Proximal mechanisms for sound production in male Pacific walruses
Ole Larsen & Colleen Reichmuth

The songs of male walruses during the breeding season have been noted to have some of the most unusual characteristics that have been observed among mammalian sounds. In contrast to the more guttural vocalizations of most other carnivores, their acoustic displays have impulsive and metallic features more similar to those found in industrial work places than in nature. The patterned knocks and bells that comprise male songs are not thought to be true vocalizations, but rather, sounds produced with structures other than the vocal tract and larynx. To determine how male walruses produce and emit impulsive and metallic signals, we conducted a series of in situ studies with two captive adult male Pacific walruses that were trained for voluntary participation in bioacoustic research. Through a combination of observational, acoustic, endoscopic, and ultrasonic methods, we confirmed the probable anatomical origins of knocking and bell sounds and gained a mechanistic understanding of how these sounds are generated within the body and transmitted to the environment. These pathways are illustrated with acoustic and video data and considered with respect to the unique biology of this species.

Tracking multiple marine mammals using widely-spaced hydrophones
Eva-Marie Nosal

Recent interest in methods to track marine mammals using passive acoustics stems from concern over anthropogenic impacts on the marine environment, and considerable progress has been made in the field over the past several years as a consequence. Nevertheless, significant challenges persist. One of the more tricky situations occurs when widely spaced hydrophones record multiple animals that make similar calls with short inter-call-intervals. In this case it can be very difficult to establish how many animals are calling, let alone to track the individuals. Conventional tracking methods require that the calls are pre-associated for an individual so that times of arrival (TOAs) or time-differences of arrival (TDOAs) can be used to locate the animal. This talk will discuss a different approach, in which association and localization/tracking are performed simultaneously. A tracking algorithm that relies on TOAs or TDOAs and that uses joint association/tracking will be described. Results from simulations and application to real data will be presented. Work supported by ONR and NSF.

Multivariate classification of echolocation clicks of Commerson's dolphins
María Vanesa Reyes Reyes, Miguel Iñíguez, John Hildebrand & Mariana Melcón

Commerson's dolphin's (Cephalorhynchus commersonii) inhabits exclusively the Southern hemisphere and its distribution is restricted to coastal waters of Southern South America and Kerguelen Islands. Little information exists on the acoustic signals emitted by this species in the wild. We recorded 478 min containing dolphins' vocalizations, using a single hydrophone in Bahía San Julián, Patagonia Argentina. Signal parameters were calculated and a cluster analysis was made on a random subsample of 850 echolocation clicks, using two parameters as variables. We obtained nine clusters where the different clusters differed in peak frequency and/or 10dB minimum frequency (ranging from 121 to 141 kHz peak frequency, and 115-125 kHz 10dB minimum frequency). Buzz clicks were analyzed separately. They had mostly two or three peak frequencies between 129 and 140 kHz, with minimum differences in sound level. This study provides the first evidence that Commerson's dolphins may produce a variety of echolocation clicks, instead of only one type of stereotyped narrow-band high frequency clicks. This information could be useful while doing passive acoustic monitoring.
We also detected other signals in a lower frequency range of clicks which may serve for communication. These novel results will be discussed.

Time versus frequency controversy in the bottlenose dolphin auditory analysis
Gennadi Zaslavski

Studies on a dolphin's sonar target recognition are greatly focused on acoustic cues associated with individual echoes returned by ensonified targets. Theoretical time resolution of a bottlenose dolphin echolocation click is as high as 15 -20 microseconds. Given a very broad frequency range of a bottlenose dolphin hearing extending from 5-10 kHz to as far as 130-140 kHz, the dolphin sonar time resolution could be as high as the theoretical time resolution of the echolocation clicks. In response to a brief echolocation click a target usually returns a multiple highlights echo having rippled energy spectrum. Theoretically, the time domain as well as the frequency domain cues both can be used to discriminate targets. In the psychophysical experiment discussed in this paper a bottlenose dolphin discriminated two pairs of clicks having rippled energy spectra. The pair spectra differed in location of the ripples within the dolphin hearing range. The locations of the energy peaks in one spectrum coincided with locations of the energy troughs in the other. The dolphin was able to discriminate the pairs having the ripple modulation smaller than 1 dB and interclick intervals as small as 10 microseconds. Surprisingly, the dolphin continued to discriminate the signals even when a third click was symmetrically added to each pair transforming them into the time reversed triplets with