consequently prey availability. These divergent responses to oceanographic conditions have implications for leatherback vulnerability to fisheries interactions and to the effects of climate change. The occurrence of leatherback turtles within both coastal and pelagic areas means they have a high risk of exposure to many different fisheries, which may be very distant from their nesting sites. The EP leatherbacks have more limited foraging grounds than the WP leatherbacks, which could make them more susceptible to any temperature or prey changes that occur in response to climate change.

Seminoff JA, Wallace BP, editors (2012) Sea Turtles of the Eastern Pacific: Advances in Research and Conservation. University of Arizona Press, Tucson. 376 pp + color plates. ISBN 978-0-8165-1158-7.

This hardback book is now available via Amazon.com, or please contact Jeff Seminoff if you would like a copy at 40% discount off the \$70.00 list price.



Week of 16 April 2012

Jones, B., **S. Rankin**, and **E. Archer**. 2011. Fin whale acoustics as a tool to assess stock structure in the north Pacific. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-485.

Identification of “stocks” (sub-species and independent populations) is important for understanding and mitigating potential sources of human-caused mortality. This is especially critical for endangered and protected species, such as the large whales. Stock identification for whales has typically been based on ecology, life history, morphology, and genetics. However, for many species, acoustic differences in whale call types may indicate population or sub-species structure. The potential role of acoustics in identifying species and sub-species has been identified in numerous publications; however, this role has yet to be realized for large whales. In an effort to include acoustic data in this process, we are contributing to current efforts to update the status of endangered fin whales, *Balaenoptera physalus*, in the North Pacific. An analysis of North Pacific fin whale populations based on identification of ‘song’ provides hypotheses that can be tested with genetics. This paper presents a preliminary summary of fin whale acoustics and stock structure in the North Pacific based on published and unpublished data as well as analysis of fin whale song obtained using sonobuoys during SWFSC surveys.

Available free at: <http://swfsc.noaa.gov/publications/TM/SWFSC/NOAA-TM-NMFS-SWFSC-485.pdf>

Week of 9 April 2012

Caro, T., Stankowich, T., **Mesnick, S.L.**, Costa, D.P. and Beeman, K. 2012. Pelage coloration in pinnipeds: functional considerations. Behavioral Ecology. Advanced access: doi:10.1093/beheco/ars025

Abstract: Pinnipeds vary in adult pelage color and pattern ranging from uniform white to black or brown, and from solid coloration to subtle spotted or bold markings. Moreover, pelage color often differs by sex and age with neonates having radically different color and patterning from those of adults. We explored the functional significance of these patterns in 34 species of pinniped using comparative phylogenetic analyses. We found strong evidence for background matching on land because species in which adults or pups have white pelage live in arctic regions and are subject to terrestrial predation. We also found evidence for background matching at sea because spotted species forage in well-lit shallow waters on-shelf, and dark pinnipeds forage in dark waters off-shelf. Species give birth to black neonates in places lacking terrestrial predators, on islands or in caves, where selection on crypsis is relaxed. Species may use distinctive markings for intraspecific communication perhaps as signals of quality or health. Sexually dichromatic pinnipeds are highly polygynous and copulate on land indicating a role for male coloration in contests for access to females. Functional differences in the coloration of pinnipeds and cetaceans reveal differences in underlying selection pressures in particular those derived from pinnipeds’ amphibious lifestyle.

Week of 2 April 2012

Eguchi T, Seminoff JA, LeRoux RA, Proserpi D, Dutton DL, Dutton PH (2012) Morphology and Growth Rates of the Green Sea Turtle (*Chelonia mydas*) in a Northern-most Temperate Foraging Ground. *Herpetologica* 68:76-87

Abstract: We examined the morphology and somatic growth rate of Green Sea Turtles living in San Diego Bay, California; one of the northern-most foraging areas for the species in the eastern Pacific. A power plant had discharged heated effluent into the urbanized bay from 1960 to 2010. Straight carapace lengths of 101 Green Sea Turtles were recorded from 31 March 1990 to 15 April 2011 (45.4 to 110.4 cm). Green Sea Turtles in San Diego Bay were morphologically indistinguishable from those foraging in Baja California Sur, Mexico. The median growth rate was 1.03 cm/yr (–1.6 to 11.4 cm/yr) for all turtles and was 4.9 cm/yr for turtles ≤ 90 cm. These growth rates were one of the fastest for the species in temperate areas and comparable to those reported for tropical regions. The estimated growth parameter of the von Bertalanffy growth function (mean growth coefficient = 0.21, 95% posterior interval = 0.19–0.23)

also was greater than for other populations of Green Sea Turtles. Based on behavioral observations and information from other diet studies, we think that the altered environment from the power plant effluent affected the growth of the Green Sea Turtles directly (longer active periods) and via shifts in the environment (changes in prey composition, abundance, and distribution). With the termination of the power plant operation at the end of 2010, the ecosystem is reverting to its natural state, which we expect will result in decreased growth rates of these turtles in the coming years.

Gerrodette, T., R. Olson, S. Reilly, G. Watters, and W. Perrin. 2012. Ecological metrics of biomass removed by three methods of purse-seine fishing for tunas in the eastern tropical Pacific Ocean. *Conservation Biology* 26:248-256.

Abstract: An ecosystem approach to fisheries management is a widely recognized goal, but describing and measuring the effects of a fishery on an ecosystem is difficult. Ecological information on the entire catch (all animals removed, whether retained or discarded) of both species targeted by the fishery and nontarget species (i.e., bycatch) is required. We used data from the well-documented purse-seine fishery for tunas (*Thunnus albacares*, *T. obesus*, and *Katsuwonus pelamis*) in the eastern tropical Pacific Ocean to examine the fishery's ecological effects. Purse-seine fishing in the eastern tropical Pacific is conducted in 3 ways that differ in the amount and composition of target species and bycatch. The choice of method depends on whether the tunas are swimming alone (unassociated sets), associated with dolphins (dolphin sets), or associated with floating objects (floating-object sets). Among the fishing methods, we compared catch on the basis of weight, number of individuals, trophic level, replacement time, and diversity. Floating-object sets removed 2–3 times as much biomass as the other 2 methods, depending on how removal was measured. Results of previous studies suggest the ecological effects of floating-object sets are thousands of times greater than the effects of other methods, but these results were derived from only numbers of discarded animals. Management of the fishery has been driven to a substantial extent by a focus on reducing bycatch, although discards are currently 4.8% of total catch by weight, compared with global averages of 7.5% for tuna longline fishing and 30.0% for midwater trawling. An ecosystem approach to fisheries management requires that ecological effects of fishing on all animals removed by a fishery, not just bycatch or discarded catch, be measured with a variety of metrics.

