Chapter 3

Seabird Breeding Population Sizes Within the North Central Coast Study Region of the California Marine Life Protection Act Initiative, 2010-2012

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EXECUTIVE SUMMARY

Baseline breeding population estimates of seabirds at colonies in the North Central Coast Study Region (NCCSR; Point Arena to Pigeon Point) of California's Marine Life Protection Act (MLPA) Initiative were derived mainly from surveys conducted in 2010-2012 for long-term assessment of the benefits of Marine Protected Areas (MPAs) established in 2010. In addition, 2010-2012 data provide an update of breeding seabird populations in the NCCSR since 1989. Surveys in 2010-2012 included a combination of boat, land, and aerial methods, with most surveys conducted in 2011. A total of 507,262 breeding birds of 13 species were estimated at 68 active colonies. By far the largest breeding colony was at the South Farallon Islands, with an estimated 328,592 breeding birds including all 13 species. The next largest colonies were at the North Farallon Islands (91,483 birds), Point Reyes Headlands (56,428 birds), Double Point Rocks (13,669 birds), and Point Resistance (6,726 birds). The most widely distributed species were Western Gull (51 colonies), Black Oystercatcher (50 colonies), and Pelagic Cormorant (48 colonies). We also compared seabird abundance between the three subregions identified by the NCCSR Scientific Advisory Team: North, South, and Farallon. The Farallon subregion held the majority of nesting birds (83%), with 16% and 1% in the South and North subregions, respectively.

Most of the NCCSR seabird breeding populations in 2010-2012 occurred within state marine protected areas (MPAs, including Special Closures), with 91% in Special Closures, 7.4% in State Marine Reserves, and 0.1% in State Marine Conservation Areas, while only 1.3% occurred outside MPAs. All species occurred within MPAs. Over 96% of the South and Farallon subregional seabird populations occurred within MPAs but only 13% of the North subregion's seabirds occurred within MPAs. This suggests that MPAs may not provide the same benefits to breeding seabirds in the North subregion as in the South or Farallon subregions.

Rough assessments of long-term population trends since 1989 indicate that NCCSR populations of six species have increased (Double-crested Cormorant, Black Oystercatcher, California Gull, Common Murre, Pigeon Guillemot, and Rhinoceros Auklet), four species have declined (Leach's Storm-Petrel, Pelagic Cormorant, Cassin's Auklet and Tufted Puffin), and three species have fluctuated or remained stable (Ashy Storm-Petrel, Brandt's Cormorant, and Western Gull). NCCSR-wide surveys should be conducted at least every 10 years, with continuation of smaller-scale long-term monitoring studies at select sites continued to better assess long-term trends and detect changes associated with climate variability and potential anthropogenic influences. For examining long-term benefits of MPAs on seabirds, focus should be given to examining changes in abundance and distribution of Pelagic Cormorant and Pigeon Guillemot. Additional studies are needed to develop correction factors for estimating true breeding population sizes.

INTRODUCTION

In 1999, the California legislature adopted the Marine Life Protection Act (MLPA) to provide additional protection of the state's coastal resources. The MLPA mandates establishing a network of marine protected areas (MPAs) in coastal waters from the Oregon border to the Mexico border. MPAs within the North Central Coast Study Region (NCCSR), located between Point Arena and Pigeon Point, were established on May 10, 2010. The NCCSR includes 763 square miles (1,976 km^2) of marine habitat between Alder Creek (just north of Point Arena) and Pigeon Point. Twenty percent of this area was protected by 25 MPAs, including:

(1) 10 State Marine Reserves (SMRs) which prohibit the take of any living marine resources;
(2) 12 State Marine Conservation Areas (SMCAs) which allow for certain specific recreational and/or commercial take; and
(3) three State Marine Recreational Management Areas (SMRMAs) which limit the take of living marine resources in a similar fashion to SMCAs while also allowing waterfowl hunting.

Additionally, six Special Closures were established to protect significant and sensitive seabird breeding sites and marine mammal haul-outs by prohibiting all access in waters immediately adjacent to the sites.

To support the adaptive management goals of the MLPA, the California Ocean Protection Trust Fund funded specific studies to collect baseline data on NCCSR resources for monitoring long-term changes in resources. The U.S. Fish and Wildlife Service (USFWS) led a team of biologists to conduct surveys to update baseline information on the breeding distribution and abundance of 13 species of breeding seabirds within the NCCSR. The entire region had not been surveyed since 1989 (Carter et al. 1992), although on-going annual or periodic studies have provided estimates for certain species or certain colonies (e.g., Carter et al. 2001, 2012; Capitolo et al. 2006; McChesney et al. 2008; Warzybok and Bradley 2011, Eigner et al. 2012). Data for most of the NCCSR region was highly outdated, with a complete lack of information at most colonies of several species since 1989.

This report summarizes breeding population estimates for 13 species of marine birds (12 seabirds and one marine shorebird) from baseline surveys of seabird breeding colonies within the NCCSR in 2010-2012, with data from the next most recent year substituted for certain colonies that were not surveyed in 2010-2012. Rough assessments of population trends are also included. Additional information for certain colonies in 2010-2012 can be found in Eigner et al. (2011, 2012) and Robinette et al. (2013).

METHODS

Surveys were conducted between Point Arena and Pigeon Point, including the Golden Gate area which is outside but adjacent to the NCCSR. Data for the North Farallon Islands from 2010 to 2012 were not available; thus, most recent available data were included. Methods included boat, land-based, and/or aerial photographic surveys, following methods by Sowls et al. (1980) and Carter et al. (1992). Single counts of nests, sites and birds for Double-crested Cormorant (*Phalacrocorax auritus*), Brandt's Cormorant (*P. penicillatus*), Pelagic Cormorant (*P. pelagicus*), Western Gull (*Larus occidentalis*), Common Murre (*Uria aalge*), Pigeon Guillemot (*Cepphus columba*) and Tufted Puffin (*Fratercula cirrhata*) were obtained at most colonies, using the most appropriate survey method, although additional counts and methods were conducted when possible for comparison. At several colonies with regular monitoring conducted by USFWS, high seasonal counts were used for certain species. These colonies included: Point Reyes Headlands; Point Resistance; Millers Point Rocks; Double Point Rocks; San Pedro Rock; and Devils Slide Rock and Mainland. At the South Farallon Islands, surveys were conducted using variable methods as part of a long-term seabird monitoring program conducted by Point Blue Conservation Science (Point Blue). For mainland coast surveys, we relocated nesting areas (i.e., colonies and subcolonies) that had been previously mapped in 1979-1980 and 1989 on U.S. Geological Survey topographic maps (Sowls et al. 1980, Carter et al. 1992) and we mapped and numbered all new nesting areas found on topographic maps. Our goal was to obtain total counts of nests, territorial sites and birds with the most complete coverage possible of each colony. Except at the South Farallon Islands, surveys were limited primarily to the seven seabird species above which visibly attend colonies during the day, as well as Black Oystercatchers (*Haematopus bachmani*) which can be easily surveyed at the same time as seabirds. Separate efforts are needed to census nocturnal burrow- and crevice-nesting species such as Leach's Storm-Petrel (*Oceanodroma leucorhoa*), Ashy Storm-Petrel (*O. homochroa*), Cassin's Auklet (*Ptychoramphus aleuticus*), and Rhinoceros Auklet (*Cerorhinca monocerata*). For these species, we provided the most recent survey information summarized from other sources.

Most surveys were conducted in 2011 when conditions appeared to be reasonably favorable for breeding. However, several colonies or species were surveyed in 2010 or 2012, while for a few others not surveyed in 2010-2012 we provided the most recent data available (described in the sections below). Surveys were conducted between late May and early July, during the peak of the breeding season for most species.

Boat and land surveys of the mainland coast

The majority of the mainland coast was surveyed by boat by USFWS, Carter Biological Consulting (CBC) and Humboldt State University (HSU) in 2011. However, because of rough weather and other logistical issues in 2011, two areas (Sea Ranch to Timber Cove in Sonoma County and Pillar Point Harbor to Pigeon Point in San Mateo County) were completed in 2012. All boat surveys along the mainland coast were conducted from a 4.2 m Zodiac inflatable boat

powered by a 25 hp outboard engine. These small vessels allow high maneuverability and access to the shallow waters close to shore that is needed to identify and count nesting seabirds in coastal habitats. Surveys at the South Farallon Islands were conducted from an approximately 5 m Safeboat. Surveys were conducted by one to three observers in relatively calm conditions (swells $\leq$ 6 ft, winds $\leq$ 15 kn). All accessible shorelines were investigated for the presence of nesting seabirds. Nesting areas were approached as close as conditions allowed without disturbing nesting birds or marine mammals.

As in 1979-1980 and 1989 surveys (Sowls et al. 1980, Carter et al. 1992), coastal areas that were easily accessible from roads were inspected with binoculars and telescopes to the best extent possible. Counts were conducted with 10X binoculars or 20-60X spotting scopes. At nearshore colonies with regular monitoring (see above), multiple counts were conducted per season (see Eigner et al. 2012). At the South Farallon Islands, colony surveys of most species are conducted once per year when numbers of nests are near the annual peak. For certain species, such as Common Murres and Cassin's Auklets, plots are monitored multiple times per season to derive seasonal average or total counts (see Warzybok and Bradley 2011).

For surface-nesting species, all nests, territorial sites, and/or birds of each species were counted within each subcolony or at adjacent roosting areas. Territorial sites, or sites, were identified when birds were present in potential breeding habitat and: 1) nests could not be seen because of poor viewing conditions; 2) adults were participating in courtship displays; or 3) small amounts of nest material were present. Common Murres do not build nests and breed on open rock surfaces mainly in large, very dense colonies; aerial photographic surveys are the primary method for counting birds attending the colony (Carter et al. 1992, 2001). We only counted murres during boat or land-based surveys when colonies were small (and possibly missed on aerial surveys) or newly colonized. Black Oystercatchers breed in coastal habitats that can be well surveyed from small boats although nests are difficult to locate. As in 1979-1980 and 1989 surveys (Sowls et al. 1980, Carter et al. 1992), we focused on complete coverage of shorelines with recording all adults seen and did not make a special effort to find nests at most colonies.

Certain burrow and crevice nesting species which visit colonies during the day also could be surveyed at the same time as surface-nesting species. Pigeon Guillemot was the only species where individuals were routinely counted on the water. Guillemots nest in rock crevices or other cavities but often raft on the water adjacent to nesting areas or roost intertidally. Counts of guillemots visibly associated with colonies (i.e., on the water, on land, or flying nearby) is the primary technique used to identify colonies and roughly estimate population size in California (Carter et al. 1992). For Rhinoceros Auklets and Tufted Puffins, counts of any birds similarly associated with colonies were conducted (but no Tufted Puffins were observed along the mainland coast in 2011-2012).

Aerial Photographic Surveys

In 2010-2011, aerial photographic surveys were conducted jointly by USFWS, University of California Santa Cruz (UCSC), (HSU), and California Department of Fish and Wildlife

(CDFW) as part of an annual survey of Common Murre, Brandt's Cormorant, and Double-crested Cormorant colonies in coastal California. Surveys were flown in a CDFW Partenavia P68, fixed-wing aircraft. Photographs were taken with digital SLR cameras. Broad-scale, overview photographs of colonies were taken with 50 mm telephoto, 29-90 mm zoom or 70-200 mm zoom lenses. Close-up photographs were taken with 200 mm telephoto lenses. Flight altitudes ranged from 500 to 1000 feet (152-305 m) above sea level (ASL), depending on location and weather conditions. Surveys were conducted in each year from 2010 to 2012.

Although not originally planned, we succeeded in obtaining counts from aerial photographs for many, but not all, colonies surveyed. Aerial counts for Brandt's Cormorants and Common Murres, as well as certain colonies of Double-crested Cormorants and Western Gulls, provided the most complete, accurate, and comparable counts possible at many locations, especially those which cannot be viewed fully by other survey methods. Most counts were obtained from either 2010 or 2011 surveys. Counts were obtained from digital images with the highest quality and best coverage of each colony. Nests, territorial sites, and birds were manually marked on a computer monitor and automatically tallied for each image using Image Pro Express 6.3® image analysis software. For cormorants, nests and sites were categorized by their stage of development following a standardized protocol that has been used since 1997 (see McChesney et al. 1998; Capitolo et al., in press). For Common Murres, only birds were counted because they do not build nests. For Western Gulls, only nests and birds were counted (see Capitolo et al. 2009).

Breeding Population Estimates

One main goal of surveys was to provide updated estimates of breeding population sizes for all diurnally-active species nesting within the NCCSR. In addition, we were able to provide revised estimates of most nocturnal species nesting at the South Farallon Islands. Because of differences in breeding biology and census methods, different estimation techniques needed to be applied to each species. Various techniques have been used for estimating breeding population sizes from single broad-scale surveys, including: 1) reporting raw numbers of nests counted, multiplied by 2 to represent both members of a breeding pair; 2) reporting raw numbers of individual birds counted; 3) using raw counts of nests or birds to roughly estimate breeding population size; 4) applying a correction factor to raw nest counts to account for nests present at time of the survey; or 5) applying a correction factor to raw bird counts to account for breeding birds away from the colony and non-breeding birds present at the colony at the time of the survey (e.g., Carter et al. 1992). The accuracy of estimates of the total number of breeding pairs at colonies made using raw counts or correction factors can vary greatly between species, colonies, and years. In general, when breeding conditions are adequate and most birds attempt to breed, standardized nest counts are more reliable indicators of the total number of breeding pairs than are bird counts because nest counts have much less variability and exclude non-breeding birds. However, for some species (i.e., Common Murre and Pigeon Guillemot), nest counts are not possible without great effort and thus bird counts were substituted.

For this report, we focused on obtaining standardized raw counts of nests, sites and birds at all breeding colonies between Point Arena and Pigeon Point. Obtaining data for calculation of

correction factors was not planned or conducted. For many species, we used raw counts of nests multiplied by two to estimate annual breeding population size. However, other methods were used for certain species or colonies. For Black Oystercatchers, which mainly breed in isolated pairs and whose nests can be difficult to locate, at most colonies we used raw numbers of birds counted (like Carter et al. 1992). For Pigeon Guillemots, we used raw bird counts to represent relative breeding population size. For Common Murres, we applied a correction factor to raw bird counts. Correction factors were developed from multiple plots on Southeast Farallon Island (Point Blue, unpubl. data), averaged among plots. Because correction factors can vary between years, we used year-specific correction factors. These methods differed from those used in Carter et al. (1992) in various ways but raw counts of nests and birds from 1989 surveys were available for direct comparisons using the same methods.

To provide the most complete and best estimates possible, we first compared boat with land or aerial (when available) counts for each species at each subcolony, and used the highest count. Then, we summed highest subcolony counts to provide a total count for each colony. However, in some cases it was recorded that a subset of nests or birds counted using one census method were different from another method. In those cases, counts from each method were included.

Methods for estimating breeding population sizes at the South Farallon Islands differed from broad-scale NCCSR surveys, as discussed briefly in Results and Discussion.

Assessments of population trends since 1989

To provide assessment of population changes since the last NCCSR-wide survey, we provided rough comparisons of total counts and numbers of colonies detected between 1989 (Carter et al. 1992) and 2010-2012 for seven focal species: all three cormorants, Black Oystercatcher, Western Gull, Common Murre, and Pigeon Guillemot. For better comparability, we used raw nest (cormorants) or bird (guillemot) count data from Carter et al. (1992) instead of reported population estimates which included correction factors. For Common Murres, population estimates (including those derived with correction factors) from both Carter et al. (1992) and this study were compared. Since neither study adjusted counts of the gull or oystercatcher with correction factors, direct comparisons of population estimates were made.

For each species, comparisons included percent change between 1989 and 2010-2012 for the entire NCCSR and for the three subregions as well as total numbers of active colonies. In addition, we summarized available information for each species to provide further assessments of population trends.

RESULTS AND DISCUSSION

In 2010-2012, a total of 507,262 breeding birds of 13 species were recorded at 68 active colonies within the NCCSR (Figures 1, 2; Table 1; Appendix IV). Three new colonies (Rockaway Point, Gray Whale Cove South, and Pillar Point Harbor) were discovered, and two historic colonies (Moat Cove and Pillar Point) were inactive when surveyed. By far the largest breeding colony was at the South Farallon Islands, with an estimated 328,592 breeding birds. This was the only colony with all 13 of the NCCSR's breeding seabird species. South Farallon Islands host: 1) the world's largest breeding colonies of Ashy Storm-Petrels, Western Gulls, and in many years, Brandt's Cormorants; and 2) all or nearly all of the NCCSR's breeding California Gulls, Cassin's Auklets, Rhinoceros Auklets, and Tufted Puffins. The next largest colonies were the North Farallon Islands (91,483 birds), Point Reyes Headlands (56,428 birds), Double Point Rocks (13,669 birds), and Point Resistance (6,726 birds).

By far the most abundant species within the NCCSR in 2010-2012 was the Common Murre, with an estimated population size of 439,429 breeding birds. The next four most abundant species were the Cassin's Auklet (21,030 birds), Brandt's Cormorant (8,910 birds), Ashy Storm-Petrel (6,175 birds), and Pigeon Guillemot (4,861 birds). The most wide-spread species (i.e., greatest numbers of colonies throughout the NCCSR) were Western Gull (51 colonies), Black Oystercatcher (49 colonies), Pigeon Guillemot (50 colonies), and Pelagic Cormorant (48 colonies). However, for Black Oystercatcher and Pigeon Guillemot, identification of most colonies was based mainly on birds observed at potential breeding areas and breeding may not have occurred at certain colonies in the survey year (see Methods, above, and Species Accounts, below).

Breeding populations differed dramatically among subregions. In 2010-2012, the Farallon subregion held 83% of the total number of seabirds within the NCCSR (Table 2), as well as most of the NCCSR populations of 10 species (Table 2). The South subregion held 16% of NCCSR's breeding seabirds. While the North subregion held only 1% of the NCCSR's total seabirds, it was important for certain species. Nearly 50% of the NCCSR breeding populations of Pelagic Cormorant and Black Oystercatcher, and 80% of Double-crested Cormorants, occurred there.

Seabird Population Sizes in Relation to MPAs

Numbers of seabirds breeding within each MPA are summarized in Table 3. Southeast Farallon Island and North Farallon Islands Special Closures, also within SMRs, surround these entire colonies and contain by far the largest numbers of seabirds of all NCCSR MPAs. The Point Reyes Headlands Special Closure (also within the Point Reyes SMR) is adjacent to most of the large Point Reyes Headlands colony but does not include the colony's largest breeding concentration at the west end of the headlands. Other large seabird colonies occur within Special Closures at Point Resistance, Double Point Rocks (Stormy Stack), and Devil's Slide (or, Egg) Rock.

All 13 species of NCCSR breeding seabirds occurred within Special Closures, and the vast majority (91%) of NCCSR populations in 2010-2012 occurred within Special Closures (Table 4). For each species, between 20% and 100% of the NSSCR population occurred within Special Closures. SMRs and SMCAs accounted for 7.4% and 0.1% of breeding seabirds within the NCCSR, respectively, while 1.4% occurred outside MPAs. However, over 50% of Pelagic Cormorants and Black Oystercatchers, and nearly 80% of Double-crested Cormorants, bred outside MPAs.

Overall, 98% of NCCSR populations bred at colonies within MPAs (Table 5). However, North subregion MPAs contained only 16% of this subregion's population, compared to 97% and 100% for South and Farallon subregions, respectively. However, fairly large proportions of the North subregion populations of Pelagic Cormorants (47%) and Black Oystercatchers (37%) occurred within MPAs.

Species Accounts

Leach's Storm-Petrel: This species nests in burrows and rock crevices and is active at the colony only at night. Foraging occurs far offshore. Thus, estimating populations and even detecting colonies can be very difficult. Specific surveys were not conducted for this species in 2010-2012. Two small colonies in the North subregion were not surveyed. At the South Farallon Islands, about 1,400 birds were estimated in the early 1970s (Ainley and Lewis 1974). No more recent estimate is available. However, recent numbers appear to be much lower based on mist-net capture data (Point Blue, unpubl. data). We categorized Leach's Storm-Petrels only as present (X) at the South Farallon Islands in 2010-2012 and possibly present (P) at Fish Rocks and Gull Rock. At Fish Rocks, Sowls et al. (1980) estimated 100 breeding birds based on captures of 29 mist-netted birds (3 recaptures) over three nights in 1980. Carter et al. (1992) failed to detect this species on one night of mist-netting in 1989 but did not consider that sufficient effort had been expended to prove absence and reported the estimate from Sowls et al. (1980). At Gull Rock, Carter et al. (1992) estimated 10 breeding birds based on one nest found and other potential habitat. In Humboldt County where most of the California breeding population occurs, numbers appear to have declined dramatically between 1989 and 2012 (Parker et al. 2013) and thus these small NCCSR colonies may no longer exist. More work is needed to assess the status of this species in the NCCSR.

Ashy Storm-Petrel: This species nests in small rock crevices and is active at the colony only at night. Foraging occurs far offshore. Thus, estimating population size and even detecting colonies can be very difficult. Colony size estimates have been based on capture-recapture of mist-netted birds, nest searches of available habitat, or a combination of methods. Population estimates for 2010-2012 are based on studies conducted by Whitworth et al. (2002), Carter et al. (2008a, 2012), and Nur et al. (2013).

The South Farallon Islands hosts the world's largest known colony of this rare species. Following declines between the early 1970s and early 1990s (Sydeman et al. 1998), numbers at this colony increased in the early 2000s but have declined again in more recent years (Nur et al.

2013). Extensive Point Blue mist-net capture data over the past decade or more has been recently used to derive an estimate of 5,768 breeding birds at this colony. A small colony was first discovered in 2001 on Stormy Stack at Double Point Rocks and nesting was suspected (but not confirmed as a nest was not found) at Point Reyes Headlands (Whitworth et al. 2002). In 2013, continued nesting was confirmed at Stormy Stack and nesting was again suspected at Point Reyes Headlands based on mist-net captures (Point Reyes National Seashore and California Audubon, unpubl. data). The only other known colony in the NCCSR is at Bird Rock (off Tomales Point), where small numbers of nests were found in 2012-2013 (Carter et al. 2012; Point Reyes National Seashore and California Audubon, unpubl. data). Nesting was confirmed at historical nesting locations in central Mendocino County, just north of the study region, in 2012 (Carter et al. 2008a, unpubl. data). Surveys of other potential habitat within the NCCSR may lead to the discovery of other small colonies.

Double-crested Cormorant: In California, this species nests widely along the mainland coast, on offshore islands, in major estuaries (especially San Francisco Bay), and at inland lakes and rivers. They nest in relatively dense colonies on rocks, islands, cliffs, trees, and artificial habitats such as bridges. Foraging occurs largely in estuarine and freshwater habitats. In 2010-2012, a total of 1,770 breeding birds were estimated at six breeding colonies in the NCCSR, based on raw nest counts. Correction factors (*j*) for nest counts are not critical for estimating true population size for this species, although raw counts are lower than true population size (Carter et al. 1992). The largest colonies occurred at Hog Island (the only seabird colony in Tomales Bay; 1,182 breeding birds) and the South Farallon Islands (360 breeding birds). Although survey methods included a combination of aerial, boat, and land-based surveys, aerial photographic surveys usually provide the most complete counts and is the preferred method at larger colonies. At the South Farallon Islands, a 2011 land-based nest count was used to estimate recent population size because the most recent aerial photograph count (2008) available was outside the study period. However, only a portion of this colony is visible from the island, causing a raw count lower than true population size; in 1989, a maximum of 394 nests were visible from the lighthouse over that season compared to 475 nests counted from aerial photos taken on 23 May (Carter et al. 1992, Stenzel et al. 1995).

Double-crested Cormorant population sizes on the west coast of North America have been increasing for several decades (Carter et al. 1995; Adkins et al., in press). In the NCCSR, overall numbers were 36% greater in 2010-2012 than in 1989 (Table 6). Five colonies were new since 1989 (Table 7), including Fish Rocks, Russian Gulch, Gull Rock, Duncan Point to Arched Rock, and the large Hog Island colony. Two active colonies in 1989 (Russian River Rocks and Dillon Beach Rocks) were inactive in 2010-2012, although birds from the Russian River Rocks colony apparently shifted to other nearby colonies. Due to their close proximity to the Russian River mouth, boat disturbances are a potential cause for abandonment of the Russian River Rocks colony but observations are lacking to validate this assertion. Increase occurred mainly within the North subregion, where numbers were nearly 300% greater than in 1989. At the South Farallon Islands, 62% lower numbers than in 1989 were attributed partly to methodology differences (aerial in 1989 versus land in 2011) but 180 nests counted in 2011 also was 54.3% lower than 394 nests counted from the island in 1989. Warzybok and Bradley (2011) also noted a decline in recent years.

Brandt's Cormorant: These birds usually nest in relatively dense colonies on offshore rocks, islands, and mainland cliffs. Foraging occurs in relatively nearby continental shelf waters. Birds are particularly sensitive to human disturbance and may flush from nests when approached too closely. Colony surveys are most effectively conducted with aerial photographic surveys (Carter et al. 1992). In 2010-2012, aerial photographic surveys were the primary census technique. However, aerial counts were not available at every colony (e.g., South Farallon Islands). In those cases, either land or boat-based counts were used. Also, because of very late breeding by this species at certain colonies in 2011, greater land-based counts were sometimes used instead of lower counts from aerial photographs.

In 2010-2012, a total of 8,910 breeding birds were estimated at 18 colonies, based on raw nest counts (Table 1). Correction factors (*j*) for one-time annual nest counts are not critical for estimating breeding population size for this species, although raw counts are slightly lower than true breeding population size. However, in certain years, early season breeding failures or late nesting can result in counts more greatly underestimating true breeding population sizes (Carter et al. 1992). The majority of Brandt's Cormorants (56%) occurred in the Farallon subregion, while the North and South subregions held 24% and 20% of the NCCSR populations, respectively (Table 2).

Regional Brandt's Cormorant population sizes increased dramatically in the early 2000s, then declined dramatically in 2008-2009 (Warzybok and Bradley 2011; Robinette et al. 2013; Capitolo et al., in press; USFWS, unpubl. data). Trends in the Monterey Bay area were similar to the NCCSR (Bechaver et al. 2013), but in the Point Sur to Point Conception area numbers rebounded quickly following a brief decline in 2008 (Capitolo et al. 2012). In the NCCSR, population size appeared to be recovering in 2011-2012 (Robinette et al. 2013; this study). Compared to 1989, numbers of Brandt's Cormorant nests counted were 55.1% lower in 2010-2012 (Table 6). Lower numbers were evident in all subregions, ranging from -15% (North) to -68% (Farallon). However, the number of active colonies was nearly unchanged (Table 7).

Pelagic Cormorant: These birds nest mainly in relatively small, loose colonies on steep cliffs. Foraging occurs in nearby nearshore waters. Birds are sensitive to human disturbance and may flush from nests when approached too closely. Colony surveys are most effectively conducted with boat surveys and land-based surveys where cliffs can be viewed at fairly close range (Carter et al. 1992).

A total of 2,166 breeding birds were estimated at 48 colonies, based on raw nest and site counts (Table 1). Correction factors (*j*) for one-time annual nest counts are not critical for estimating breeding population size for this species, although raw counts are slightly lower than true breeding population size. However, in certain years, early season breeding failures or late nesting can result in counts more greatly underestimating true breeding population (Carter et al. 1992). About 50% occurred in the North subregion, with 38% and 12% in the South and Farallon subregions, respectively (Table 2). Numbers at the South Farallon Islands have declined dramatically over the last 2-3 decades (Warzybok and Bradley 2011). Trends have not been assessed at other NCCSR colonies. However, seasonal nest counts at colonies in the Point Reyes Headlands, Drakes Bay area, and Devil's Slide Rock and Mainland since the mid- to late 2000s were variable but appear to be relatively stable (Robinette et al. 2013). Compared to

1989, total nest counts in 2010-2012 were 46% lower (Table 6). Lower numbers were most evident in the North (-58%) and Farallon (-70%) subregions. The number of colonies remained nearly identical; both new and vacant colonies suggests some colony switching (Table 7).

Black Oystercatcher: This coastal-breeding shorebird species nests in scattered pairs on offshore rocks, islands, or near the bases of mainland cliffs where access by mammalian predators is difficult. They forage mainly in rocky intertidal zones. Because of coastal nesting and foraging habitats, nesting is often associated with colonies of other marine birds. Best survey techniques include a combination of boat and land-based methods. The secretive nature of nesting birds can make locating nests difficult, especially during broad-scale surveys of several species of seabirds.

In 2010-2012, a total of 249 birds were counted at 46 colonies in the NCCSR, based mainly on raw bird counts. However, it is unclear how these counts relate to actual breeding population size. Correction factors are critical for estimating true breeding population size for this species (Carter et al. 1992). Compared to 1989 region-wide surveys, numbers of oystercatchers counted in the NCCSR were 39% greater in 2010-2012 (Table 6). Numbers were much higher (274%) in the South subregion and were more than twice as large at the South Farallon Islands where the estimate was based on known breeding pairs, while 2010-2012 numbers were identical to 1989 in the North subregion. A separate 2011 mainly land-based survey of Black Oystercatchers in California organized by Audubon California also noted much higher numbers than 1989 (as reported in Carter et al. 1992) but since different methods were used they were not able to determine if an increase had occurred and to what degree (Weinstein et al. 2011).

Western Gull: This species nests in a variety of coastal habitats, and may nest solitarily or in colonies of up to several thousand birds. The South Farallon Islands host the world's largest colony and accounted for 90% of the NCCSR population. Best survey techniques typically include a combination of boat and land-based methods, but aerial photographs sometimes are preferred for rocks and islands not viewed well otherwise.

