

and release of manatees along the northeast coast of Brazil. Between 1994 and 2004, a radio tracking system was developed and used to monitor thirteen released manatees. Tracked individuals ranged along 1,500 kilometers of coast between Bahia and Rio Grande do Norte. The most frequently used tag type consisted of a very high frequency (VHF) radio-transmitter in a floating housing, which was tethered to a belt around the base of the manatee's tail. This system allowed the manatee to be followed by field trackers stationed along the coast or using a mobile tracking unit. Monitoring was conducted daily to determine location, behavior, and associated habitat features. Technicians tracked manatees during the early years, but in later years, field trackers selected from local communities performed the monitoring. A total of 8,138 tracking days were recorded (57,781 hours) with a median daily effort of 7 hours (maximum=18). Twenty-six transmitters were used and the total median life of the equipment was 412 days (minimum=22; maximum=1,057). The median following effort/animal was 71.5% (261 days/year). The tracking efficacy (location days/monitoring days x 100) was defined as the tracking system's performance index. The median annual tracking efficacy was 86.6%. The tracking system proved to be appropriate for monitoring captive-released manatees by field trackers and by the mobile tracking unit. The selection and training of people from local areas to work as field trackers was important for educating communities, and conservation efforts for the species in Brazil. However tracking with VHF tags was less effective for manatees that migrate long-distances and those that remained offshore. For these animals, we recommend using satellite-monitored Argos tags, which allow for remote tracking, reduced field effort and to help ensure the successful adaptation of individuals to the wild.

### A California Sea Lion (*Zalophus californianus*) Uses a Transitive Logic Rule Across Sensory Modalities to Solve Novel Transfer Problems

Lindemann, Kristy L.<sup>1</sup>; Reichmuth Kastak, Colleen<sup>2</sup>; Schusterman, Ronald J.<sup>2</sup>

(1) Department of Psychology, University of California, Santa Cruz, 1156 High Street, Santa Cruz, CA, 95064, USA

(2) Institute of Marine Sciences, University of California, Santa Cruz, 100 Shaffer Road, Santa Cruz, CA, 95060, USA

Problem solving requires that animals be able to integrate information from within and between sensory modalities to make sense of their environment. The ability to form transitive associations may help an individual to respond appropriately when presented with a novel situation. A test of associative transitivity requires an animal to follow a rule of logic such that if one has learned that 'square is related to triangle' and that 'triangle is related to circle' then one can infer that square is related to circle (if A=B & B=C, then A=C). In the past, associative transitivity was demonstrated in a sea lion within the visual modality. However, since the environment is comprised of multimodal stimuli it is necessary to investigate whether transitivity can be demonstrated across the sensory modalities. The current study examined cross-modal transitivity by investigating auditory-visual relations in the same sea lion. The animal had previously learned to discriminate two classes of visual stimuli in a matching-to-sample paradigm. Next the subject was taught using food reinforcement to associate a different acoustic stimulus with one member of each visual class. Finally, the subject was tested to determine if untrained transitive relationships would emerge between each of the acoustic cues and the remaining members of each visual class. The results show that the sea lion immediately solved novel transfer problems, with new transitive relations emerging between acoustic and visual stimuli that were separately related to a common visual mediating stimulus. This is the first demonstration of cross-modal transitivity in a nonhuman. The sea lion's ability to pass a cross-modal transitivity test allows for a more complete understanding of how this cognitive ability may function in an animal's natural environment.

### Angiomatosis in a New Species of Dolphin, *Delphinus capensis*, from Central California

Lipscomb, Thomas P.<sup>1</sup>; Berman-Kowalewski, Michelle<sup>2</sup>; Cowan, Daniel F.<sup>3,4</sup>

(1) Department of Veterinary Pathology, Armed Forces Institute of Pathology, 6825 16<sup>th</sup> Street, N.W., Washington, DC, 20306, USA

(2) Department of Vertebrate Zoology, Santa Barbara Museum of Natural History, 2559 Puesta Del Sol, Santa Barbara, CA, 93105, USA

(3) Department of Pathology, University of Texas, 301 University Boulevard, Galveston, TX, 77555, USA

(4) Texas Marine Mammal Stranding Network, 4700 Ave U Building 303, Galveston, TX, 77555, USA

Angiomatosis is a disease, apparently unique to the dolphin, characterized by proliferation of small thick-walled blood vessels diffusely throughout the lungs, without inflammation, exudation or alveolar hemorrhage. Similar vascular proliferation commonly occurs in lung-associated lymph nodes, and may also be accompanied by the formation of hemangiomas in the lymph nodes and lung. Marked thickening and opacification of the visceral pleura is present in more severe forms of the disease. In severe instances of the disease there may be right ventricular hypertrophy, suggesting pulmonary hypertension, a life-shortening condition. The etiology of this disease remains undefined. Initial observations (1999) were limited to Atlantic bottlenose dolphins, *Tursiops truncatus*, in the western Gulf of Mexico, but have increased in incidence and severity over a span of a few years, reaching an incidence of 100% of mature animals. Since publication of the initial report, incidence remains high, but severity appears to be diminishing. If the apparent limitation to bottlenose dolphins in the western Gulf of Mexico is a valid finding, it has implications for etiology. However, unpublished observations (personal communications) suggest that it may occur in other dolphin species and other waters as well. We have observed lesions of angiomatosis in another species, the long beaked common dolphin *Delphinus capensis*, from the central California coast. In three observed cases, the lesions were never more than mild, but were very consistent with the disease in *T. truncatus*, including lymph node involvement. This observation confirms that angiomatosis is not limited by dolphin species or by geography.

### Calculating Length Frequencies of a Crustacean Prey in Marine Mammal Diets Using Carapace Measurements

Lipsky, Jessica D.<sup>1</sup>; Goebel, Michael E.<sup>1</sup>; Reiss, Christian S.<sup>1</sup>; Loeb, Valerie<sup>2</sup>

(1) NOAA, NMFS, Southwest Fisheries Science Center, Antarctic Ecosystem Research Division, 8604 La Jolla Shores Drive, La Jolla, CA 92037 USA

(2) Moss Landing Marine Laboratory, 8272 Moss Landing Rd., Moss Landing, CA 95039

Krill carapaces measurements have been used to reconstruct krill length frequencies in Antarctic fur seal diet. The discriminant function currently used to determine sex, and the sex-specific allometric equations for calculating total length from carapace length, were derived from South Georgia krill populations. The equations have been applied to fur seal diet studies in the South Shetlands but until now have not been validated using locally sampled krill. This study reports on a three year study validating the use of discriminant functions to determine sex of krill based on carapace length and width and independently derives sex-specific regression models for krill collected in the South Shetlands. Allometric equations derived from South Georgia krill overestimated total length. Applying a discriminant function derived from mature krill in years following significant recruitment events with large proportions of immature krill resulted in significant bias towards male krill and an overestimation of krill length. We propose some standard guidelines for applying discriminant functions, allometric equations and for interpreting results.

### Remote Determination of Harp Seal Sizes in the White Sea by Data of Air Surveys of 2003-2004

Lisovsky, A.S.; Shafikov, I.N.

Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO), 6, Knipovich Street, 183763, Murmansk, Russia

Application of the modern digital photo cameras during the air surveys of harp seals gives an opportunity to determine remotely their sizes.