Gaas AR, Lewison RL, Wallace BP, Yañez IL, Liles MJ, Nichols WJ, Baquero A, Hasbún CR, Vasquez M, Urteaga J, **Seminoff JA** (2012) Spatial ecology of critically endangered hawksbill turtles *Eretmochelys imbricata*: implications for management and conservation. *Marine Ecology Progress Series* 450:181–194.

Abstract: Elucidating spatio-temporal movements of animals is an integral component of wildlife conservation and protected species management. Between 2008 and 2010 we satellite tracked 15 adult female hawksbill turtles *Eretmochelys imbricata* in the eastern Pacific Ocean to evaluate their movement behavior and to guide management and conservation efforts of this highly endangered population. Movements and habitat use were highly neritic, and post-nesting migration distances (maximum = 283.11 km) were short relative to migrations of other sea turtle species. In foraging areas, the majority of hawksbills established restricted, inshore home ranges within mangrove estuaries. A large proportion (>65%) of turtle location points fell within protected areas, although many of these sites lack enforcement and monitoring. The consistent use of estuarine and mangrove habitat for nesting and foraging may explain why hawksbills went virtually undetected in the eastern Pacific for decades. The spatially restricted and neritic life cycles of adult hawksbills in the eastern Pacific highlight threats (e.g. overlap with coastal fisheries, increased susceptibility to habitat degradation and/or catastrophic events) and opportunities for conservation (e.g. acute conservation target areas, less variant jurisdictional boundaries/regulations) for this species. Our results underscore the importance of strengthening protected area management, mangrove estuary protection and hawksbill research and conservation in the eastern Pacific.

Matkin C, **Durban J**, Andrews R, Straley J, Ellis G, Matkin D. 2012. Contrasting abundance and residency patterns of two sympatric populations of transient killer whales in the northern Gulf of Alaska. *Fisheries Bulletin* 110:143–155.

Abstract: Two sympatric populations of “transient” (mammal-eating) killer whales were photo-identified over 27 years (1984-2010) in Prince William Sound and Kenai Fjords coastal waters of the northern Gulf of Alaska (GOA). A total of 88 individuals were identified during 203 encounters with “AT1” transients (n= 22 individuals) and 91 encounters with “GOA” transients (n=66 individuals). The median number of individuals identified annually was similar for both populations (AT1 n=7; GOA n=8), but mark-recapture estimates showed the AT1s to have much higher fidelity to the study area, whereas the GOAs had higher exchange of individuals. Apparent survival estimates were generally high for both populations, but there was a significant reduction in the survival of AT1 transients following the Exxon Valdez oil spill in 1989, with an abrupt decline in estimated abundance from a high of 22 in 1989 to a low of 7 at the end of the series. There was no detectable decline in the GOA abundance or survival over the same period, but abundance ranged from just 6 to 18 whales annually. Re-sighting data from adjacent coastal waters and movement tracks from satellite tags further suggested that the GOAs are part of a larger population with a more extensive range, whereas AT1s are resident to the study area.

Week of 12 March 2012

Carretta, J.V., S.J. Chivers, W.L. Perryman. 2011. Abundance of the long-beaked common dolphin (*Delphinus capensis*) in California and western Baja California waters estimated from a 2009 ship-based line-transect survey. *Bulletin Southern California Academy of Sciences* 110(3):152-164.

Abstract - The abundance of the long-beaked common dolphin (*Delphinus capensis*) is estimated from data collected during a 2009 ship-based line-transect survey. The survey was designed to provide fine-scale coverage of the known range of *D. capensis* along the California and west Baja California coasts. Estimates of *D. capensis* abundance presented are the highest to date for California waters and may reflect a combination of improved survey design for this species and increasing numbers of *D. capensis* in California waters. Estimates of *D. capensis* abundance within California waters are 183,396 (CV=0.41, 95% CI 78,149 – 379,325) animals. An additional 95,786 (CV=0.47, 95% CI 36,881 – 209,507) *D. capensis* were estimated in Baja California waters from the U.S./Mexico border south to the tip of Baja California. Total estimated abundance of *D. capensis* in California and Baja California west coast waters is 279,182 (CV=0.31, 95% CI 148,753 – 487,323) animals.

Sremba, A.L., **B.L. Hancock-Hanser**, T.A. Branch, R.L. LeDuc, and C.S. Baker. 2012. Circumpolar Diversity and Geographic Differentiation of mtDNA in the Critically Endangered Antarctic Blue Whale (*Balaenoptera musculus intermedia*). *PLoS ONE* 7(3):e32579.

Abstract - The Antarctic blue whale (*Balaenoptera musculus intermedia*) was hunted to near extinction between 1904 and 1972, declining from an estimated initial abundance of more than 250,000 to fewer than 400. Here, we describe mtDNA control region diversity and geographic differentiation in the surviving population of the Antarctic blue whale, using 218 biopsy samples collected under the auspices of the International Whaling Commission (IWC) during research cruises from 1990–2009. Microsatellite genotypes and mtDNA sequences identified 166 individuals among the 218 samples and documented movement of a small number of individuals, including a female that traveled at least 6,650 km or 131u longitude over four years. mtDNA sequences from the 166 individuals were aligned with published sequences from 17 additional individuals, resolving 52 unique haplotypes from a consensus length of 410 bp. From this minimum census, a rarefaction analysis predicted that only 72 haplotypes (95% CL, 64, 86) have survived in the contemporary population of Antarctic blue whales. However, haplotype diversity was relatively high (0.96860.004), perhaps as a result of the longevity of blue whales and the relatively recent timing of the bottleneck. Despite the potential for circumpolar dispersal, we found significant differentiation in mtDNA diversity ($F_{ST} = 0.032$, $p,0.005$) and microsatellite alleles ($F_{ST} = 0.005$, $p,0.05$) among the six Antarctic Areas historically used by the IWC for management of blue whales.