In 2010-2012, a total of 19,326 breeding birds were estimated at 51 colonies, based mainly on raw nest and site counts (Table 1). Correction factors are not critical for estimating true population size if nest and site counts are conducted during the main part of the breeding season and extensive nest failure does not occur prior to surveys (Carter et al 1992). Western Gulls have declined slightly in recent years at the South Farallon Islands (Warzybok and Bradley 2011). On the mainland coast, birds nested mainly in scattered small colonies or lone pairs. Numbers were increasing or stable at most sample colonies examined in northern and central California in 2007 (Capitolo et al. 2009). Compared to 1989, total numbers in the NCCSR were 18% lower in 2010-2012 (Table 6), largely because of lower numbers at the South Farallon Islands. Numbers in the North and South subregions were actually 17% and 74% greater in 2010-2012, respectively. The number of colonies did not change since 1989 despite some new and some vacant colonies (Table 7).

California Gull: In California, California Gulls mainly nest at large inland lakes and in San Francisco Bay. At the single NCCSR breeding colony at the South Farallon Islands, 208

breeding birds were estimated, based on a raw nest count. This species colonized the South Farallon Islands in 2008 (Warzybok and Bradley 2008). Numbers have changed little since then. These gulls have been nesting in two fairly dense groups on the flat marine terrace of Southeast Farallon Island.

Common Murre: This species often nests in large, very dense colonies on offshore rocks and islands, and occasionally on mainland cliffs. Birds do not build a nest but lay a single egg directly on the ground. Foraging occurs throughout the continental shelf and slope, and birds are capable of travelling long distances from the colony to obtain prey. In California, the aerial photographic survey is the most effective and standardized method of censusing colonies (Carter et al. 2001).

In 2010-2012, a total of 439,429 breeding birds were estimated 11 colonies. Most counts were conducted in 2010 or 2011, but the estimate for the North Farallon Islands was based on the most recent available aerial photographic count in 2007 (USFWS, unpubl. data). Most colony estimates were based on bird counts obtained from aerial photographs. However, at the South Farallon Islands, a total bird count was estimated using a combination of the most recent aerial photograph count from 2007 (USFWS, unpubl. data) and percent change in several land-based count plots (Warzybok and Bradley 2011). Most whole-colony counts were adjusted with annual *k* correction factors of 1.53 (2007), 1.35 (2010) and 1.40 (2011), determined at the South Farallon Islands (Point Blue, unpubl. data). Use of correction factors is critical to derive true population estimates for this species (Takekawa et al. 1990; Carter et al. 1992). At two new colonies, Fish Rocks and Gull Rock, counts apparently were mostly of non-breeding birds and use of the available *k* correction factor was not appropriate. At a small subcolony on the mainland at Devil's Slide Rock and Mainland, a seasonal breeding site count (30 nests, multiplied by 2 for each pair member) was used.

After suffering major declines in the 1980s from a combination of factors (mainly gill-net and oil spill mortality; Takekawa et al. 1990, Carter et al. 2001), the central California population of this species has increased dramatically since 1998 (McChesney et al. 2008; Warzybok and Bradley 2011; USFWS, unpubl. data). New colonies at Fish Rocks and Gull Rock, in the North subregion, may be part of an expansion occurring between Point Reyes and Humboldt County that has been ongoing since at least the 1970s (Carter et al. 2001, Capitolo et al. 2006). Compared to 1989 estimates, numbers in the NCCSR were 379% greater in 2010-2012 (Table 6), with dramatic increases at nearly all colonies. Increases have occurred as murres recover from the impacts of egging and human disturbance mainly in the 19th century, gill-net fishing mortality in the late 1970s to late 1990s, and extensive oil spill mortality throughout the 20th century (Ainley and Lewis 1974, Takekawa et al. 1990, Carter et al. 2001, Carter 2003, Forney et al. 2001).

Pigeon Guillemot: This species nests in rock crevices on offshore rocks/islands or mainland cliffs, but are active at the colony during the day. However, locating nests is very difficult in most circumstances. Birds are mainly counted on the water, at intertidal roosts, and flying near colonies, from small boats or the adjacent shore.

In 2010-2012, a total of 4,861 breeding birds were estimated at 50 colonies in the NCCSR, based on unadjusted bird counts. Without available correction factors in 2010-2012, true breeding population size is unclear but likely is much higher than estimated given relatively high *k* correction factors determined at the South Farallon Islands in 1989 (Carter et al. 1992). Use of correction factors (*k*) are critical to derive true breeding population estimates. At the South Farallon Islands in 2010-2012, we reported the peak count obtained during pre-egg laying surveys in late April to early May, when counts tend to be the highest of the year. At other colonies, counts were obtained during breeding season surveys in late May or June when counts are typically much lower than before egg laying (Carter et al. 1992; USFWS, unpubl. data).

Counts of Pigeon Guillemot have been increasing at the South Farallon Islands since the early 2000s (Warzybok and Bradley 2011). Compared to 1989, the total NCCSR count was 71% greater in 2010-2012 (Table 6). While counts were 84% higher in 2010-2012 in both the South and Farallon subregions, the North subregion count was 7% lower than in 1989. Ten colonies were inactive when surveyed in 2010-2012, although five new colonies also were identified (Table 7).

Cassin's Auklet: This species nests in burrows and rock crevices, and birds are only active at the colony at night. Thus, finding colonies and counting nests is difficult at most locations. Surveys are conducted by counting the numbers of potential nest burrow or crevice sites. Use of correction factors (*l*) for burrow occupancy are required to estimate true population size (Carter et al. 1992). We did not conduct surveys for this species in 2010-2012 but report most recent estimates from other studies.

A total of 21,030 breeding birds were estimated at two colonies; nearly all birds occurred at the South Farallon Islands (Table 1). In addition, birds were reported as possibly present (P) at Fish Rocks based on surveys in 1989 (Carter et al. 1992) and a small colony was discovered at the North Farallon Islands in 1994 (McChesney et al. 1994). At the South Farallon Islands, our estimate was based on a combination of: 1) for Southeast Farallon Island, a full island burrow count in 2009 (Warzybok and Bradley 2009) adjusted for burrow occupancy was revised to provide an estimate for 2011 based on percent changes in several plots (Warzybok and Bradley 2011); and 2) for all other areas, the estimate from 2009 (Warzybok and Bradley 2009).

The Cassin's Auklet colony on the South Farallon Islands has declined dramatically from 1971 (135,000 breeding birds; Manuwal 1974) to 1989 (38,274 breeding birds; Carter et al. 1992) to 2009-11 (20,994 breeding birds; Warzybok and Bradley 2009, 2011). Estimation methods differed between the three surveys but major population changes swamped much smaller differences that may be related to methodology.

Rhinoceros Auklet: This species nests in burrows and rock crevices, and are mainly active at the colony during crepuscular periods and at night. Thus, locating and counting nests is difficult at most locations. Surveys at larger colonies are conducted by counting the numbers of potential nest burrow or crevice sites. Use of correction factors (*l*) for burrow occupancy are required to estimate true population size (Carter et al. 1992). At small colonies or when nesting in isolated pairs, counts of birds on the water or flying onto land during the day (not at crepuscular times) are made to indicate presence and possible breeding at the colony and these raw counts are

reported as population estimates. It is not clear if small numbers of nests or isolated pairs breed at most of these locations, whether these birds are non-breeders or breed elsewhere in the NCCSR. We did not conduct surveys at the one large NCCSR colony at the South Farallon Islands in 2010-2012 but we did record single birds at Sea Ranch and Bodega Head (Table 1). We used the estimate at the South Farallon Islands from burrow and crevice surveys conducted in 2009 (Warzybok and Bradley 2009).

A total of 3,194 breeding birds were estimated at 3 colonies in 2010-2012 (Table 1). Nearly all birds (3,192) bred at the South Farallon Islands. This colony has increased dramatically since it became re-established in 1971-72, after an absence of about a century (Ainley and Lewis 1974, Carter et al. 1992, Warzybok and Bradley 2009). Little is known of their status elsewhere in the NCCSR, except that numbers appear to be small. However, Rhinoceros Auklets also appear to be expanding elsewhere in California (Carter et al. 1992, McChesney et al. 1995, Carter et al. 2008b). Four smaller colonies along the NCCSR mainland coast attended in 1989 (i.e., Fish Rocks, Pinnacle Rock, Bird Rock, and Point Reyes Headlands) and three other pre-1989 historical colonies (i.e., Point Arena, Gualala Point Island, and Arched Rock) were not attended during surveys in 2010-2012. However, small numbers of birds were observed during the 2005-2009 period at Point Reyes Headlands, San Pedro Rock, and Devil's Slide Rock and Mainland (USFWS, unpubl. data), but not in 2010-2012. Repeated observations over a span of years supports potential breeding at Sea Ranch, Bodega Head and Point Reyes Headlands, although more regular presence also may only represent more consistent nearshore foraging near these locations.

Tufted Puffin: In California, these birds nest in rock crevices and burrows on offshore rocks/islands or mainland cliffs, but are active at the colony during the day. However, locating nests is very difficult in most circumstances. The estimate at the South Farallon Islands was based on seasonal monitoring of potential breeding sites (Warzybok and Bradley 2011). During mainland surveys, birds are mainly counted as they raft on the water just offshore of the colony, sit outside the entrances of nest sites, or fly around the colony.

In 2010-2012, a total of 246 breeding birds were estimated at the South Farallon Islands, the only currently attended colony in the NCCSR. Tufted Puffins have declined over the last century at the South Farallon Islands and at colonies in Del Norte and Humboldt counties, but some other small colonies in the NCCSR region have been occupied periodically and one historic colony last occupied in 1912 was reoccupied from at least 1991 to 1997 (Ainley and Lewis 1974, Carter et al. 1992, 2008b, McChesney et al. 1995, McChesney and Carter 2008, Parker et al. 2013). The South Farallon Islands colony has increased in recent years (Warzbok and Bradley 2011). Two smaller colonies along the mainland coast attended in 1989 (i.e., Fish Rocks and Point Reyes Headlands) and three other pre-1989 historical colonies (i.e., Arched Rock, Bird Rock and San Pedro Rock) were not attended during 2010-2012 surveys.

Population Estimation

For this report, we focused on obtaining standardized raw counts of nests, sites and birds at all breeding colonies between Point Arena and Pigeon Point and did not have sufficient

funding to obtain data for calculation of correction factors. Still, our estimation techniques were similar to many other colony surveys (e.g., Ainley and Boekelheide 1990, Naughton et al. 2007). In 1989, a special study was conducted at the South Farallon Islands to determine correction factors for several species that were used for population estimates throughout northern and central California (Carter et al. 1992). Although various issues surround the application of *j*, *k*, and *l* correction factors for estimating true population size, Carter et al. (1992) considered that population estimates for certain species in 1989 using correction factors were closer to true breeding population sizes than not using correction factors. After 1992, the focus of seabird survey efforts has shifted away from most closely estimating actual population size to best measurement of population trends. Carter et al. (2001, 2003) indicated that changes in standardized raw whole colony complex counts of Common Murres in years when most birds breed (i.e., not strong El Niño years) was the best method of examining large-scale murre population trends in California. Similarly, changes in standardized raw whole colony complex counts of nests or nests plus sites have been considered to be the best method of examining trends or changes in population size for Brandt's Cormorants, Pelagic Cormorants, and Western Gulls in California (McChesney et al. 1998; Carter et al. 2003, 2008b; Capitolo et al. 2006, 2009, 2012, in press). For Pigeon Guillemots, trend analyses for large areas of California have not yet been conducted but changes in raw whole-colony bird counts have been used to assess major changes at the South Farallon Islands (Ainley et al. 1990) and San Miguel Island (Carter et al. 2008b).

For population estimates of Double-crested Cormorant, Brandt's Cormorant, Pelagic Cormorant, Western Gull and California Gull in this report, we did not assess to what degree our raw nest or nest plus site counts may underestimate the actual total number of breeding pairs. Instead, we simply reported raw whole-colony nest or bird counts as roughly representative of true population size mainly for 2011, a year when most birds bred and conditions for breeding were reasonably adequate. This treatment is commonly used for estimating population sizes. If nest counts of these species are well timed within the breeding season, adequate breeding conditions persist, and breeding failures do not occur, single nest counts can account for about 80-100% of breeding pairs (Carter et al. 1992), such that population estimates derived directly from raw counts can be relatively close to the actual total number of breeding pairs.

For population estimates for Common Murres and Pigeon Guillemots based on bird counts, correction factors are critical for estimating true population size and raw bird counts greatly underestimate true population size (Carter et al. 1992). For Pigeon Guillemots, we used raw bird counts for examining major changes in breeding population size, even though we are aware that raw counts may either greatly underestimate or overestimate the number of breeding birds and great variability exists in these counts within and between days and times of the breeding season (Carter et al. 1992). For Common Murres, we applied a *k* correction factor to raw bird counts to derive breeding population estimates because raw murre counts greatly underestimate the total number of breeding birds (Takekawa et al. 1990) and data for calculating correction factors was available through other projects. Correction factors for 2010-2011 were developed from multiple plots on Southeast Farallon Island (Point Blue, unpubl. data), averaged among plots within each year. Because correction factors can vary annually, we used year-specific correction factors in 2007-2011. Carter et al. (1992) used a *k* correction factor of 1.68 for Common Murres that was developed from only one plot at Southeast Farallon Island, averaged

over four years (1980, 1981, 1985 and 1986). Sydeman et al. (1997) calculated a very similar average *k* correction factor of 1.67 based on data from the same plot at Southeast Farallon Island over 11 years from 1985 to 1995. Correction factors based on multiple plots and in the same year at the same colony may provide more accurate estimates of the total number of breeding birds at that colony in the survey year, because subcolonies can differ substantially in timing of breeding and attendance patterns by breeders and non-breeders. In 1989, the average *k* correction factor of 1.68 was used at all colonies in northern and central California (Carter et al. 1992) and considered to be reasonable and similar to the single 1.67 value from Southeast Farallon Island (D.G. Ainley , unpubl. data) used for 1979-1980 estimates by Sowls et al. (1980). However, more work is needed to determine: (1) the best and most efficient methods of determining correction factors for all species; (2) if correction factors derived from the South Farallon Islands are similar to and can applied at smaller mainland colonies; and (3) if correction factors differ between the north and south NCCSR mainland subregions..

For population estimates for Black Oystercatchers, Rhinoceros Auklets, and Tufted Puffins, based on bird counts, correction factors are critical for estimating true population size and raw bird counts may underestimate or overestimate true population size (Carter et al. 1992). In some cases, birds that are not breeding at the colony may be observed and considered to be breeding in that area when they are not.

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FIGURES

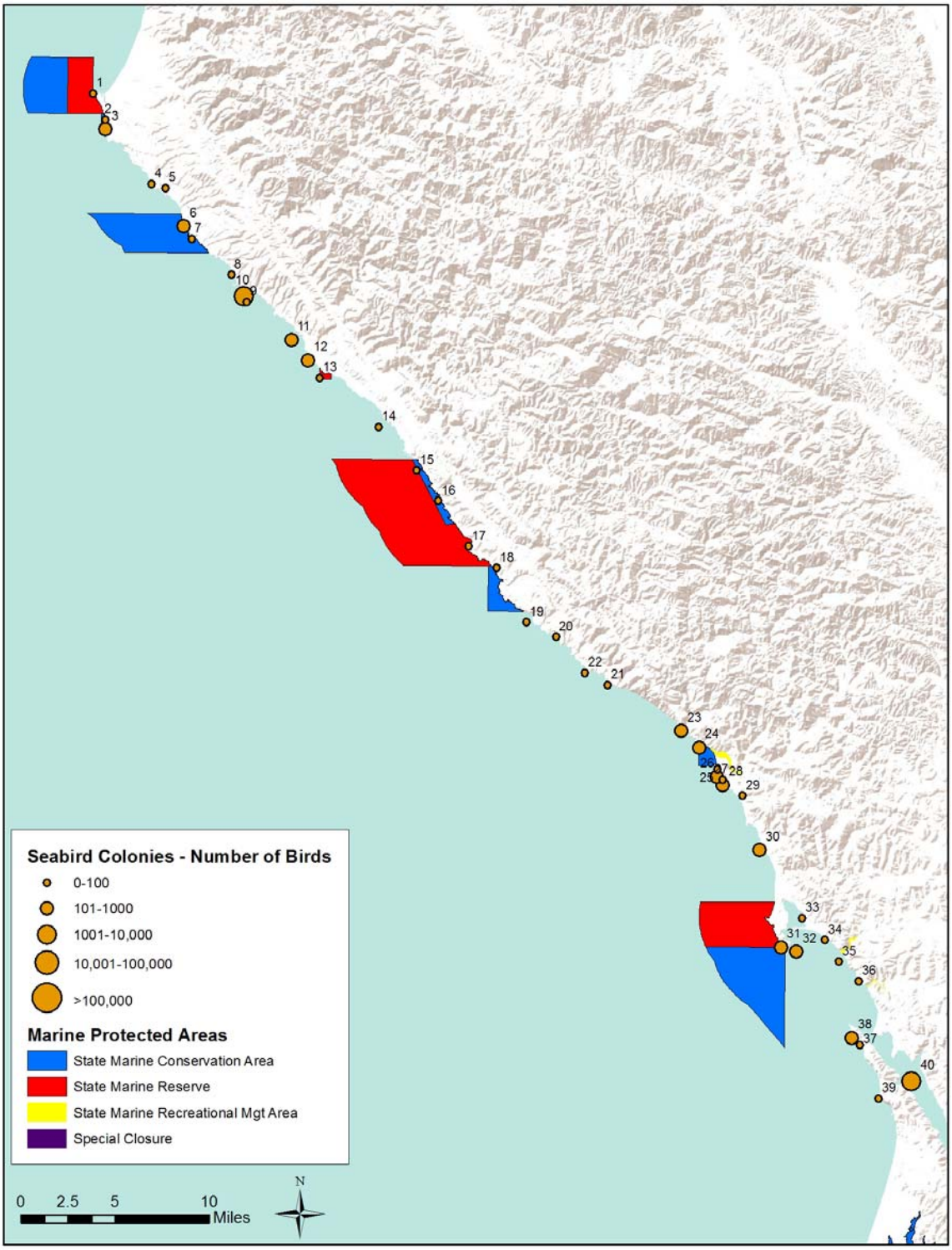


Figure 1. Locations and relative sizes of seabird breeding colonies in the north subregion of the NCCSR. Colonies are numbered north to south (see Table 1, Appendix 1).

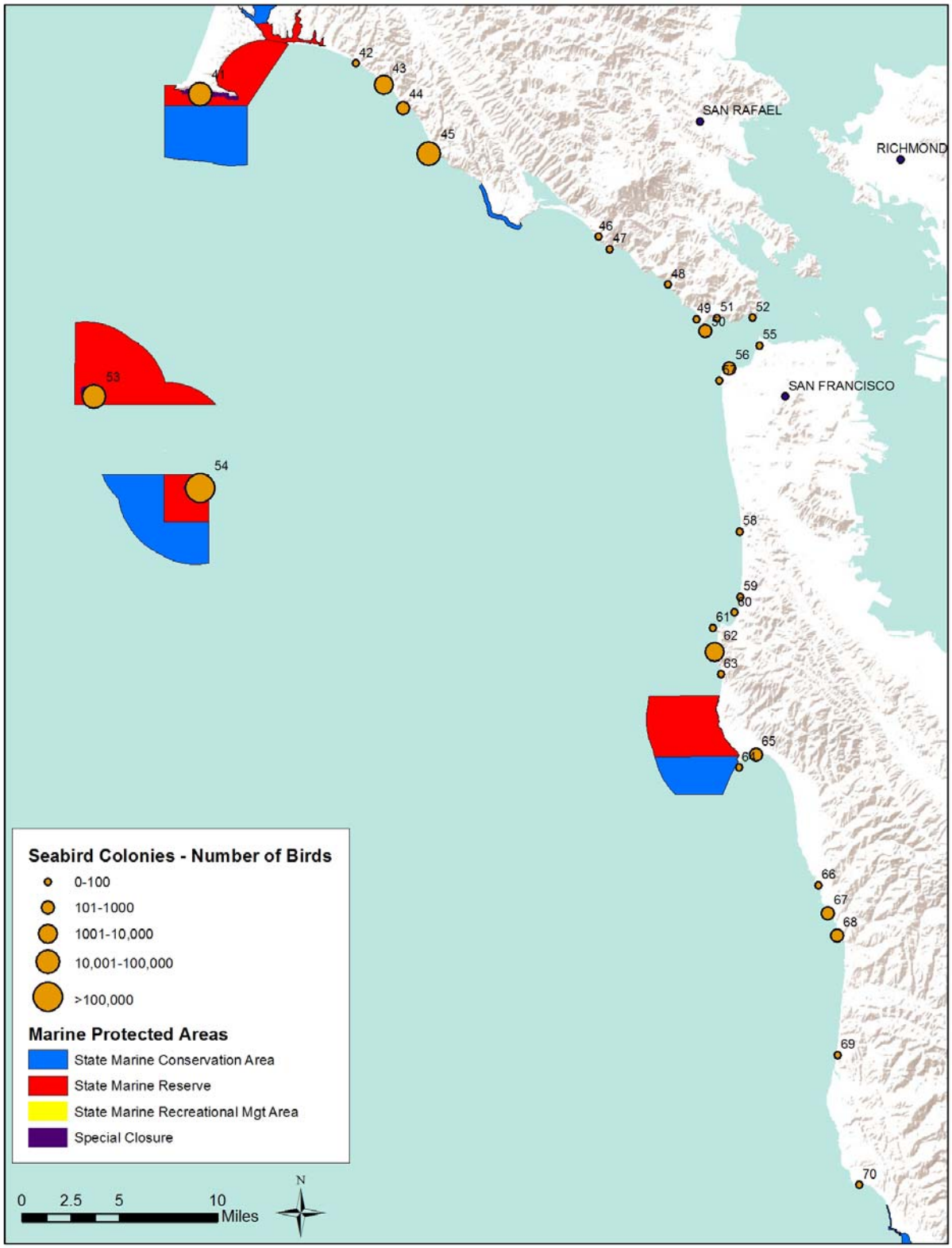


Figure 2. Locations and relative sizes of seabird breeding colonies in the south and Farallon subregions of the NCCSR. Colonies are numbered north to south (see Table 1, Appendix 1).

TABLES

Table 1. Seabird breeding colonies (n = 70) within the MLPA North Central Coast Study Region (NCCSR) in 2010-2012, including current numbers of species and breeding birds. Colonies are listed north to south along the mainland, then Farallon Islands.[1,2,3]

Colony Code	Colony Name	No. Species	Total	LHSP	ASSP	DCCO	BRAC	PECO	BLOY	WEGU	CAGU	COMU	PIGU	CAAU	RHAU	TUPU
	North subregion															
1	Point Arena	4	58	-	-	-	-	30	12	4	-	-	12	-	H	-
2	Sea Lion Rocks	3	59	-	-	-	-	10	2	H	-	-	47	-	-	-
3	Sea Lion Rocks to Arena Cove	4	113	-	-	-	-	54	6	22	-	-	31	-	-	-
4	Moat Cove	2	8	-	-	-	-	H	4	-	-	-	4	-	-	-
5	Section 30 Cove	0	0	-	-	-	-	H	-	-	-	-	H	-	-	-
6	Saunders Landing	4	177	-	-	-	-	158	10	2	-	-	7	-	-	-
7	Iverson Landing	4	86	-	-	-	-	74	2	2	-	-	8	-	-	-
8	Triplett Gulch	4	55	-	-	-	-	30	9	8	-	-	8	-	-	-
9	Fish Rock Cove	2	3	-	-	-	H	H	H	2	-	-	1	-	-	-
10	Fish Rocks	7-8	1006	P	-	22	450	90	4	210	-	168	62	P	H	H
11	Collins Landing to Gualala River	4	120	-	-	-	-	78	10	4	-	-	28	-	-	-
12	Gualala Point Island	4	356	-	-	-	160	H	H	140	-	34	22	-	H	-
13	Del Mar Point	2	16	-	-	-	-	14	2	-	-	-	H	-	-	-
14	Sea Ranch	4	24	-	-	-	-	16	5	2	-	-	H	-	1	-
15	Black Point to Stewart's Point	4	50	-	-	-	-	34	6	8	-	-	2	-	-	-
16	Stewart's Point to Rocky Point	4	51	-	-	-	-	26	6	8	-	-	11	-	-	-
17	Horseshoe Cove	3	46	-	-	-	-	38	-	2	-	-	6	-	-	-
18	Cannon Gulch to Stump Beach	2	36	-	-	-	-	34	2	-	-	-	-	-	-	-
19	Gerstle Cove to Stillwater Cove	4	17	-	-	-	-	4	3	8	-	-	2	-	-	-
20	Bench Mark 125 to Timber Cove	3	54	-	-	-	8	24	H	22	-	-	H	-	-	-
21	Windermere Point to Jewell Gulch	3	24	-	-	-	-	14	6	4	-	-	H	-	-	-
22	Northwest Cape Rocks	2	26	-	-	-	-	2	H	24	-	-	H	-	-	-
23	Russian Gulch	6	328	-	-	170	38	46	8	52	-	-	14	-	-	-

Table 1 (con't).

Colony Code	Colony Name	No. Species	Total	LHSP	ASSP	DCCO	BRAC	PECO	BLOY	WEGU	CAGU	COMU	PIGU	CAAU	RHAU	TUPU
24	Russian River Rocks	5	129	-	-	H	62	22	4	30	-	-	11	-	-	-
25	Goat Rock to Peaked Hill	3	34	-	-	-	-	28	2	H	-	-	4	-	-	-
26	Arched Rock	2	135	-	-	-	H	H	-	130	-	-	5	-	H	H
27	Peaked Hill	2-3	53		-	-	-	50	1	P	-	-	2	-	-	-
28	Gull Rock	3	367	P	-	14	286	2	H	44	-	10	11	-	-	-
29	Shell-Wright Beach Rocks	4	18	-	-	H	-	10	3	2	-	-	3	-	-	-
30	Duncan Point to Arched Rock	4	135	-	-	22	-	76	9	28	-	-	H	-	-	-
31	Bodega Head	5	132	-	-	-	-	70	7	38	-	-	16	-	1	-
32	Bodega Rock	2	874	-	-	-	858	-	H	16	-	-	H	-		-
33	Bodega Harbor	1	54	-	-	-	-	-	-	54	-	-	H	-	-	-
34	Pinnacle Rock Area	2	29	-	-	-	-	H	H	2	-	-	27	-	H	-
35	Sonoma-Marin County Line	2	14	-	-	-	H	10	4	H	-	-	H	-	-	-
36	Dillon Beach Rocks	4	18	-	-	H	H	2	2	4	-	-	10	-	-	-
37	Tomales Point	2	25	-	-	-	-	20	H	H	-	-	5	-	-	-
38	Bird Rock	4	558	-	40	-	300	H	H	210	-	-	8	-	H	H
39	Elephant Rock Complex	2	21	-	-	-	-	12	-	H	-	-	9	-	-	-
40	Hog Island	1	1182	-	-	1182	-	-	-	-	-	-	-	-	-	-
	South subregion															
41	Point Reyes Headlands	7	56428	-	15	-	646	270	18	380	-	54630	469	-	H	H
42	Coast Campground South	1	37	-	-	-	-	-	-	-	-	-	37	-	-	-
43	Point Resistance	4	6726	-	-	H	60	18	2	H	-	6630	16	-	-	-
44	Millers Point Rocks	6	643	-	-	-	100	46	4	24	-	444	25	-	-	-
45	Double Point Rocks	7	13669	-	50	-	238	16	2	30	-	13308	25	-	-	-
46	Stinson Beach to Rocky Point	2	4	-	-	-	-	-	2	2	-	-	H	-	-	-
47	Gull Rock Area	4	70	-	-	-	-	14	2	6	-	-	48	-	-	-
48	Muir Beach Headlands to Tennessee Cove	4	57	-	-	-	-	18	2	2	-	-	35	-	-	-
49	Bird Island	4	57	-	-	-	H	-	2	28	-	22	5	-	-	-
50	Point Bonita	3	108	-	-	-	-	82	-	2	-	-	24	-	-	-
51	Bonita Cove	1	1	-	-	-	-	H	1	H	-	-	H	-	-	-

Table 1 (con't).

Colony Code	Colony Name	No. Species	Total	LHSP	ASSP	DCCO	BRAC	PECO	BLOY	WEGU	CAGU	COMU	PIGU	CAAU	RHAU	TUPU
52	Point Diablo Bluffs and Needles	4	60	-	-	-	-	26	2	28	-	-	4	-	-	-
55	Fort Point Rock to Helmet Rock	2	9	-	-	-	-	-	1	8	-	-	H	-	-	-
56	Lobos Rock and Land's End	4	228	-	-	-	182	-	3	12	-	-	31	-	-	-
57	Seal Rocks	2	70	-	-	H	H	-	2	68	-	-	H	-	-	-
58	Mussel Rock Area	4	16	-	-	-	-	6	1	-	-	2	7	-	-	-
59	Mori Point	4	31	-	-	-	-	2	2	4	-	-	23	-	-	-
60	Rockaway Point	3	13	-	-	-	-	-	2	4	-	-	7			
61	San Pedro Rock	3	66	-	-	-	H	H	2	16	-	H	48	-	H	H
62	Devil's Slide Rock and Mainland	6	1705	-	-	-	334	84	2	32	-	1139	114	-	H	-
63	Gray Whale Cove South	2-3	6	-	-	-	-	2	4	P	-	-	-	-	-	-
64	Pillar Point	0	0	-	-	H	-	H	-	-	-	-	H	-	-	-
65	Pillar Point Harbor	2	153	-	-	-	-	-	5	148	-	-	-	-	-	-
66	Eel Rock Cliffs	1	12	-	-	-	-	12	-	-	-	-	H	-	-	-
67	Seal Rock Cliffs	5	204	-	-	-	56	136	1	4	-	-	7	-	-	-
68	Martin's Beach	5	281	-	-	-	154	90	3	2	-	-	32	-	-	-
69	Pomponio Beach to Pescadero Beach	2	13	-	-	-	-	-	4	-	-	-	9	-	-	-
70	Pigeon Point	4	27	-	-	-	-	8	3	10	-	-	6	-	-	-
	Farallon subregion															
53	North Farallon Islands	6	91,483	-	-	-	62	52	-	26	-	91,255	52	36	-	-
54	South Farallon Islands	13	328,592	X	5768	360	4916	206	48	17,406	208	271,787	3461	20,994	3192	246
	TOTAL	13	507,262	X	5873	1770	8910	2166	249	19,326	208	439,429	4861	21,030	3194	246

[1] Species codes: LHSP – Leach's Storm-Petrel, ASSP – Ashy Storm-Petrel, DCCO – Double-crested Cormorant, BRAC – Brandt's Cormorant, PECO – Pelagic Cormorant, BLOY – Black Oystercatcher, WEGU – Western Gull, CAGU – California Gull, COMU – Common Murre, PIGU - Pigeon Guillemot, CAAU - Cassin's Auklet, RHAU - Rhinoceros Auklet, TUPU - Tufted Puffin.

