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Density Estimates for Minke Whales off Kaua'i and the Northern Marianas Islands Using Acoustic Line-transect Survey Data: Pros and Cons of Passive Acoustic Density Estimation

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Minke whales (Balaenoptera acutorostrata) are one of the smallest and most elusive species of the baleen whales, and are rarely sighted in sub-tropical wintering areas. Passive acoustic methods provide an effective alternative to survey this this species. Minke whale densities were estimated from passive acoustic data recorded using a towed hydrophone array system during two vessel based surveys, one in the waters of the Commonwealth of the Northern Marianas Islands (CNMI), and the second at the Pacific Missile Range Facility northwest of Kaua'i, Hawaii (PMRF-HI). These line-transect surveys were conducted during daylight hours in the winter/spring of 2007 and 2010, respectively. The CNMI survey covered a large area of 616,000 km2 and the PMRF-HI survey covered a much smaller area of 2,055 km2. During both surveys, most of the effort was conducted in Beaufort sea states of 4 or higher, greatly compromising visual efforts. Minke whales were not sighted during either survey, however, numerous minke whale 'boings' (a distinctive sound they produce in spring/winter in the North Pacific) were detected. Acoustic data were post-processed using customized Matlab algorithms to detect and localize and estimate distances to animals, resulting in approximately 30 localizations for the CNMI and 50 for PMRF-HI. This information was used to estimate detection functions for the distance sampling analyses. To account for possible changes in vocalization rates for animals near the trackline, data were left-truncated before fitting detection function models. A density of 0.15(CV=34 %) animals/1000 km2 was estimated for CNMI, and 3.7(CV= 28%) animals/1,000 km2 for PMRF-HI. These results represent the first acoustic-based density estimates for minke whales using line-transect methods. We will use examples from these analyses to highlight biases and issues associated with the acoustic density estimation methods we used, including effects of animal movement and changes in vocalization behaviors on the accuracy of the estimates. [Funded by ONR and NAVFAC-Pacific]