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Clicking to be Counted: using passive acoustic monitoring to estimate the density and abundance of sperm whales in the central Gulf of Alaska

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A 26 day visual and acoustic line-transect survey of marine mammals was conducted in the central Gulf of Alaska (GoA) during the summer of 2013. The survey area was divided into four strata to reflect distinct habitats; 'inshore', 'slope', 'offshore' and 'seamounts'. Passive acoustic monitoring was conducted around the clock for 23 days using a towed-hydrophone array system. One of the main objectives of the acoustic survey was to obtain an acoustic-based density estimate for sperm whales (Physeter macrocephalus) in the study area. A total of 241 individual sperm whale acoustic encounters were obtained during 6,304 km of towed array effort compared to only 19 sightings during 4,155 km of visual effort. Line-transect distance sampling methods were used to estimate the density and abundance of sperm whales. Detection probability was estimated from perpendicular distances of the whales to the ship's track computed from localizations obtained using target motion analysis. Encounter rate varied by strata and was highest in the slope stratum (0.07 animals/km), followed by the offshore (0.03 animals/km) and seamount strata (0.007 animals/km), respectively. An acoustic-based abundance and density estimate was obtained for each stratum with sperm whale encounters (offshore: N=78, D= 0.0013, CV = 0.36; seamount: N=16, D = 0.0004, CV = 0.55; and slope: N=121, D = 0.0033, CV = 0.18) and for the entire survey area (A = 142,204 km², N = 216, D = 0.0015, CV = 0.19). These results are consistent with the visual-based estimates (N = 220, D = 0.0015, CV = 0.51). The advantages, disadvantages and biases of acoustic-based methods for density estimation, as well as application of these methods to other species (e.g. beaked whales) and areas, will be discussed. Results from this study present the first density and abundance estimates for sperm whales within the central Gulf of Alaska.

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