[2] X – Breeding, no estimate; P – Possibly/Probably breeding in small numbers; H – Historical nesting or presence but not recorded as active in 2010-2012; a dash (-) indicates the species has not been recorded breeding at the colony.

[3] Colony Code – refers to colony number in Figures 2, 3 and Appendix 1. Colony codes were numbered north to south.

Table 2. Numbers of breeding seabirds and percentages of the total NCCSR population within three NCCSR subregions, 2010-2012. See Table 1 for definitions.

Subregion	No. Species	Total	LHSP	ASSP	DCCO	BRAC	PECO	BLOY	WEGU	CAGU	COMU	PIGU	CAAU	RHAU	TUPU
North	9-11	6,491	P	40	1,410	2,162	1,078	129	1,082	0	212	376	P	2	0
		1.3%	-	0.7%	79.7%	24.3%	49.8%	51.8%	5.6%	-	0.05%	7.7%	-	0.1%	-
South	7	80,696	0	65	0	1,770	830	72	812	0	76,175	972	0	0	0
		15.9%	-	1.1%	0.0%	19.9%	38.3%	28.9%	4.2%	-	17.3%	20.0%	-	-	-
Farallon	13	420,075	X	5,768	360	4,978	258	48	17,432	208	363,042	3,513	21,030	3,192	246
	100%	82.8%	-	98.2%	20.3%	55.9%	11.9%	19.3%	90.2%	100%	82.6%	72.3%	100%	99.9%	100%
NCCSR Total	13	507,262	X	5,873	1,770	8,910	2,166	249	19,326	208	439,429	4,861	21,030	3,194	246

Table 3. Numbers of breeding seabirds within each state marine protected area (MPA) of the NCCSR in 2010-2012.[1,2] Only MPAs intersecting outer coast shorelines are included. See Table 1 for definitions.

MPA Name	No. Species	Total	LHSP	ASSP	DCCO	BRAC	PECO	BLOY	WEGU	CAGU	COMU	PIGU	CAAU	RHAU	TUPU
Point Arena SMR	4	32	0	0	0	0	16	8	4	0	0	4	0	0	0
Sea Lion Cove SMCA	3	102	0	0	0	0	36	2	0	0	0	64	0	0	0
Saunders Reef SMCA	4	263	0	0	0	0	232	12	4	0	0	15	0	0	0
Del Mar Landing SMR	2	10	0	0	0	0	8	2	0	0	0	0	0	0	0
Stewarts Pt SMCA	4	101	0	0	0	0	60	12	16	0	0	13	0	0	0
Stewarts Pt SMR	4	50	0	0	0	0	40	2	2	0	0	6	0	0	0
Salt Point SMCA	1	32	0	0	0	0	32	0	0	0	0	0	0	0	0
Gerstle Cove SMR	1	2	0	0	0	0	0	0	2	0	0	0	0	0	0
Russian R. SMCA	5	110	0	0	0	62	14	3	20	0	0	11	0	0	0
Bodega Head SMR	5	124	0	0	0	0	68	7	32	0	0	16	0	1	0
Bodega Head SMCA	1	6	0	0	0	0	0	0	6	0	0	0	0	0	0
Point Reyes SMR	5	37,516	0	0	0	0	94	4	34	0	37,191	193	0	0	0
Point Reyes Head SC	7	18,871	0	15	0	646	172	13	346	0	17,439	240	0	0	0
Pt. Resistance Rk SC	2	6,690	0	0	0	60	0	0	0	0	6,630	0	0	0	0
Double Pt. SC	7	13,547	0	50	0	134	8	2	20	0	13,308	25	0	0	0
North Farallon Is. SC	6	91,483	0	0	0	62	52	0	26	0	91,255	52	36	0	0
SE Farallon I. SC	13	328,592	X	5,768	360	4,916	206	48	17,406	208	271,787	3,461	20,994	3,192	246
Devil's Slide Rk. SC	5	1,289	0	0	0	176	0	2	4	0	1,079	28	0	0	0
Montara SMR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pillar Point SMCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4. Numbers of breeding seabirds and percentages of total NCCSR 2010-2012 populations within each type of state marine protected area (SMR – State Marine Reserve; SMCA – State Marine Conservation Area; SC – Special Closure) and outside MPAs. See Table 1 for definitions.

MPA Type	No. Species	Total	LHSP	ASSP	DCCO	BRAC	PECO	BLOY	WEGU	CAGU	COMU	PIGU	CAAU	RHAU	TUPU
SMR	6	37,734	0	0	0	0	226	23	74	0	37,191	219	0	1	0
		7.4%	-	-	-	-	10.4%	9.2%	0.4%	-	8.5%	4.5%	-	<0.1%	-
SMCA	5	614	0	0	0	62	374	29	46	0	0	103	0	0	0
		0.1%	-	-	-	0.7%	17.3%	11.6%	0.2%	-	-	2.1%	-	-	-
SC	13	460,473	X	5,833	360	5,994	438	65	17,802	208	401,499	3,806	21,030	3,192	246
		90.8%	-	99.3%	20.3%	67.3%	20.2%	26.1%	92.1%	100%	91.4%	78.3%	100%	99.9%	100%
Outside	10	8,441	P	40	1,410	2,854	1,128	132	1,404	0	793	733	P	1	0
		1.7%	-	0.7%	79.7%	32.0%	52.1%	53.0%	7.3%	-	0.2%	15.1%	<0.1%	<0.1%	-

Table 5. Numbers of breeding seabirds and percentages of NCCSR regional and subregional populations in MPAs (SMRs, SMCAs, and SCs) in 2010-2012. See Table 1 for definitions descriptions.

Subregion	No. Species	Total	LHSP	ASSP	DCCO	BRAC	PECO	BLOY	WEGU	CAGU	COMU	PIGU	CAAU	RHAU	TUPU
NCCSR	13	498,820	X	5,833	360	6,056	1,038	117	17,922	208	438,689	4,128	21,030	3,193	246
		98.3%	-	99.3%	20.3%	68.0%	47.9%	47.0%	92.7%	100%	99.8%	84.9%	100%	100%	100%
North	6	832	P	0	0	62	506	48	86	0	0	129	P	1	0
		12.8%	-	-	-	2.9%	46.9%	37.2%	7.9%	-	-	34.3%	-	50.0%	-
South	7	77,913	0	65	0	1,016	274	21	404	0	75,647	486	0	H	H
		96.6%	-	100%	-	57.4%	33.0%	29.2%	49.8%	-	99.3%	50.0%	-	-	-
Farallon	13	420,075	X	5,768	360	4,978	258	48	17,432	208	363,042	3,513	21,030	3,192	246
		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6. Numbers of breeding birds in the NCCSR in 1989 (modified from Carter et al. 1992; see Methods) and percent changes from 1989 to 2010-2012 for eight species. Codes - + indicates colonization of this region since 1989.

Species	Total NCCSR 1989	% Change 1989-2012	North Subregion 1989	% Change 1989-2012	South Subregion 1989	% Change 1989-2012	Farallon Subregion 1989	% Change 1989-2012
Double-crested Cormorant	1,306	35.5%	356	296%	0	-	950	-62.1%
Brandt's Cormorant	19,752	-55.1%	2,546	-15.1%	1,840	-6.2%	15,366	-67.6%
Pelagic Cormorant	4,172	-45.5%	2,564	-58.0%	4,426	-0.9%	862	-70.1%
Black Oystercatcher	178	39.9%	129	0%	71	279%	30	60.0%
Western Gull	23,659	-18.4%	927	16.7%	454	74.0%	22,278	-21.8%
Common Murre	91,663	379%	0	+	23,495	224%	68,168	433%
Pigeon Guillemot	2,838	71.0%	403	-6.7%	526	83.5%	1,909	84.0%

Table 7. Changes in colony occupation between 1989 and 2010-12 by eight species of seabirds in the NCCSR.

Species	No. Active Colonies (1989)	No. Active Colonies (2010-12)	No. Colonies active in 1989 but inactive in 2010-12	No. Colonies active in 2010-12 but inactive in 1989
Double-crested Cormorant	3	6	2	5
Brandt's Cormorant	16	18	2	4
Pelagic Cormorant	49	48	8	7
Black Oystercatcher	39	50	9	19
Western Gull	51	51	8	8
Common Murre	6	11	0	5
Pigeon Guillemot	55	50	10	5

Appendix I. Seabird population count data at each breeding colony in the NCCSR, 2010-2012, summarized by colony.

This appendix only includes counts used to obtain total bird counts (breeding population estimate), summed for each species at each colony. Additional raw count data will be provided separately. A description of each follows:

CC: Colony Code. Colonies were numbered north to south from 1 to 70.
CCN: California Colony Number, following a two letter alpha county code, three digit latitude code, then a sequential unique number (see Carter et al. 1992). New colonies were assigned new colony numbers.
USFWSCN: U.S. Fish and Wildlife Service Colony Number (see Sowls et al. 1980, Carter et al. 1992). New colonies were assigned new colony numbers.
Colony Name: These followed Sowls et al. (1980) and Carter et al. (1992) with some minor revisions. New colonies were given new names.
SC: Species numeric code, following Carter et al. (1992). These codes allow sorting in taxanomic order. See below.
SPEC: Species four letter alpha code, following the American Ornithological Union. See below:

SC	SPEC	Species Name	Scientific Name
02	LHSP	Leach's Storm-Petrel	*Oceanodroma leucorhoa*
03	ASSP	Ashy Storm-Petrel	*Oceanodroma homochroa*
07	DCCO	Double-crested Cormorant	*Phalacrocorax auritus*
08	BRAC	Brandt's Cormorant	*Phalacrocorax penicillatus*
09	PECO	Pelagic Cormorant	*Phalacrocorax pelagicus*
10	BLOY	Black Oystercatcher	*Haematopus bachmani*
12	WEGU	Western Gull	*Larus occidentalis*
13	CAGU	California Gull	*Larus californianus*
24	COMU	Common Murre	*Uria aalge*
25	PIGU	Pigeon Guillemot	*Cepphus columba*
28	CAAU	Cassin's Auklet	*Ptychoramphus aleuticus*
29	RHAU	Rhinoceros Auklet	*Cerorhinca monocerata*
30	TUPU	Tufted Puffin	*Fratercula cirrhata*

Nest: Total number of nests counted. Missing values indicate no data.
Site: Total number of territorial sites counted. Missing values indicate no data.
Bird: Total number of birds counted. Missing values indicate no data.
Total: Total numbers of breeding birds estimated. See text for estimation methods.

Appendix I (continued).

CC	CCN	USFWSCN	Colony Name	SC	SPEC	Nest	Site	Bird	Total
1	ME-384-01	404-017	Point Arena	9	PECO	15	0	41	30
1	ME-384-01	404-017	Point Arena	10	BLOY	1	1	12	12
1	ME-384-01	404-017	Point Arena	12	WEGU	2	1	5	4
1	ME-384-01	404-017	Point Arena	25	PIGU	0	0	12	12
2	ME-384-02	404-001	Sea Lion Rocks	9	PECO	5	0	7	10
2	ME-384-02	404-001	Sea Lion Rocks	10	BLOY	0	0	2	2
2	ME-384-02	404-001	Sea Lion Rocks	25	PIGU	0	8	47	47
3	ME-384-03	404-042	Sea Lion Rocks to Arena Cove	9	PECO	27	0	49	54
3	ME-384-03	404-042	Sea Lion Rocks to Arena Cove	10	BLOY	0	2	6	6
3	ME-384-03	404-042	Sea Lion Rocks to Arena Cove	12	WEGU	11	0	64	22
3	ME-384-03	404-042	Sea Lion Rocks to Arena Cove	25	PIGU	0	4	31	31
4	ME-384-04	404-018	Moat Cove	10	BLOY	0	0	4	4
4	ME-384-04	404-018	Moat Cove	25	PIGU	0	0	4	4
5	ME-384-05	404-019	Section 30 Cove	99	ZERO	0	0	0	0
6	ME-384-06	404-020	Saunders Landing	9	PECO	79	0	93	158
6	ME-384-06	404-020	Saunders Landing	10	BLOY	2	1	10	10
6	ME-384-06	404-020	Saunders Landing	12	WEGU	1	3	6	2
6	ME-384-06	404-020	Saunders Landing	25	PIGU	0	0	7	7
7	ME-384-07	404-002	Iverson Landing	9	PECO	37	0	41	74
7	ME-384-07	404-002	Iverson Landing	10	BLOY	1	0	2	2
7	ME-384-07	404-002	Iverson Landing	12	WEGU	1	1	3	2
7	ME-384-07	404-002	Iverson Landing	25	PIGU	0	4	8	8
8	ME-384-08	404-021	Triplett Gulch	9	PECO	15	1	18	30
8	ME-384-08	404-021	Triplett Gulch	10	BLOY	2	1	9	9
8	ME-384-08	404-021	Triplett Gulch	12	WEGU	4	0	6	8
8	ME-384-08	404-021	Triplett Gulch	25	PIGU	0	0	8	8
9	ME-384-09	404-022	Fish Rock Cove	12	WEGU	1	0	1	2
9	ME-384-09	404-022	Fish Rock Cove	25	PIGU	0	0	1	1
10	ME-384-10	404-003	Fish Rocks	7	DCCO	11	0	11	22
10	ME-384-10	404-003	Fish Rocks	8	BRAC	225	39	341	450
10	ME-384-10	404-003	Fish Rocks	9	PECO	45	2	59	90
10	ME-384-10	404-003	Fish Rocks	10	BLOY	0	1	4	4
10	ME-384-10	404-003	Fish Rocks	12	WEGU	105	0	434	210
10	ME-384-10	404-003	Fish Rocks	24	COMU	0	0	168	168
10	ME-384-10	404-003	Fish Rocks	25	PIGU	0	11	62	62

Appendix I (continued).

CC	CCN	USFWSCN	Colony Name	SC	SPEC	Nest	Site	Bird	Total
11	ME-384-11	404-023	Collins Landing to Gualala River	9	PECO	39	5	91	78
11	ME-384-11	404-023	Collins Landing to Gualala River	10	BLOY	0	2	10	10
11	ME-384-11	404-023	Collins Landing to Gualala River	12	WEGU	2	0	4	4
11	ME-384-11	404-023	Collins Landing to Gualala River	25	PIGU	0	6	28	28
12	SO-384-01	404-004	Gualala Point Island	8	BRAC	80	3	100	160
12	SO-384-01	404-004	Gualala Point Island	12	WEGU	70	5	89	140
12	SO-384-01	404-004	Gualala Point Island	24	COMU	0	0	34	34
12	SO-384-01	404-004	Gualala Point Island	25	PIGU	0	4	22	22
13	SO-384-02	404-024	Del Mar Point	9	PECO	7	0	11	14
13	SO-384-02	404-024	Del Mar Point	10	BLOY	0	0	2	2
14	SO-384-03	404-025	Sea Ranch	9	PECO	8	5	18	16
14	SO-384-03	404-025	Sea Ranch	10	BLOY	0	0	5	5
14	SO-384-03	404-025	Sea Ranch	12	WEGU	1	1	7	2
14	SO-384-03	404-025	Sea Ranch	29	RHAU	0	0	1	1
15	SO-384-04	404-026	Black Point to Stewart's Point	9	PECO	17	0	16	34
15	SO-384-04	404-026	Black Point to Stewart's Point	10	BLOY	0	1	6	6
15	SO-384-04	404-026	Black Point to Stewart's Point	12	WEGU	4	3	14	8
15	SO-384-04	404-026	Black Point to Stewart's Point	25	PIGU	0	0	2	2
16	SO-382-01	404-027	Stewart's Point to Rocky Point	9	PECO	13	0	21	26
16	SO-382-01	404-027	Stewart's Point to Rocky Point	10	BLOY	0	2	6	6
16	SO-382-01	404-027	Stewart's Point to Rocky Point	12	WEGU	4	1	15	8
16	SO-382-01	404-027	Stewart's Point to Rocky Point	25	PIGU	0	2	11	11
17	SO-382-02	404-028	Horseshoe Cove	9	PECO	19	0	28	38
17	SO-382-02	404-028	Horseshoe Cove	12	WEGU	1	0	1	2
17	SO-382-02	404-028	Horseshoe Cove	25	PIGU	0	1	6	6
18	SO-382-03	404-029	Cannon Gulch to Stump Beach	9	PECO	17	0	2	34
18	SO-382-03	404-029	Cannon Gulch to Stump Beach	10	BLOY	0	1	2	2
19	SO-382-04	404-030	Gerstle Cove to Stillwater Cove	9	PECO	2	0	5	4
19	SO-382-04	404-030	Gerstle Cove to Stillwater Cove	10	BLOY	0	0	3	3
19	SO-382-04	404-030	Gerstle Cove to Stillwater Cove	12	WEGU	4	1	9	8
19	SO-382-04	404-030	Gerstle Cove to Stillwater Cove	25	PIGU	0	0	2	2
20	SO-382-05	404-031	Bench Mark 125 to Timber Cove	8	BRAC	4	0	10	8
20	SO-382-05	404-031	Bench Mark 125 to Timber Cove	9	PECO	12	0	11	24
20	SO-382-05	404-031	Bench Mark 125 to Timber Cove	12	WEGU	11	0	127	22
21	SO-382-06	404-043	Windermere Point to Jewell Gulch	9	PECO	7	0	14	14
21	SO-382-06	404-043	Windermere Point to Jewell Gulch	10	BLOY	0	2	6	6
21	SO-382-06	404-043	Windermere Point to Jewell Gulch	12	WEGU	2	0	5	4

Appendix I (continued).

CC	CCN	USFWSCN	Colony Name	SC	SPEC	Nest	Site	Bird	Total
22	SO-382-07	404-032	Northwest Cape Rocks	9	PECO	1	0	2	2
22	SO-382-07	404-032	Northwest Cape Rocks	12	WEGU	12	0	32	24
23	SO-382-08	404-033	Russian Gulch	7	DCCO	85	0	98	170
23	SO-382-08	404-033	Russian Gulch	8	BRAC	19	6	37	38
23	SO-382-08	404-033	Russian Gulch	9	PECO	23	2	31	46
23	SO-382-08	404-033	Russian Gulch	10	BLOY	0	1	8	8
23	SO-382-08	404-033	Russian Gulch	12	WEGU	26	1	39	52
23	SO-382-08	404-033	Russian Gulch	25	PIGU	0	1	14	14
24	SO-382-09	404-005	Russian River Rocks	8	BRAC	31	0	37	62
24	SO-382-09	404-005	Russian River Rocks	9	PECO	11	0	25	22
24	SO-382-09	404-005	Russian River Rocks	10	BLOY	0	1	4	4
24	SO-382-09	404-005	Russian River Rocks	12	WEGU	15	0	30	30
24	SO-382-09	404-005	Russian River Rocks	25	PIGU	0	0	11	11
25	SO-382-10	404-044	Goat Rock to Peaked Hill	9	PECO	14	0	19	28
25	SO-382-10	404-044	Goat Rock to Peaked Hill	10	BLOY	0	0	2	2
25	SO-382-10	404-044	Goat Rock to Peaked Hill	25	PIGU	0	0	4	4
26	SO-382-11	404-006	Arched Rock	12	WEGU	65	9	80	130
26	SO-382-11	404-006	Arched Rock	25	PIGU	0	1	5	5
27	SO-382-12	404-034	Peaked Hill	9	PECO	25	0	43	50
27	SO-382-12	404-034	Peaked Hill	10	BLOY	0	1	1	1
27	SO-382-12	404-034	Peaked Hill	12	WEGU	0	1	2	0
27	SO-382-12	404-034	Peaked Hill	25	PIGU	0	0	2	2
28	SO-382-13	404-035	Gull Rock	7	DCCO	7	0	7	14
28	SO-382-13	404-035	Gull Rock	8	BRAC	143	29	191	286
28	SO-382-13	404-035	Gull Rock	9	PECO	1	0	6	2
28	SO-382-13	404-035	Gull Rock	12	WEGU	22	1	27	44
28	SO-382-13	404-035	Gull Rock	24	COMU	0	0	10	10
28	SO-382-13	404-035	Gull Rock	25	PIGU	0	0	11	11
29	SO-382-14	404-036	Shell-Wright Beach Rocks	9	PECO	5	0	7	10
29	SO-382-14	404-036	Shell-Wright Beach Rocks	10	BLOY	0	2	3	3
29	SO-382-14	404-036	Shell-Wright Beach Rocks	12	WEGU	1	2	5	2
29	SO-382-14	404-036	Shell-Wright Beach Rocks	25	PIGU	0	1	3	3
30	SO-382-15	404-037	Duncan Point to Arched Rock	7	DCCO	11	0	12	22
30	SO-382-15	404-037	Duncan Point to Arched Rock	9	PECO	38	3	50	76
30	SO-382-15	404-037	Duncan Point to Arched Rock	10	BLOY	1	3	9	9
30	SO-382-15	404-037	Duncan Point to Arched Rock	12	WEGU	14	5	27	28
31	SO-380-01	404-038	Bodega Head	9	PECO	35	1	69	70
31	SO-380-01	404-038	Bodega Head	10	BLOY	0	1	7	7

Appendix I (continued).

CC	CCN	USFWSCN	Colony Name	SC	SPEC	Nest	Site	Bird	Total
31	SO-380-01	404-038	Bodega Head	12	WEGU	19	0	36	38
31	SO-380-01	404-038	Bodega Head	25	PIGU	0	0	16	16
31	SO-380-01	404-038	Bodega Head	29	RHAU	0	0	1	1
32	SO-380-02	404-008	Bodega Rock	8	BRAC	429	87	689	858
32	SO-380-02	404-008	Bodega Rock	12	WEGU	8	2	21	16
33	SO-380-03	404-045	Bodega Harbor	12	WEGU	27	1	34	54
34	SO-380-04	404-039	Pinnacle Rock Area	12	WEGU	1	1	2	2
34	SO-380-04	404-039	Pinnacle Rock Area	25	PIGU	0	6	27	27
35	MA-380-01	404-040	Sonoma-Marin County Line	9	PECO	5	1	30	10
35	MA-380-01	404-040	Sonoma-Marin County Line	10	BLOY	0	0	4	4
36	MA-380-02	404-009	Dillon Beach Rocks	9	PECO	1	0	5	2
36	MA-380-02	404-009	Dillon Beach Rocks	10	BLOY	0	0	2	2
36	MA-380-02	404-009	Dillon Beach Rocks	12	WEGU	2	6	18	4
36	MA-380-02	404-009	Dillon Beach Rocks	25	PIGU	0	0	10	10
37	MA-380-03	404-011	Tomales Point	9	PECO	10	0	16	20
37	MA-380-03	404-011	Tomales Point	25	PIGU	0	0	5	5
38	MA-380-04	404-010	Bird Rock	3	ASSP	5	0	6	40
38	MA-380-04	404-010	Bird Rock	8	BRAC	150	41	284	300
38	MA-380-04	404-010	Bird Rock	12	WEGU	105	0	170	210
38	MA-380-04	404-010	Bird Rock	25	PIGU	0	0	8	8
39	MA-380-05	404-041	Elephant Rock Complex	9	PECO	6	0	9	12
39	MA-380-05	404-041	Elephant Rock Complex	25	PIGU	0	0	9	9
40	MA-380-06	404-068	Hog Island	7	DCCO	591	2	885	1182
41	MA-374-01	429-001	Point Reyes Headlands	3	ASSP	0	0	5	15
41	MA-374-01	429-001	Point Reyes Headlands	8	BRAC	323	1	23	646
41	MA-374-01	429-001	Point Reyes Headlands	9	PECO	135	3	218	270
41	MA-374-01	429-001	Point Reyes Headlands	10	BLOY	0	3	18	18
41	MA-374-01	429-001	Point Reyes Headlands	12	WEGU	183	7	333	380
41	MA-374-01	429-001	Point Reyes Headlands	24	COMU			40467	54630
41	MA-374-01	429-001	Point Reyes Headlands	25	PIGU	1	5	469	469
42	MA-374-02	429-042	Coast Campground South	25	PIGU	0	2	37	37
43	MA-374-03	429-024	Point Resistance	8	BRAC	30	0	2	60
43	MA-374-03	429-024	Point Resistance	9	PECO	9	0	11	18
43	MA-374-03	429-024	Point Resistance	10	BLOY	0	0	2	2
43	MA-374-03	429-024	Point Resistance	24	COMU			4911	6630
43	MA-374-03	429-024	Point Resistance	25	PIGU	0	0	16	16
44	MA-374-04	429-002	Millers Point Rocks	8	BRAC	50	0	0	100
44	MA-374-04	429-002	Millers Point Rocks	9	PECO	23	0	30	46

Appendix I (continued).

CC	CCN	USFWSCN	Colony Name	SC	SPEC	Nest	Site	Bird	Total
44	MA-374-04	429-002	Millers Point Rocks	10	BLOY	2	0	4	4
44	MA-374-04	429-002	Millers Point Rocks	12	WEGU	12	0	12	24
44	MA-374-04	429-002	Millers Point Rocks	24	COMU			329	444
44	MA-374-04	429-002	Millers Point Rocks	25	PIGU	0	0	25	25
45	MA-374-05	429-003	Double Point Rocks	3	ASSP	4	0	1	50
45	MA-374-05	429-003	Double Point Rocks	8	BRAC	119	0	132	238
45	MA-374-05	429-003	Double Point Rocks	9	PECO	8	0	12	16
45	MA-374-05	429-003	Double Point Rocks	10	BLOY	1	0	2	2
45	MA-374-05	429-003	Double Point Rocks	12	WEGU	15	1	15	30
45	MA-374-05	429-003	Double Point Rocks	24	COMU			9858	13308
45	MA-374-05	429-003	Double Point Rocks	25	PIGU	0	0	25	25
46	MA-374-06	429-043	Stinson Beach to Rocky Point	10	BLOY	0	0	2	2
46	MA-374-06	429-043	Stinson Beach to Rocky Point	12	WEGU	1	0	4	2
47	MA-374-07	429-025	Gull Rock Area	9	PECO	7	1	9	14
47	MA-374-07	429-025	Gull Rock Area	10	BLOY	0	0	2	2
47	MA-374-07	429-025	Gull Rock Area	12	WEGU	3	2	14	6
47	MA-374-07	429-025	Gull Rock Area	25	PIGU	0	2	48	48
48	MA-374-08	429-026	Muir Beach Headlands to Tennessee Cove	9	PECO	9	0	22	18
48	MA-374-08	429-026	Muir Beach Headlands to Tennessee Cove	10	BLOY	0	1	2	2
48	MA-374-08	429-026	Muir Beach Headlands to Tennessee Cove	12	WEGU	1	0	1	2
48	MA-374-08	429-026	Muir Beach Headlands to Tennessee Cove	25	PIGU	0	0	35	35
49	MA-374-09	429-007	Bird Island	10	BLOY	0	0	2	2
49	MA-374-09	429-007	Bird Island	12	WEGU	14	0	25	28
49	MA-374-09	429-007	Bird Island	24	COMU	0	0	16	22
49	MA-374-09	429-007	Bird Island	25	PIGU	0	0	5	5
50	MA-374-10	429-008	Point Bonita	9	PECO	41	0	51	82
50	MA-374-10	429-008	Point Bonita	12	WEGU	1	1	4	2
50	MA-374-10	429-008	Point Bonita	25	PIGU	0	2	24	24
51	MA-374-11	429-027	Bonita Cove	10	BLOY	0	0	1	1
52	MA-374-12	429-028	Point Diablo Bluff and Needles	9	PECO	13	0	22	26
52	MA-374-12	429-028	Point Diablo Bluff and Needles	10	BLOY	0	0	2	2
52	MA-374-12	429-028	Point Diablo Bluff and Needles	12	WEGU	14	0	28	28
52	MA-374-12	429-028	Point Diablo Bluff and Needles	25	PIGU	0	0	4	4
53	SF-FAI-01	429-051	North Farallon Islands	8	BRAC	31	5	63	62
53	SF-FAI-01	429-051	North Farallon Islands	9	PECO	26			52
53	SF-FAI-01	429-051	North Farallon Islands	12	WEGU	13	5	47	26
53	SF-FAI-01	429-051	North Farallon Islands	24	COMU			59644	91255
53	SF-FAI-01	429-051	North Farallon Islands	25	PIGU			52	52

Appendix I (continued).

