## ABOUT THESE MAPS

Maps a, b and c show the at-sea density (birds/km$^2$) of Red-necked Phalarope (*Phalaropus lobatus*) in three ocean seasons – Upwelling, Oceanic, and Davidson Current, displayed in cells of 5' latitude by 5' longitude. Densities are based on the combined data sets of several studies; see the Data and Analyses section of this chapter.

To provide an integrated look at the patterns of a species' spatial and temporal occurrence and abundance in the study area, map d shows seasonal high-use areas, displayed in cells of 10' latitude by 10' longitude, and also breeding colonies (when available). The seasonal high use map provides a further synthesis of densities presented in maps a, b and c, and portrays the relative importance of various areas to the species. Areas with consistently high use are highlighted. See the Data and Analyses section of this chapter for further explanation of high-use areas.

The color and mapping intervals were selected to show the most structure and highlight significant areas, while allowing comparisons among marine bird species. Cells that were surveyed but in which no Red-necked Phalaropes were observed have a density of zero. Areas not surveyed appear white; no information was available for these areas. 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 m and 2,000 m isobaths are shown in light blue.

## DATA SOURCES AND METHODS

The at-sea data set is referred to as the CDAS central California data set (1980-2001) and was developed using software called Marine Mammal and Seabird Computer Data Analysis System (CDAS), by the R.G. Ford Consulting Co. The data set extends from Pt. Arena to Pt. Sal in the study area, and the surveys used were conducted between 1980 and 2001. See the Data and Analyses section of this chapter for more information on the at-sea survey data sets and methods.

## RESULTS AND DISCUSSION

The Red-necked Phalarope, like the Red Phalarope, occurs commonly in the study area during southward and northward migrations that take them between nesting areas on the Arctic tundra and wintering areas in waters off South and Central America. On surveys in CDAS, when the two phalarope species were differentiated, 782 sightings of 7,670 Red-necked Phalaropes were recorded. Their migrations took place mainly during the early and late Upwelling Season (when they were most abundant). Thus, their time in the Arctic was relatively short. The Red-necked Phalarope, occurring principally over the continental shelf, was concentrated farther inshore than the Red Phalarope. This is best seen in central California where, on boat surveys, the two species could be differentiated; on aerial surveys, which spanned the entire coast, they were not. During the Oceanic Season occurrence was scattered, and the species was almost absent during the Davidson Current Season.

A multiple regression model of nine independent variables in CDAS for both Red and Red-necked Phalaropes (grouped together for regression analysis) explained only 9.6% of the variation in cell density; see Table 3.8. This was a relatively low value given their abundance. Perhaps this was due to the differences in habitat use by the two species, thus masking the effect of environmental variables in the analysis; grouping the two species for the analysis, as well as the fact that both were rapidly moving through the study area, likely homogenized habitat preferences. Important variables for these species were ENSO (more abundant during La Niña), and negative relationships with ocean depth (indicating association with the mid-slope waters for both; mean depth 941 m) and distance from land (mean distance 27.7 km). Within the study area, abundance of these species has remained stable between 1985 and 2002.

These species feed on small invertebrates and fish eggs concentrated at the surface especially along convergence lines. See Tables 3.5, 3.8, 3.9, 3.10 and 3.11 for related summary information.