Week of 5 March 2012

Becker EA, Foley DG, Forney KA, Barlow J, Redfern JV, Gentemann CL. 2012. Forecasting cetacean abundance patterns to enhance management decisions. *Endangered Species Research* 16:97-112 (ESR Special Issue: Beyond marine habitat modeling: applications for ecology and conservation).

Abstract: Species-environment models are increasingly recognized as valuable tools for assessing protected species distributions and developing measures to reduce or avoid adverse impacts. Cetacean-habitat models can provide a finer spatial resolution than traditional abundance estimates, but model predictions are generally based on past observations rather than current or projected ocean conditions. We present and evaluate methods for near real-time and forecast models of cetacean distribution based on remotely sensed and modeled oceanographic data. Recent advancements in processing satellite-derived data (e.g. microwave/infrared blended sea surface temperature [SST] products) have virtually eliminated data gaps due to cloud cover, allowing short-term forecasts based on single-day snapshots of oceanic conditions. Ocean circulation models (e.g. the Regional Ocean Modeling System [ROMS]) allow medium-range forecast predictions of oceanic variables, including SST, chlorophyll and salinity. We developed habitat models for striped dolphin, fin whale and Dall's porpoise using line-transect data collected from July to November 1991–2005 in the California Current Ecosystem. We incorporated daily blended SST data and monthly ROMS SST forecasts as input variables to predict relative species density in 2008. Forecast ability was assessed by the models' ranked predictions across 8 geographic strata, and by visual inspection of predicted and observed distributions. For all 3 species, there was a significant correlation between model predictions using daily blended SSTs and actual survey observations ($p < 0.05$). Longer-term (3–4 mo) predictions also showed good concordance with observed sighting locations. Cetacean-habitat models that allow weekly to monthly forecasting of cetacean abundance can greatly enhance short-term decision-making and advanced mitigation planning.

Forney KA, Ferguson MC, Becker EA, Fiedler PC, Redfern JV, Barlow J, Vilchis IL, Ballance LT. 2012. Habitat-based spatial models of cetacean density in the eastern Pacific Ocean. *Endangered Species Research* 16:113-133 (ESR Special Issue: Beyond marine habitat modeling: applications for ecology and conservation).

Abstract: Many users of the marine environment (e.g. military, seismic researchers, fisheries) conduct activities that can potentially harm cetaceans. In the USA, Environmental Assessments or Environmental Impact Statements evaluating potential impacts are required, and these must include information on the expected number of cetaceans in specific areas where activities will occur. Typically, however, such information is only available for broad geographic regions, e.g. the entire West Coast of the United States. We present species-habitat models that estimate finer scale cetacean densities within the eastern Pacific Ocean. The models were developed and validated for 22 species or species groups, based on 15 large-scale shipboard cetacean and ecosystem assessment surveys conducted in the temperate and tropical eastern Pacific during the period from 1986 to 2006. Model development included consideration of different modeling frameworks, spatial and temporal resolutions of input variables, and spatial interpolation techniques. For the final models, expected group encounter rate and group size were modeled separately, using generalized additive models, as functions of environmental predictors, including bathymetry, distance to shore or isobaths, sea surface temperature (SST), variance in SST, salinity, chlorophyll, and mixed-layer depth. Model selection was performed using cross-validation on novel data. Smoothed maps of species density (and variance therein) were created from the final models for the California Current Ecosystem and eastern tropical Pacific Ocean. Model results were integrated into a web-interface that allows end-users to estimate densities for specified areas and provides fine-scale information for marine mammal assessments, monitoring, and mitigation.

Week of 27 February 2012

Kinch, J., **S. Benson**, P. Anderson, and K. Anana. 2012. Leatherback Turtle Nesting in the Autonomous Region of Bougainville, Papua New Guinea. *Marine Turtle Newsletter* 132:15-17.

Abstract - Previous satellite tagging projects of leatherback turtles (*Dermochelys coriacea*) from the Huon Coast of Papua New Guinea (PNG) provided indication of movement by nesters from this area to the beaches of Bougainville Island in the Autonomous Region of Bougainville (ARB). In 2007, the number of leatherback turtle nests laid annually on all western Pacific beaches was estimated to be 5067-9176 nests/year, including 160-415 nests/year in ARB. Bougainville Island accounted for 14-41% of all nests estimated in PNG based on January 2005-2007 aerial surveys. Thus, leatherback turtle nesting on Bougainville Island represents a significant but variable proportion of total nesting activity during the austral summer. In January 2009, the Secretariat of the Pacific Regional Environment Programme conducted an on-the-ground survey of leatherback turtle nesting beaches identified by previous aerial surveys. The six-day survey of beaches covered 389 km by small boat and foot patrol and included consultation with local inhabitants to collect information about the level of consumptive use and the status of leatherback turtles in the area, as well as any traditional knowledge and management regimes. Combined results from the 2005-2007 aerial and 2009 ground-based surveys revealed consistency in locations of primary nesting activity. Surveys and interviews with local inhabitants suggest that leatherback turtles have been harvested on a relatively frequent basis by communities on Bougainville Island in the past. Perceptions of abundance amongst villagers varied, but the consensus was that leatherback turtle numbers had declined within the last 30-50 years. Reasons for the decrease were unanimously given as wide-scale egg removal and the killing of adult nesting leatherback turtle females. It is apparent that leatherback turtle resources in the ARB are under severe pressure, which has implications for leatherback turtle nesting populations in Papua New Guinea and possibly the Solomon islands. The combined data from 2005-2009 confirm that leatherback nesting occurs regularly at ARB, and the total number of nests may represent a substantial portion of the austral summer nesting activity in the Western Pacific.