CC	CCN	USFWSCN	Colony Name	SC	SPEC	Nest	Site	Bird	Total
53	SF-FAI-01	429-051	North Farallon Islands	28	CAAU				36
54	SF-FAI-02	429-052	South Farallon Islands	2	LHSP				
54	SF-FAI-02	429-052	South Farallon Islands	3	ASSP				5768
54	SF-FAI-02	429-052	South Farallon Islands	7	DCCO	180			360
54	SF-FAI-02	429-052	South Farallon Islands	8	BRAC	2458			4916
54	SF-FAI-02	429-052	South Farallon Islands	9	PECO	103			206
54	SF-FAI-02	429-052	South Farallon Islands	10	BLOY	24			48
54	SF-FAI-02	429-052	South Farallon Islands	12	WEGU				17406
54	SF-FAI-02	429-052	South Farallon Islands	13	CAGU	104			208
54	SF-FAI-02	429-052	South Farallon Islands	24	COMU				271787
54	SF-FAI-02	429-052	South Farallon Islands	25	PIGU			3461	3461
54	SF-FAI-02	429-052	South Farallon Islands	28	CAAU				20994
54	SF-FAI-02	429-052	South Farallon Islands	29	RHAU				3192
54	SF-FAI-02	429-052	South Farallon Islands	30	TUPU				246
55	SF-374-01	429-044	Fort Point to Helmet Rock	10	BLOY	0	0	1	1
55	SF-374-01	429-044	Fort Point to Helmet Rock	12	WEGU	4	0	5	8
56	SF-374-02	429-029	Lobos Rock and Land’s End	8	BRAC	91	9	118	182
56	SF-374-02	429-029	Lobos Rock and Land’s End	10	BLOY	1	1	3	3
56	SF-374-02	429-029	Lobos Rock and Land’s End	12	WEGU	6	0	8	12
56	SF-374-02	429-029	Lobos Rock and Land’s End	25	PIGU	0	1	31	31
57	SF-374-03	429-009	Seal Rocks	10	BLOY	1	0	2	2
57	SF-374-03	429-009	Seal Rocks	12	WEGU	34	3	47	68
58	SM-374-01	429-045	Mussel Rock Area	9	PECO	3	0	4	6
58	SM-374-01	429-045	Mussel Rock Area	10	BLOY	0	0	1	1
58	SM-374-01	429-045	Mussel Rock Area	12	WEGU	1	0	1	2
58	SM-374-01	429-045	Mussel Rock Area	25	PIGU	0	0	7	7
59	SM-372-01	429-046	Mori Point	9	PECO	1	0	7	2
59	SM-372-01	429-046	Mori Point	10	BLOY	0	1	2	2
59	SM-372-01	429-046	Mori Point	12	WEGU	2	0	4	4
59	SM-372-01	429-046	Mori Point	25	PIGU	1	0	23	23
60	SM-372-08	429-118	Rockaway Point	10	BLOY	0	0	2	2
60	SM-372-08	429-118	Rockaway Point	12	WEGU	2	0	6	4
60	SM-372-08	429-118	Rockaway Point	25	PIGU	0	0	7	7
61	SM-372-02	429-013	San Pedro Rock	10	BLOY	0	0	2	2
61	SM-372-02	429-013	San Pedro Rock	12	WEGU	8	0	15	16
61	SM-372-02	429-013	San Pedro Rock	25	PIGU	0	0	48	48
62	SM-372-03	429-014	Devil's Slide Rock and Mainland	8	BRAC	167	37	63	334
62	SM-372-03	429-014	Devil's Slide Rock and Mainland	9	PECO	42	2	33	84

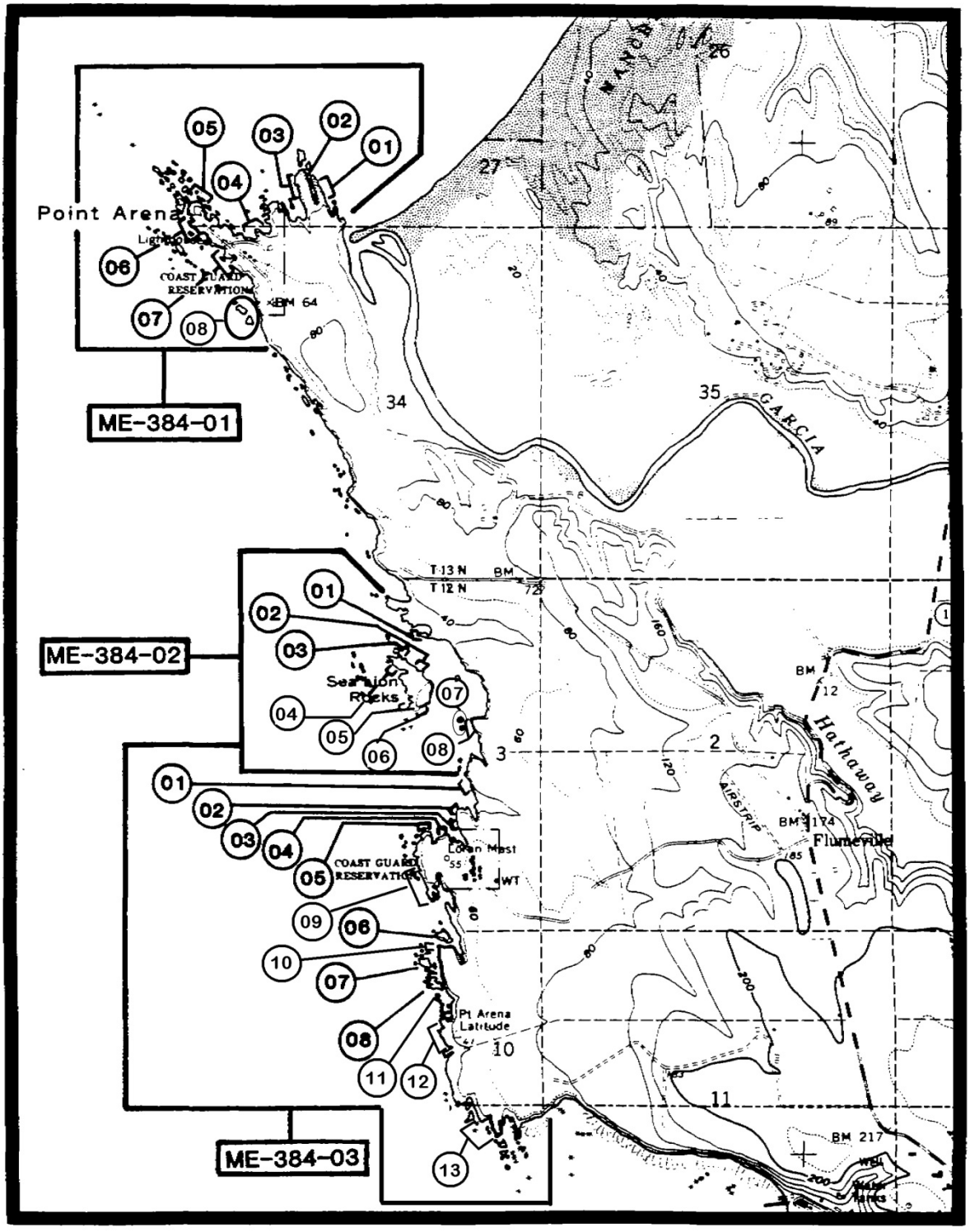
Appendix I (continued).

CC	CCN	USFWSCN	Colony Name	SC	SPEC	Nest	Site	Bird	Total
62	SM-372-03	429-014	Devil's Slide Rock and Mainland	10	BLOY	1	0	2	2
62	SM-372-03	429-014	Devil's Slide Rock and Mainland	12	WEGU	16	0	17	32
62	SM-372-03	429-014	Devil's Slide Rock and Mainland	24	COMU	30	0	771	1139
62	SM-372-03	429-014	Devil's Slide Rock and Mainland	25	PIGU	0	0	114	114
63	SM-372-09	429-119	Gray Whale Cove South	9	PECO	1	1	6	2
63	SM-372-09	429-119	Gray Whale Cove South	10	BLOY	2	0	4	4
63	SM-372-09	429-119	Gray Whale Cove South	12	WEGU	0	1	1	0
64	SM-372-04	429-030	Pillar Point	99	ZERO	0	0	0	0
65	SM-372-10	429-120	Pillar Point Harbor	10	BLOY	3	0	5	5
65	SM-372-10	429-120	Pillar Point Harbor	12	WEGU	74	0	182	148
66	SM-372-05	429-031	Eel Rock Cliffs	9	PECO	6	0	6	12
67	SM-372-06	429-032	Seal Rock Cliffs	8	BRAC	28	0	66	56
67	SM-372-06	429-032	Seal Rock Cliffs	9	PECO	68	4	97	136
67	SM-372-06	429-032	Seal Rock Cliffs	10	BLOY	0	0	1	1
67	SM-372-06	429-032	Seal Rock Cliffs	12	WEGU	2	1	8	4
67	SM-372-06	429-032	Seal Rock Cliffs	25	PIGU	0	0	7	7
68	SM-372-07	429-033	Martins Beach	8	BRAC	77	1	139	154
68	SM-372-07	429-033	Martins Beach	9	PECO	45	0	53	90
68	SM-372-07	429-033	Martins Beach	10	BLOY	0	0	3	3
68	SM-372-07	429-033	Martins Beach	12	WEGU	1	0	5	2
68	SM-372-07	429-033	Martins Beach	25	PIGU	0	0	32	32
69	SM-370-01	429-047	Pomponio Beach to Pescadero Beach	10	BLOY	1	0	4	4
69	SM-370-01	429-047	Pomponio Beach to Pescadero Beach	25	PIGU	0	0	9	9
70	SM-370-02	429-034	Pigeon Point	9	PECO	4	0	6	8
70	SM-370-02	429-034	Pigeon Point	10	BLOY	0	1	3	3
70	SM-370-02	429-034	Pigeon Point	12	WEGU	5	0	13	10
70	SM-370-02	429-034	Pigeon Point	25	PIGU	0	0	6	6

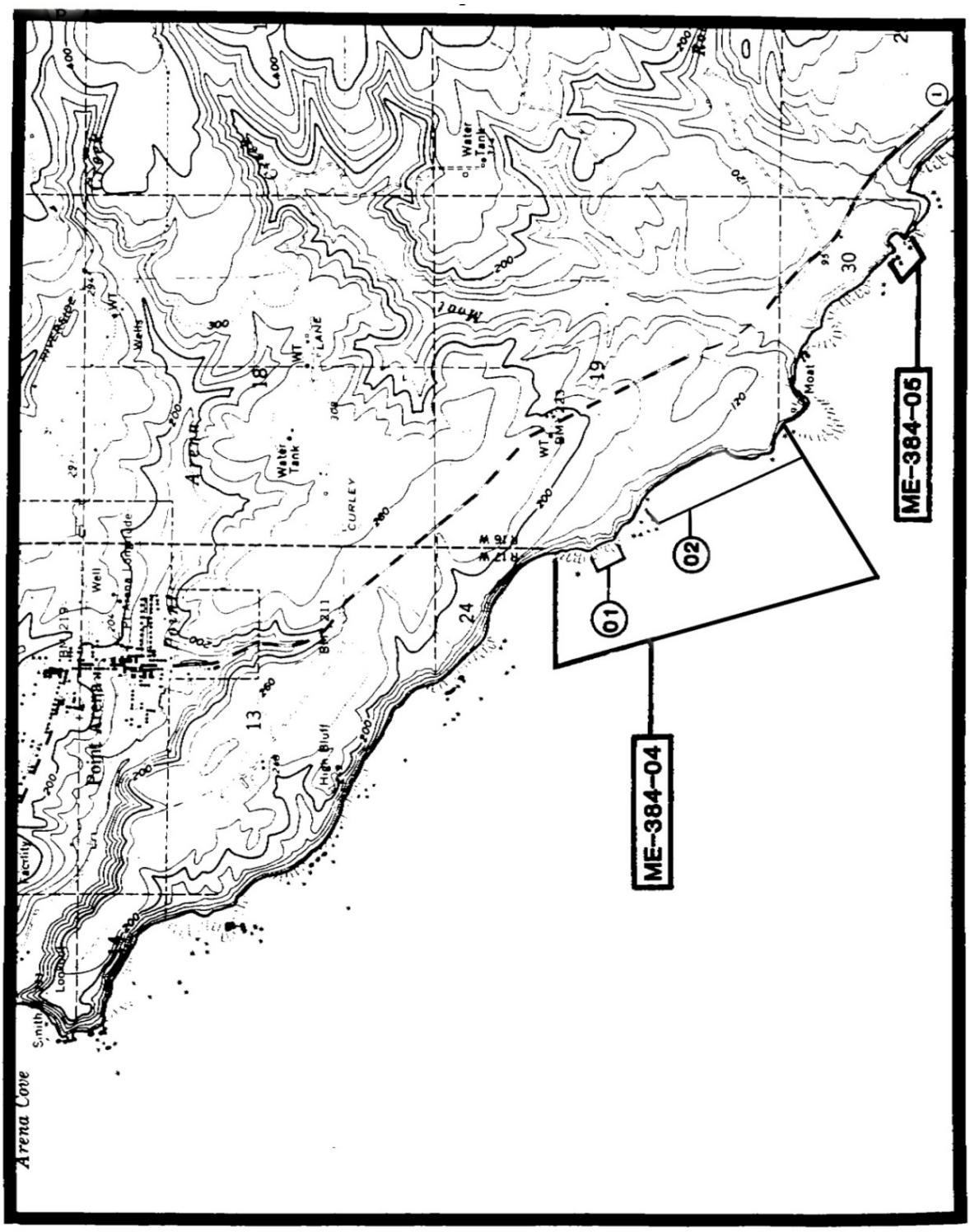
Appendix II. Maps of NCCSR Seabird Colonies.

Maps are presented north to south. The extent of each colony was mapped on USGS topographic maps or NOAA nautical chart (Bodega Harbor only). Most maps were revised from Carter et al. (1992). Other maps were created using the software program National Geographic Topo, then revised.

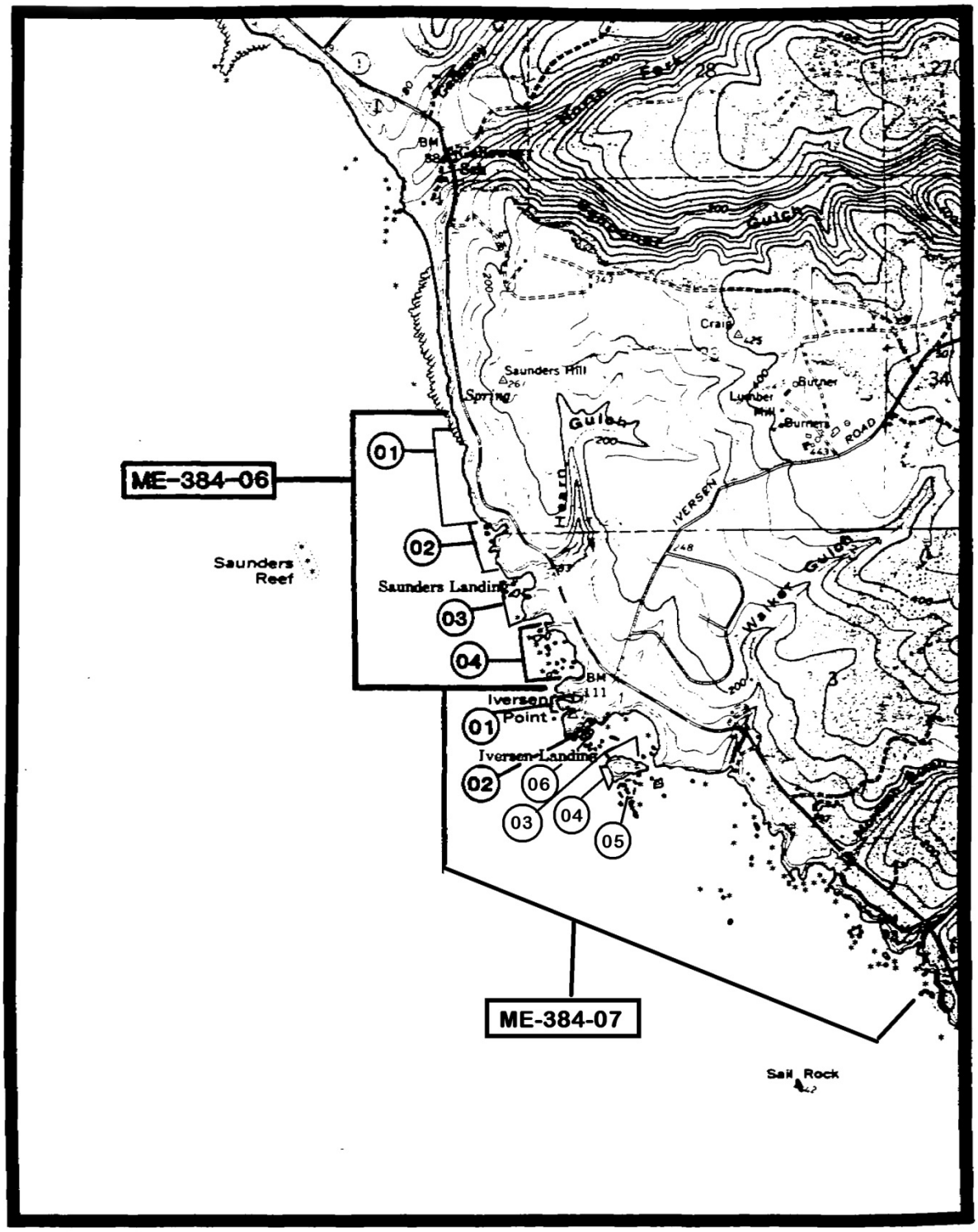
Colonies are identified by the California Colony Number (e.g., ME-384-01; see Appendix I). Circled numbers indicated subcolonies, which are more precise locations of where nesting birds were recorded. Subcolony data were not presented in this report but are available on Ocean Spaces.



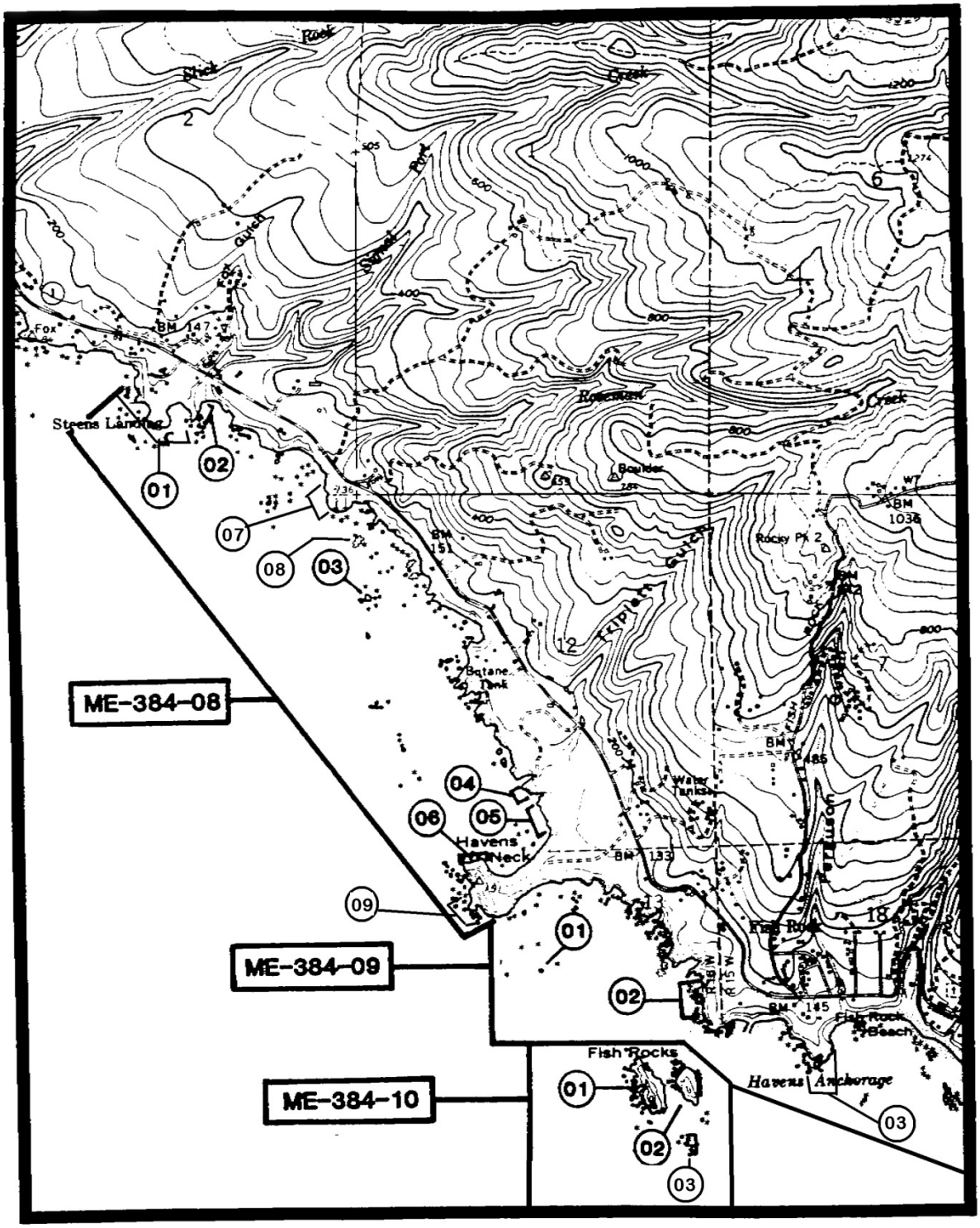
Map 1. Section from USGS map “Point Arena” (modified from Carter et al. 1992: II-42 [Map 40]), indicating colony and subcolony locations for Point Arena (ME-384-01), Sea Lion Rocks (ME-384-02), and Sea Lion Rocks to Arena Cove (ME-384-03).



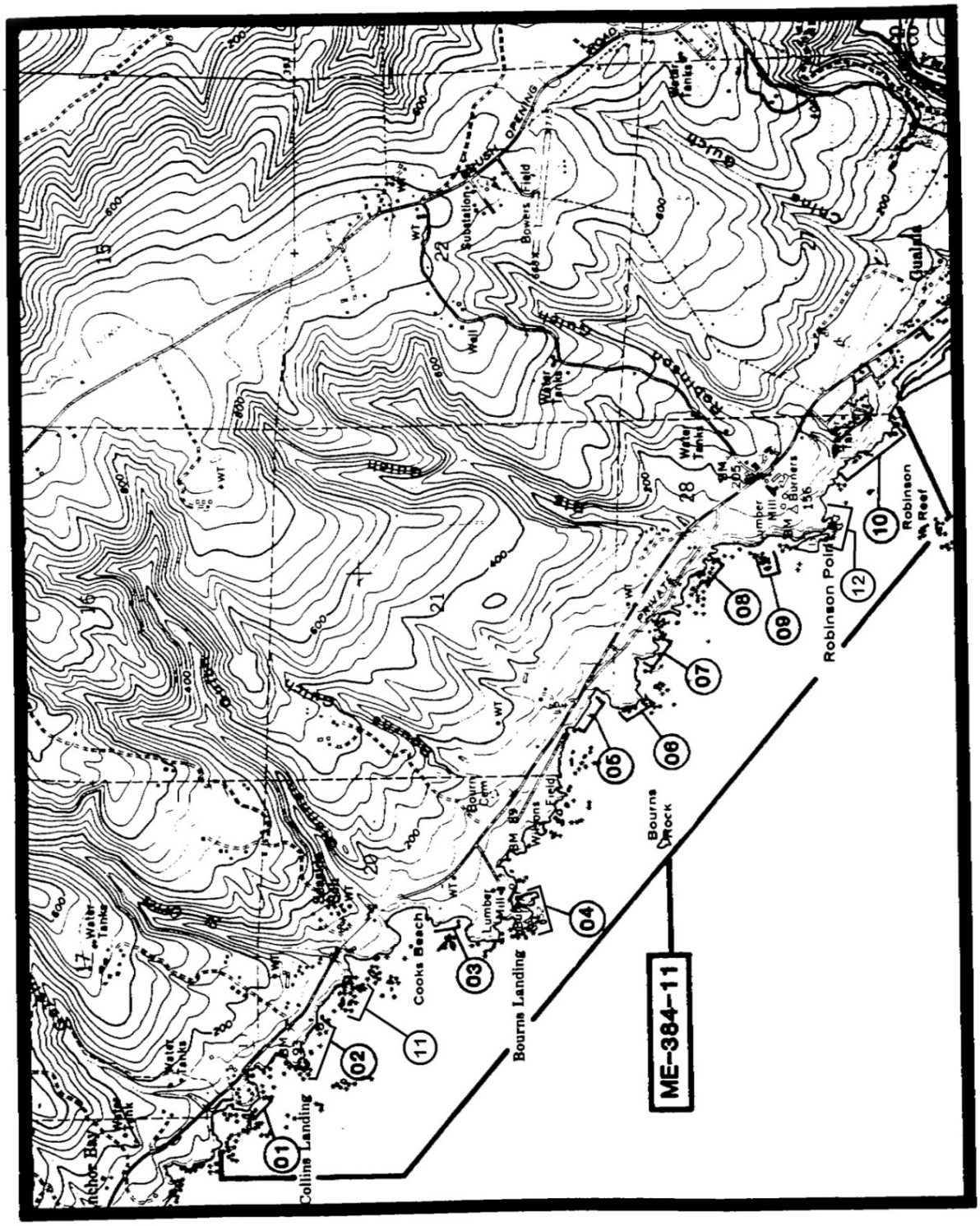
Map 2. Section from USGS map “Point Arena” (modified from Carter et al. 1992: II-43 [Map 41]), indicating colony and subcolony locations for Moat Cove (ME-384-04) and Section 30 Cove (ME-384-05).



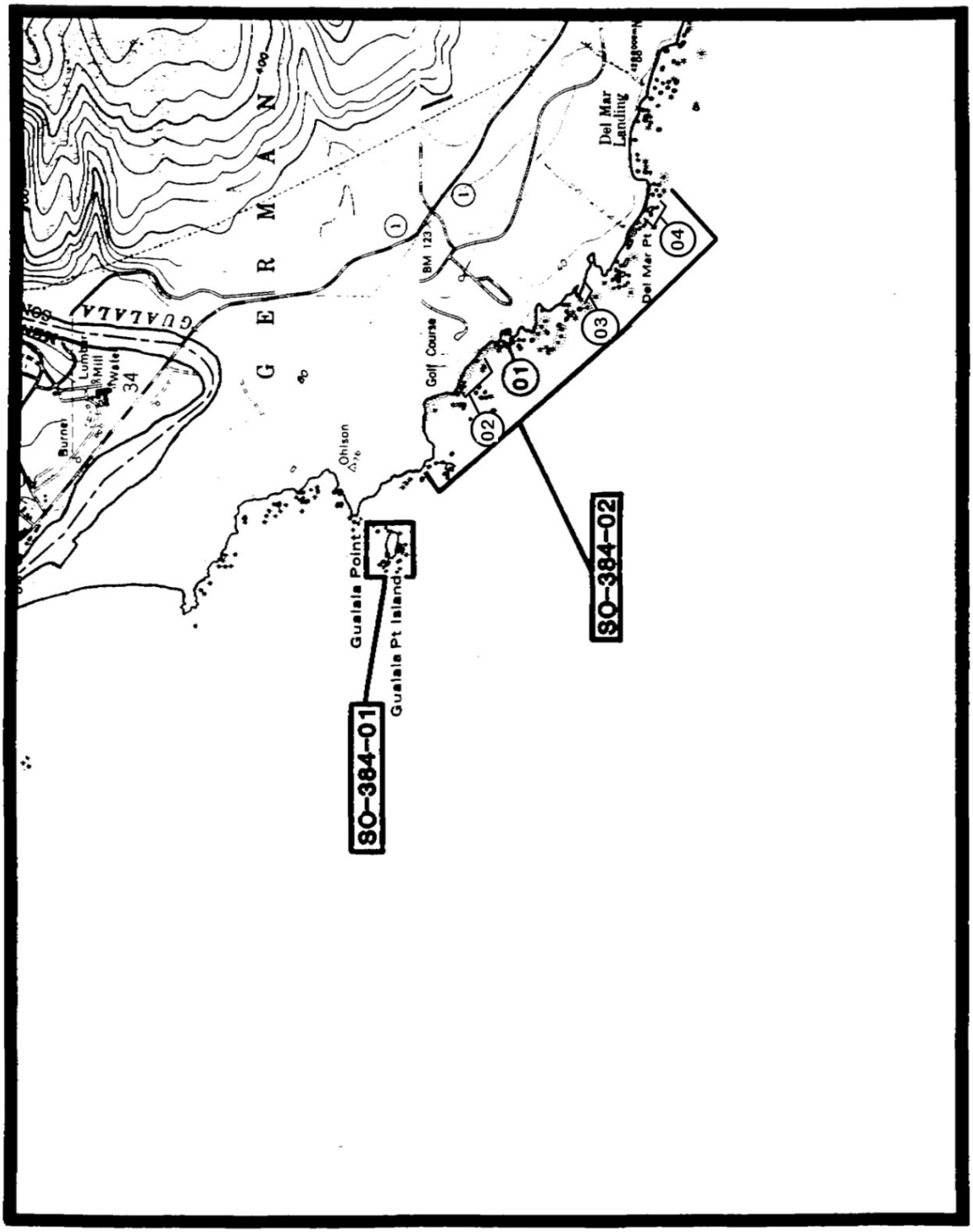
Map 3. Section from USGS map "Saunders Reef" (modified from Carter et al. 1992: II-44 [Map 42]), indicating colony and subcolony locations for Saunders Landing (ME-384-06) and Iverson Landing (ME-384-07).



