ABOUT THESE MAPS

Figures 4.10a, b and c show the density (animals/km^2) of northern fur seals (*Callorhinus ursinus*) in three ocean seasons: Upwelling, Oceanic, and Davidson Current, displayed in cells of 10' latitude by 10' longitude. Figure 4.10d shows the overall density combining all three seasons. Densities are based on the combined data sets of several studies conducted from 1980-2003; see Data Sources below and the Data and Analyses section of this chapter for more information. The only known rookery for northern fur seal in the study area is included on Figure 4.10d.

The color and mapping intervals were selected to show the most structure and highlight significant areas, while allowing comparisons among species. Cells that were surveyed but in which no northern fur seals were observed have a density of zero. Areas not surveyed appear white; no information is available for these areas. Dark blue lines indicate the boundaries of the National Marine Sanctuaries in the study area: Cordell Bank, Gulf of the Farallones and Monterey Bay. Bathymetric contours for the 200 meter and 2,000 meter isobaths are shown in blue.

DATA SOURCES AND METHODS

Densities for marine mammals at sea in this assessment are based on the CDAS central California data set (1980-2003), developed using software called Marine Mammal and Seabird Computer Data Analysis System (CDAS), by the R.G. Ford Consulting Co. This data set contains data from eight survey programs (five aerial surveys, three ship surveys) conducted between 1980 and 2003; the data extends from Pt. Arena to Pt. Sal in the study area. See the Data and Analyses section of this chapter for information on the at-sea survey data sets and methods used to estimate density.

Information on the northern fur seal rookery was provided in 2006, courtesy of PRBO Conservation Science and the Farallon Islands National Wildlife Refuge.

RESULTS AND DISCUSSION

Northern fur seals occur from the Okhotsk Sea and Honshu Island, Japan, the Bering Sea, and south to southern California. Within U.S. waters, two separate stocks of northern fur seals are recognized: an Eastern Pacific stock and a San Miguel Island stock (Angliss and Outlaw, 2005; Carretta *et al.,* 2006). During the breeding season, approximately 74% of the worldwide population is found on the Pribilof Islands in the southern Bering Sea; within U.S. waters and outside of the Pribilofs, approximately 1% of the population is found in the southern Bering Sea on Bogoslof Island, and on San Miguel Island off southern California (Carretta *et al.,* 2006). A small rookery recently was recently re-established at Southeast Farallon Island (see below). Rookery occupancy is characterized by males arrival in early June followed by female arrival mid-June. Males are generally at the rookery for two months; peak pupping occurs in mid-June – mid-July and lactation lasts about three to four months. The female goes to sea to feed after about one week and comes to shore to suckle her pup once a week. Molting occurs in August (Reidman, 1990).

The northern fur seal is one of the most pelagic of the pinnipeds, and during winter and early spring, is most abundant over the continental shelf and slope and deep ocean waters of mid-latitudes off western North America. Adult females and juveniles migrate to the central California study area (and Oregon and Washington) from rookeries on San Miguel Island in the southern California Bight (the San Miguel Island stock); (Carretta *et al.,* 2006), and from the Pribilof Islands (the Eastern Pacific stock) in the Bering Sea (Kajimura, 1980; Kenyon and Wilke, 1953; Pyle *et al.,* 2001; Ream *et al.,* 2005). Although both genders (adult females and juveniles) spend 7-8 months at sea (Roppel, 1984; Ream *et al.,* 2005), adult males remain closer to the breeding colonies (Kajimura, 1984; Loughlin *et al.,* 1999; Ream *et al.,* 2005). During their winter migration, female northern fur seals from the Pribilof Islands cue on a variety of oceanographic features and travel south in the California Current off Canada, British Columbia, Washington, and Oregon, and arrive off California beginning in February (Ream *et al.,* 2005).