Holly Fearnbach, **John W. Durban**, Sally A. Mizroch, Steve Barbeaux and Paul R. Wade. 2012. Winter observations of a group of female and immature sperm whales in the high-latitude waters near the Aleutian Islands, Alaska. *Marine Biodiversity Records*, doi:10.1017/S1755267211001047; Vol. 5; e13; 2012 Published online.

Abstract - Sperm whales (*Physeter macrocephalus*) have one of the most extensive global distributions of any cetacean, but distribution and movement patterns vary significantly between sexes. Adult male sperm whales are predominantly solitary and have an expansive distribution, whereas females and their offspring typically form groups of both sexes, remaining in the tropics and sub-tropics throughout the year. Here we present observations and photographs from a rare winter sighting of a group of female and immature sperm whales near Koniuji Island, in the Central Aleutians, in the high-latitude waters of the Bering Sea. This sighting is consistent with historic whaling catches of sperm whales of both sexes, including pregnant females, above 50°N in the North Pacific, but no groups of females and immatures have been observed in ten years of summer sighting surveys in the Aleutian Islands and Bering Sea region, despite regular sightings of adult males. We discuss possible reasons for the absence of recent sightings of these mixed schools.

Week of 20 February 2012

Bradford, A.L., **D.W. Weller**, A.E. Punt, Y.V. Ivashchenko, A.M. Burdin, G.R. VanBlaricom, and **R.L. Brownell, Jr.** 2012. Leaner leviathans: body condition variation in a critically endangered whale population. *Journal of Mammalogy* 93:251-266.

Abstract - The role of environmental limitation and density-dependent regulation in shaping populations is debated in ecology. Populations at low densities may offer an unobstructed view of basic environmental and physiological interactions that impact individual fitness and thus population productivity. The energy reserves of an organism are reflected in its body condition, a measure linking individual fitness and the environment. From 1997 to 2007, we monitored the critically endangered western gray whale

(*Eschrichtius robustus*) population on its primary summer feeding ground off the northeastern coast of Sakhalin Island, Russia. This effort resulted in a large data set of photo-identification images from 5,007 sightings of 168 individual whales that we used to visually assess western gray whale body condition. We quantified temporal variation in the resulting 1,539 monthly body condition determinations with respect to observations of reproductive status and sex. Western gray whale body condition varied annually, and we identified years of significantly better (2004) and worse (1999, 2006, and 2007) body condition. This study is the 1st to track the within-season body condition of individual whales. Body condition improved significantly as the summer progressed, although results suggest that not all whales replenish their energy stores by the end of the season. The body condition of lactating females was significantly worse than that of other whales at all times and was most often determined to be compromised. The body condition of their weaning calves exhibited no temporal variation and was consistently good. It is possible lactating females provide an energetic buffer to their offspring at the expense of their own body condition and future reproductive success. Findings from the analysis establish a foundation for quantifying links between western gray whale body condition, demographic parameters, and environmental conditions; and provide a baseline for monitoring individual and population condition of an ecosystem sentinel species in a changing environment. Overall, this study highlights the presence of density-independent environmental and physiological mechanisms that affect the abundance and growth of populations.

Week of 13 February 2012

Eguchi, T., J.A. Seminoff, R.A. LeRoux, D. Prosperi, P.H. Dutton, D.L. Dutton. 2012. Morphology and growth rates of the green turtle (*Chelonia mydas*) in San Diego Bay. *Herpetologica* 68:76-87.

Abstract - We examined the morphology and somatic growth rate of Green Sea Turtles living in San Diego Bay, California; one of the northern-most foraging areas for the species in the eastern Pacific. A power plant had discharged heated effluent into the urbanized bay from 1960 to 2010. Straight carapace lengths of 101 Green Sea Turtles were recorded from 31 March 1990 to 15 April 2011 (45.4 to 110.4 cm). Green Sea Turtles in San Diego Bay were morphologically indistinguishable from those foraging in Baja California Sur, Mexico. The median growth rate was 1.03 cm/yr (-1.6 to 11.4 cm/yr) for all turtles and was 4.9 cm/yr for turtles ≤ 90 cm. These growth rates were one of the fastest for the species in temperate areas and comparable to those reported for tropical regions. The estimated growth parameter of the von Bertalanffy growth function (mean growth coefficient = 0.21, 95% posterior interval = 0.19-0.23) also was greater than for other populations of Green Sea Turtles. Based on behavioral observations and information from other diet studies, we think that the altered environment from the power plant effluent affected the growth of the Green Sea Turtles directly (longer active periods) and via shifts in the environment (changes in prey composition, abundance, and distribution). With the termination of the power plant operation at the end of 2010, the ecosystem is reverting to its natural state, which we expect will result in decreased growth rates of these turtles in the coming years.

Lemons, G., T. Eguchi, B.N. Lyon, R. LeRoux, and J.A. Seminoff. 2012. Effects of blood anticoagulants on stable isotope values of sea turtle blood tissue. *Aquatic Biology* 14:201-206.

Abstract - Collecting tissue samples from sea turtles for stable isotope analysis often occurs at remote field sites. For blood tissue, samples are treated with an anticoagulant that allows for later separation of plasma from cellular components. However, the effect of this technique on stable isotope values of sea turtle blood has not been established. We measured the effects of 3 widely used anticoagulants, acid citrate dextrose (ACD), sodium heparin (SH) and ethylenediaminetetraacetic acid (EDTA), on stable carbon ($\delta^{13}\text{C}$) and stable nitrogen ($\delta^{15}\text{N}$) values in whole blood, red blood cells, and blood plasma of 11 green turtles *Chelonia mydas* captured in San Diego Bay, California, USA. Vials containing each of the 3 blood preservatives as well as a vial containing no additive (i.e. control vial) were filled in random order. Blood in the no-additive vial was immediately separated into fractions (e.g. red blood cells, plasma) via centrifugation, whereas blood collected in the treatment vials was chilled and then centrifuged 48 h after collection. We found that, relative to the controls, ACD-preserved whole blood and blood plasma

were 13C enriched, EDTA-treated red blood cells and plasma were 15N depleted, and SH-treated whole blood was 15N enriched. Because SH was the only anticoagulant with no measured effect on blood plasma and red blood cells — the most commonly studied blood fractions for sea turtle stable isotope studies—we recommend its exclusive use as a blood anticoagulant for field studies where prompt centrifugation is not possible.

