clans of one ecotype, each clan having discrete culturally transmitted vocal traditions. The V4 call was found in recordings of each ecotype and each vocal clan. Nine independent observers reproduced our classification of the V4 call from each population with high inter-observer agreement. Our results suggest the V4 call may be universal in Pacific killer whale populations and that transmission of this call is independent of cultural tradition or ecotype. We argue that such universality is more consistent with an innate vocalisation than one acquired through social learning and may be linked to its apparent function of motivational expression.

Temporal processing of low-frequency sounds by seals

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Concerns about the effects of noise on marine mammals underscore the need for psychoacoustic studies of signal processing. Such studies provide direct information about how sounds are received in time and frequency domains and perceived by individuals. In diving mammals, the relationship between signal durations and detection thresholds has been described for several species and for different signal types including tonal and transient sounds. As in other mammals, hearing thresholds decrease with increasing signal duration to a certain time constant, beyond which thresholds do not change with increasing time. Studies of marine mammal temporal processing have not considered low-frequency signals until a recent report by Kastelein et al. [J. Acoust. Soc. Am. 127, 1135-1145 (2010)], which showed integration times for harbor seals exceeding 3000 ms for 200 Hz tonal signals. This finding is unexpected and potentially significant given that time constants measured in mammals for tones above 1 kHz are less than 500 ms. To further explore temporal processing at low frequencies, we measured the hearing thresholds of a trained harbor seal listening in air for 200 Hz tones with durations of 500 ms or 2500 ms. The difference predicted by Kastelein et al. (2010) between thresholds for these variable duration signals was 9 dB, but we found no difference in the measured hearing thresholds for this seal. Although there are methodological differences between the studies, these are unlikely to explain this discrepancy. We suggest that the improved detection of long duration, low-frequency signals documented in the earlier study cannot be attributed to auditory integration times exceeding 500 ms, but rather may be explained by other factors related to detection probability. Additional data are needed to sort out how seals and other marine mammals process low-frequency auditory information, including intermittent and transient signals common to both communicative and anthropogenic sounds.

Movements and Habitat Use by Radio Tagged Manatees along Florida's Northern Big Bend Coast

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Florida manatees (*Trichechus manatus latirostris*) range along the northern Gulf of Mexico coast from Florida to Louisiana, and occasionally to Texas. However, little is known about specific manatee use areas and habits west of the Suwannee River. Photo identification studies in the region have documented individually identifiable scarred manatees, many of which over-winter at Crystal River or Wakulla Springs State Park. To document manatee movement and habitat use patterns along the northern Gulf, we radio tagged manatees at the Wakulla River and selectively tagged individuals at Crystal River having known sightings in the northern Gulf. From April 2008 to May 2011, we deployed Argos-linked GPS tags on twelve manatees (7 females, 5 males); 6 in Crystal River and 6 in the Wakulla. Manatee size classes ranged from subadult to large adult. Tracking data revealed the use of estuarine and marine seagrass beds that provide ample forage along the Big Bend coast, with abundant freshwater vegetation also accessed within the lower reaches of coastal rivers. Spring migration timing and paths for tagged manatees traveling north from Crystal River varied by individual, but typically included foraging and freshwater resources of coastal creeks and rivers (Suwannee, Steinhatchee, Econfina, Aucilla, and Wakulla/St Marks rivers). From late spring through fall, manatee use focused primarily on the coastal estuaries and rivers from the Aucilla River to Apalachicola, with the greatest concentration of use at the Wakulla/St Marks rivers and in Apalachicola Bay. Migrations to warm water refuges at Wakulla Spring and Crystal River were primarily triggered by the onset of early winter cold weather, although we also documented mid-winter migrations south from Wakulla. Understanding the distribution of resources and patterns of use in this area will be valuable for managing the increasingly large numbers of manatees utilizing the northern extent of their Gulf coast range.

Keep your Head Down: Huge Hyoid Assists Cetacean Locomotion

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The cetacean (toothed and baleen whale) hyoid apparatus is comprised of basal elements (basihyal and paired thyrohyals), and paired suspensory elements (ceratohyal, epihyal, stylohyal, and tympanohyal) that attach to the skull base. As in other mammals, the basal portion (hyoid) is attached to the skull, mandible, tongue, floor of the mouth, larynx, pharyngeal walls, and sternum. Movements therefore affect feeding, swallowing, breathing and sound production. The cetacean hyoid is absolutely and relatively large compared with other mammals. It is hypothesized that the large size provides increased surface area for muscle insertions. Hyoid morphology was studied to assess muscle insertions and vector movements. Hyoids from 4 mysticete genera (representing 7 species) and 14 odontocete genera were compared with hyoids from 43 terrestrial genera. The hyoid is gently curved or angled at the midline to make a symmetrical V or C shape, with the extremities pointing latero-caudally. The odontocete hyoid is flattened dorso-ventrally, and the concavity is directed towards the larynx. The mysticete hyoid is rod-shaped, and the concavity is directed dorsally. An unusually thick hyoid periostium extends caudally in the midline. This thick tissue is sometimes augmented by paired posterior projections of the basihyal, and provides additional surface area for muscular attachments of the infrahyoid muscles. Two prominent rostral projections of the basihyal provide additional surfaces for attachments of the suprahyoid muscles. These projections indicate primary movements in the rostro-caudal axis, e.g., mandibular depression. Contraction of the geniohyoid and sternohyoid muscles while the gape is held closed would cause head depression, thus initiating the body wave of forward swimming. Locomotion is thus proposed as a novel role for the hyoid and may be unique to whales.

Impacts of Fishing Gear and other Marine Debris on Florida Manatees

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