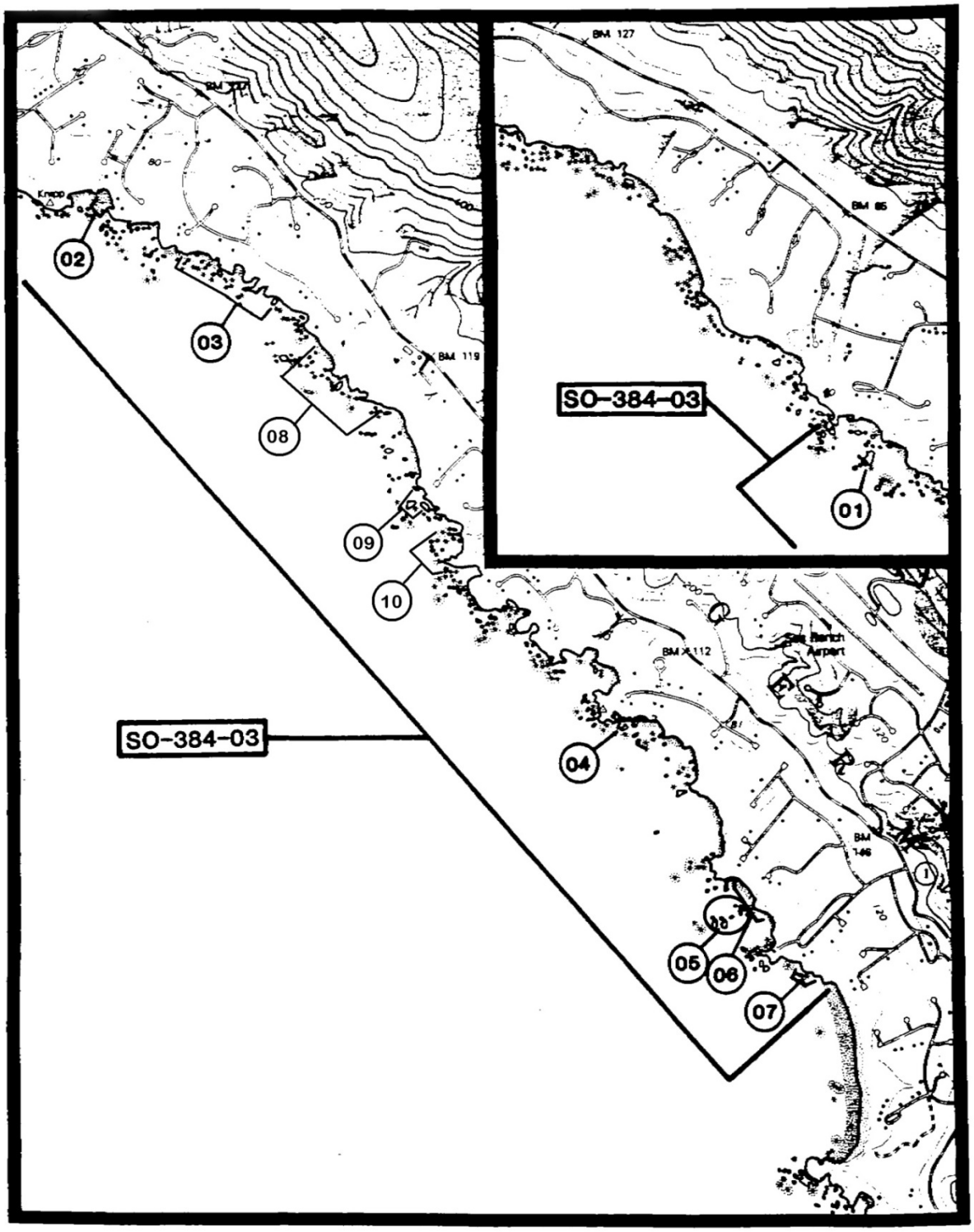
Map 4. Section from USGS map "Gualala" (modified from Carter et al. 1992: II-45 [Map 43]), indicating colony and subcolony locations for Triplett Gulch (ME-384-08), Fish Rock Cove (ME-384-09), and Fish Rocks (ME-384-10).



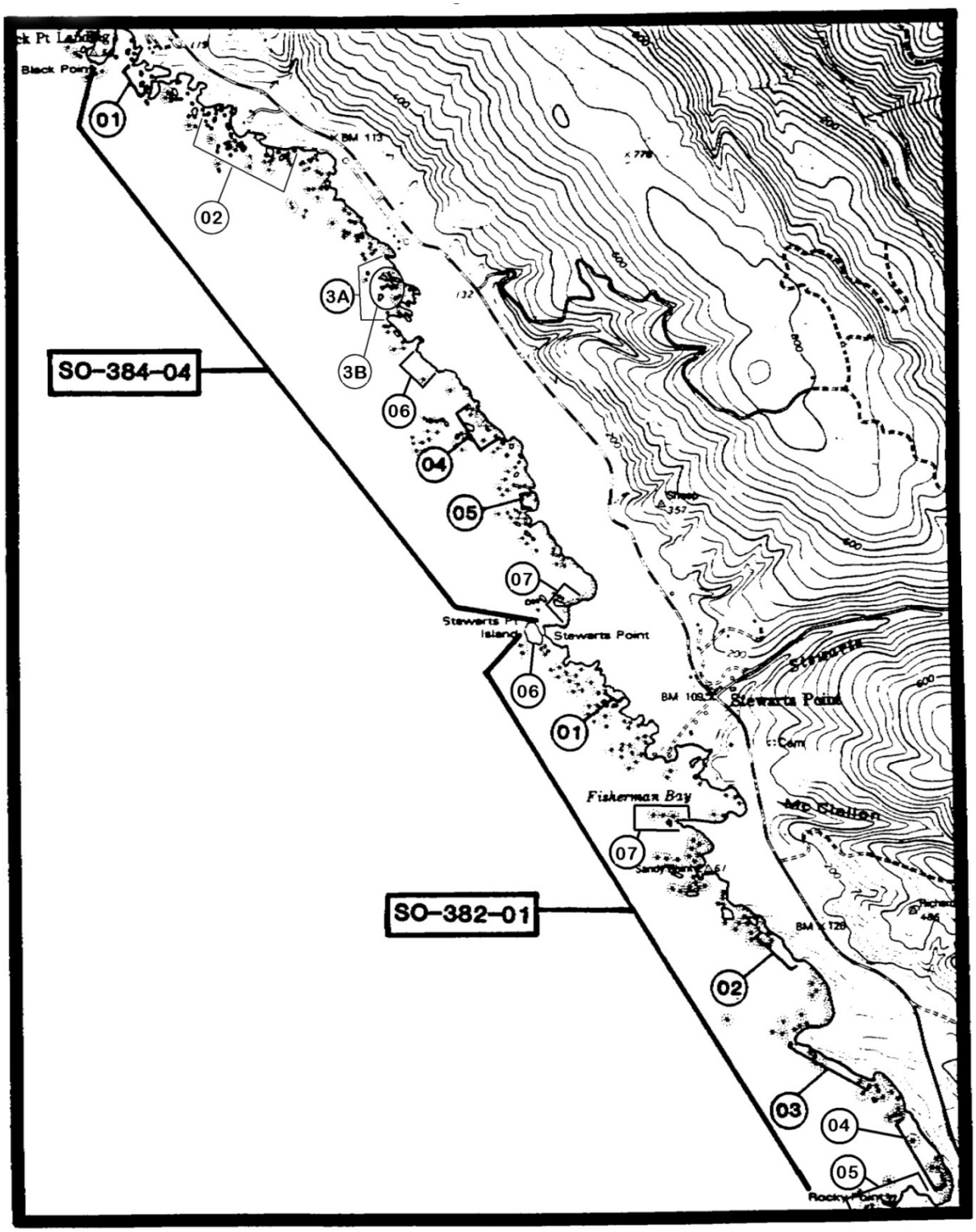
Map 5. Section from USGS map “Gualala” (modified from Carter et al. 1992: II-46 [Map 44]), indicating colony and subcolony location for Collins Landing to Gualala River (ME-384-11).



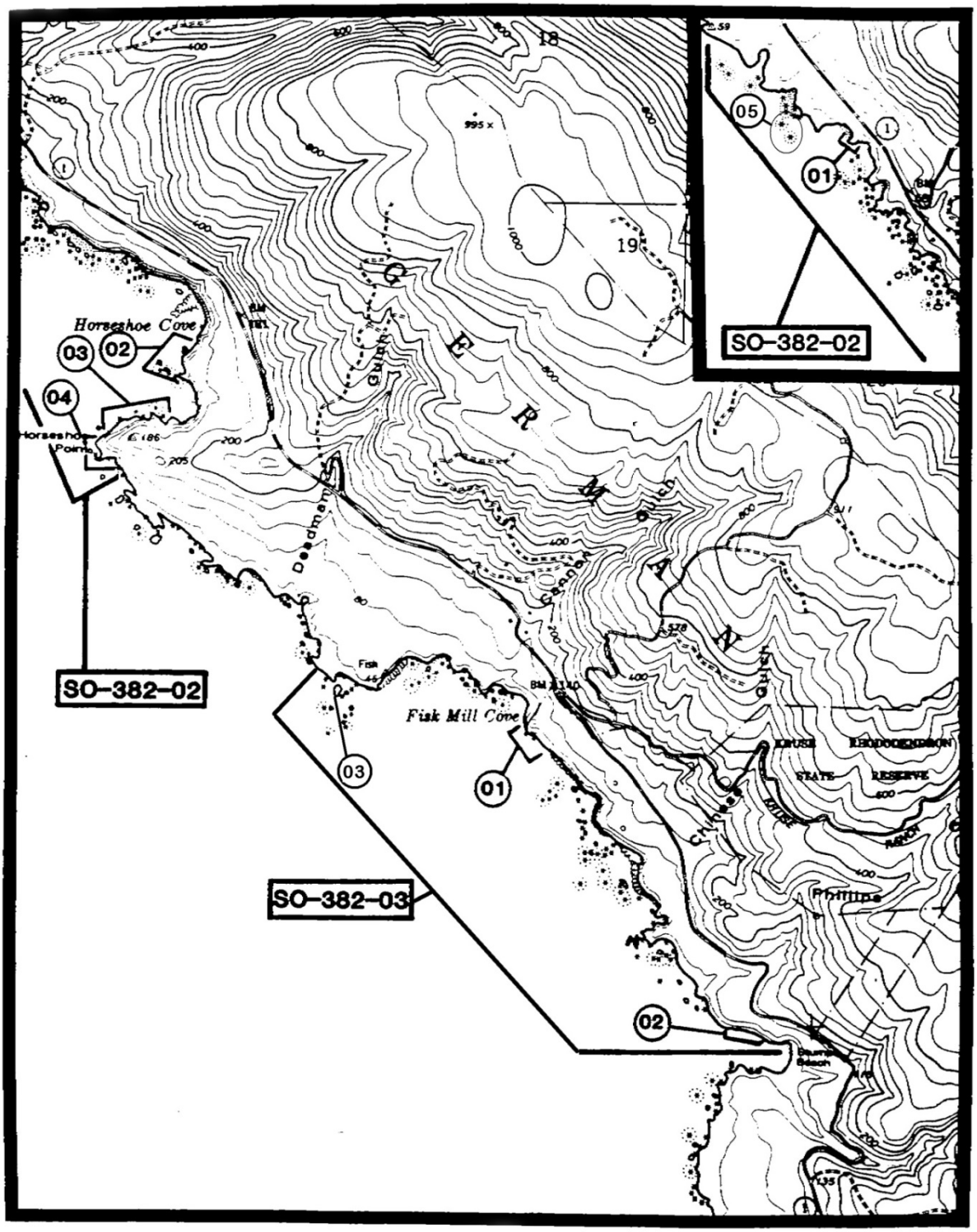
Map 6. Section from USGS maps “Gualala” and “Stewarts Point” (modified from Carter et al. 1992: II-47 [Map 45]), indicating colony and subcolony locations for Gualala Point Island (SO-384-01) and Del Mar Point (SO-384-02).



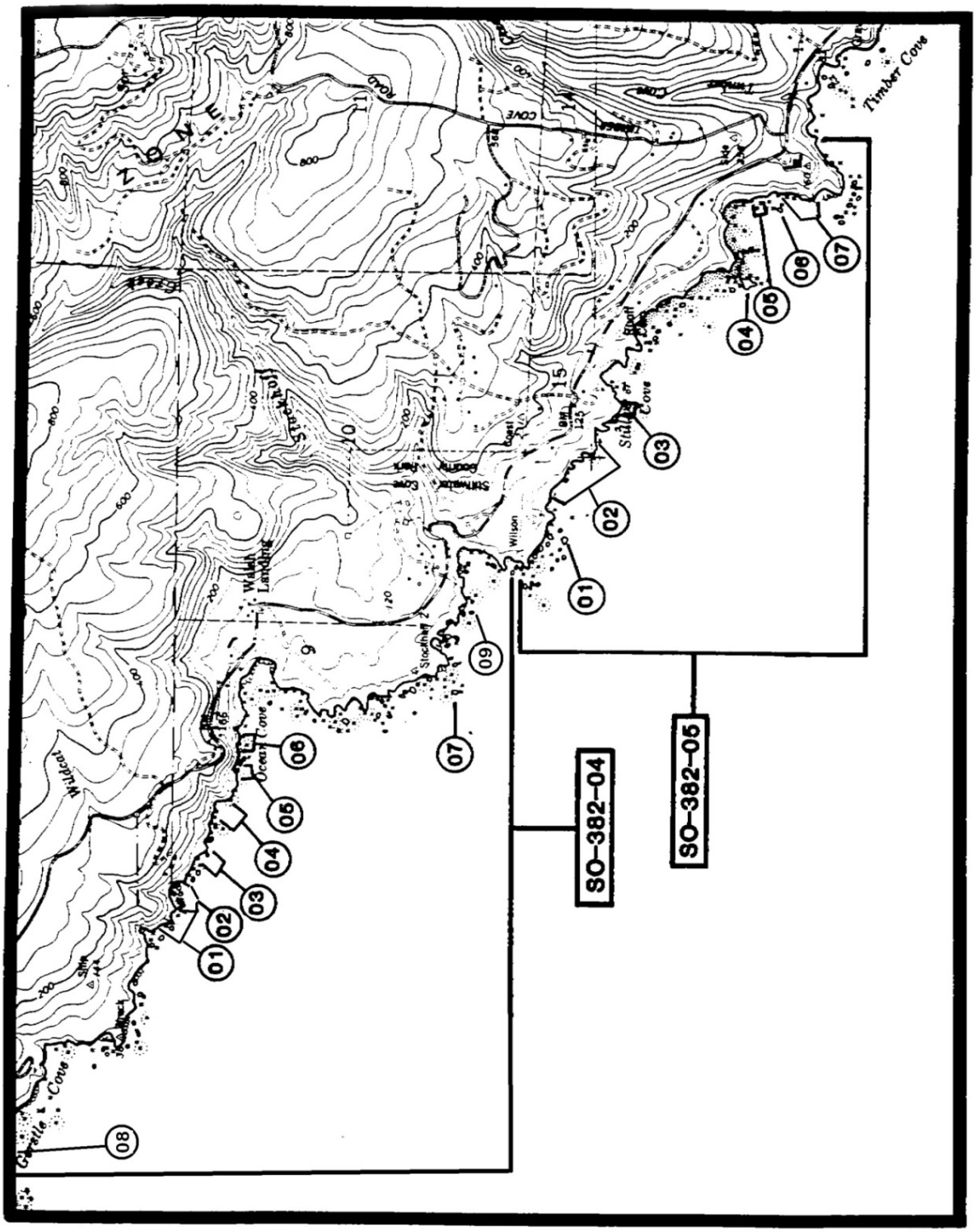
Map 7. Section from USGS map “Stewarts Point” (modified from Carter et al. 1992: II-48 [Map 46]), indicating colony and subcolony location for Sea Ranch (SO-384-03).



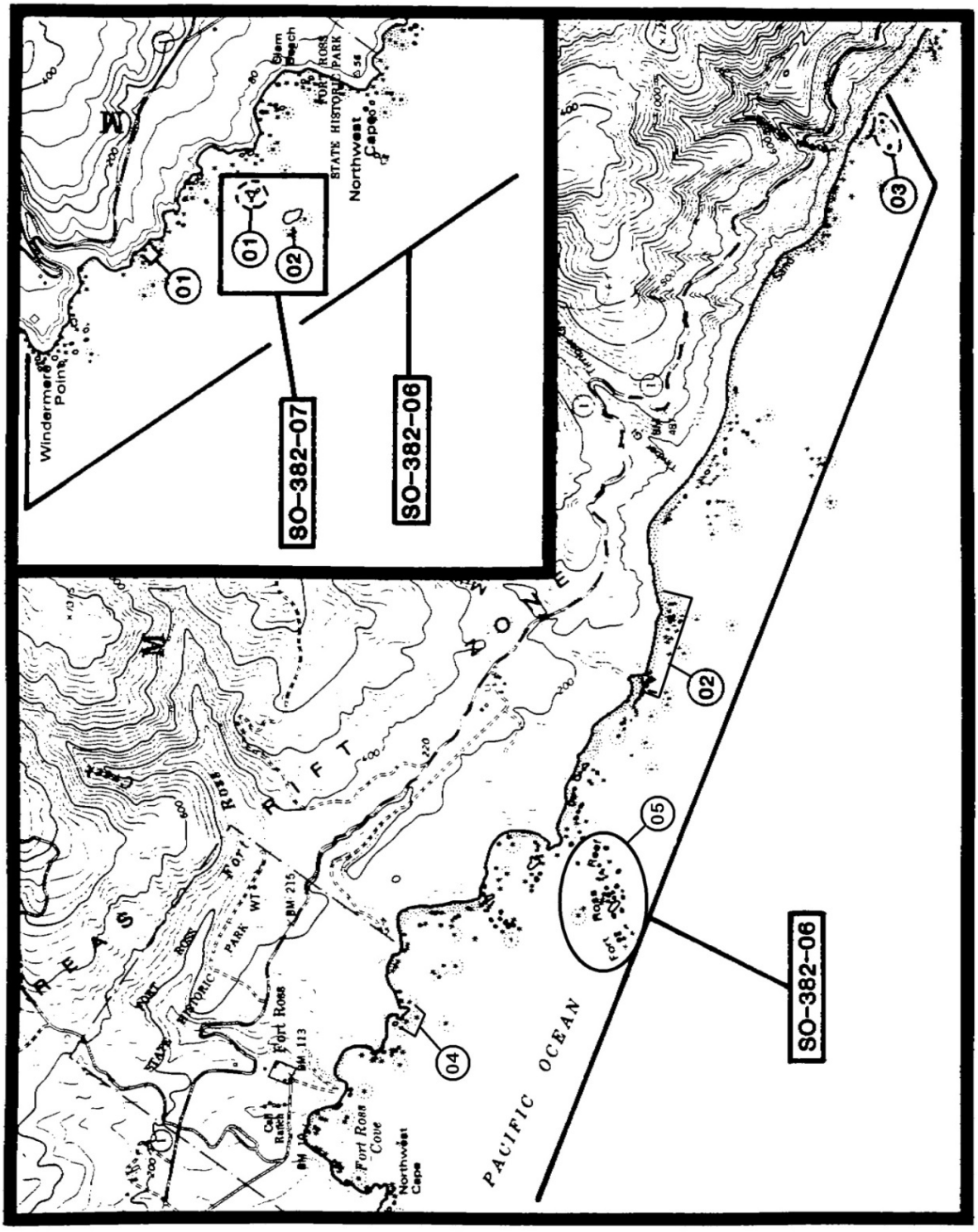
Map 8. Section from USGS map "Stewarts Point" (modified from Carter et al. 1992: II-49 [Map 47]), indicating colony and subcolony locations for Black Point to Stewart's Point (SO-384-04) and Stewart's Point to Rocky Point (SO-382-01).



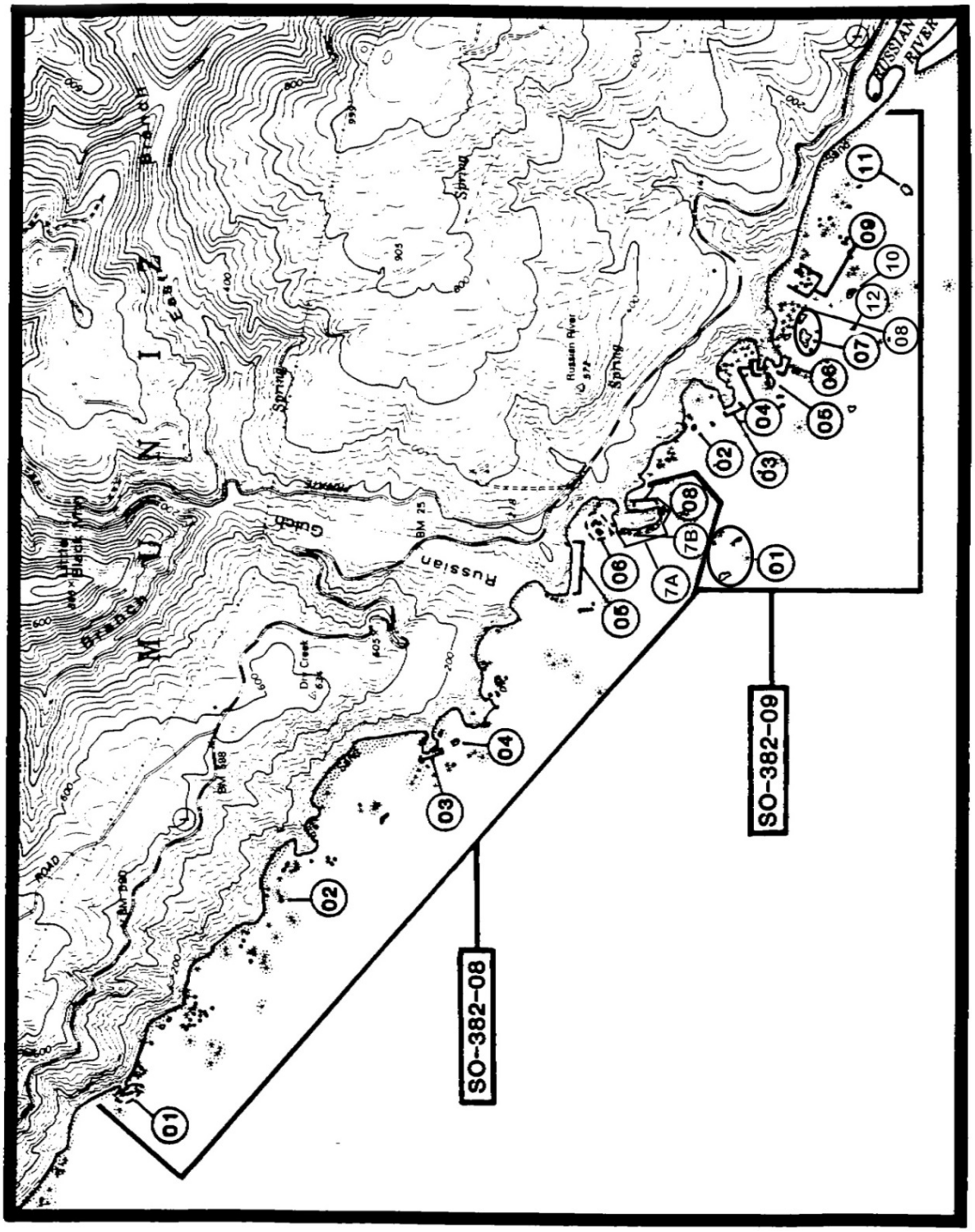
Map 9. Section from USGS maps “Stewarts Point” and “Plantation” (modified from Carter et al. 1992: II-50 [Map 48]), indicating colony and subcolony locations for Horseshoe Cove (SO-382-02) and Cannon Gulch to Stump Beach (SO-382-03).



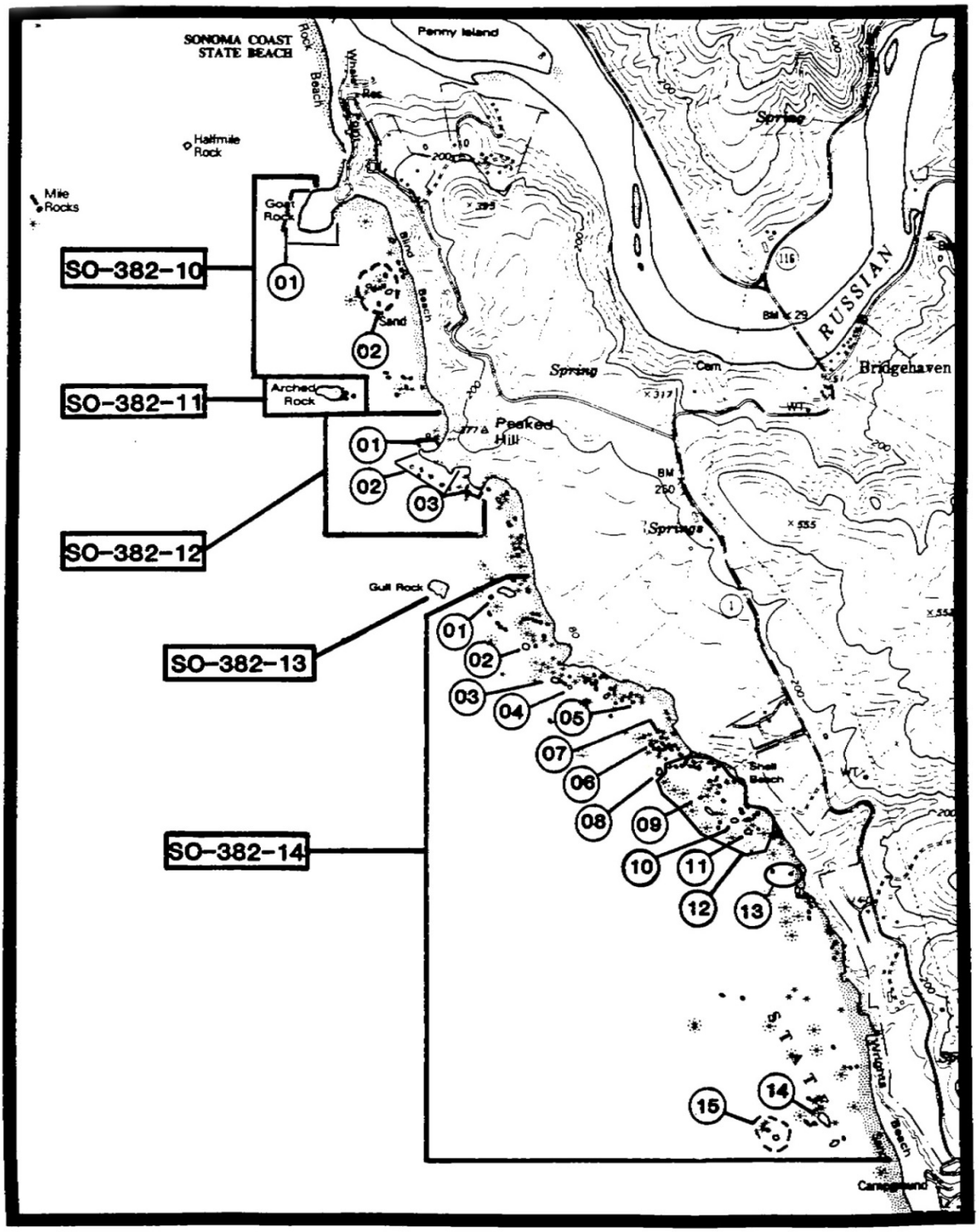
Map 10. Section from USGS map "Plantation" (modified from Carter et al. 1992: II-51 [Map 49]), indicating colony and subcolony locations for Gerstle Cove to Stillwater Cove (SO-382-04) and Bench Mark 125 to Timber Cove (SO-382-05).



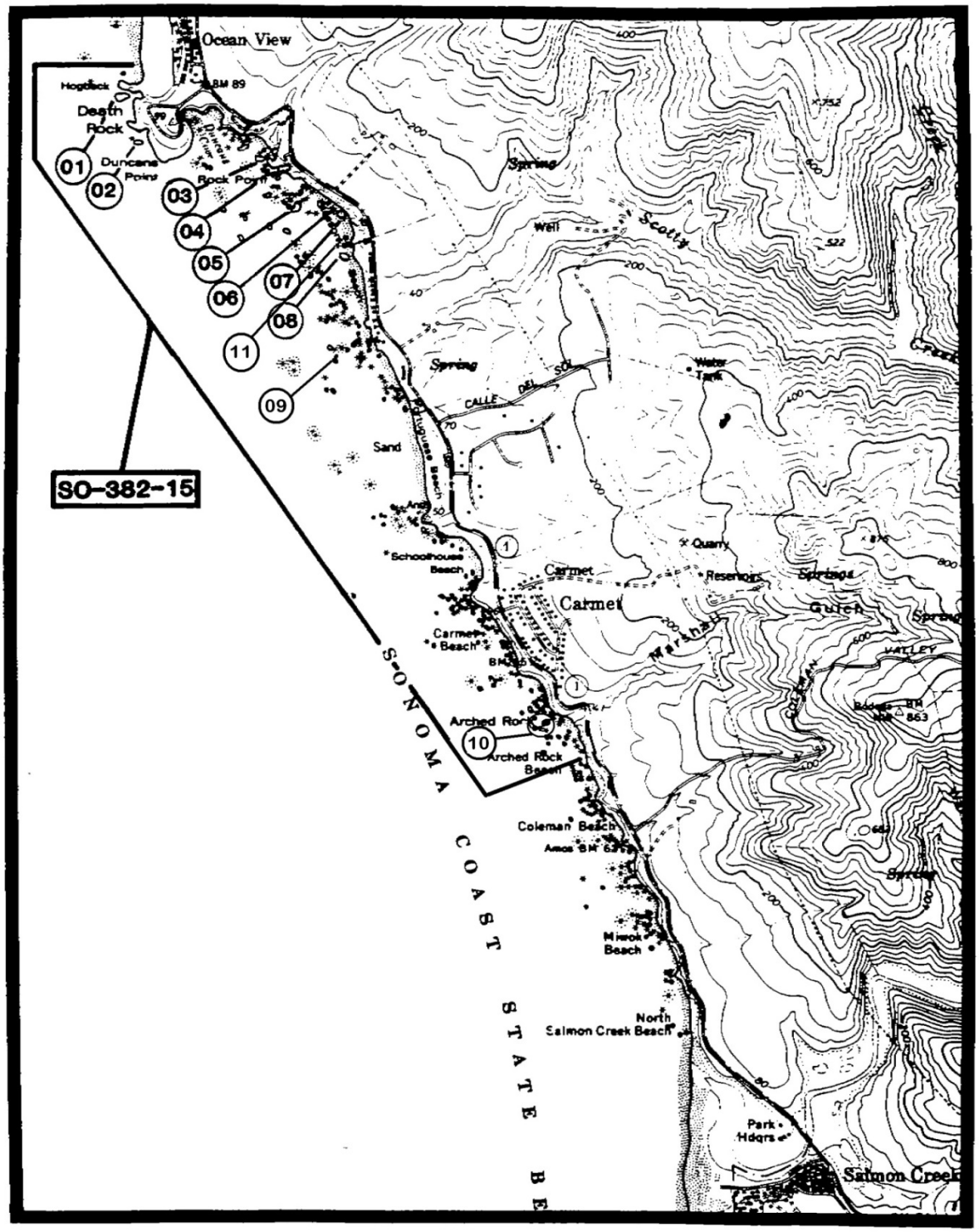
Map 11. Section from USGS maps “Plantation”, “Fort Ross”, and “Arched Rock” (modified from Carter et al. 1992: II-52 [Map 50]), indicating colony and subcolony locations for Windermere Point to Jewell Gulch (SO-382-06) and Northwest Cape Rocks (SO-382-07).