Week of 6 February 2012

Amorocho, D.F., A. Abreu-Grobois, **P.H. Dutton** and R.D. Reina (2012). Multiple distant origins for green sea turtles aggregating off Gorgona Island in the Colombian Eastern Pacific. PLoS One 7(2): e31486.

Abstract - Mitochondrial DNA analyses have been useful for resolving maternal lineages and migratory behavior to foraging grounds (FG) in sea turtles. However, little is known about source rookeries and haplotype composition of foraging green turtle aggregations in the southeastern Pacific. We used mitochondrial DNA control region sequences to identify the haplotype composition of 55 green turtles, *Chelonia mydas*, captured in foraging grounds of Gorgona National Park in the Colombian Pacific. Amplified fragments of the control region (457 bp) revealed the presence of seven haplotypes, with haplotype (h) and nucleotide (p) diversities of $h = 0.30060.080$ and $p = 0.00960.005$ respectively. The most common haplotype was CMP4 observed in 83% of individuals, followed by CMP22 (5%). The genetic composition of the Gorgona foraging population primarily comprised haplotypes that have been found at eastern Pacific rookeries including Mexico and the Galapagos, as well as haplotypes of unknown stock origin that likely originated from more distant western Pacific rookeries. Mixed stock analysis suggests that the Gorgona FG population is comprised mostly of animals from the Galapagos rookery (80%). Lagrangian drifter data showed that movement of turtles along the eastern Pacific coast and eastward from distant western and central Pacific sites was possible through passive drift. Our results highlight the importance of this protected area for conservation management of green turtles recruited from distant sites along the eastern Pacific Ocean.

Available free at: <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0031486>

Ana R. Amaral, Luciano B. Beheregaray, Kerstin Bilgmann, Dmitri Boutov, Lui's Freitas, **Kelly M. Robertson**, Marina Sequeira, Karen A. Stockin, M. Manuela Coelho, Luciana M. Moller. 2012. Seascape Genetics of a Globally Distributed, Highly Mobile Marine Mammal: The Short-Beaked Common Dolphin (Genus *Delphinus*). PLoS ONE 7(2): e31482.

Abstract - Identifying which factors shape the distribution of intraspecific genetic diversity is central in evolutionary and conservation biology. In the marine realm, the absence of obvious barriers to dispersal can make this task more difficult. Nevertheless, recent studies have provided valuable insights into which factors may be shaping genetic structure in the world's oceans. These studies were, however, generally conducted on marine organisms with larval dispersal. Here, using a seascape genetics approach, we show that marine productivity and sea surface temperature are correlated with genetic structure in a highly mobile, widely distributed marine mammal species, the short-beaked common dolphin. Isolation by distance also appears to influence population divergence over larger geographical scales (i.e. across different ocean basins). We suggest that the relationship between environmental variables and population structure may be caused by prey behaviour, which is believed to determine common dolphins' movement patterns and preferred associations with certain oceanographic conditions. Our study highlights the role of oceanography in shaping genetic structure of a highly mobile and widely distributed top marine predator. Thus, seascape genetic studies can potentially track the biological effects of ongoing climate-change at oceanographic interfaces and also inform marine reserve design in relation to the distribution and genetic connectivity of charismatic and ecologically important megafauna.

Jay Barlow, Lisa T. Ballance, and Karin A. Forney. 2012. Effective Strip Widths for Ship-based Line-transect Surveys of Cetaceans. NOAA Technical Memorandum, NMFS-SWFSC-484.

Abstract - Effective strip width is a key parameter in estimating abundance and density from line-transect surveys. Here we estimate effective strip widths for 58 categories (genera, species, subspecies, stocks, or other groups) of cetaceans based on 13,500 sightings from 32 line-transect surveys conducted in the eastern Pacific Ocean by the Southwest Fisheries Science Center from 1991 to 2008. Generalized linear models (GLMs) are used to first identify factors that are important in determining the perpendicular sighting distances using stepwise model selection based on AIC. Six species groups of similar taxa are created and modeled separately. Important factors for most species groups include Beaufort sea state, swell height, visibility, group size, species, and a survey-specific categorical variable (Cruise#). Interactions between species and the other factors generally do not improve GLM fits, indicating that the effects of those factors are relatively consistent for species within a species group. Factors selected for the best-fit GLMs are included as potential covariates in a line-transect model fit to a subset of the same data, again using stepwise model selection based on AIC. The best-fit line-transect models do not include Cruise# and are generally simpler than the GLMs, likely because distant sightings were eliminated by truncation. Species-specific differences in ESW are seen within the species groups indicating that species of cetacean do differ in the distances at which they can be detected, even after accounting for the effects of group size and other covariates that affect sighting distances. Results from this analysis of multiple surveys can be used to improve estimates of effective strip widths for any survey using the same methods and similar vessels. This is especially true for seldom-seen species whose abundance is difficult to estimate from a single survey.

Available at:

http://swfsc.noaa.gov/uploadedFiles/Divisions/PRD/Programs/Coastal_Marine_Mammal/Barlow%20et%20al%202011%20EffectiveStripWidths%20TM-484.pdf

Week of 23 January 2012

Moore, J.E., and Merrick, R., editors. (With contributions from: Robyn Angliss, **Jay Barlow**, Shannon Bettridge, **Jim Carretta**, Tom Eagle, Christina Fahy, Patricia Rosel, Mike Simpkins, **Barbara Taylor**, and Paul Wade). 2011. Guidelines for Assessing Marine Mammal Stocks: Report of the GAMMS III Workshop, February 15 – 18, 2011, La Jolla, California. Dept. of Commerce, NOAA Technical Memorandum NMFS-OPR-47.

