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A SURVEY OF HISTORIC ROOKERY SITES FOR CALIFORNIA AND NORTHERN SEA LIONS IN THE SOUTHERN CALIFORNIA BIGHT

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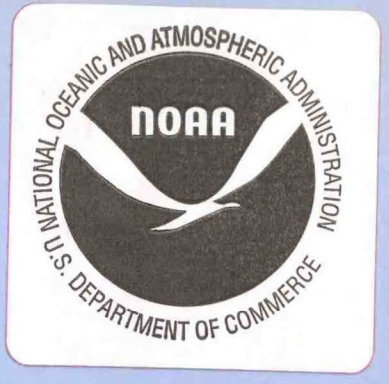

A Survey of Historic Rookery Sites for California and Northern Sea Lions in the Southern California Bight

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ABSTRACT

In this paper, we examined the distribution and use of rookery sites for California (Zalophus californianus) and northern sea lions (Eumetopias jubatus) in the Southern California Bight (SCB) from about 1850 to the present. To augment population surveys that are being conducted in other areas of the California Channel Islands, we made a two-day survey of sea lion rookeries on Santa Rosa, Santa Cruz, and Anacapa Islands. These rookeries had been inhabited previously by sea lions, although they have not been surveyed regularly in recent years.

The literature indicates that California sea lions historically have used four of eight Channel Islands as principal rookery sites: San Miguel, San Nicolas, San Clemente and Santa Barbara Islands. Marginal rookeries, which are used sporadically by small numbers of sea lions, have been observed at Santa Cruz and Anacapa Island. We found no evidence of rookeries on Santa Rosa and Santa Catalina Islands or on the mainland southern California coast. California sea lions are currently pupping and breeding at virtually all locations historically identified as rookery sites. We report considerable expansion of breeding distribution at most of these sites, concurrent with substantial population growth, since the earliest complete rookery survey in 1927 (Bonnot 1928 a,b). Current colonies at Coche Point and Gull Island, Santa Cruz Island, and east Anacapa Island may be incipient rookeries.

Northern sea lions have traditionally used San Miguel Island, its associated islets (including Wilson and Richardson Rocks), and the westernmost rocks offshore Santa Rosa Island as rookery sites. A marginal rookery may have been located on Santa Cruz Island for a short period. Coincident with a decline in abundance throughout the southern portion of their range over the past 40 years, northern sea lions have all but abandoned historic rookery sites in the SCB. No pupping and virtually no northern sea lions now are found on Santa Rosa and Santa Cruz Islands. Only a very few (<5) pups are born on San Miguel Island, and Castle and Richardson Rocks.

In order to continue to monitor sea lion rookery distribution and use, several actions are recommended: expand and continue ongoing aerial photographic surveys of all current and potential rookery sites on an annual basis; conduct periodic (biennial or triennial) vessel surveys during the breeding season to validate aerial surveys and assess social structure of potential incipient rookeries; monitor human disturbance at both incipient and established sites; and continue to collect detailed site-specific data on the species, age and sex composition of the populations.

INTRODUCTION

Sea lions in the California Channel Islands were first described in the 1820's (Choris 1822 and Lesson 1828 in Allen 1870, 1880). Disputes and confusion over species descriptions, range, and distribution followed for the next half century. Scammon (1874) provided the first on-scene descriptions of sea lion behavior and rookery sites in California, although he incorrectly identified the species. Finally, Allen (1880) accurately described the two species occurring along the west coast, identifying them as the California sea lion (Zalophus californianus) and the northern (or Stellar) sea lion (Eumetopias jubatus). Although he noted the overlapping ranges of these similarly appearing but distinct species, their respective distributions along the California coast were not clearly understood for another 50 years (Bonnot 1928 a,b).

The purpose of this review is (1) to examine the history of California and northern sea lion breeding sites on the California Channel Islands and (2) to determine the extent of the current breeding distribution. This review is based on published and unpublished literature, discussions with pinniped biologists and historians, and a two-day breeding season survey of the northern chain of the California Channel Islands.

DISTRIBUTION

There are three subspecies of the California sea lion: Zalophus californianus wollebaeki (found on the Galapagos Islands), Z. c. californianus (ranging from Baja California to British Columbia), and Z. c. japonicus (Sea of Japan, but now believed to be extinct) (Scheffer 1958). The major breeding distribution of Z. c. californianus (about 130,000 individuals) ranges from San Miguel Island (Bartholomew and Boolootian 1960; Bonnell et al. 1980) to at least Isla Margarita, Baja California and throughout the Gulf of California, Mexico (Mate 1975, 1977; Aurioles et al. 1983; King 1983; Le Boeuf et al. 1983). In recent years, a few pups have been born north of San Miguel Island in San Luis Obispo County (Braham 1974), on Ano Nuevo Island (Keith et al. 1984), and on the Farallon Islands (Pierotti et al. 1977; Huber et al. 1983). However, these births most likely are due to wandering individuals or represent short-term fluctuations to be expected at the extreme end of the species' characteristic breeding range.

