



21st Biennial Conference on the Biology of Marine Mammals

13-18 DECEMBER 2015
HILTON SAN FRANCISCO UNION SQUARE
SAN FRANCISCO, CA USA

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Regional and Seasonal Density and Abundance of Harbor Porpoise: Recolonization of Puget Sound, Aerial Surveys 2013-2015

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Although harbor porpoise (*Phocoena phocoena*) were historically common in Puget Sound in the 1940s, their abundance declined in successive decades, with no individuals observed in southern Puget Sound during 1994 aerial and vessel surveys. Since 2009, sightings, strandings and acoustic detections have increased, suggesting their recolonization of Puget Sound. We present the first regional and seasonal density estimates of harbor porpoise available for Puget Sound waters since the 1990s. We conducted systematic line-transect aerial surveys for marine mammals in eight sub-regions of Puget Sound in 2013-2015 during spring, summer and fall, funded by the U.S. Navy. Observers recorded species, group size, calves, behavior state (mill, travel, or rest), group heading and group cohesion based on animals' body lengths apart. Species, calf presence and group size were confirmed with high-resolution photographs. Density and abundance were estimated following conventional distance sampling methods. A total of 882 harbor porpoise sightings (~1,912 individuals) were recorded during 17,573 km of observation effort. Density and abundance analyses were limited to 322 harbor porpoise sightings and 4,902 km of observation effort considered suitable for distance sampling analysis using DISTANCE 6.2 software (Beaufort sea state <3, cloud cover ≤50%). Estimates were corrected for missed trackline animals using $g(0)$ from previous studies. Overall, estimated pooled harbor porpoise density was 0.91 individuals/km², abundance 2,387 (95% CI 1,942-2,935, CV=0.11). Highest seasonal densities occurred in spring (1.60) and lowest in fall (0.90). Geographically, highest densities occurred in the South Whidbey (2.47 individuals/km²), Admiralty Inlet (1.46) and southern Puget Sound (0.89) sub-regions, with notably fewer animals between Seattle and Tacoma. Harbor porpoises were also observed in shallow tidal waters of Hood Canal, where they were absent for decades. Results confirm harbor porpoise are recolonizing Puget Sound, and are at minimum present spring through fall in relatively large numbers. Reasons for this increase are unknown.

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