distinct calling patterns. Unlike other baleen whales, animals sharing the same acoustic space used different patterns simultaneously, without switching. Analysis of seasonal occurrence patterns revealed peak acoustic presence in higher latitudes during late summer and fall and in lower latitudes during winter. A higher abundance of calls at offshore recording sites, particularly in winter and spring, suggests that there is a winter habitat located in deeper waters off the Southeastern US. In addition, minke whales were heard further offshore during the northerly spring migration compared with a more coastal distribution during the southerly fall migration. This large-scale analysis provides the first detailed description of minke whale acoustic behavior and migration in the Western North Atlantic, demonstrating the utility of passive acoustics in expanding the spatio-temporal range of visual data and identifying key habitats, especially for cryptic species with offshore distributions.

Capability to use LF sound as an evolutionary advantage in opening up new habitats during a time of global ocean and climate change

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Cetaceans developed a highly specific organ of hearing adapted to a broad acoustic range. To date, there is only rare information on the origin of low-frequency (LF) hearing and the LF sound source in mysticetes. We focus on the origin and evolution of LF hearing in baleen whales by examinations of the inner ear anatomy of representatives of several extinct Mysticeti and their ancestors including some extant Balaenidae and Balaenopteridae. In detail, we are studying mostly petrosal bones of fossil and recent species of doubtless taxonomy from nearly all known geographic ranges. As the cochlear shape with its ratio of radii of curvature from the outermost and innermost turns of the cochlear spiral in extant mammals is clearly functionally correlated with LF hearing limits, the existence of this feature in fossil whales allows new insights in the evolution of LF hearing in baleen whales and to discuss its role in opening up new habitats, in modifying communication (long range acoustic signaling) and in evolving filter feeding strategies in mysticetes during a time of dramatic change in global circulation system and climate system. Therefore the radii of curvature and basal and apical widths of the lamina gap of cochleae are measured after visualisation of detailed anatomy by non-invasive methods, such as micro X-ray tomography and neutron tomography and subsequent 3D reconstruction of the petrosal scans. Our research will constitute an important starting point for advanced models of LF hearing evolution in baleen whales.

Density Surface Models for Cetaceans Along the U.S. East Coast and Gulf of Mexico Using Multiple Platforms and Dynamic Predictors

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The stresses of human activities such as offshore energy and military sonar demand spatially and temporally explicit advice for minimizing impacts on marine mammals. We present new high-resolution seasonal density maps for 20 species of cetaceans distributed within the United States Exclusive Economic Zone in the north Atlantic and Gulf of Mexico. Using over 1 million linear km of line-transect effort from more than 100 cetacean surveys carried out by U.S. NOAA NMFS and partner organizations from 1991-2012, with approximately 40,000 reported sightings of cetaceans, we constructed density surface models using distance sampling methodology. We utilized transects from both aerial and shipboard surveys and fitted species- and survey-specific detection functions to compensate for differences in detection efficiency. After splitting transects into segments and predicting effective strip width using the detection functions, we pooled the segments and fitted seasonal spatial models for encounter rate and group size using a suite of remotely-sensed and modeled physiographic and oceanographic predictors, including dynamic predictors such as eddy kinetic energy, wind stress curl, and distance to SST fronts. Finally, we predicted density across the U.S. EEZ using remote sensing and ocean model images, to generate seasonal density maps for these 20 species. The results provide a comprehensive and detailed model of cetacean distribution throughout U.S. waters of the north Atlantic and Gulf of Mexico. We will present highlights, covering both methodology and results, and discuss how these models are being used by management agencies in spatial planning exercises. Finally, we will conclude by describing a follow-on project to extend the models to the central north Atlantic, where little survey effort is available.

An Endocrine Indicator of Maternal Success in Phocid Seals

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Concentration of phocid seal reproductive effort into brief, energy-costly annual episodes in colonies should select for mothers recognizing and expending resources only on filial pups. Nevertheless maternal care in phocid seals is highly variable. Grey seals (*Halichoerus grypus*) can exhibit mother/pup separation, abandonment, inconsistent ability to recognise offspring, adoption of unrelated pups, pup theft and infanticide, with direct impacts on pup survival and maternal reproductive success. The hormone oxytocin is responsible for the correct expression of maternal behaviour, and maintaining social bonds. Plasma concentrations of oxytocin were measured in mother/pup pairs on two breeding colonies with different levels of maternal attendance. Mothers exhibiting “poor” maternal behaviour were predicted to have lower basal oxytocin levels during the breeding season than those that raised their pups to weaning. Successfully pupping mothers had higher oxytocin concentrations than “poor” mothers who lost their pups through abandonment or death during lactation ($p=0.01$). In addition, “poor” mothers had levels of oxytocin that were not significantly different to those found in non-breeding individuals ($p=0.6$), while “successful” mothers had higher plasma concentrations than non-breeding animals ($p< 0.001$). These results provide the first physiological explanation for why some grey seal mothers fail to express effective maternal behaviour. Unexpectedly, there was consistent evidence that dependant pups had plasma oxytocin concentrations three times greater than those of their mothers ($p< 0.001$). After weaning, pup oxytocin levels fell by 50%. We suggest that pups play an active role in maintaining the mother/pup bond, via the elevated oxytocin levels they experience from a positive feedback loop involving sustained contact with the mother. This hypothesis is supported further by prior behavioural studies on the two colonies, with pups from the colony with greater amounts of mother/pup contact having higher oxytocin concentrations than the other ($p< 0.001$).