In the CDAS data used for the marine mammal assessment (1980-2003), the northern fur seal was the second most abundant pinniped observed (total number sightings: n=1,474; total number individuals: n=2,088; maximum group size: n=26). In the study area, mapping results revealed distinct spatial/temporal patterns that reflect the pelagic

nature of the northern fur seal; greatest densities occurred in deep ocean habitats, mostly to the west of the National Marine Sanctuary boundaries, in the shelf-break, slope, and deep ocean habitats. The distinctly seasonal presence of this species in the study area is clearly evident in the maps: greatest densities occurred during the non-breeding period when animals migrate to the study area (Davidson Current [Nov-Mar] 0.17 animals/km^2) and remain until the early months of the Upwelling season [Mar-Aug] 0.10 animals/km^2). Lesser densities (0.04 animals/km^2) occurred during the Oceanic Season (Aug-Nov) and coincided with a time period when the largest abundance of breeding fur seals is found on the Pribilof Islands, and where 72% of the total numbers of seals have been estimated to congregate (Loughlin *et al.,* 1994).

Except for severe declines in 1983 and 1998 associated with El Niño Southern Oscillation events (ENSO), the San Miguel population off southern California has increased steadily since its discovery in 1968 (Carretta *et al.,* 2006). Severe declines associated with periods of unusually warm ocean conditions (e.g., ENSO) affect pup production and mortality rates at San Miguel Island and at the Pribilof Islands (DeLong and Antonelis, 1991; Allen, 1994; DeLong and Melin, 1999; Melin and DeLong, 2000; Keiper, 2001; and Keiper *et al.,* 2005). In the early 19th century, American, British, and Russian sealers removed the breeding population from the Southeast Farallon Islands (Pyle *et al.,* 2001). Beginning in 1996, however, the species has re-established a breeding population on the Southeast Farallon Island, and although fewer than 10 pups were produced each year (1997-2001), (Pyle *et al.,* 2001) recent counts (2006) indicate the numbers of northern fur seals on the Farallon Islands appear to be increasing (PRBO, unpublished data). Fur seal recovery on the Farallones appears to be in the initial stages of exponential growth; emigration is from San Miguel (Sydeman, pers. comm., 2006).

Status of the San Miguel Island northern fur seal stock is not considered to be "depleted" or listed as "threatened" or "endangered"; furthermore, because the estimated annual level of total human-caused mortality and serious injury does not exceed the potential biological removal (PBR), the San Miguel Island stock of northern fur seals is not classified as a "strategic" stock (Carretta *et al.,* 2006). Human-related sources of mortality of this stock include: takes of northern fur seals by commercial fisheries; strandings of seals entangled in fishing gear; and injuries caused by interactions with gear. Carretta *et al.,* (2006) reported the estimated mean mortality rate from 2000-2004 in observed fisheries and fisher self reports was zero northern fur seals per year for the San Miguel stock, but this number is considered a minimum mortality estimate. Estimated mortality from 2000-2004 for fishery-related strandings was 1.0 animal per year from the San Miguel stock. The most recent population estimate (2005) for the San Miguel Island northern fur seal stock is 9,424 animals (Carretta *et al.,* 2006).

The eastern Pacific stock of northern fur seals is considered separate from the San Miguel stock. The status of the Eastern Pacific stock of northern fur seals is considered "strategic" because it is "depleted"; the current (2006) population estimate is 721,935 animals, less than 50% of the estimate observed in the late 1950's - 1.8 million animals (Angliss and Outlaw, 2006). From 1998-2004, pup production declined 6.2% per year on St. Paul island, and 4.5% on St. George Island. Human-related sources of mortality for the Eastern Pacific stock include commercial groundfish trawl fisheries in the North Pacific and foreign high-seas driftnet fisheries, however, estimated mortality rates from these fisheries are thought to be minimal. Other sources of mortality include illegal shooting, subsistence harvest and entanglement. A conservation plan for the Eastern Pacific stock of northern fur seal is being developed by NMFS to address levels of impacts and habitat concerns (Angliss and Outlaw, 2007).

Northern fur seals feed on a great diversity of seasonally abundant prey; off California the primary prey species include Pacific hake, northern anchovy, mesopelagic fishes, and market squid (Kajimura, 1984; Riedman, 1990).