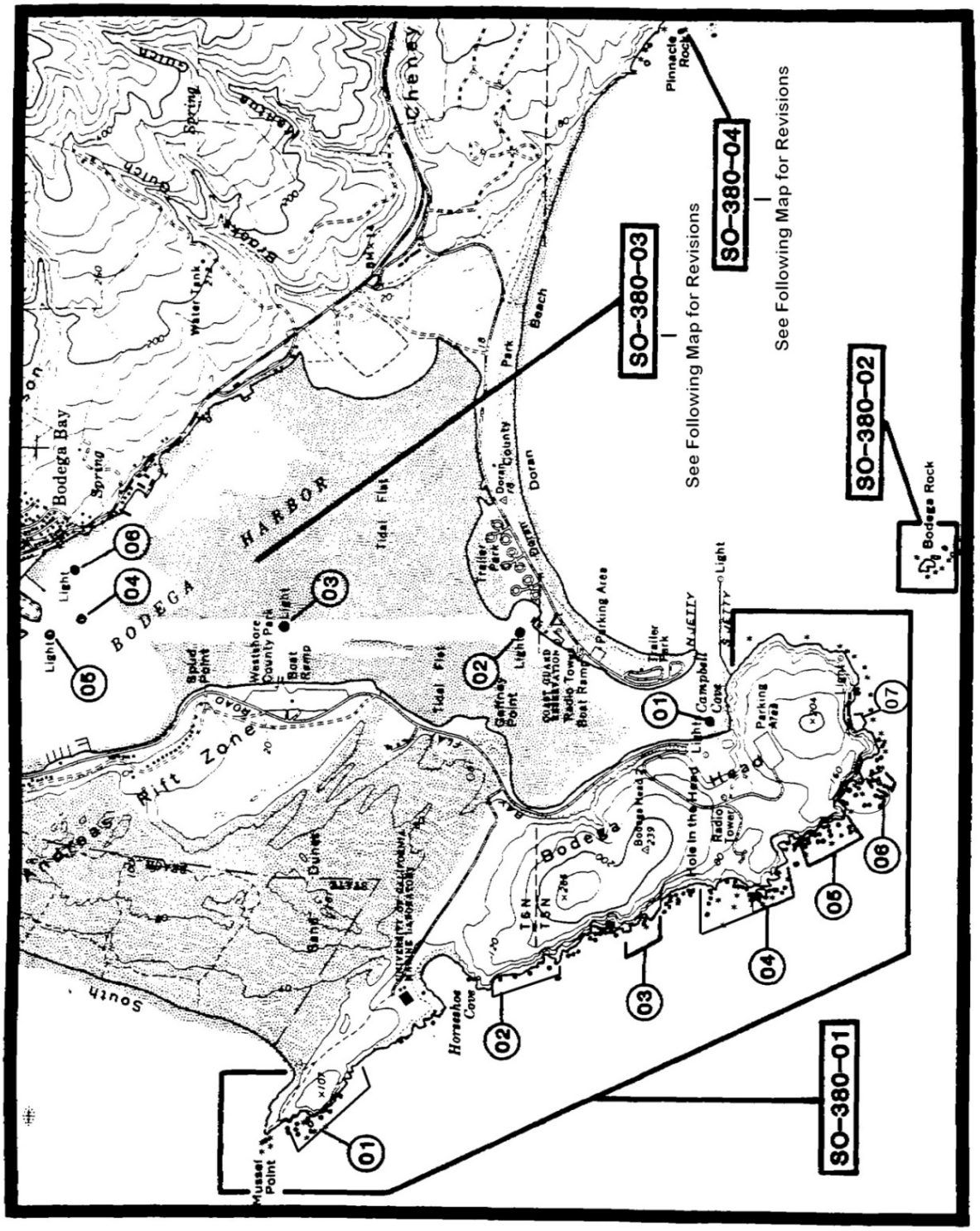
Map 12. Section from USGS map “Arched Rock” (modified from Carter et al. 1992: II-53 [Map 51]), indicating colony and subcolony locations for Russian Gulch (SO-382-08) and Russian River Rocks (SO-382-09).



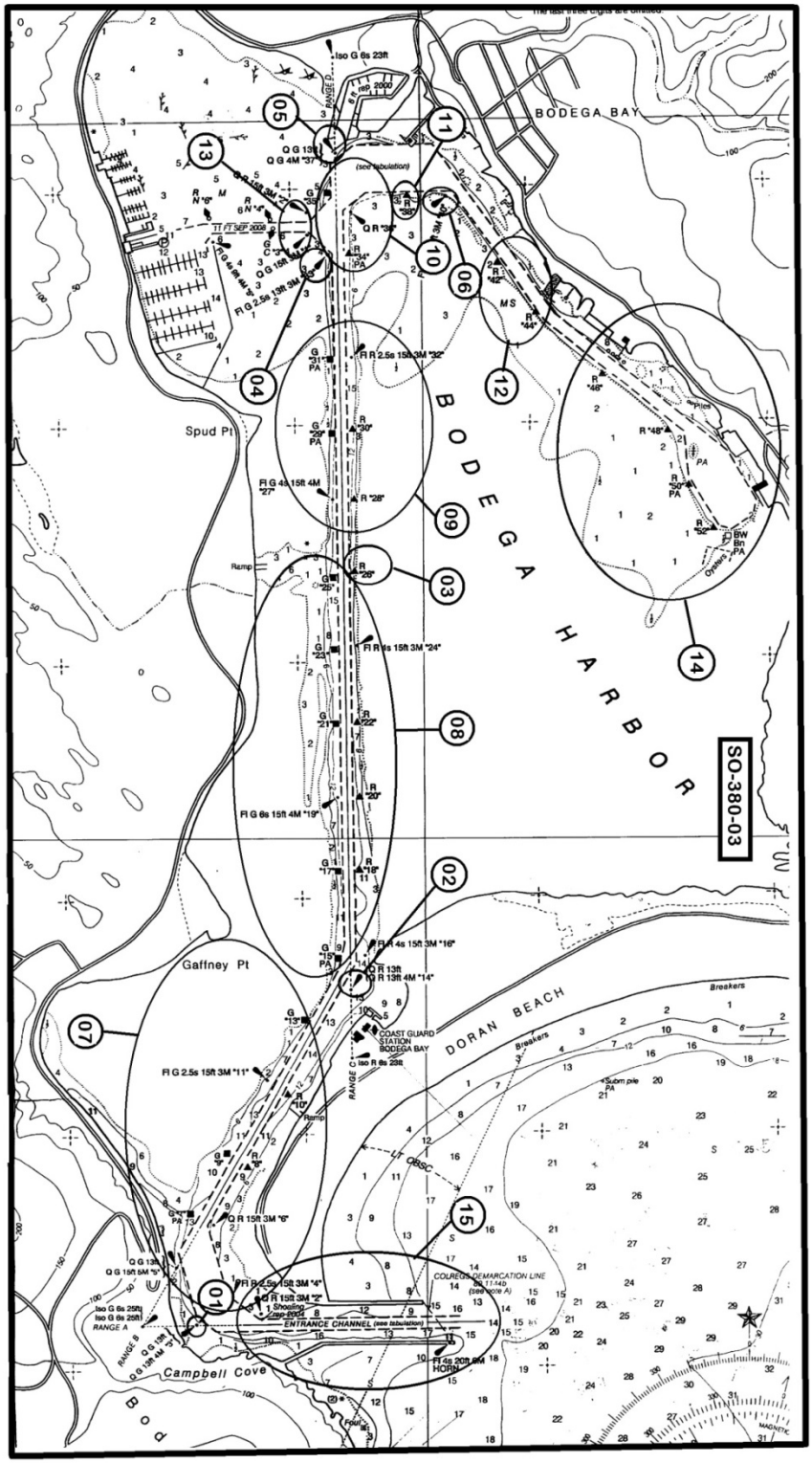
Map 13. Section from USGS maps “Arched Rock” and “Duncans Mills” (modified from Carter et al. 1992: II-54 [Map 52]), indicating colony and subcolony locations for Goat Rock to Peaked Hill (SO-382-10), Arched Rock (SO-382-11), Peaked Hill (SO-382-12), Gull Rock (SO-382-13), and Shell-Wright Beach Rocks (SO-382-14).



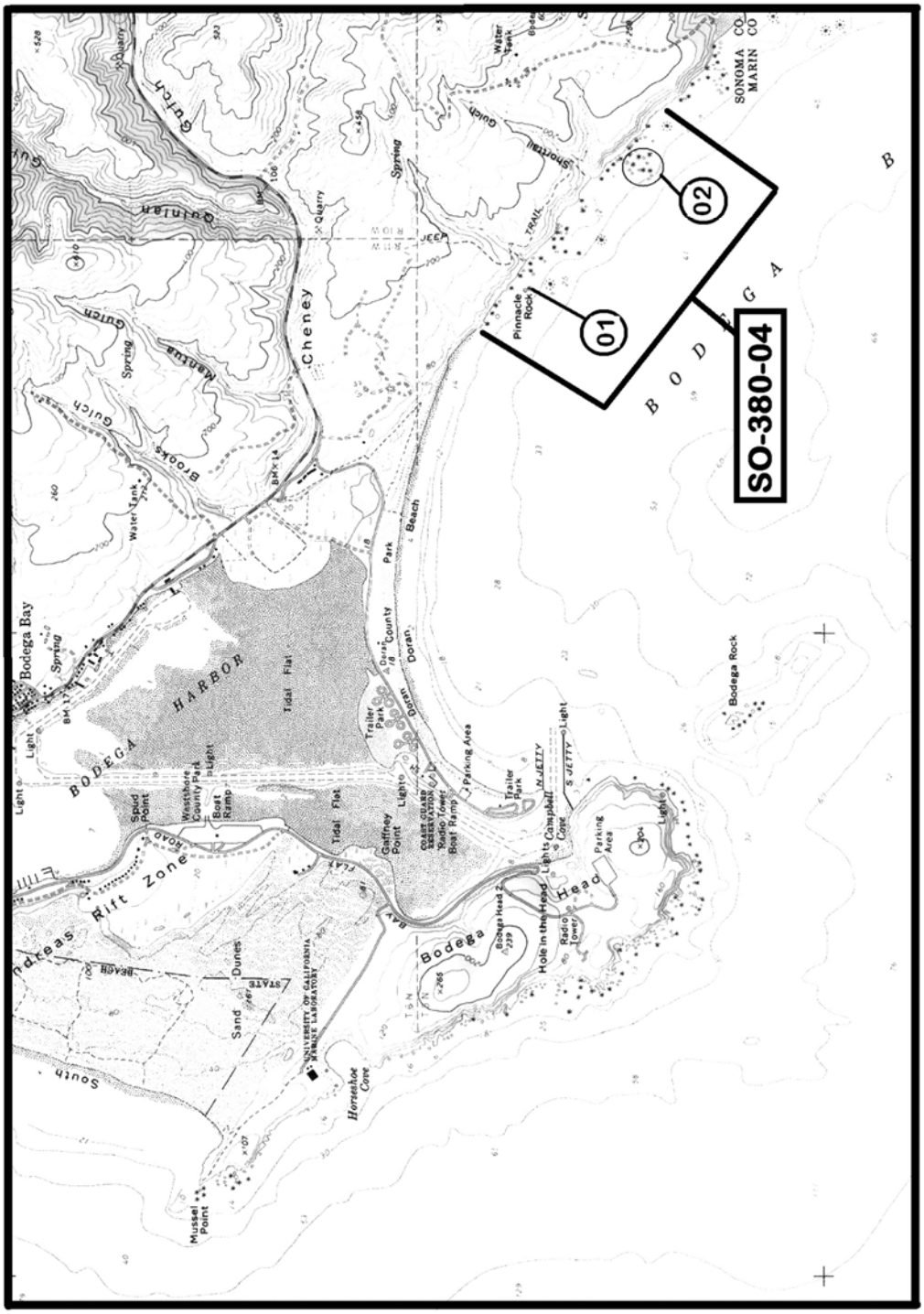
Map 14. Section from USGS maps “Duncans Mills” and “Bodega Head” (modified from Carter et al. 1992: II-55 [Map 53]), indicating colony and subcolony location for Duncan Point to Arched Rock (SO-382-15).



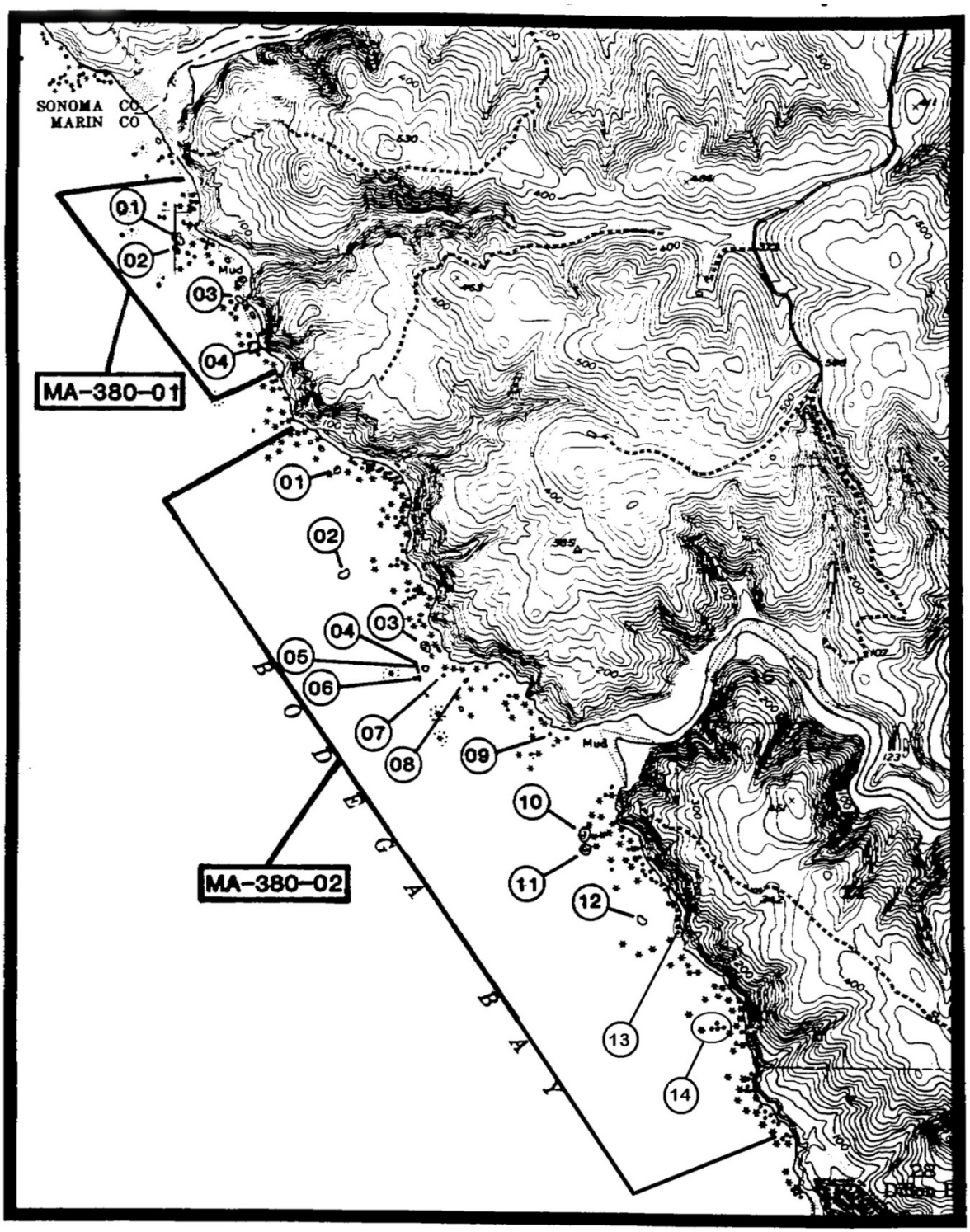
Map 15. Section from USGS map “Bodega Head” (modified from Carter et al. 1992: II-56 [Map 54]), indicating colony and subcolony locations for Bodega Head (SO-380-01), Bodega Rock (SO-380-02), Bodega Harbor (SO-380-03), and Pinnacle Rock (SO-380-04).



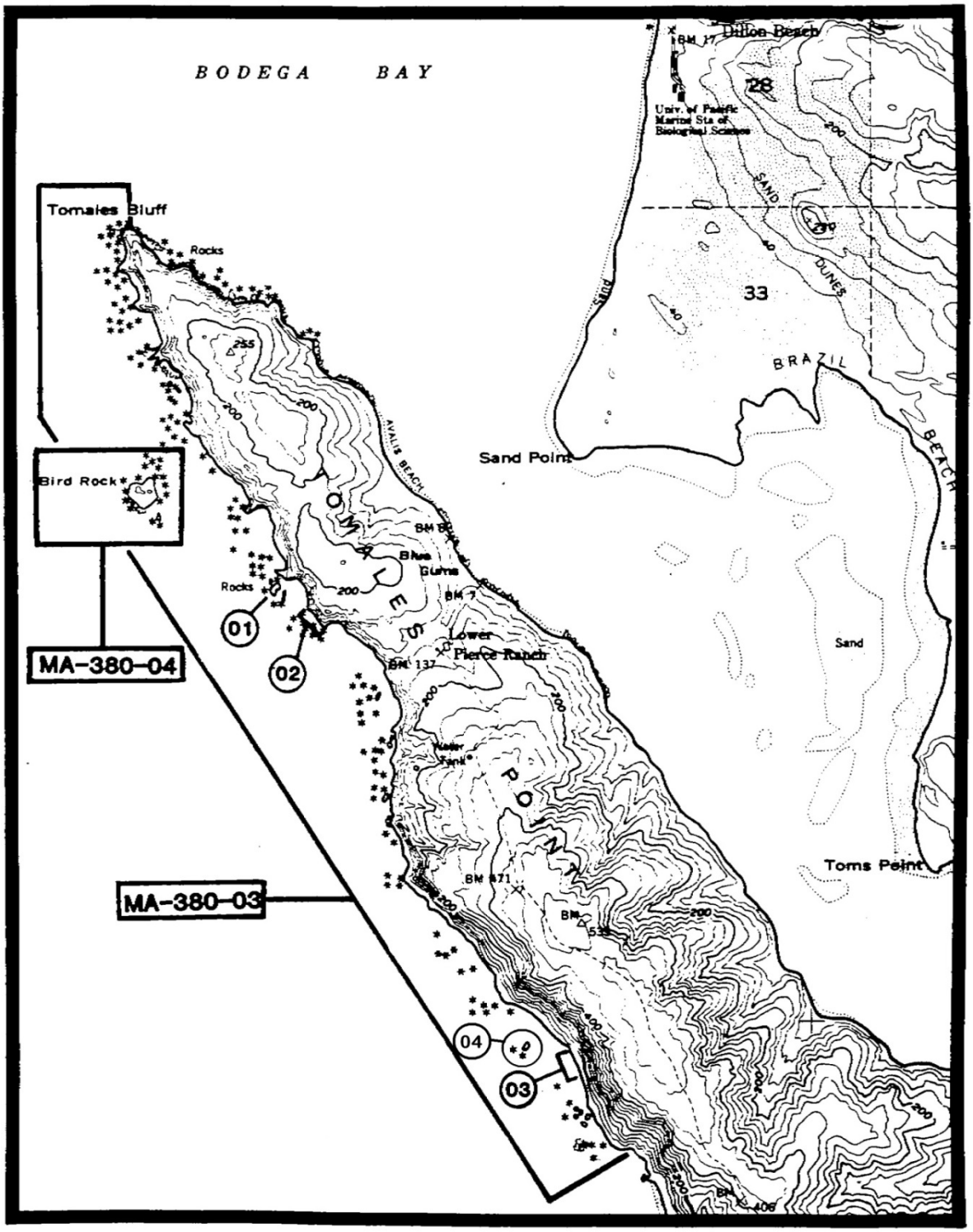
Map 16. Section from USGS map “Bodega Head”, indicating colony and subcolony location for Bodega Harbor (SO-380-03).



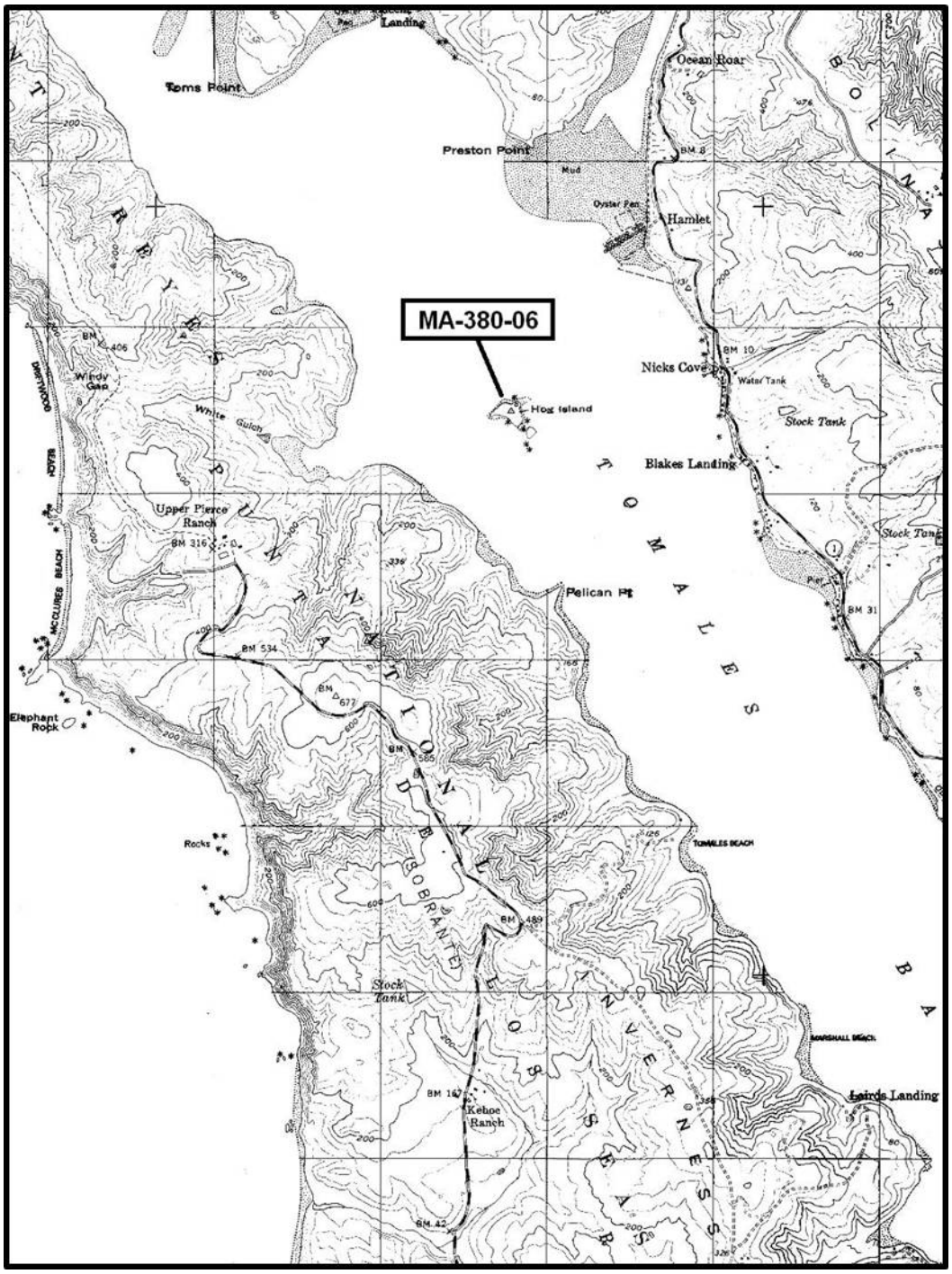
Map 17. Section from USGS map “Bodega Head”, indicating colony and subcolony location for Pinnacle Rock (SO-380-04).



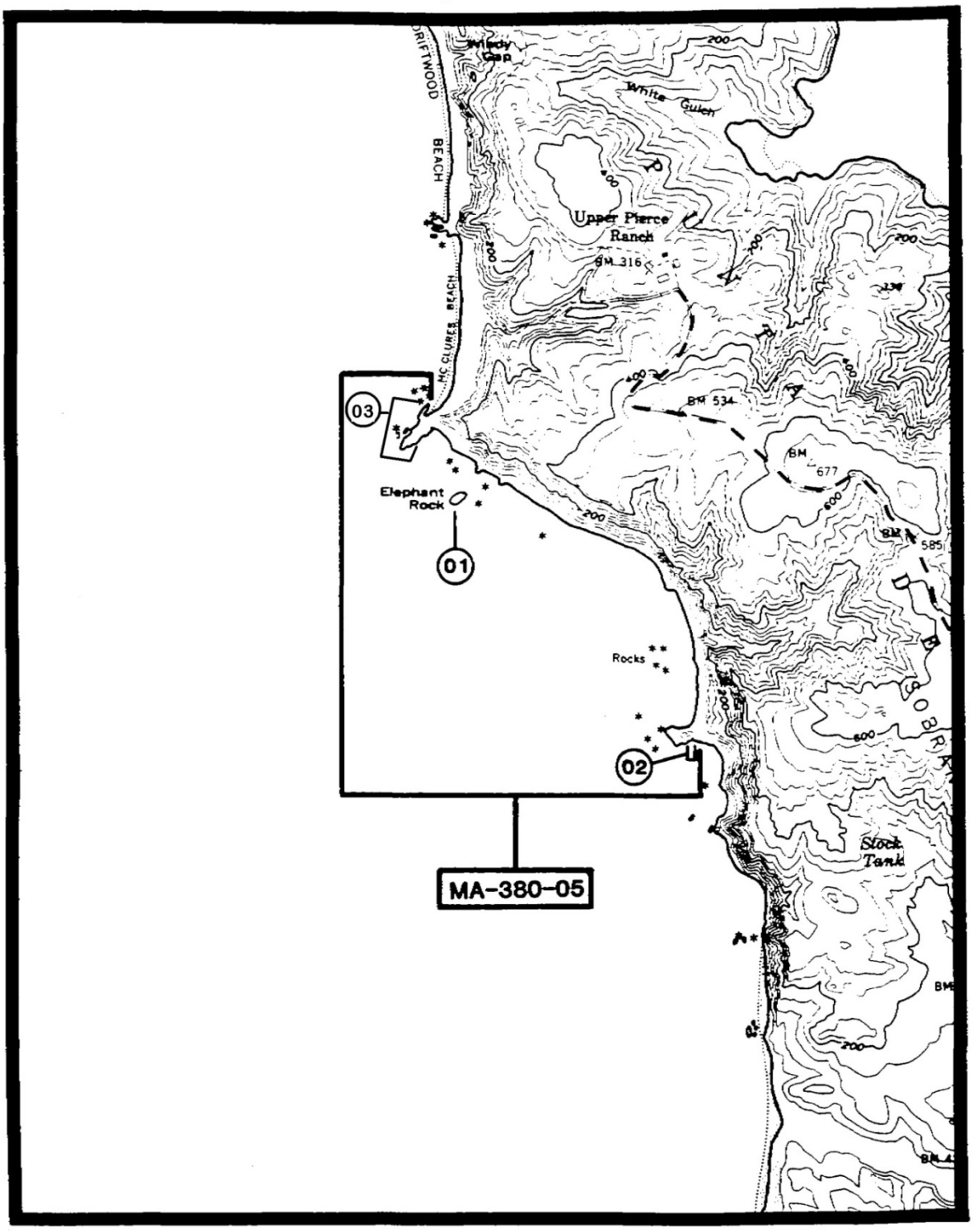
Map 18. Section from USGS maps “Bodega Head” and “Valley Ford” (modified from Carter et al. 1992: II-57 [Map 55]), indicating colony and subcolony locations for Sonoma-Marin County Line (MA-380-01) and Dillon Beach Rocks (MA-380-02).



