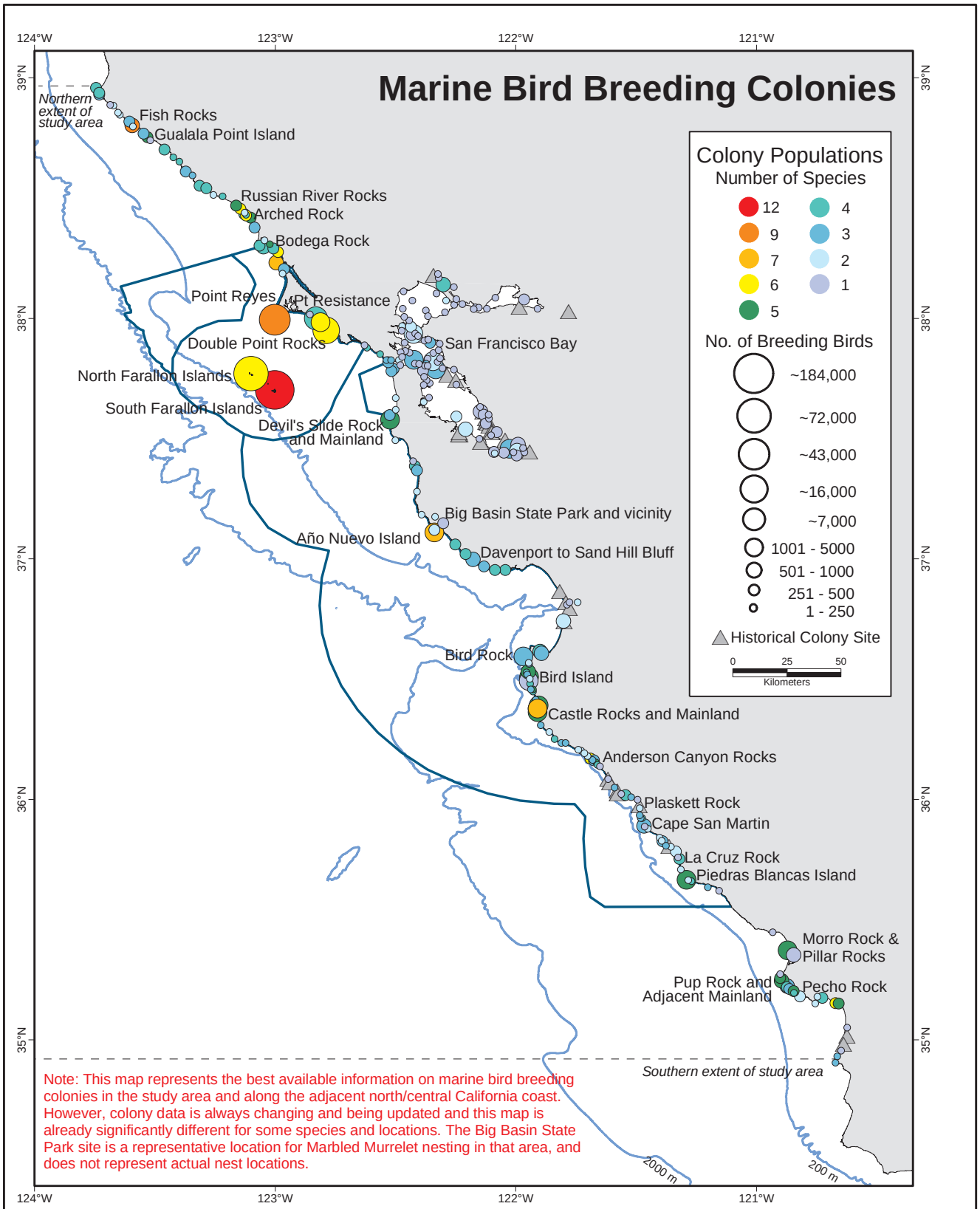

Figure 3.42. Marine bird breeding colonies along the coast of north/central California.

