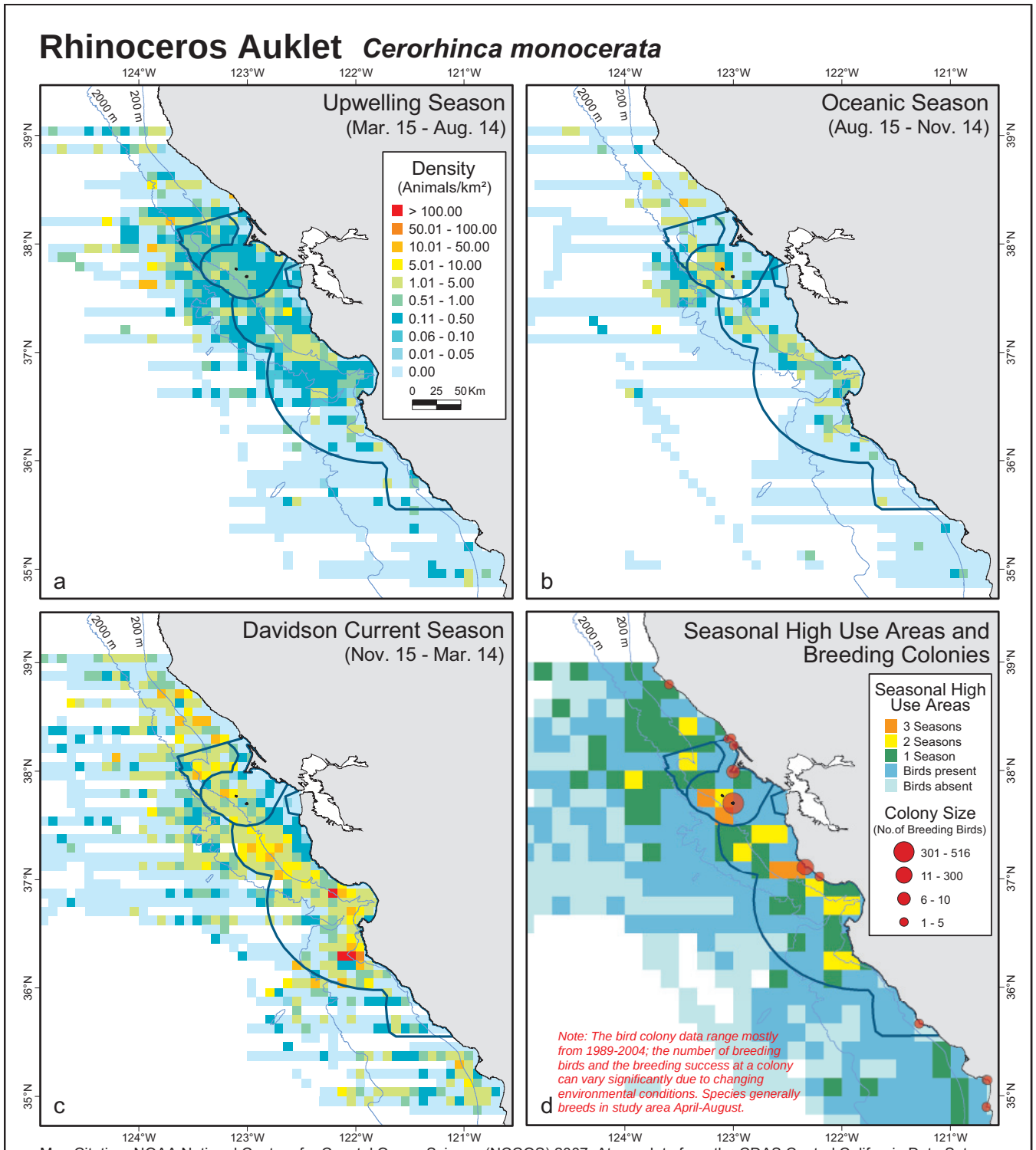

Figure 3.35. Rhinoceros Auklet: maps of seasonal density, high use areas, and breeding colonies.

ABOUT THESE MAPS

Maps a, b and c show the at-sea density (birds/km^2) of Rhinoceros Auklet (*Cerorhinca monocerata*) 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 Rhinoceros Auklets 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.

Data on colony sizes were obtained primarily from Carter *et al.,* (1992), Thayer and Sydeman (2002a,b), Warzybok *et al.*, (2002), McChesney *et al.,* (2000), and G.J. McChesney (pers.comm). Because this species nests in burrows and crevices and is active only at night and crepuscular periods, estimating breeding population size is difficult. Depending on the colony, estimates have been based on counts of nest burrows, birds counted on the water adjacent to nesting areas, or birds counted flying into colonies at dusk.

RESULTS AND DISCUSSION

In the study area, this species nests principally at the South Farallon Islands, with smaller nesting populations at Año Nuevo Island and several other sites (see Appendix 1A). At-sea surveys in CDAS recorded 5,415 sightings of 15,454 individuals. Based on the analysis of the combined data sets described in this section, the abundance of Rhinoceros Auklets has increased significantly since the 1970s (Ainley *et al*., 1994). Based on patterns apparent in the maps, the current at-sea population probably far exceeds the nesting population in central California (Michelle Hester, pers. comm.). Therefore, if there was more nesting habitat (e.g., burrows, holes, crevices on offshore islands), the nesting population would probably be much larger.

In the CDAS central California data set, Rhinoceros Auklets occurred principally in waters overlying the slope (mean depth where the species occurred was 762 ± 22 m), particularly over the shelf break, and including the Farallon Escarpment. A sizeable proportion of the population occurs outside of the National Marine Sanctuary boundaries. This is especially true in the vicinity of the Gulf of the Farallones during the Upwelling (nesting) and Oceanic seasons, when these auklets occur farther offshore (mean depths 791 m and 1,370 m, respectively). This expansion of habitat, causing a 'halo' of increased density around the islands, may be a response to the large numbers nesting at the Farallones, a pattern exhibited by the Western Gull and Common Murre as well (see those map discussions). The species' concentration, especially along the shelf break and upper continental slope, is particularly evident during the Oceanic Season, at which time the nesting populations are no longer associated with colonies. Rhinocereos Auklet occurred in the study area during all three ocean seasons.

A multiple-regression model of nine independent variables in the CDAS data set explained 19.8% of variation in cell density; important variables were a negative relationship to distance to land, and positive ones to season and ocean depth; see Table 3.8. The relationship with season reflected a dramatic increase in abundance during the Davidson Current Season (mean density of 161 birds per 100 km^2) compared to the Upwelling and Oceanic seasons (mean densities of 48 and 62 birds per 100 km^2, respectively). This increase during the Davidson Current Season was likely due to an influx of birds from the north where much larger populations breed compared to those of the study area.

Rhinoceros Auklets recolonized the South Farallon Islands in the early 1970s after nearly a century of absence (Ainley and Boekelheide, 1990). Since then, numbers on the islands have increased and other colonies have been founded. These auklets now nest south to the northern Channel Islands off southern California (Carter *et al*., 1992).

Rhinoceros Auklets feed by diving, probably to relatively deep depths (100 m; Ainley and Boekelheide, 1990), capturing mostly fish but also euphausiids. Important prey include juvenile rockfish, anchovy and saury. See Tables 3.5 - 3.11 for related summary information.