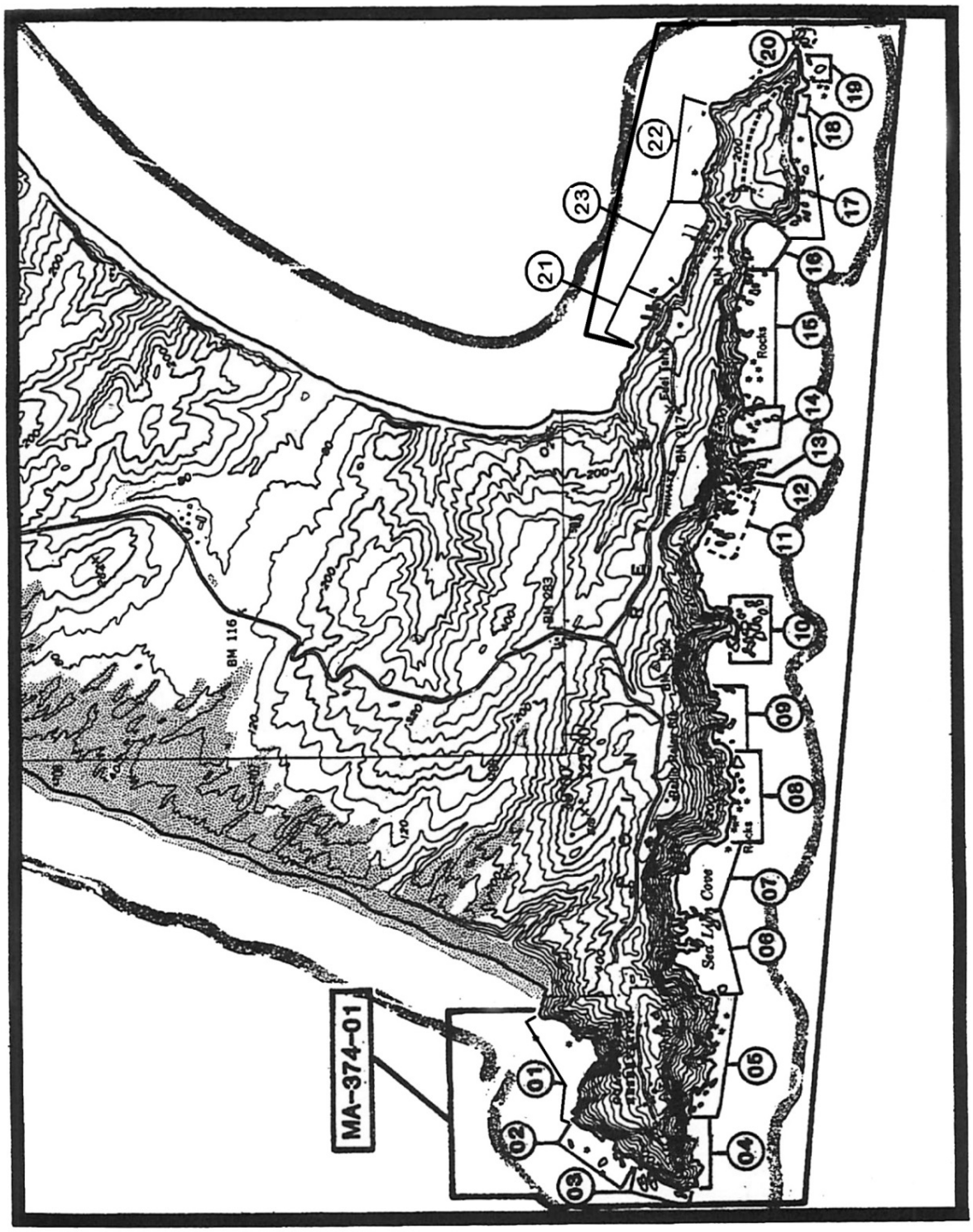
Map 19. Section from USGS map "Tomales" (modified from Carter et al. 1992: II-58 [Map 56]), indicating colony and subcolony locations for Bird Rock (MA-380-04) and Tomales Point (MA-380-03).



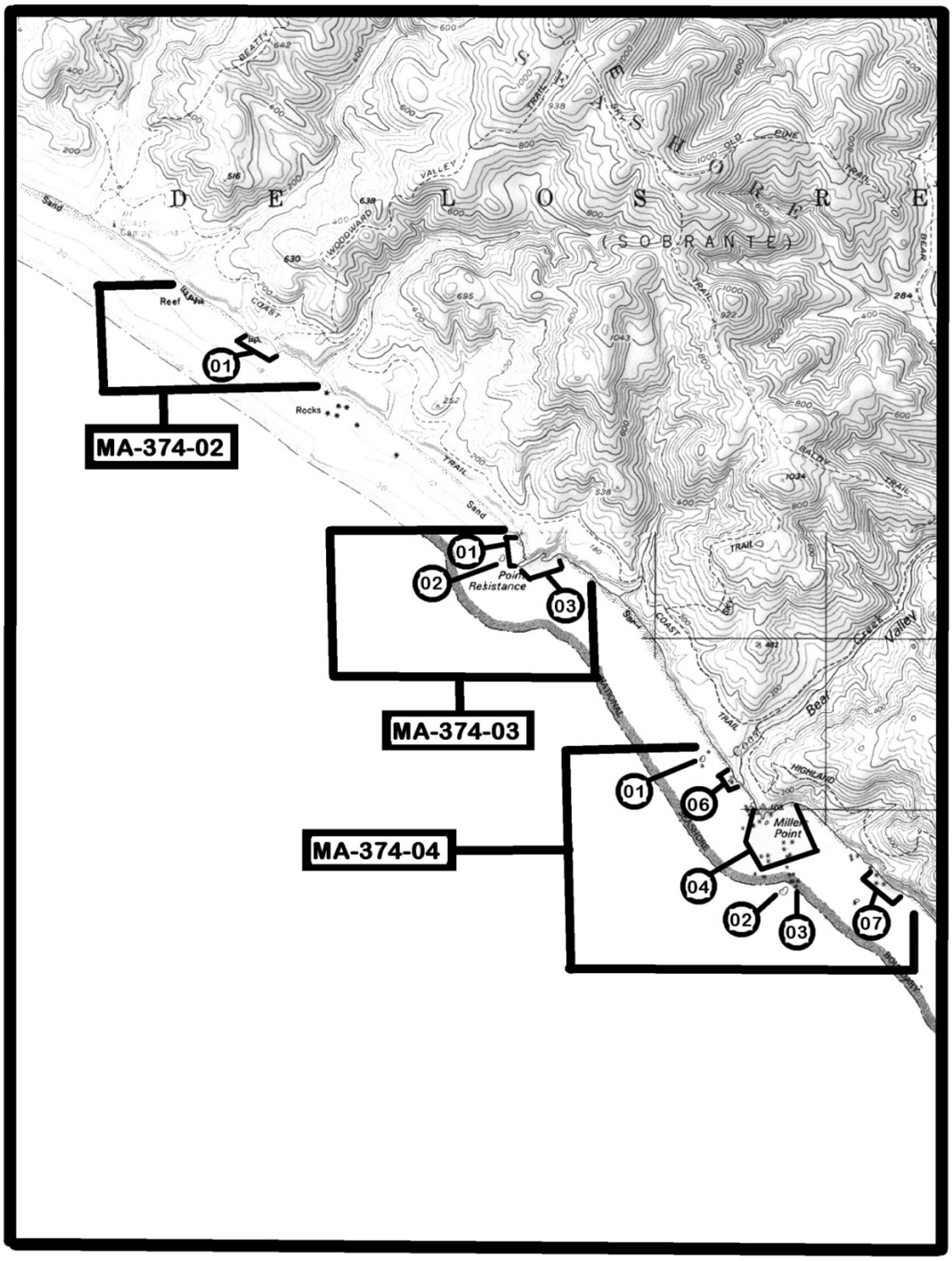
Map 20. Section from USGS map “Tomales”, indicating colony and subcolony location for Hog Island (MA-380-06).



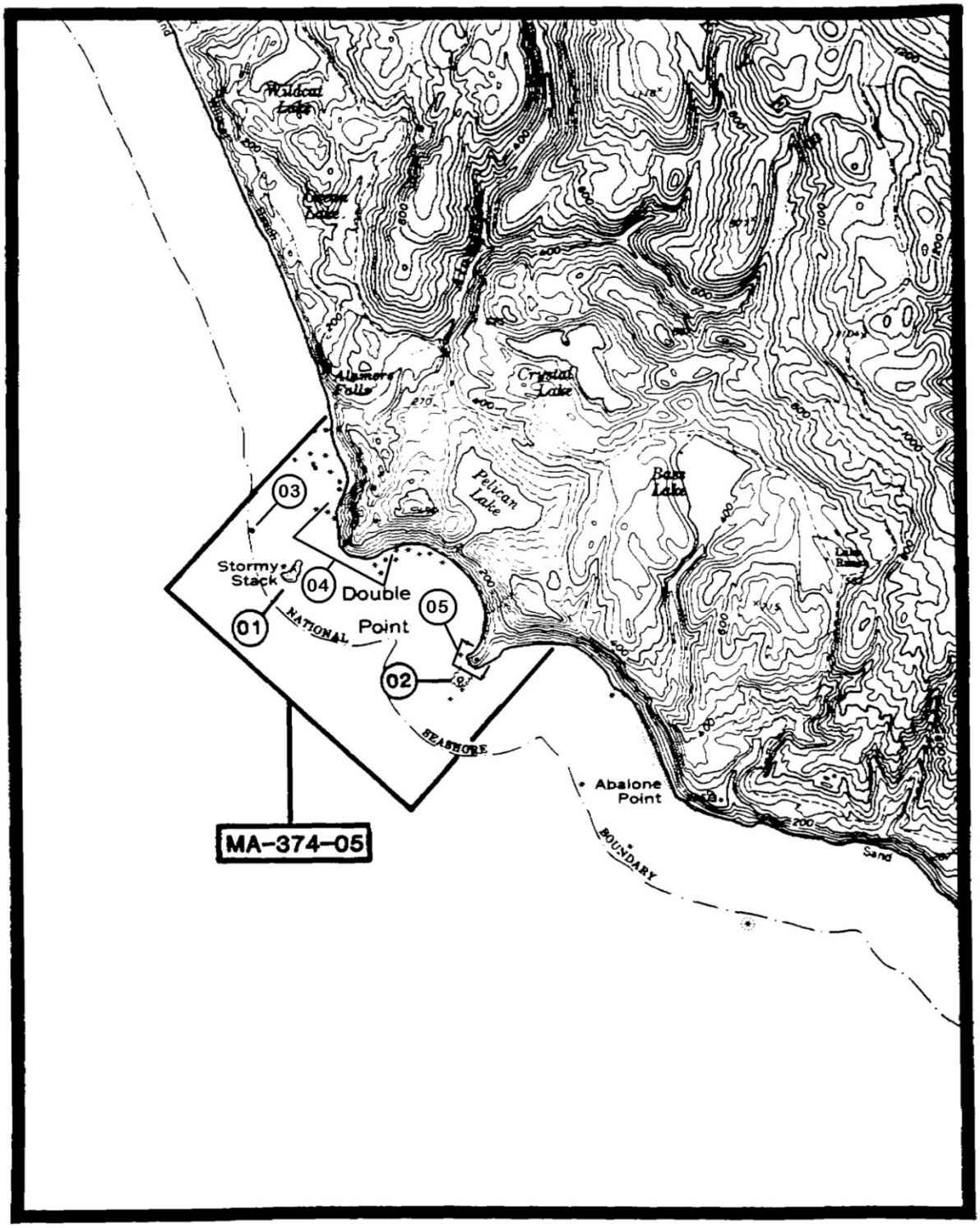
Map 21. Section from USGS map “Tomales” (modified from Carter et al. 1992: II-59 [Map 57]), indicating colony and subcolony location for Elephant Rock Complex (ME-380-05).



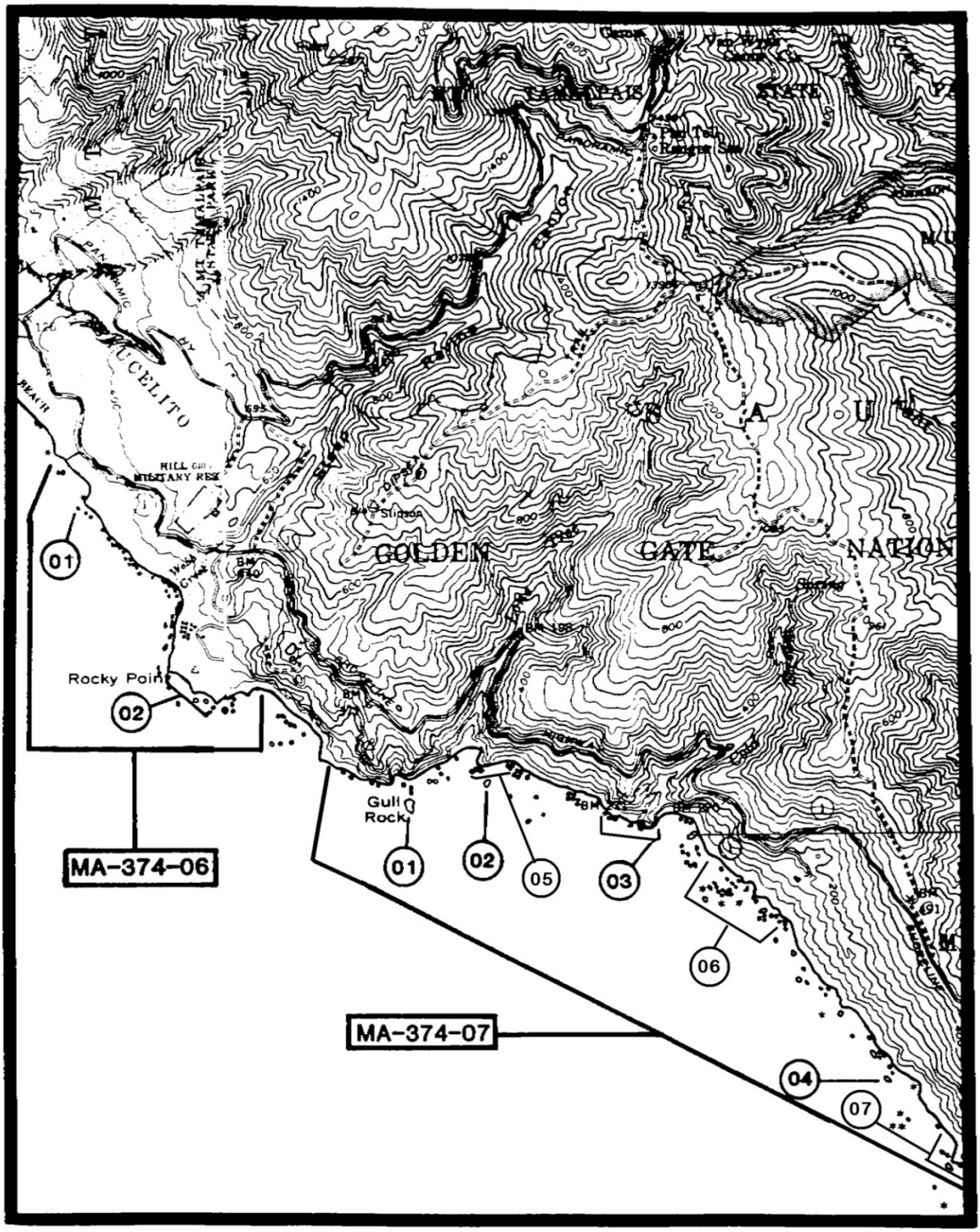
Map 22. Section from USGS map “Drakes Bay” (modified from Carter et al. 1992: II-60 [Map 58]), indicating colony and subcolony location for Point Reyes (MA-374-01).



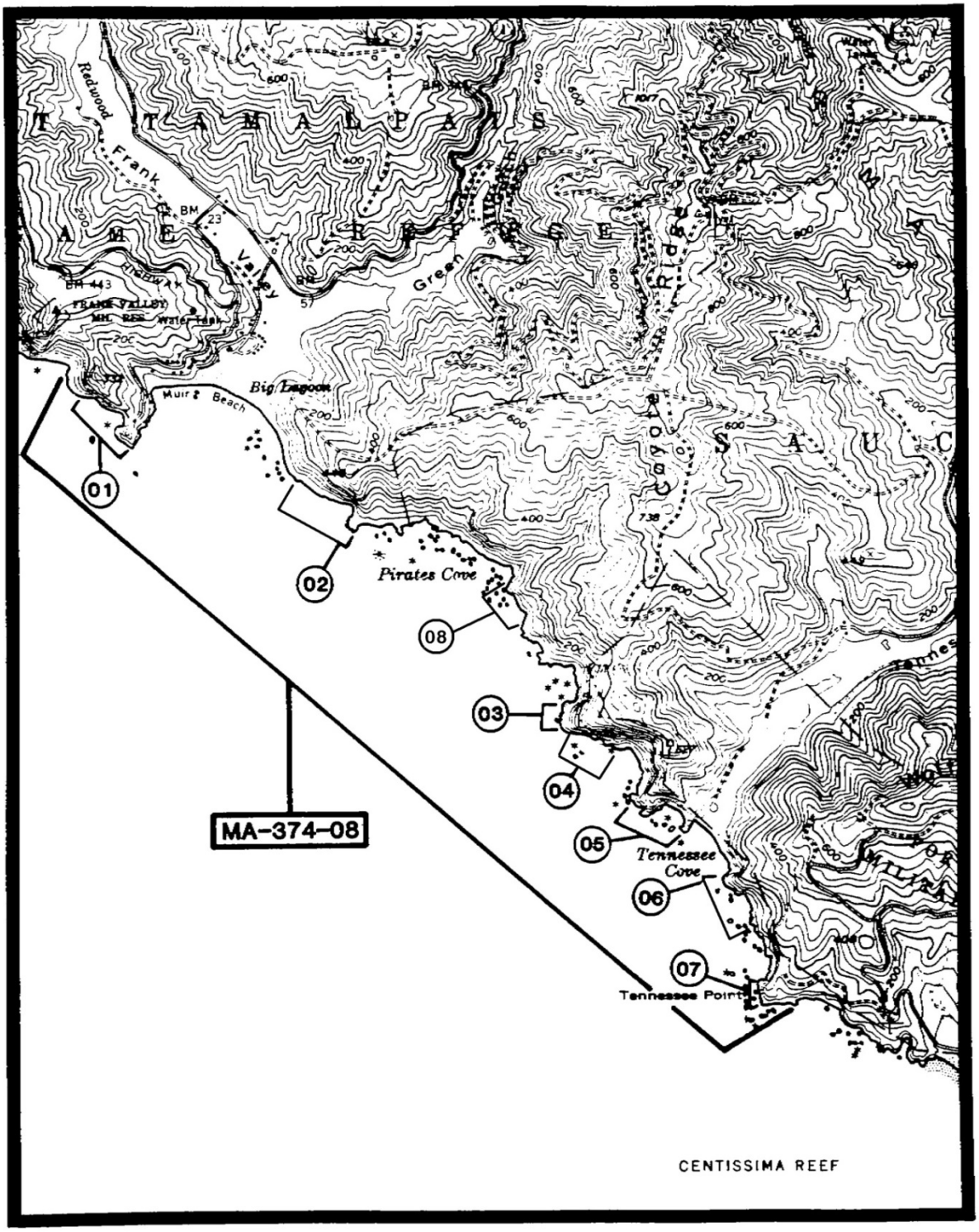
Map 23. Section from USGS maps “Inverness” and “Double Point”, indicating colony and subcolony locations for Coast Campground South (MA-374-02), Point Resistance (MA-374-03), and Millers Point Rocks (MA-374-04).



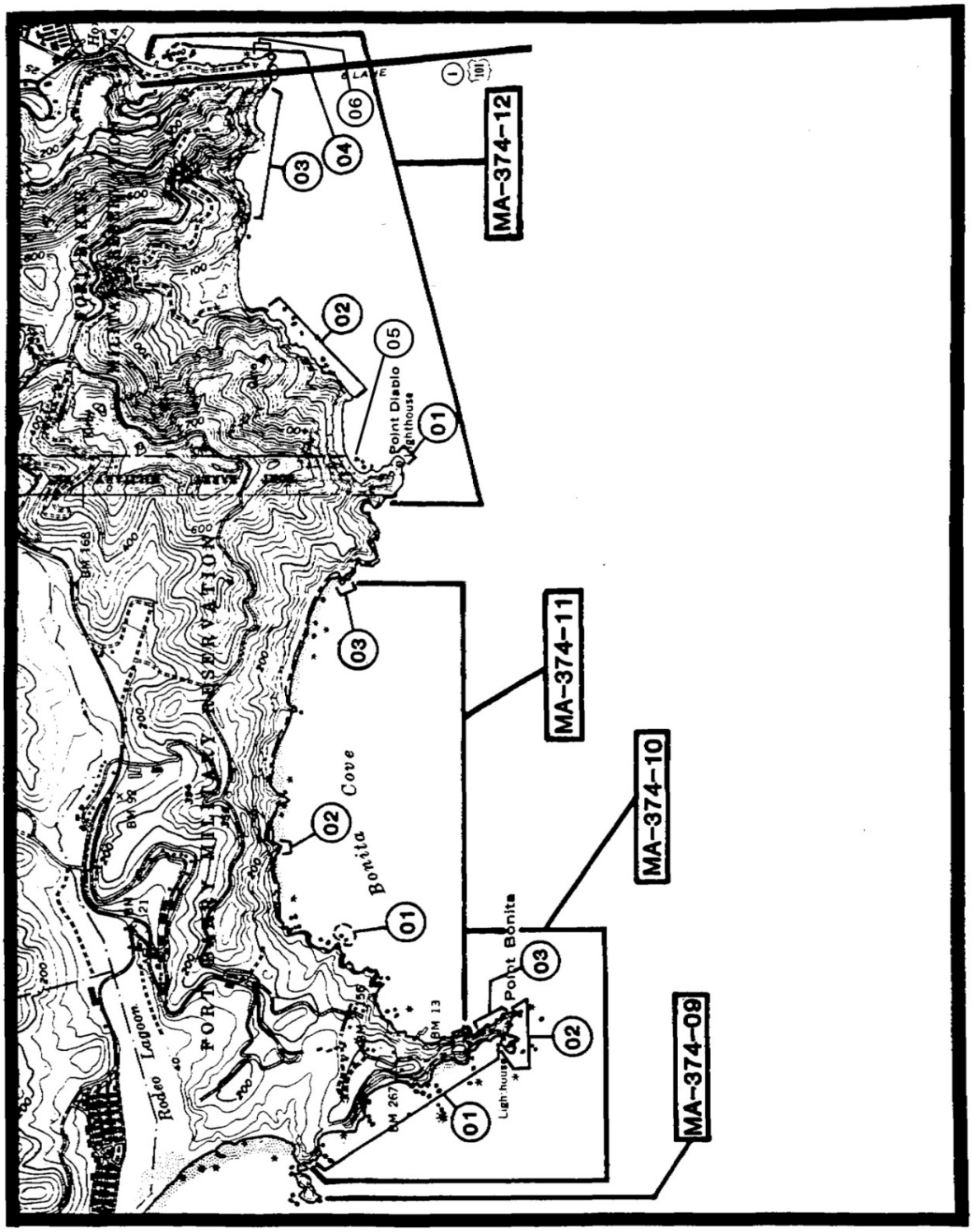
Map 24. Section from USGS map “Double Point” (modified from Carter et al. 1992: II-62 [Map 60]), indicating colony and subcolony location for Double Point Rocks (MA-374-05).



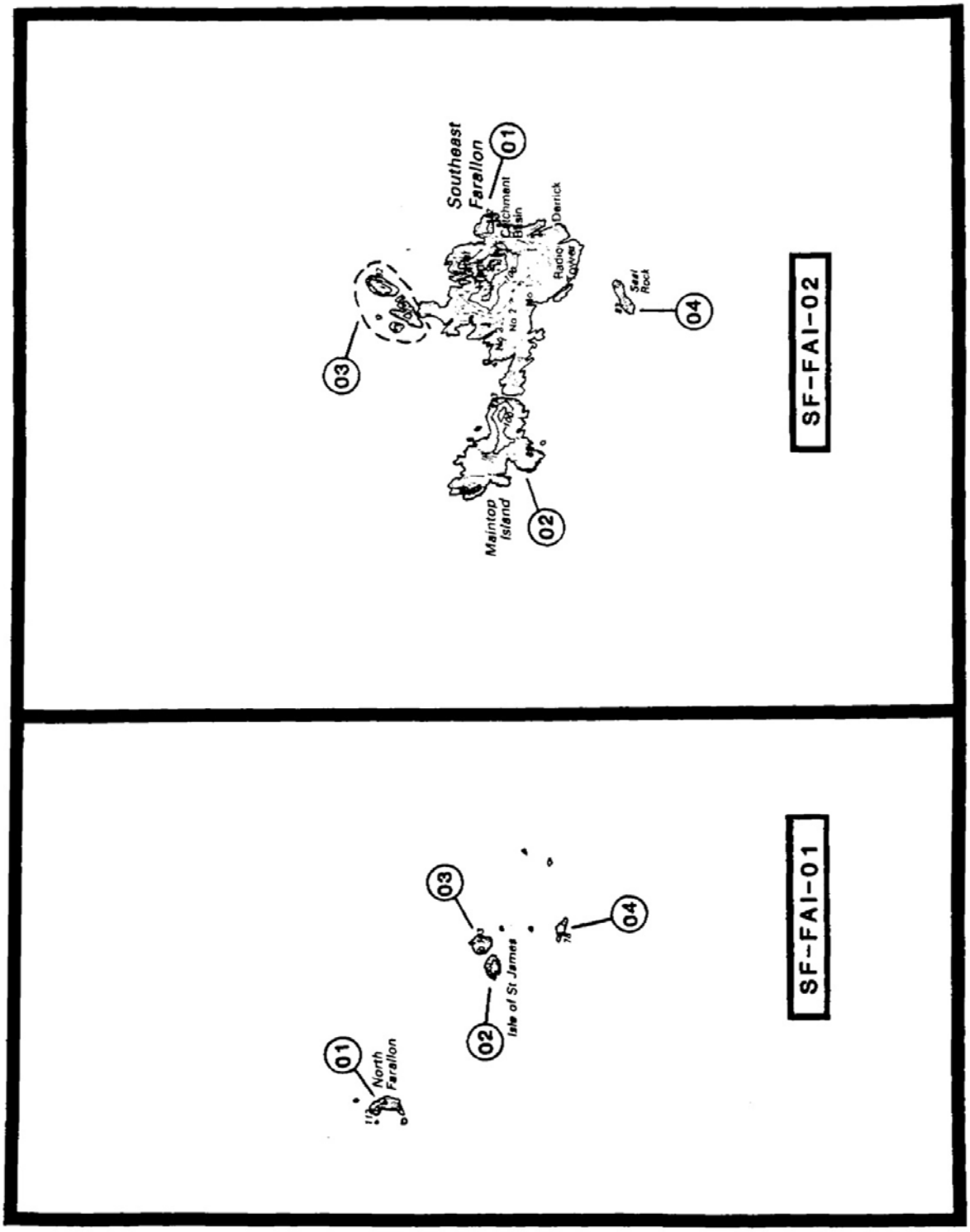
Map 25. Section from USGS maps “Bolinas”, “San Rafael”, and “Point Bonita” (modified from Carter et al. 1992: II-63 [Map 61]), indicating colony and subcolony locations for Stinson Beach to Rocky Point (MA-374-06) and Gull Rock Area (MA-374-07).



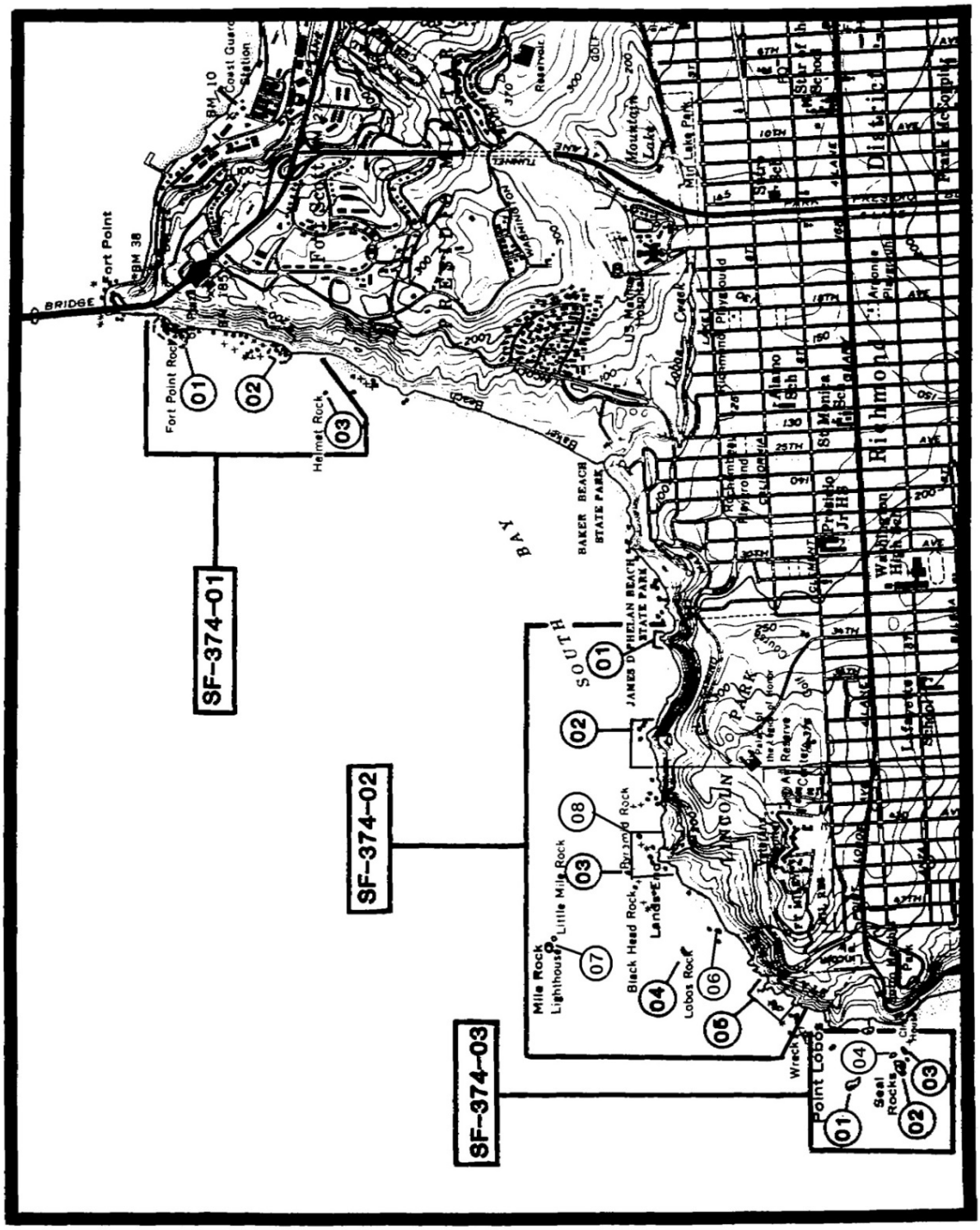
Map 26. Section from USGS map "Point Bonita" (modified from Carter et al. 1992: II-64 [Map 62]), indicating colony and subcolony location for Muir Beach Headlands to Tennessee Cove (MA-374-08).



