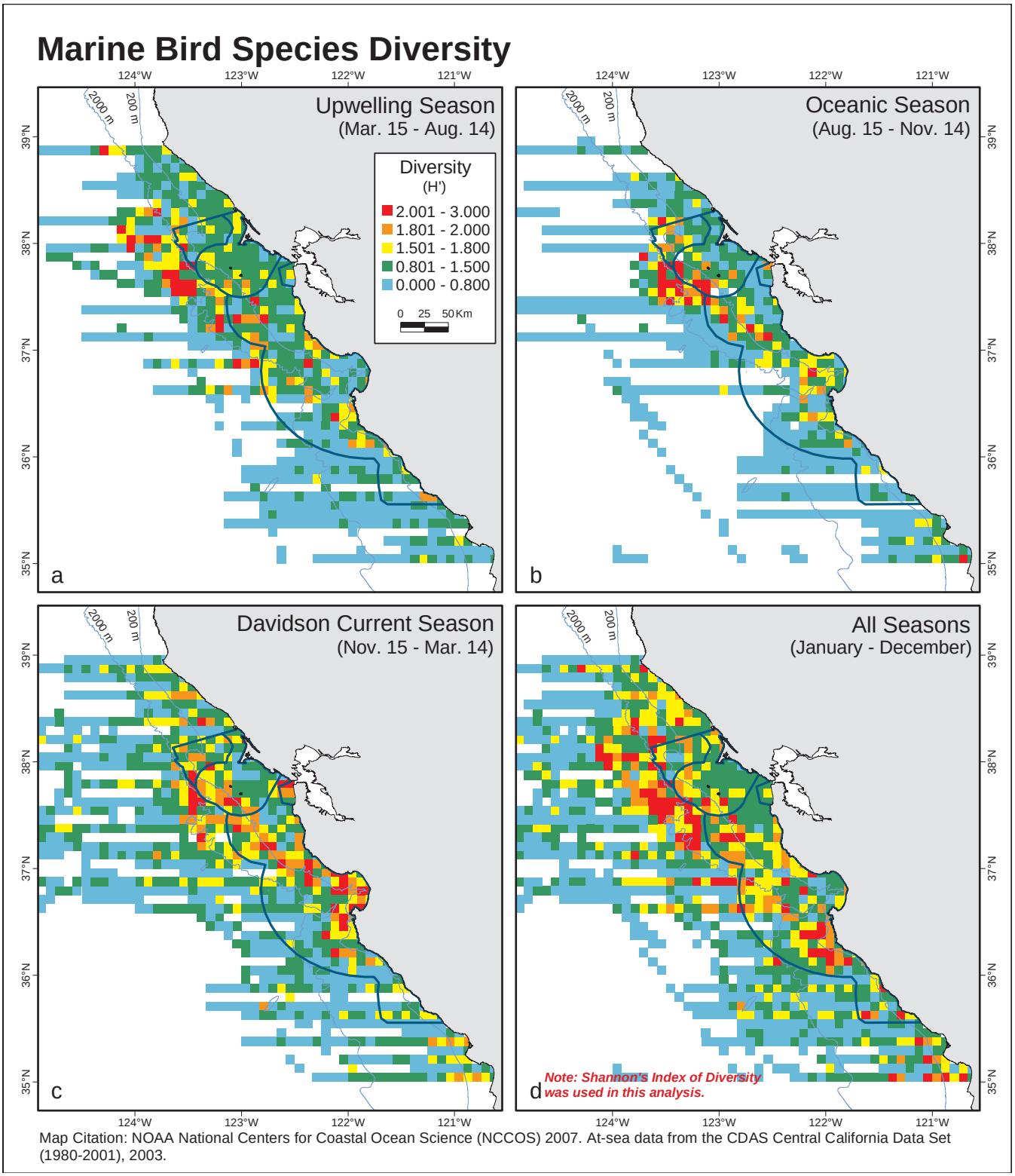

Map Citation: NOAA National Centers for Coastal Ocean Science (NCCOS) 2007. At-sea data from the CDAS Central California Data Set (1980-2001), 2003.

Figure 3.41. Marine bird diversity, by season and for all seasons.

ABOUT THESE MAPS

Maps a, b and c show the diversity of marine birds at sea, based on data from 76 species in the Upwelling, Oceanic, and Davidson Current seasons, displayed in 5' latitude by 5' longitude cells. Map d shows diversity for all seasons and years combined. Species diversity was calculated using density as variable in the Shannon Index of diversity (Shannon and Weaver 1949). All 76 marine bird species that had been recorded in the data set and study area were included in the analysis. This diversity index (H') measures the degree to which a species assemblage is dominated by a few species. If a cell contains high densities of a few species and low densities of all others, the value of H' will be low, indicating low diversity. Alternatively, if many species are present at similar densities, the value will be high, indicating high diversity.

Diversity index values were based on the combined data 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. Cells are colored based on the value of H' computed for a particular ocean season, or for map d, all seasons. Red indicates high diversity, blue indicates low diversity. Cells that were surveyed but in which no birds were observed have a diversity 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.

The Shannon Index was selected as the diversity metric; see the Data and Analyses section of this chapter for information on the at-sea survey data sets, data synthesis, and analysis methods used. Species diversity was estimated for the three oceanographic seasons and all seasons using CDAS data from 1980-2001.

RESULTS AND DISCUSSION

In the summary of all seasons from 1980-2001 (map d), the marine avifauna was most diverse in areas largely outside of National Marine Sanctuary boundaries, especially in areas over the continental slope and particularly the Farallon Escarpment. Localized areas of high diversity occurred within sanctuary boundaries, and included: Pioneer, Ascension/Cabrillo, and Carmel canyons, as well as the continental slope off Point Sur.

During the Upwelling Season (spring/summer), the avifauna was the least diverse; areas of highest diversity in this season included waters over the Farallon Escarpment, and Pioneer, Ascension, and Carmel canyons. This is the season when the avifauna is dominated by locally breeding species and Sooty and Pink-footed Shearwater, with many wintering species gone to their more northern breeding locations.

During the Oceanic Season (fall), diversity was comparable to that of the Upwelling Season in general. Areas of high diversity continued to include the Farallon Escarpment area, Pioneer Canyon and inner Monterey Bay Canyon. During this season, some breeding species or major portions of their populations have departed (e.g., various alcids), while other species have come to the region from locations elsewhere (e.g., Elegant Tern, California Brown Pelican).

During the Davidson Current Season (winter), marine bird diversity, in general, was the highest of the year. Areas of high diversity were all localized, and most occurred over the continental slope (e.g., Farallon Escarpment, and Pioneer, Ascension, Monterey Bay and Carmel canyons) but some also occurred over the shelf (e.g., the inner San Francisco Bay tidal plume and inner portions of Monterey Bay). Many species of birds, breeding elsewhere, have come to the region at this time of the year. Here, food is abundant and weather is more benign than farther north. See related Tables 3.5 and 3.6.