

ABOUT THESE MAPS

Maps a, b and c show the combined at-sea densities (birds/km²) of Western Grebe (*Aechmophorus occidentalis*) and Clark's Grebe (*A. clarkii*) 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. 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 Western or Clark's grebes 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.

In order 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.

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

Individuals of Western and Clark's grebes are separable by plumage, but share the same ecological niche; they are abundant in the nearshore waters of the study area. Surveys in CDAS tallied

2,511 sightings of 13,526 individuals. During most oil spills in this region, these species have been near the top of the list, by number, of oiled birds. These birds breed inland at freshwater lakes and marshes (e.g., Clear Lake, Lake County; reservoirs in Santa Clara County).

A multiple regression model of nine independent variables explained 15.5% of variation in cell density; most important variables were season, and an inverse relationship with distance to land and to depth; see Table 3.8. These results reflect the large number of grebes occurring primarily during the Oceanic Season, in shallow waters (mean depth 42 ± 11 m), and within a few kilometers of shore (mean distance to land 7.4 ± 1 km). Moderate numbers are present during the Upwelling and Davidson Current seasons. During the latter, these grebes expanded farther offshore to the middle continental shelf (mean depth of occurrence 79 ± 24 m), mainly in association with the San Francisco Bay tidal plume.

Inshore waters of the Gulf of the Farallones (tidal plume area), Monterey Bay, and Estero/San Luis Obispo bays had particularly high concentrations of these birds. North and south of National Marine Sanctuary boundaries in the study area, these species were observed mostly at isolated river mouths. Therefore, the sanctuary boundaries encompass the majority of the species' habitat in the study area, except for the 'sanctuary exclusion area', off San Francisco and Pacifica, which contained many grebes. The broad continental shelf off central California is ideal for these grebes, which capture prey by diving; it is likely they are capable of exploiting most of the water column lying over the shelf, in spite of their inshore occurrence. Abundance of this species-pair remained stable between 1985 and 2002.

These grebes feed mainly on fish, such as surf-perch, anchovy, smelt and herring, which are also abundant in these shallow, nearshore waters. See Tables 3.5, 3.8, 3.9, 3.10 and 3.11 for related summary information.