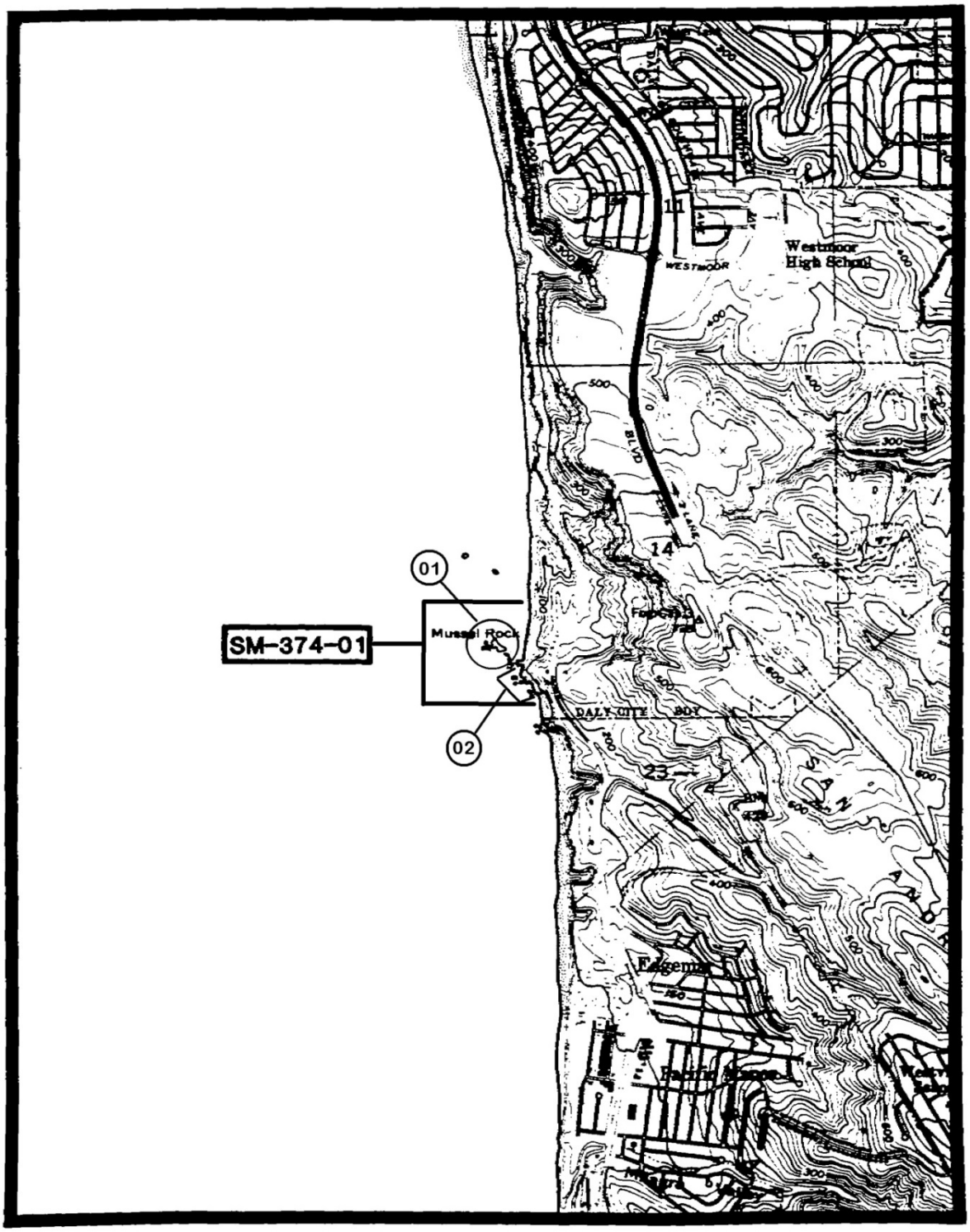
Map 27. Section from USGS maps “Point Bonita” and “San Francisco North” (modified from Carter et al. 1992: II-65 [Map 63]), indicating colony and subcolony locations for Bird Island (MA-374-09), Point Bonita (MA-374-10), Bonita Cove (MA-374-11), and Point Diablo Bluffs and Needles (MA-374-12).



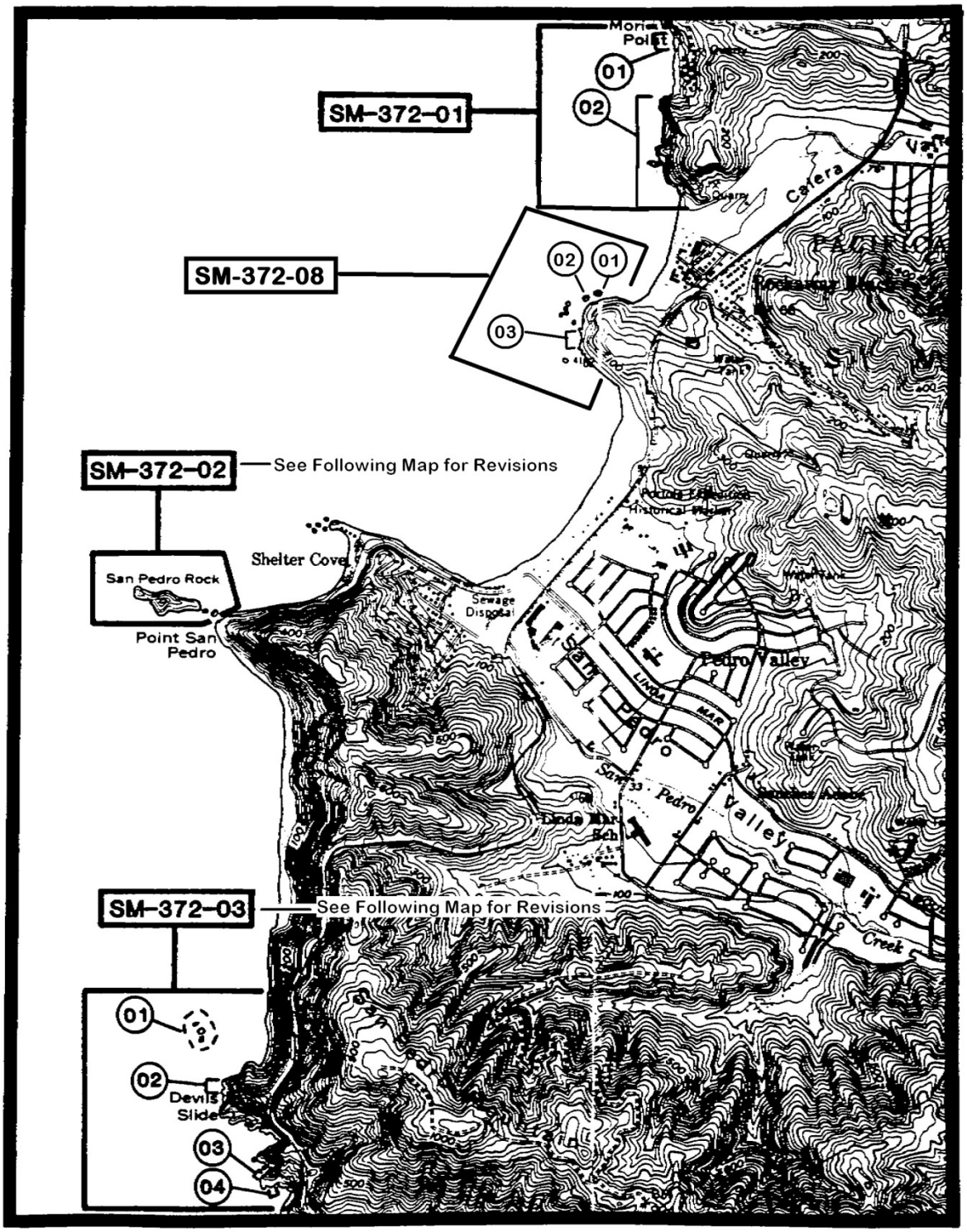
Map 28. Section from USGS map “Farallon Islands” (unmodified from Carter et al. 1992: II-66 [Map 64]), indicating colony and subcolony locations for North Farallon Islands (SF-FAI-01) and South Farallon Islands (SF-FAI-02).



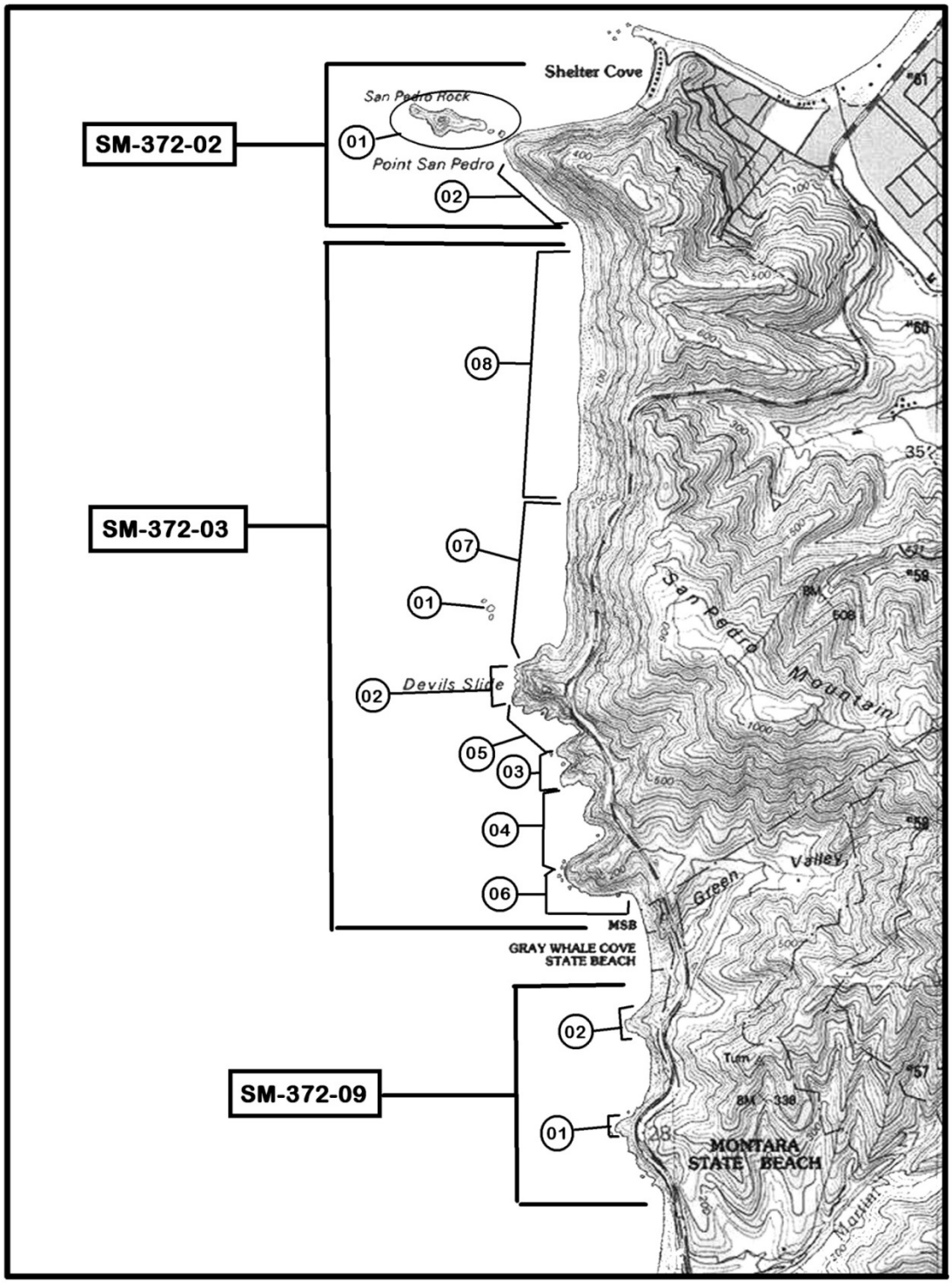
Map 29. Section from USGS map “San Francisco North” (modified from Carter et al. 1992: II-67 [Map 65]), indicating colony and subcolony locations for Fort Point Rock to Helmet Rock (SF-374-01), Lobos Rock and Lands End (SF-374-02), and Seal Rocks (SF-374-03).



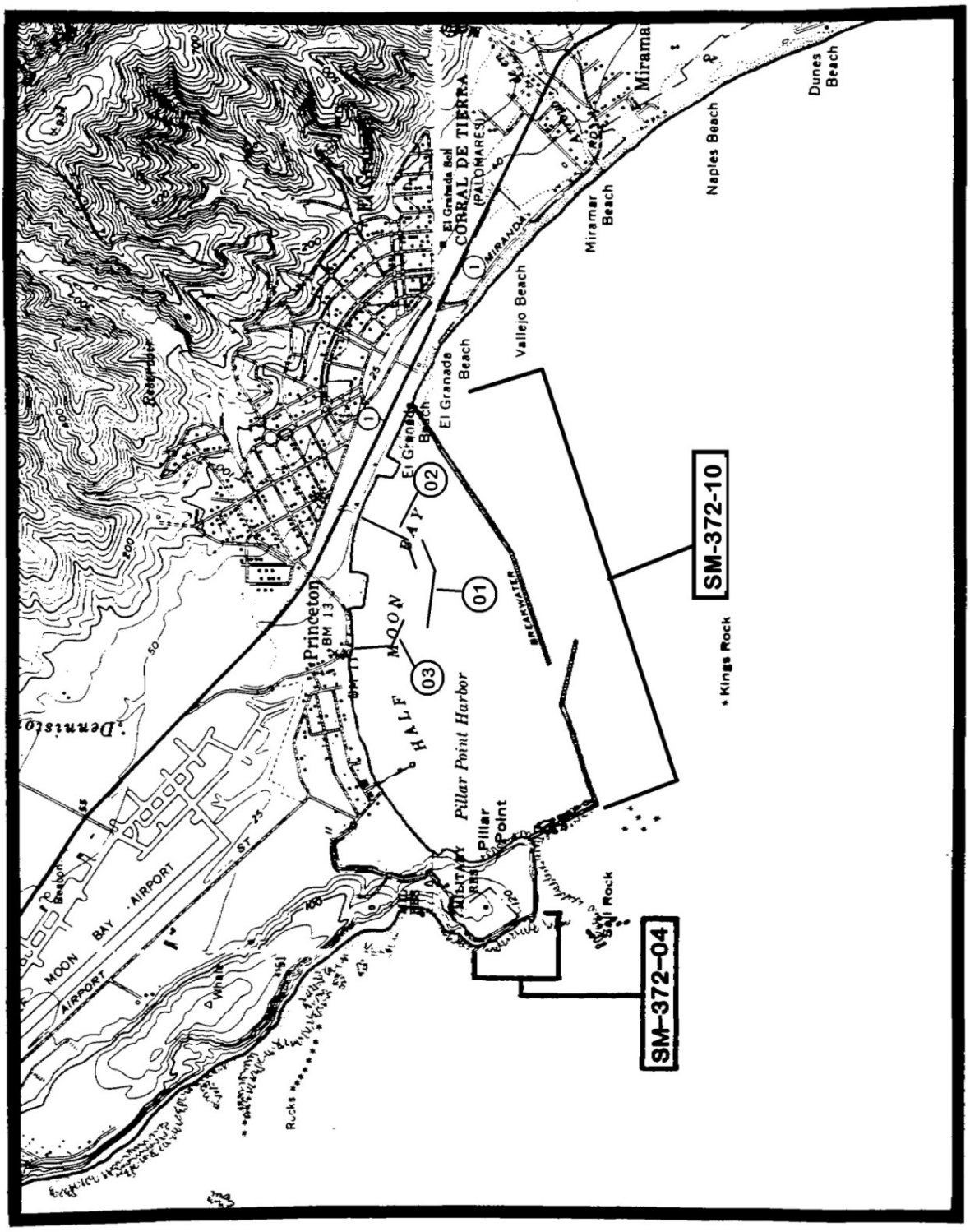
Map 30. Section from USGS map "San Francisco South" (modified from Carter et al. 1992: II-68 [Map 66]), indicating colony and subcolony location for Mussel Rock Area (SM-374-01).



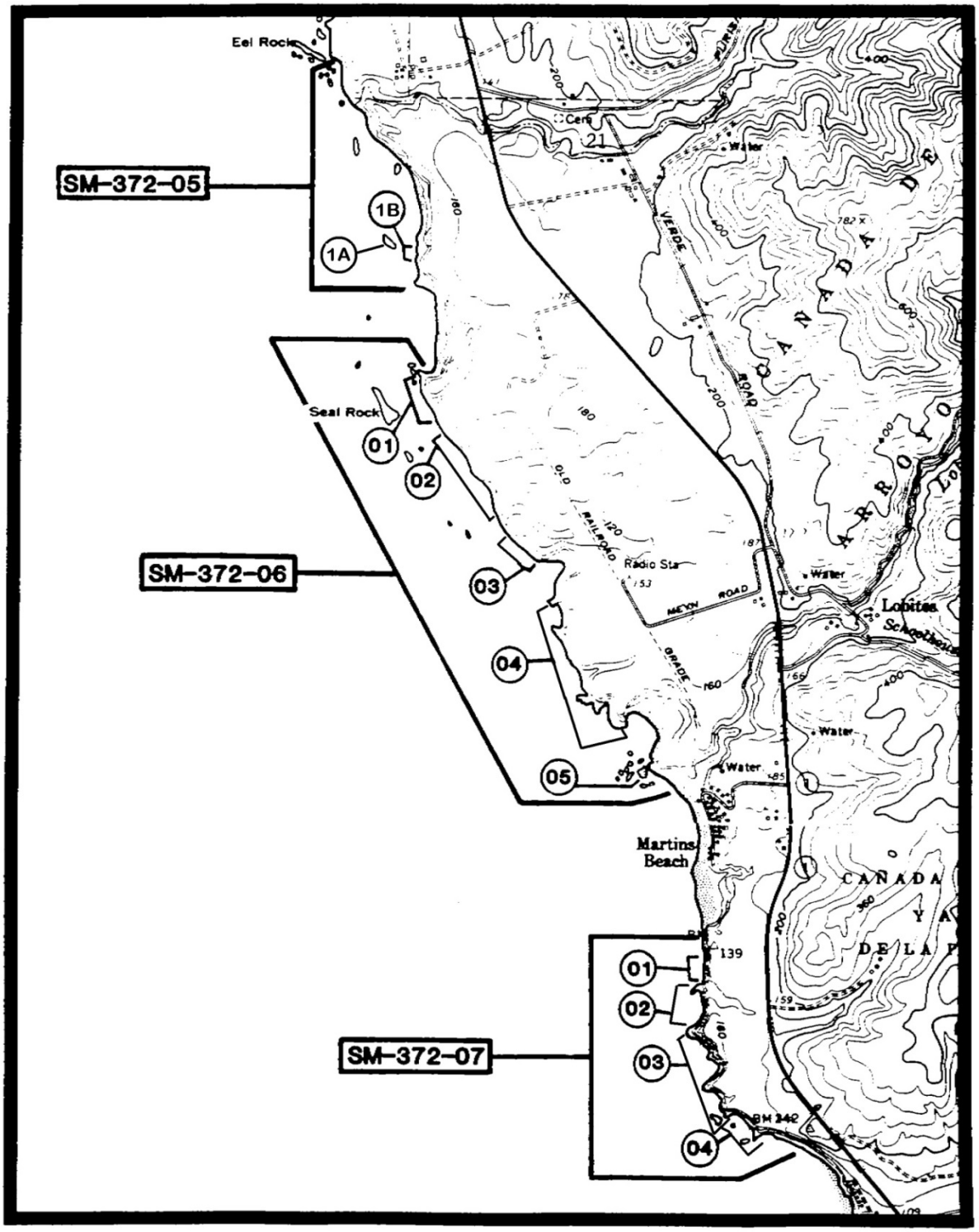
Map 31. Section from USGS map "Montara Mountain" (modified from Carter et al. 1992: II-69 [Map 67]), indicating colony and subcolony locations for Mori Point (SM-372-01), Rockaway Point (SM-372-08), San Pedro Rock (SM-372-02), and Devil's Slide Rock (SM-372-03).



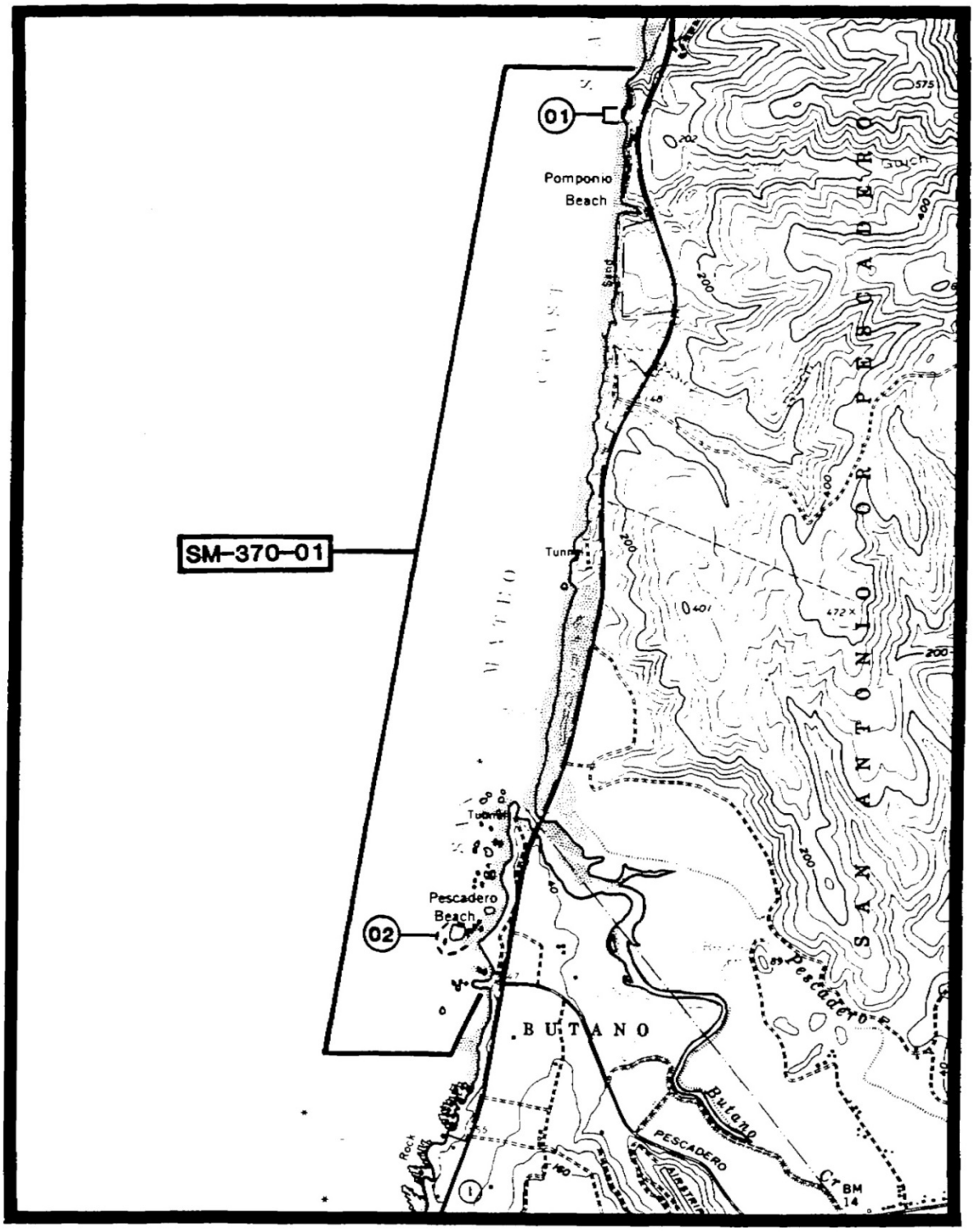
Map 32. Section from USGS map "Montara Mountain", indicating colony and subcolony locations for San Pedro Rock (SM-372-02), Devil's Slide Rock (SM-372-03), and Gray Whale Beach South (SM-372-09).



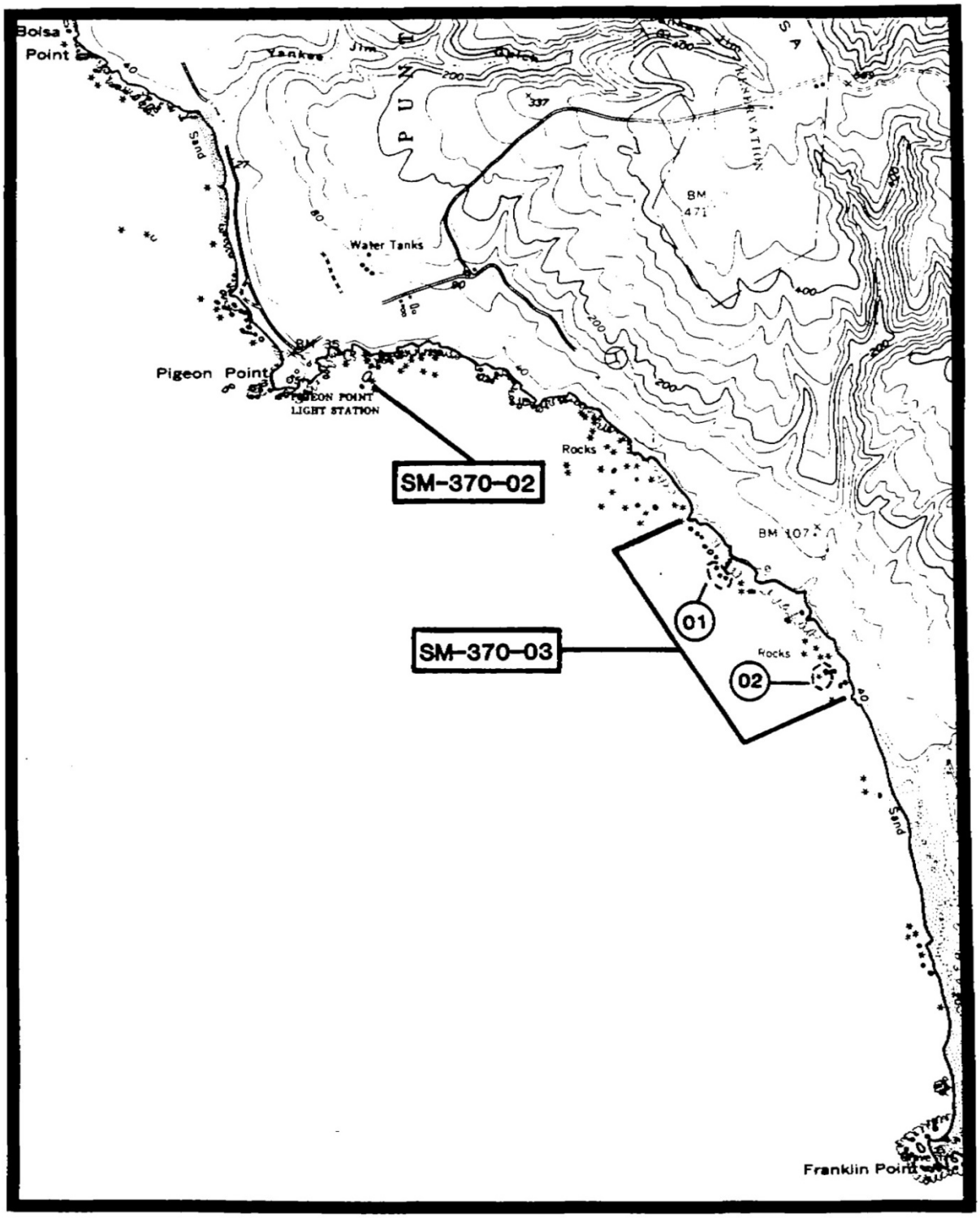
Map 33. Section from USGS maps “Montara Mountain” and “Half Moon Bay” (modified from Carter et al. 1992: II-70 [Map 68]), indicating colony and subcolony locations for Pillar Point (SM-372-04) and Pillar Point Harbor (SM-372-10).



Map 34. Section from USGS maps “Half Moon Bay” and “San Gregorio” (modified from Carter et al. 1992: II-71 [Map 69]), indicating colony and subcolony locations for Eel Rock Cliffs (SM-372-05), Seal Rock Cliffs (SM-372-06), and Martins Beach (SM-372-07).



Map 35. Section from USGS map "San Gregorio" (unmodified from Carter et al. 1992: II-72 [Map 70]), indicating colony and subcolony location Pomponio Beach to Pescadero Beach (SM-370-01).



Map 36. Section from USGS maps "Pigeon Point" and "Franklin Point" (unmodified from Carter et al. 1992: II-73 [Map 71]), indicating colony and subcolony locations for Pigeon Point (SM-370-02) and Gazos Creek North (SM-370-03).