Summary - The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) (collectively, the Agencies) are obliged under Section 117 of the Marine Mammal Protection Act (MMPA) to prepare Stock Assessment Reports (Reports) for marine mammal stocks within U.S. waters. The MMPA provides only general guidance on assessment methods and on the content of the Reports. As a result, the Agencies have held a series of workshops since 1994 to develop guidelines that may be consistently applied nationally to marine mammal stock assessments. These guidelines underlie NMFS and USFWS policy for implementing provisions of MMPA section 117. Since the last workshop in 2004, the need has arisen for additional changes and clarifications to the Guidelines for Assessing Marine Mammal Stocks (GAMMS). To meet this need, the two Agencies convened a workshop (GAMMS III) on 15-18 February 2011 at the Southwest Fisheries Science Center, La Jolla, CA to:

- * Consider methods for assessing stock status (i.e., how to apply the Potential Biological Removal framework, or PBR) when abundance data are outdated, nonexistent, or only partially available.
- * Develop policies on stock identification and application of PBR to small stocks, transboundary stocks, and situations where stocks mix.
- * Develop consistent national approaches to a variety of other issues, including application of mortality and serious injury (M&SI) information in assessments, and consideration of M&SI from recreational fisheries.

The deliberations of these topics resulted in a series of suggested modifications to the current Report

guidelines (NMFS 2005), which are being proposed for formal adoption by NMFS and USFWS as revised guidance on U.S. marine mammal stock assessments. The proposed revised guidelines are provided as Appendix IV of this report.

Week of 9 January 2012

Pitman, R.L. and J.W. Durban. 2012. Cooperative hunting behavior, prey selectivity and prey handling by pack ice killer whales (*Orcinus orca*), type B, in Antarctic Peninsula waters. *Marine Mammal Science* 28(1):16-36.

Abstract - Currently, there are three recognized ecotypes (or species) of killer whales (*Orcinus orca*) in Antarctic waters, including type B, a putative prey specialist on seals, which we refer to as “pack ice killer whale” (PI killer whale). During January 2009, we spent a total of 75.4 h observing three different groups of PI killer whales hunting off the western Antarctic Peninsula. Observed prey taken included 16 seals and 1 Antarctic minke whale (*Balaenoptera bonaerensis*). Weddell seals (*Leptonychotes weddellii*) were taken almost exclusively (14/15 identified seal kills), despite the fact that they represented only 15% of 365 seals identified on ice floes; the whales entirely avoided taking crabeater seals (*Lobodon carcinophaga*; 82% relative abundance) and leopard seals (*Hydrurga leptonyx*; 3%). Of the seals killed, the whales took 12/14 (86%) off ice floes using a cooperative wave-washing behavior; they produced 120 waves during 22 separate attacks and successfully took 12/16 (75%) of the Weddell seals attacked. The mean number of waves produced per successful attack was 4.1 (range 1–10) and the mean attack duration was 30.4 min (range 15–62). Seal remains that we examined from one of the kills provided evidence of meticulous postmortem prey processing perhaps best termed “butchering.”



Week of 2 January 2012

Danil, K., and J.A. St. Leger. 2011. Seabird and Dolphin Mortality Associated with Underwater Detonation Exercises. *Marine Technology Society Journal* 45(6): 89–95.

Abstract - We report the details of two wildlife mortality events that were associated with underwater detonations. The detonations occurred as part of military training activities at Silver Strand Training Complex in San Diego, California. In March 2006, an underwater detonation resulted in 70 western grebes (*Aechmophorus occidentalis*) being killed by subsequent sequential detonations in the same training exercise. Ten of the 70 western grebes impacted were necropsied, verifying cause of death as primary blast injury. In March 2011, a time-delayed underwater detonation resulted in the death of three or possibly four long-beaked common dolphins (*Delphinus capensis*). While these blast events were unlikely to impact these species on a population level, underwater detonations do have the potential for population-level impacts on wildlife. Both events were accidental mortalities and the first ever documented from Navy underwater detonation training in Hawaii, Southern California, and along the U.S. East Coast. The Navy updated its underwater explosive mitigation measures after each of these mortality events to limit the potential of future mortalities by requiring sequential detonations to occur either less than 5 s or more than 30 min apart and by suspending time-delayed detonation training exercises until more robust precautionary measures can be developed.

Available at: <http://www.ingentaconnect.com/content/mts/mts/2011/00000045/00000006/art00012> . The article is in the first volume of a 2- volume special edition "Legacy Underwater Munitions: Assessment, Evaluation of Impacts, and Potential Response Technologies". Part 1 of this 2 volume edition can be purchased at: <https://www.mtsociety.org/publications/>

Week of 5 December 2011

David J. St. Aubin, **Karin A. Forney**, **Susan J. Chivers**, Michael D. Scott, **Kerri Danil**, Tracy Romano, Randall S. Wells and Frances M. D. Gulland. 2011. Hematological, serum, and plasma chemical constituents in pantropical spotted dolphins (*Stenella attenuata*) following chase, encirclement, and tagging. *Marine Mammal Science* (Early View Online), DOI: 10.1111/j.1748-7692.2011.00536.x

Abstract - Hematology, serum chemistry, and plasma hormones were evaluated in 72 pantropical spotted dolphins (*Stenella attenuata attenuata*) from the eastern tropical Pacific in an attempt to define the degree of stress associated with chase and encirclement by a tuna purse seiner, and are here reported for the first time for this species. Dolphins had high levels of dopamine and moderately elevated levels of enzymes indicative of the expected muscle damage following exertion of the chase. The length of time between the start of the capture operation and blood sampling correlated with increases in platelet and white blood cell counts and mean cell hemoglobin concentration, while the length of time between net tie-down and blood sampling influenced platelet, white blood cell, and eosinophil counts. Ten dolphins recaptured 1–3 d after their first capture had significantly lower serum creatinine kinase, thyroid (T4) and globulin levels compared to values in dolphins sampled at nominal first capture. Although small sample sizes and large individual variation limit interpretation, these data indicate a stress response occurred in all dolphins, but the extent of the response is within the expected range for adaptive responses previously measured in limited numbers of wild mammals.

Week of 28 November 2011

Gerrodette, T. and T. Eguchi. 2011. Precautionary design of a marine protected area based on a habitat model. *Endangered Species Research* 15: 159-166.

