

## Co-occurrence of Large Whales and Fixed Commercial Fishing Gear: California, Oregon, and Washington

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Large whale entanglement in commercial fishing gear off the U.S. West Coast has been identified as an issue of concern by the National Marine Fisheries Service (NMFS) because of the potential impacts to both large whales (individually and at a stock/population level) and the commercial fishing industry. Fin (*Balaenoptera physalus*), gray (*Eschrichtius robustus*), humpback (*Megaptera novaeangliae*) and sperm (*Physeter macrocephalus*) whales were included in this study based on their endangered status and historic entanglement records. Little information has been confirmed from entanglement reports about the origin of the entangling fishing gear; therefore NMFS has developed analytical tools to assess the potential entanglement risk associated with various fixed gear fisheries relative to their co-occurrence with large whale species. One primary tool was mapping commercial fishing effort, focusing on fisheries with gear that has been confirmed or suspected of entangling whales based upon documented sightings and strandings of entangled animals. Fishing effort represented in this study, both state and federally managed, was derived from landings data obtained through the Pacific Fisheries Information Network (PacFIN). The relative density of fishing effort throughout the calendar year was overlaid with species-specific whale distribution patterns, modeled from systematically-collected marine mammal survey data, to help identify spatial and temporal overlap between whales and fisheries. The co-occurrence model identified potential species-specific "hot spots" of where and when large whales are more likely to encounter fishing gear, thus increasing entanglement risk. Information gained during port visits and interviews with fishery representatives and state and federal fishery experts were compiled to improve knowledge of fishing gear off the west coast. The identification of spatial or temporal "hot spots", combined with a better understanding of fishing gear, will improve the ability to minimize or mitigate the risk of large whale entanglements.

## Temporal separation of fin whale calls across the eastern North Pacific

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Fin whales (*Balaenoptera physalus*) produce a variety of low-frequency, short duration, frequency modulated calls. The differences in temporal patterns between two fin whale call types are described from long-term passive acoustic data collected between 2005 and 2011 at three locations across the eastern North Pacific: the Bering Sea, off Southern California, and in Canal de Ballenas in the northern Gulf of California. Fin whale calls were detected at all sites year-round, during all periods with recordings. At all three locations, 40 Hz calls peaked in June, preceding a peak in 20 Hz calls by 3–5 months. The 40 Hz call likely has a foraging function and temporal separation between 40 Hz and 20 Hz calls may indicate the separation between predominately feeding behavior and other social interactions.

## Changes in Abundance, Density and Diversity of Marine Mammals in the Southern California Bight 1998–1999 vs. 2008–2010

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Twelve line-transect aerial surveys occurred during summer/fall 2008–2011 to monitor the occurrence, abundance and behavior of marine mammals in the Southern California Bight. The study area overlapped where Carretta et al. (2000) flew surveys in 1998–1999, coinciding with their "warm-water period". Density and abundance were estimated using standard line transect methods and DISTANCE software. Analyses were limited to 12,206 km flown in Beaufort 0–4 conditions and 495 marine mammal sightings of the seven most common and observed species. Blue whale densities were all well below historical estimates. Fin whales continue to be the most common and abundant large whale. Risso's dolphins have apparently dramatically increased in numbers and/or distribution over the last several decades: calculated density east of San Clemente Island (SCI) was 19.99 animals/100 km<sup>2</sup>. This is much higher than those for Carretta et al.'s warm season, but similar to those they estimated for the cold season. Our densities of common dolphins were lower than Carretta et al.'s warm-water season (318.99 animals/100 km<sup>2</sup> east of and 58.43 animals/100 km<sup>2</sup> west of SCI). However, short-beaked common dolphins were still by far the most abundant species (~29,044 individuals). Historically, Pacific white-sided dolphins were seen only in the cold-water season, but we had 26 sightings (density 19.7 individuals/100 km<sup>2</sup>) in the warm-water period. Pilot whales, though historically common, were never seen. Results indicate that recent patterns of cetacean relative abundance and presence are, in many cases, very different from historical records. This is likely related to previous exploitation and depletion of these species and long-term changes in oceanographic conditions, concomitant changes in prey distribution and densities, and anomalous El Niño and La Niña events. This study provides the only available recent estimates of abundance for marine mammal species east and west of San Clemente Island where the U.S. Navy conducts major training exercises.

# SOUTHERN CALIFORNIA MARINE MAMMAL WORKSHOP

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