

Cetaceans of the California Current System

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(Summary of the three presentations compiled by the conveners)

A diverse cetacean fauna characterizes the California Current system. Eight mysticete (baleen whale) and twenty-one odontocete (toothed whale) species regularly occur off the west coast of North America. Amongst the mysticetes, blue (*Balaenoptera musculus*) and humpback whales (*Megaptera novaeangliae*) have been the focus of intensive telemetry and photo-identification studies to characterize their movements and migrations. These species range over vast areas, and routinely travel thousands of kilometers from summer feeding areas in the California Current to distant wintering grounds at lower latitudes. However, there are no simple migratory patterns for humpback whales between the California Current and the three wintering areas. Similarly, blue whales migrate to the Costa Rica dome, Baja California and the Galapagos Islands. Moreover, researchers have identified distinct feeding aggregations along the west coast of North America, with little or no overlap between distinct regional groups. However, why certain individuals migrate to specific areas remains unknown.

In addition to these vast seasonal movements, large mysticete whales forage over large spatial scales while in the California Current. These species range over hundreds of kilometers, as they visit coastal upwelling centers off Baja, southern and central California. In spite of these far ranging movements, these predators often concentrate at specific localities. However, because these aggregations shift in space seasonally and from year to year, composite distributional maps do not reveal distinct high-density “hotspots”. Nevertheless, when distribution data are analyzed on a per survey basis, large numbers of whales regularly occur within specific areas like Monterey Bay, the Gulf of the Farallones, Point Conception, Cordell Bank, and Morro Bay, CA and Heceta Bank, OR.

The more diverse odontocete fauna is composed of species with an affinity for diverse habitats: warm offshore waters (e.g., short-beaked common dolphin, *Delphinus delphis*), cooler within shelf-slope regions (white-sided dolphin, *Lagenorhynchus obliquidens*), upwelling-modified waters along shelf-slope regions (Dall’s porpoise,

Phocoenoides dalli), bathymetrically complex regions with warm water (Risso's dolphin, *Grampus griseus*), and nearshore shelf areas with cool ocean temperatures (Harbor porpoise, *Phocoena phocoena*). Because marine mammals have distinct habitat preferences and use a variety of habitats to feed, migrate and breed, there is little overlap between the distributions of many of these species. Thus, the selection of habitats for protection will have to be prioritized on the basis of the status, ecology (e.g., distribution, movements), threats, and the feasibility of implementing effective protective measures. Conceivably, multi-species initiatives may be designed to protect "habitat guilds" subject to similar threats.

(Summary of Croll et al. presentation by Forney)

An integrated ecosystem study, conducted by Don Croll, Baldo Marinovic, Scott Benson, Jim Harvey, and Francisco Chavez in Monterey Bay since 1996, illustrates some of the physical-biological coupling mechanisms for baleen whales. Random-systematic line-transect surveys of marine mammals were conducted monthly from August to November 1996, and May to November 1997-1999. Conductivity-Temperature-Depth (CTD) casts and zooplankton net tows were conducted opportunistically and at 10 predetermined locations, and sea-surface temperature was measured continuously while underway. Underway hydroacoustic backscatter was used to estimate abundance of zooplankton, with emphasis on euphausiids, a key trophic link between primary production and higher trophic level consumers. The study identified spatial and temporal concordance between baleen whales and krill aggregations. However, a proportionally greater number of whales were present during the 1998 El Niño compared to other years. It is hypothesized that a dramatic reduction in zooplankton biomass offshore during El Niño 1997/98 led to the concentration of rorquals in the remaining productive coastal upwelling areas, including Monterey Bay. Higher densities of other species, including warm-water zooplankton, fish and dolphins at this time, support this theory.

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(Forney presentation summary)

Marine mammals in the California Current System are diverse and adapted to their dynamic environment. At least 29 species of cetaceans have been documented in California waters, including whales that migrate annually between summer feeding and winter breeding areas, temperate odontocetes, tropical odontocetes, and species associated with offshore waters. Each species is uniquely adapted to different marine processes, feeding on a variety of fish and cephalopod prey and exhibiting large interannual and seasonal variation in distribution. Few generalities can be drawn to identify broadly applicable 'hotspots'. Examples of documented species-environment patterns include the temperate Dall's porpoise, which appears tightly linked to upwelling-modified waters < 17°C along the California coast. Common dolphins exhibit the opposite pattern, with a widespread distribution in warmer waters as far north as about 42°N. Pacific white-sided dolphins are largely restricted to cooler shelf and slope waters, and Risso's dolphins are common in shelf waters and well offshore, but are conspicuously absent from slope waters. The harbor porpoise is distributed nearshore and also appears linked to cooler waters.

Without broadly important "hotspots," an alternate approach to identifying appropriate pelagic marine reserves may be to focus on specific risks to each species or region. Species and areas could be prioritized based on (1) vulnerability (influenced by population size, distribution, movements & demography), (2) the nature of threats (e.g., fishing, vessel traffic, pollution or direct harvest), and (3) the feasibility of protective measures. Coastal species (harbor porpoise, bottlenose dolphin, gray whale), depleted populations (large whales), and naturally rare species (beaked whales, pilot whales) would be potential candidates for targeted measures. Habitat 'guilds' of taxonomically diverse species exposed to similar threats may alternately provide a means of prioritizing protective measures. One example would be coastal species, such as harbor porpoise, common murre, and sea otters, which are vulnerable to gillnets and coastal oil pollution. Highly migratory, offshore species face fewer threats throughout most of their range, but can nonetheless be exposed to large impacts, such as those created by pelagic long lines, high seas driftnet fisheries (1980s), and marine debris. Such species include albatross, shearwaters, pelagic dolphins, highly migratory fishes, and sea turtles. A multi-step decision process to identify human impacts and potential protective measures can aid in planning MPAs to complement other conservation and management efforts for vulnerable species. Implementation steps should include determining species priorities, identifying important regions, outlining required measures, establishing feasibility, building inter-agency and international cooperation and collaboration, and ensuring enforcement and feedback mechanisms.

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