Abstract - A basic principle of effective resource management is that decisions should be conservative in the face of uncertainty. Due to limited data, there is often considerable uncertainty about species' habitat relationships and requirements. If the boundaries of a protected area are based on relationships estimated by a habitat model, effective management takes the uncertainty into account. The inclusion of uncertainty in the design of a hypothetical marine protected area is described for a coastal population of the long-beaked common dolphin *Delphinus capensis* off Baja California, Mexico. Line-transect and depth data were combined in a hierarchical Bayesian model. Two possible management goals were considered: protecting 100,000 animals or protecting 60% of the population. A precautionary approach was adopted, meaning that the management goal should be met with a high probability. The model estimated that a seaward boundary at 360 m would include 100 000 dolphins with a probability of 0.9. A conventional but less precautionary 'best estimate' boundary at 160 m would meet the management goal with a probability of 0.5. For the second goal of including 60% of the population, the precautionary and non-precautionary depths were 210 and 170 m, respectively. Habitat models are useful for management, but management decisions based on such models should consider the uncertainty inherent in estimating parameters from data. Models which include the data observation process can improve inference about habitat relationships.

Available online at http://www.int-res.com/articles/esr_oa/n015p159.pdf

Nagaoka, S.M., A. Silva Martins, R.G. dos Santos, M.M. Pereira Tognella, E.C. de Oliveira Filho, and **J.A. Seminoff**. 2011. Diet of juvenile green turtles (*Chelonia mydas*) associating with artisanal fishing traps in a subtropical estuary in Brazil. *Marine Biology*. DOI 10.1007/s00227-011-1836-y

Abstract: The diet of 50 juvenile green turtles *Chelonia mydas* live-captured incidentally by fixed fishing traps between January and June 2009 in Cananéia Estuarine– Lagoon complex, Brazil, was studied through analysis of esophageal lavage samples. Green turtles consumed an omnivorous diet, with 18 food components identified and grouped into 4 categories as follows: terrestrial plants, algae, invertebrates, and seagrass. Black mangrove leaves were of the greatest importance to diet. Turtles

incidentally get into fixed traps probably because these devices are located on mangrove margins, where they forage. The additional foods suggest that green turtles also feed opportunistically on material adhered to the trap structure and/or on items that cross into its interior. Green turtle diet in estuarine environments appears to be determined by the availability of food components, with some selectivity toward items of apparently greater nutritional value.

Week of 14 November 2011

Mancini, A., V. Koch, **J.A. Seminoff**, and B. Madon. 2011. Small-scale gillnet fisheries provoke massive East Pacific green turtle (*Chelonia mydas*) mortality: a case study from Baja California Mexico. *Oryx*. doi:10.1017/S0030605310001833

Abstract: The coastal waters of Baja California Sur, Mexico, include some of the most important foraging grounds of the East Pacific green turtle *Chelonia mydas*. However, they are also important fishing grounds for artisanal fleets, leading potentially to high levels of bycatch mortality. We studied the impact of a small-scale gill-net fishery at San Ignacio lagoon, north-west Mexico, an important green turtle feeding ground. We conducted mortality censuses and interviewed local fishers to estimate total bycatch mortality at the lagoon. We also used marked drifters and carcasses to estimate stranding probabilities of turtles taken as bycatch. During 2006–2009 we found 262 dead turtles; 96% of the mortality occurred in May–August corresponding to the fishing season for halibut *Paralichthys californicus* and guitarfish (*Rhinobatus* sp.). Stranding probability estimated from drifters was 0.062 (95% confidence interval, CI, 0.035–0.094), yielding a minimum mortality of 3,516 turtles during 2006–2008 (95% CI 2,364–6,057) or 1,172 animals per year. This is probably an underestimate of real mortality as the drifters have higher stranding probabilities than carcasses and most of the nets were set in the lower lagoon where carcasses rarely strand. Interviews with local fishers yielded a similar estimate of 1,087 (95% CI 901–1,286) dead turtles per year. This study is emblematic of the impact of artisanal fleets on marine turtles caused by overlap of fishing and turtle feeding areas. In 2009 strandings declined by > 97%, resulting from a change in fishing practices because of increased vigilance by enforcement authorities, underscoring the importance of law enforcement to protect threatened species.

Week of 7 November 2011

Duchene, S., F. I. Archer, J. Vilstrup, S. Caballero and P. A. Morin. 2011. Mitogenome phylogenetics: The impact of using single regions and partitioning schemes on topology, substitution rate and divergence time estimation. *PLoS ONE* 6: e27138.

Abstract: The availability of mitochondrial genome sequences is growing as a result of recent technological advances in molecular biology. In phylogenetic analyses, the complete mitogenome is increasingly becoming the marker of choice, usually providing better phylogenetic resolution and precision relative to traditional markers such as cytochrome b (CYTB) and the control region (CR). In some cases, the differences in phylogenetic estimates between mitogenomic and single-gene markers have yielded incongruent conclusions. By comparing phylogenetic estimates made from different genes, we identified the most informative mitochondrial regions and evaluated the minimum amount of data necessary to reproduce the same results as the mitogenome. We compared results among individual genes and the mitogenome for recently published complete mitogenome datasets of selected delphinids (Delphinidae) and killer whales (genus *Orcinus*). Using Bayesian phylogenetic methods, we investigated differences in estimation of topologies, divergence dates, and clock-like behavior among genes for both datasets. Although the most informative regions were not the same for each taxonomic group (COX1, CYTB, ND3 and ATP6 for *Orcinus*, and ND1, COX1 and ND4 for Delphinidae), in both cases they were equivalent to less than a quarter of the complete mitogenome. This suggests that gene information content can vary among groups, but can be adequately represented by a portion of the complete sequence. Although our results indicate that complete mitogenomes provide the highest phylogenetic resolution and

most precise date estimates, a minimum amount of data can be selected using our approach when the complete sequence is unavailable. Studies based on single genes can benefit from the addition of a few more mitochondrial markers, producing topologies and date estimates similar to those obtained using the entire mitogenome.

