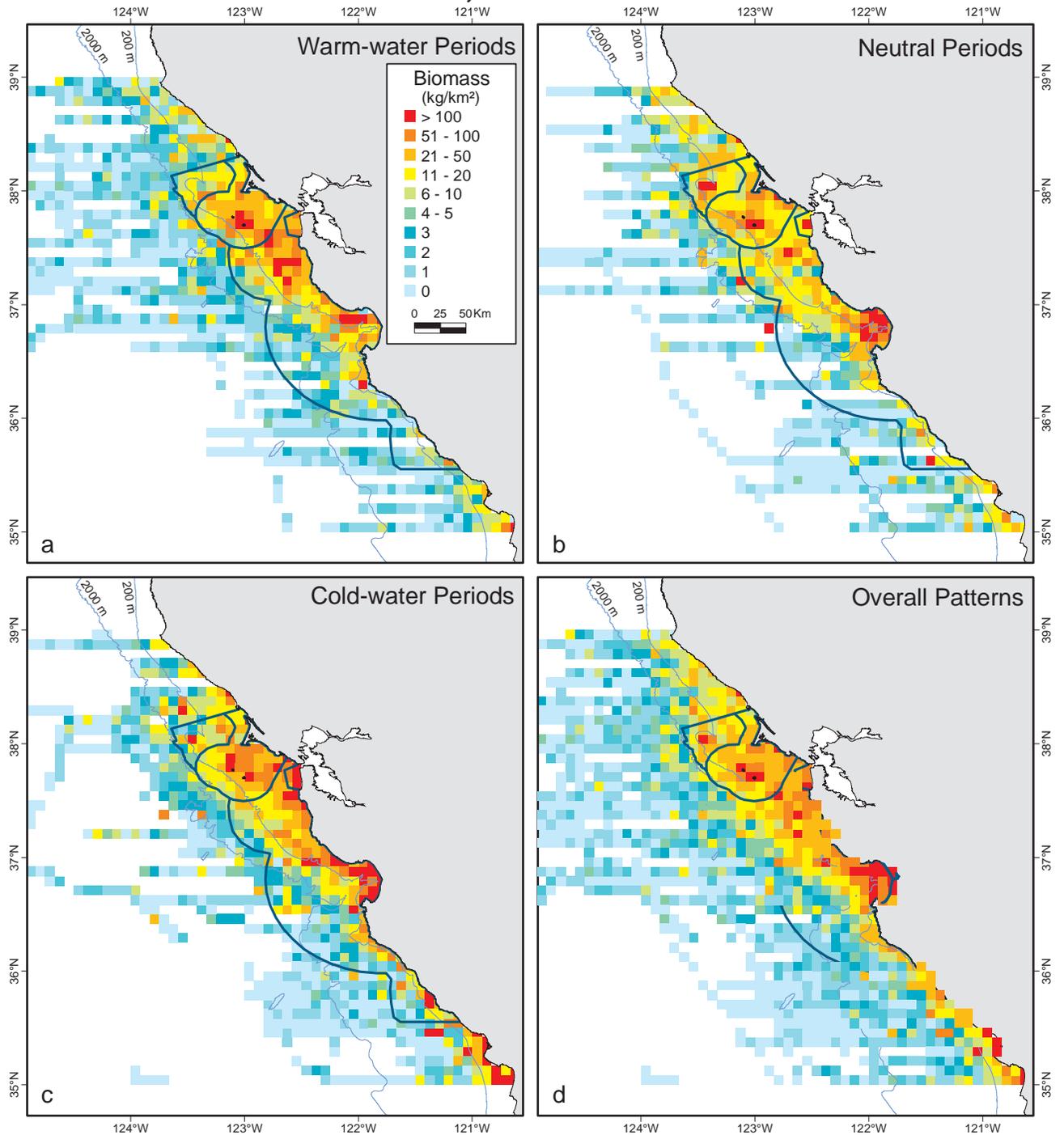


### Marine Bird Biomass in Warm, Cool and Neutral Periods: 1980-2001



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 3.44. Marine bird biomass in warm, cold and neutral periods: 1980-2001.

### ABOUT THESE MAPS

These four maps show a comparison of the biomass density (birds/km<sup>2</sup>) of 76 species of marine birds at sea during: warm-water periods (e.g., El Niño, map a); typical or neutral temperature periods (map b); cold-water periods (e.g., La Niña, map c); and overall biomass density, from 1980-2001 (map d). The information was analyzed and displayed in 5' latitude by 5' longitude cells. These analyses provide an example of how marine birds may respond to short-term excursions from the usual marine climate. For a description of how these periods were chosen, see the following topic in this chapter: "Response to Variation in Marine Climate".

The color and mapping intervals were selected to show the most structure and highlight significant areas. Cells that were surveyed but in which no birds were observed have a density of zero; areas not surveyed are shown in white. Blue lines indicate the National Marine Sanctuary boundaries of Cordell Bank, Gulf of the Farallones, and Monterey Bay; bathymetric contours for the 200 m and 2,000 m isobaths are also 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 used for estimating density and biomass.

Calculating Marine Bird Biomass Density for Different Temperature Periods. For each species that occurred in a cell, the average density was multiplied by a species' body mass (from Dunning, 1993); see Appendix 2. In a few instances, a species was not listed in this reference; in these cases, the mass of a closely-related bird of a similar size was used. This resulted in an estimate of biomass for that species. The biomass of all species in each cell was then summed to give the cell biomass. Once the selection of data were made for each analysis period (i.e., warm, neutral or cold), the density of all

species seen within respective cells during those periods was summed for that cell.

Marine bird density data was organized into periods when surface ocean conditions were warm (including El Niño), cold (including La Niña) or neither (neutral). The data for each condition map was grouped as shown below; these groupings were based on the assignments made in Table 3.4.

For the warm-water conditions (including El Niño) map, the following seasons and years were used: Davidson Current Season - 1981, 1983, 1984, 1992, 1993, 1994, 1996, and 1998; Upwelling Season - 1985, 1987, 1992, 1993, 1995, and 1998; and Oceanic Season - 1983 and 1997. For the "neutral" conditions map, the following seasons and years were used: Davidson Current Season - 1982, 1986, 1995, and 1997; Upwelling Season - 1980, 1982, 1986, 1988, 1989, 1994, 1996, and 1997; and Oceanic Season - 1982, 1991, and 1995. For the cold-water conditions (including La Niñas) map, the following seasons and years were used: Davidson Current Season - 1985, 1991, 1999, 2000, 2001, and 2002; Upwelling Season - 1981, 1990, 1991, 1999, 2000, and 2001; and the Oceanic Season - 1980, 1981, 1994, 1996, 1998, 1999, 2000, and 2001.

### RESULTS AND DISCUSSION

There was slightly more difference in biomass than was observed for the analogous comparison of density. Biomass was generally more concentrated during warm and cold conditions than during neutral conditions, especially cold-water periods that were mimicked by the overall patterns (all seasons) summary. Many inner-shelf habitat areas exhibited high marine bird biomass during cold-water periods. The Farallon Ridge and Monterey Bay had relatively high biomass under all conditions.

Marine bird biomass in this analysis is generally dominated by two relatively heavy-bodied, numerically dominant species - Common Murre and Sooty Shearwater, and to a lesser degree by the species identified as abundant in the study area (see Table 3.11). The National Marine Sanctuaries in the study area encompass a major portion of the biomass density of marine birds in the study area.