ABOUT THIS MAP

This map shows the locations and relative sizes of all known marine bird breeding colonies within the study area, based on best available information. The total number of breeding birds of all marine bird species is indicated by the size of the circle, while the number of species using a particular colony is indicated by the circle color. Table 3.7 shows the top 50 largest colonies of breeding marine birds in the study area, and Appendix 1A and 1B contains information on all breeding bird colonies in the study area.

DATA SOURCES

Data on marine bird colonies were derived primarily from "Breeding Populations of Seabirds in California, 1989-1991" (Carter *et al.,* 1992, unpublished data). Colony data were updated where more current information was available. Data citations are provided in Appendix 1A and the full references are at the end of the bird chapter, and include the following references: Capitolo *et al.,* (2006); McChesney *et al.,* (2005); Capitolo *et al.,* (2004a, b); Thayer and Sydeman (2002 a, b); Warzybok *et al.,* (2002); Whitworth *et al.,* (2002) and Sydeman *et al*., (1998). Personal communications were provided by Steve Hampton (CDFG), Gerry McChesney (USFWS), and Bill Sydeman (PRBO Conservation Science).

METHODS

Colony locations were plotted using latitude and longitude. Colonies were surveyed using a variety of methods, including boat, ground, and aerial photographic surveys. Data collected by Carter *et al*., (1992) were part of a broad-scale survey of all seabird colonies in California. Colonies on the outer coast were surveyed in 1989 and San Francisco Bay colonies were surveyed in 1990. For the South Farallon Islands, data for all species except Brandt's Cormorant, Double-crested Cormorant, and Common Murre were provided by Point Reyes Bird Observatory or other published sources. Data for most tern colonies and certain other colonies in San Francisco were provided by San Francisco Bay Bird Observatory or other sources.

In Carter *et al*., (1992), population estimates for most species were derived from raw nest or bird counts adjusted with a correction factor. Some colony estimates include correction factors; these factors are used to improve estimates for nests or breeding birds that are present during the season, but not present on the day or time of the survey. Correction factors are also used to estimate certain colony sizes for species that nest in burrows and crevices (e.g., storm-petrels, auklets and puffins). These correction factors adjust counts based on typical occupancy rates of burrows or crevices, since not all available sites are used each season. More recent population estimates are based on a variety of methods. Recent estimates for most colonies of Brandt's Cormorants, Double-crested Cormorants, and Common Murres are from annual photographic surveys conducted by the U.S. Fish and Wildlife Service (USFWS), in cooperation with Humboldt State University (HSU), California Department of Fish and Game, and others (Capitolo *et al*., 2004a, b, 2006; McChesney *et al.,* 2005). For the cormorants, raw nest counts were multiplied by two to account for both members of each breeding pair. For Common Murre, raw bird counts were adjusted by a k correction factor of 1.67 to account for pair members not present and nonbreeders present during the survey. Estimates for other species at the South Farallon Islands and Año Nuevo Island are from annual seabird monitoring by PRBO Conservation Science. More recent data from Devil's Slide Rock and Mainland are from annual monitoring conducted by USFWS and HSU. Other estimates are from various other studies and monitoring programs.

RESULTS AND DISCUSSION

The study area is in a geologic subduction zone of the eastern Pacific and adjacent continental margin. Therefore, as with analogous regions elsewhere on the globe (e.g., west coasts of South America and Africa), large islands are not common. Obvious in this map is the importance of the Gulf of the Farallones to breeding marine birds. The Gulf of the Farallones is defined as the broad shelf from Point Reyes/Tomales Point to Año Nuevo and out to the Farallon Islands. The largest colonies and majority of the breeding seabirds within the study area nest in this region.