Luke Rendell, **Sarah L. Mesnick**, Merel L. Dalebout, Jessica Burtenshaw and Hal Whitehead. 2011. Can Genetic Differences Explain Vocal Dialect Variation in Sperm Whales, *Physeter macrocephalus*? Behavior Genetics, DOI: 10.1007/s10519-011-9513-y

Abstract: Sperm whale social groups can be assigned to vocal clans based on their production of codas, short stereotyped patterns of clicks. It is currently unclear whether genetic variation could account for these behavioural differences. We studied mitochondrial DNA (mtDNA) variation among sympatric vocal clans in the Pacific Ocean, using sequences extracted from sloughed skin samples. As in previous studies of sperm whales, mtDNA control region diversity was low ($\pi = 0.003$), with just 14 haplotypes present in our sample. Both hierarchical AMOVAs and partial Mantel tests showed that vocal clan was a more important factor in matrilineal population genetic structure than geography, even though our sampling spanned thousands of kilometres. The variance component attributed to vocal dialects (7.7%) was an order of magnitude higher than those previously reported in birds, while the variance component attributed to geographic area was negligible. Despite this, the two most common haplotypes were present in significant quantities in each clan, meaning that variation in the control region cannot account for behavioural variation between clans, and instead parallels the situation in humans where parent-offspring transmission of language variation has resulted in correlations with neutral genes. Our results also raise questions for the management of sperm whale populations, which has traditionally been based on dividing populations into geographic 'stocks', suggesting that culturally-defined vocal clans may be more appropriate management units.

Week of 31 October 2011

Durban, J.W. and R.L. Pitman. 2011. Antarctic killer whales make rapid, round-trip movements to sub-tropical waters: evidence for physiological maintenance migrations? Biology Letters doi: 10.1098/rsbl.2011.0875

Abstract - Killer whales (*Orcinus orca*) are important predators in high latitudes, where their ecological impact is mediated through their movements. We used satellite telemetry to provide the first evidence of migration for killer whales, characterized by fast (more than 12 km h⁻¹, 6.5 knots) and direct movements away from Antarctic waters by six of 12 type B killer whales tagged when foraging near the Antarctic Peninsula, including all tags transmitting for more than three weeks. Tags on five of these whales revealed consistent movements to subtropical waters (30–378 S) off Uruguay and Brazil, in surface water temperatures ranging from 21.98C to 24.28C; one 109 day track documented a nonstop round trip of almost 9400 km (5075 nmi) in just 42 days. Although whales travelled slower in the warmest waters, there was no obvious interruption in swim speed or direction to indicate calving or prolonged feeding. Furthermore, these movements were aseasonal, initiating over 80 days between February and April; one whale returned to within 40 km of the tagging site at the onset of the austral winter in June. We suggest that these movements may represent periodic maintenance migrations, with warmer waters allowing skin regeneration without the high cost of heat loss: a physiological constraint that may also affect other whales.

Available at <http://rsbl.royalsocietypublishing.org/content/early/2011/10/18/rsbl.2011.0875.short?rss=1>

Week of 24 October 2011

Carretta, J.V. and J. Barlow. 2011. Long-term effectiveness, failure rates, and "dinner bell" properties of acoustic pingers in a gillnet fishery. *Marine Technology Society Journal* 45(5):7-19.

Abstract - The long-term effectiveness of acoustic pingers in reducing marine mammal bycatch was assessed for the swordfish and thresher shark drift gillnet fishery in California. Between 1990 and 2009, data on fishing gear, environmental variables, and bycatch were recorded for over 8,000 fishing sets by at-sea fishery observers, including over 4,000 sets outfitted with acoustic pingers between 1996 and 2009. Bycatch rates of cetaceans in sets with ≥ 30 pingers were nearly 50% lower compared to sets without pingers ($p = 1.2 \times 10^{-6}$), though this result is driven largely by common dolphin (*Delphinus delphis*) bycatch. Beaked whales have not been observed entangled in this fishery since 1995, the last full year of fishing without acoustic pingers. Pinger failure (≥ 1 nonfunctioning pingers in a net) was noted in 3.7% of observed sets. In sets where the number of failed pingers was recorded, approximately 18% of deployed pingers had failed. Cetacean bycatch rates were 10 times higher in sets where ≥ 1 pingers failed versus sets without pinger failure ($p = 0.002$), though sample sizes for sets with pinger failure were small. No evidence of habituation to pingers by cetaceans was apparent over a 14-year period of use. Bycatch rates of California sea lions in sets with ≥ 30 pingers were nearly double that of sets without pingers, which prompted us to examine the potential "dinner bell" effects of pingers. Depredation of swordfish catch by California sea lions was not linked to pinger use—the best predictors of depredation were total swordfish catch, month fished, area fished, and nighttime use of deck lights on vessels. **Keywords:** acoustic pingers, bycatch, marine mammals, habituation, gillnets

Palmer, C., Murphy S. A., Thiele, D., Parra G. J., **Robertson, K. M.**, Beasley, I., and C. M. Austin. 2011. Analysis of mitochondrial DNA clarifies the taxonomy and distribution of the Australian snubfin dolphin (*Orcaella heinsohni*) in northern Australian waters. *Marine and Freshwater Research*, doi.org/10.1071/MF11063

Abstract - Conservation management relies on being able to identify and describe species. Recent morphological and molecular analyses of the dolphin genus *Orcaella* show a species-level disjunction between eastern Australia and Southeast Asia. However, because of restricted sampling, the taxonomic affinities of the geographically intermediate populations in the Northern Territory and Western Australia remained uncertain. We sequenced 403 base pairs of the mitochondrial control region from five free-ranging *Orcaella* individuals sampled from north-western Western Australia and the Northern Territory. Low net nucleotide divergence (0.11–0.67%) among the Australian *Orcaella* populations show that populations occurring in the Northern Territory and Western Australia belong to the Australian snubfin (*O. heinsohni*) rather than the Asian Irrawaddy dolphin (*O. brevirostris*). Clarifying the distribution of *Orcaella* is an important first step in the conservation and management for both species; however, an understanding of the metapopulation structure and patterns of dispersal among populations is now needed.

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