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DIAGNOSTIC PROCEDURES FOR HEARING LOSS IN CETACEANS: AUDITORY EVOKED POTENTIALS AND BEHAVIOR
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Marine mammals are auditory-based predators, with a vast majority of their brain devoted to auditory processing1 for echolocation. Hearing loss, and especially deafness, in these animals presents a unique and severe impedance to survivability in the wild due to an inability to find food, navigate, socialize and explore the ocean. In 2010 Mann et al2 demonstrated that 57% of stranded bottlenose dolphins (Tursiops truncatus) and 36% of stranded rough toothed dolphins (Steno bredanensis) studied were deaf, which makes diagnosing deafness an essential component of stranding response and rehabilitation. Hearing loss can also be attributed to aging as the cilia in, especially the higher frequency zone of, the cochlea degrade3, causing age-related sensorineural hearing loss4 (presbycusis). Little is published regarding behavioral changes as a result of hearing loss, and the majority of information is anecdotal. The primary objective of this study was to identify whether specific behaviors of cetaceans correlate with a diagnosis of hearing loss as evaluated by the auditory evoked potential (AEP) in both previously stranded and aging animals. The authors also aimed to define and quantify presbycusis in older cetaceans. We hypothesized that individuals with severe hearing impairment or deafness will take longer to adapt to new environments, may be unresponsive to certain recall signals by trainers, and be more introverted than average animals. Presbycusis was hypothesized to exist in all animals over 30 years. Each animal (n=27) studied had either previously received an AEP hearing test or received one as a consequence of this study. Behavior questionnaires for participating animals (n=22) were completed by individuals with extensive knowledge of the animal’s history and behavior. Results indicate that stranded individuals with any degree of hearing loss significantly exhibit a behavior change when compared with normal animals; Of 15 variables evaluated, the only significant change included increased vocalizing compared to average. Single stranders were more likely to display hearing losses. Increased vocalizations were seen in individuals with profound hearing loss, both those with no response to AEP stimuli and those with responses at levels over 90dB on the kHz scale.

Individuals with no response to AEP stimuli were more likely to exhibit behavior changes, associated with taking longer times to acclimate to new environments and taking longer periods of time to learn new behaviors. Individuals with profound hearing loss (>90dB losses) also took longer periods of time to learn behaviors and acclimate to new environments compared to normal individuals. Results regarding prebycusis indicated that all individuals tested over 35 years had some degree of hearing loss, however degree of loss was not associated with age. Behavior changes were significant in all individuals within this category, with a significant change in responsiveness to trainers. These individuals seem to continue to adapt and learn well, however the extent of change to environment by each facility was not examined in this study. Changes to training methodologies were not significant in this group, likely because of the lack of behavioral
indicators. As a result of these findings, the authors recommend conducting AEP studies in individuals that stranded alone and who are vocal, seem to be adapting poorly to a rehabilitation environment, or learn slowly. All animals over 35 years should be tested via AEP.

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