See Appendix 1A for a numerical summary of each species' and colony's contribution to the breeding marine (and some estuarine) avifauna of the study area, composed of 16 species 12 of which breed within the Gulf of the Farallones. Appendices 1A and 1B contain all available information for all breeding

bird colonies in the study area. Available colony data for the following 16 bird species were mapped: Leach's Storm-Petrel, Ashy Storm-Petrel, Brandt's Cormorant, Double-crested Cormorant, Pelagic Cormorant, Black Oystercatcher, California Gull, Western Gull, Caspian Tern, Forster's Tern, Least tern, Common Murre, Pigeon Guillemot, Cassin's Auklet, Rhinoceros Auklet and Tufted Puffin. Table 3.7 shows the top 50 marine bird colonies based on size. In this analysis, the following three colonies accounted for approximately 77% of the total number of breeding marine birds estimated in the study area: South Farallon Islands (~48%), North Farallon Islands (~19%) and Point Reyes (~11%). These colonies are large and relatively diverse owing to the high productivity of surrounding waters and large amount of "land-predator free" breeding habitat available. Several other colonies, or colony complexes (collection of "colonies" within close association to one another), on the outer coast are important overall and on a local basis. These colonies are important numerically and, in many cases, for the diversity of seabird species they harbor. Examples include: Fish Rocks, Gualala Point Island, Russian River Rocks, Arched Rock-Gull Rock complex, Bodega Rock, Point Resistance-Double Point complex (including Point Resistance, Miller's Point Rocks and Double Point Rocks), Devil's Slide Rock and Mainland, Año Nuevo Island, colonies within and near Point Lobos State Reserve (Bird Rock [Monterey County]), Guillemot Island, Pinnacle Point, Bird Island, Yankee Point), Castle-Hurricane complex (Bench Mark-227X, Castle Rocks and Mainland, Hurricane Point Rocks), Cape San Martin, Piedras Blancas Island, Morro and Pillar Rocks, and the Point Buchon/Diablo Canyon area (Point Buchon, Unnamed Rocks, Lion Rock, Pup Rock and Adjacent Mainland, Diablo Rock and Adjacent Mainland, Diablo Canyon Nuclear Power Plant South).

Based on the number of marine bird species (species richness) at each colony, the top six colonies in the study area are: South Farallon Islands (12 species), Fish Rocks and Point Reyes (9 species each), Bird Rock (Marin County), Año Nuevo Island, Castle Rocks and Mainland (with seven species each). Species richness at these colonies is a function of: size and diversity of nesting habitats, proximity to a good food supply, site disturbance, and predation.

For both numbers of breeding birds (184,442) and diversity (12 species), the South Farallon Islands is the most important seabird breeding colony in the study area and one of the largest in the 48 contiguous United States. Because of their importance to seabirds and marine mammals, the Farallon Islands are protected by the USFWS as a national wildlife refuge.

The South Farallon Islands' importance stems from: their size (ca. 100 acres), a variety of breeding habitats, a diversity of nearby, marine foraging areas with abundant prey resources, lack of land-based predators, and protection from human disturbance. The world's largest known colonies of three species occur at South Farallon Islands: Ashy Storm-Petrel, Brandt's Cormorant, and Western Gull. In addition, the South Farallon colonies of Leach's Storm-Petrel, Common Murre, Cassin's Auklet, Rhinoceros Auklet and Tufted Puffin are the largest in the study area for each of those species.

Beyond the Gulf of the Farallones, most colonies contain fewer than 3,000 breeding birds and fewer than five species. However, nearly the entire coastal zone is dotted with these small colonies, making the whole study area important for breeding seabirds.

The Common Murre is the most abundant breeding seabird in the study area, with an estimated population of 269,720 birds. However, 98% of the population occurs within the Gulf of the Farallones. Other species that are numerically dominant include Brandt's Cormorant, Western Gull, Pigeon Guillemot and Cassin's Auklet.

Within the study area but outside the Gulf of the Farallones, Brandt's Cormorant is the most abundant breeding seabird. Many of the largest seabird colonies within the study area are comprised mainly of this species. However, annual aerial surveys for this species have shown some "colonies" to be highly mobile, with birds switching between nearby colony sites over annual and possibly decadal scales (i.e., some colonies decrease in size and neighboring ones increase in size). Because of this, single year surveys do not necessarily portray all important colonies.

Within the San Francisco Bay estuary, species composition is different from the outer coast. Within

the Bay, the predominant species are Double-crested Cormorant, California Gull, Western Gull, Caspian Tern, and Forster's Tern. Among these, only the Double-crested Cormorant, Western Gull and Caspian Tern breed on the outer coast. Habitats within San Francisco Bay are highly altered. Most colonies are on such habitats as salt pond levees and islands, bridges, breakwaters, and old buildings. The colonies of Double-crested Cormorant, Caspian Tern, and Forster's Tern are among the largest in California. The colony of endangered Least Terns at the former Alameda Naval Air Station is the largest for that species in the study area.

For species or colonies other than those surveyed regularly, most colonies have not been surveyed systematically since 1989 or 1990. Although species composition has likely remained mostly the same at most locations, changes in numbers of birds have almost certainly occurred; these changes can be discerned from colonies where surveys have continued and data are available. For example, Common Murres in central California have increased dramatically since 1989, recovering from drastic declines in the early 1800s and again in the early 1980s (Ainley and Lewis, 1974; Carter *et al*., 2001; USFWS, unpubl. data). Brandt's Cormorants within the nearshore zone of the Gulf of the Farallones have increased dramatically since the mid-1990s (USFWS, unpubl. data). Alternatively, Cassin's Auklets declined through the 1980s and 1990s, likely due to interdecadal climate changes that reduced availability of their favorite prey, euphausiids (Pyle, 2001; Abraham and Sydeman, 2004). The decline may also be influenced by local increases in trophic competitors, such as the blue and humpback whales. Other bird species, such as Pelagic Cormorant, also may be in decline due to climate and prey changes.

In San Francisco Bay, changes have been dramatic for certain species; colonies have come and gone. For example, Caspian Terns have abandoned some colony sites, such as the formerly large Alameda Naval Air Station, and moved to others. California Gulls have vastly increased since 1989 (Strong *et al*., 2004). An additional species, the Black Skimmer (*Rynchops niger*), recently extended it's breeding range north into San Francisco Bay (Ainley and Divoky, 2001).

Seabirds are sensitive to disturbance and predation, and have evolved the strategy to breed on islands and steep mainland cliffs for protection. Current threats to seabirds include human disturbance, such as from low-flying aircraft, boats, and humans approaching colonies too closely. Low-flying aircraft and fishing boats have been the primary source of human disturbance to Common Murres and Brandt's Cormorants at monitored central California colonies (USFWS, unpubl. data). Colonies of burrow-nesting species are susceptible to trampling of this unstable habitat. Certain fisheries interactions have resulted in high mortality for seabirds. Diving seabirds are particularly susceptible, as they get captured and drowned in nets or hooks of long-lines. Oil spills also have killed thousands of seabirds in this area in recent years. In central California, Common Murres tend to be impacted from oil spills and fisheries interactions more than any other species. The central California murre population declined about 50% in the early 1980s from mortality in set gill-nets and oil spills (Takekawa *et al*., 1990, Carter *et al*., 2001). Seabirds may also be susceptible to overfishing of important prey resources, such as anchovy, sardine, rockfish, squid and krill. Bright artificial lights that illuminate colonies, such as from boats and cities, may cause distress and abandonment of nests. Like moths, nocturnal seabirds (e.g., storm-petrels, Cassin's Auklet) are notorious for their attraction to artificial lights, which can cause disorientation and collisions with boats or other structures.

Increasing numbers of predators is also a concern. In recent years, Common Ravens (*Corvus corax*) have increased and expanded their range dramatically along the central California coast (Kelly and Etienne, 2002; USFWS, unpubl. data). These nest predators have been observed causing many disturbances and nest predation in coastal Common Murre colonies; this has led to abandonment of some murre nesting areas (USFWS, unpubl. data.). In San Francisco Bay, rapidly increasing numbers of California Gulls may be cause for concern, as these birds may out-compete the small tern species and raise predation levels of several waterbirds (Strong *et al.,* 2004). Increases of both ravens and California Gulls are believed to be anthropogenic in origin, as these birds feed extensively on human refuse.