Northern sea lions breed across the North Pacific Ocean rim from the Kuril Islands and Sea of Okhotsk, through the Pribilof and Aleutian Islands, and south to the California Channel Islands (Loughlin et al. 1984). Less than 3.0 percent of the estimated 240,000-300,000 individuals breed along the western continental United States (Bonnell et al. 1980; Braham et al. 1980). In the past, breeding colonies on the California Channel Islands have been recorded for San Miguel, Santa Rosa (Bonnot 1928 a, b), and Santa Cruz Islands (Bonnot et al. 1938) or their nearby offshore rocks.

Many early reports of sea lion distribution and abundance do not clearly identify the species discussed because of taxonomic confusion, overlapping ranges, and similarity of appearance. Throughout the 19th and the early 20th century, hunting and associated disturbance apparently caused considerable redistribution as well as population reduction (Bonnot 1928 a, b). As a result of military activities during and after World War II, sea lion use of haulout sites was altered (Bartholomew 1951; Ripley et al. 1962). Changing environmental parameters (Bartholomew 1967), harvesting of prey species (Ainley and Lewis 1974; Ainley et al. 1982), increased interspecific competition (Bartholomew and Boolootian 1960; Mate 1975), and increased public visitation to offshore breeding islands (Heath 1980), all have been implicated as contributing to localized variation in sea lion breeding distribution. These population fluctuations, as well as limitations in survey techniques, have made it difficult for investigators to compare and describe accurately sea lion status and distribution. For example, surveys conducted from 1930 to 1970 by the California Department of Fish and Game presented data based on the generalization that animals counted north of Point Conception were northern sea lions and those observed south were California sea lions. The sea lion colony at San Nicolas Island was not counted until 1946, and in 1949, it exceeded the combined count for all other sites in the Southern California Bight. Thus, many early investigator's reports do not provide data useful for assessing localized trends in breeding distribution or abundance for the region of species overlap -- the Channel Islands.

The literature concerning these two species is extensive. We used the fairly comprehensive bibliographies of Johnson (1979) and La Valley (unpub. ms.[1]) to find reports that were likely to contain rookery site descriptions or detailed distributional data for specific sea lion sites in the Channel Islands. The following papers contained related historic information, but did not include descriptions of sea lion rookery sites in the California Channel Islands: Anonymous (1902), Merriam (1902), Stevenson (1902), Dyche (1903), Townsend (1915, 1918, 1919, 1925), Starks (1918, 1922), Evermann (1921), Evermann and Hanna (1925), Ogden (1933), Abbott (1939), Fry (1939), Bonnot and Ripley (1948), Bonnot (1951), King (1954, 1983), Kenyon and Rice (1961), Rice (1963), Braham (1974), and Odell (1981).

In addition to literature cited, we searched several archives for historic information concerning the breeding distribution of sea lions. The following contacts were made: Rene Jaussaud, National Archives and Record Service; Betsy D. Cutler and Johan Kooy, California Academy of Sciences; Linda Long, Stanford University; Alan Baldridge, Hopkins Marine Station Library; Nancy Wright, California Department of Fish and Game Library, Long Beach; Kenneth Hollingshead, National Marine Fisheries Service, Washington, D.C.; Deborah D. Day, Archivist, Library, Scripps Institution of Oceanography.

[1] La Valley, R. Sea Lions of California: a summary of published data relevant to the determination of optimum sustainable population (OSP). Draft manuscript on file at Southwest Fisheries Center, 30 pgs.

Historic context

Study of sea lions along the California coast has gone through three stages. Research in the early period (1800-1928) consisted primarily of specimen collections, anecdotal descriptions of the impact of hunting on populations of sea lions, and cursory studies of food habits. Work initiated by Paul Bonnot of the California Department of Fish and Game began a transition period (1928-1951). During these years periodic surveys were conducted to census sea lions along the coast and on many of the offshore islands. The frequency of these surveys was influenced by legislative interest, budget constraints, the number of complaints received from the commercial fishing industry, and by World War II. In general, these surveys provided estimates of sea lion numbers over large geographic areas, but often did not clearly separate groups into age/sex classes or distinguish between similar species. A modern era of pinniped research began in 1950 when George Bartholomew and his colleagues developed a more systematic approach. In this approach, Bartholomew divided island (and later coastal) habitat into distinct numbered regions, systematically surveyed these regions, and noted the numbers of pinnipeds present by species and age/sex classes. This approach has rapidly evolved to include aerial photographic surveys which have the potential to cover the entire range of a species over a period of a few days.

Sea lions on the California Channel Islands were hunted long before they were counted. Anthropologic reviews (Levy 1978; Palou 1924) and archaeological studies (Lyon 1937; Walker and Craig 1979) document the prehistoric exploitation and trade of pinnipeds by California coastal Indians. It is unknown to what extent hunting influenced the prehistoric distribution of these animals. However, the persistent abundance of pinniped remains in middens over time implies that the Channel Island populations were stable and not influenced to a great extent by aboriginal hunting.

There are no published reports on the pinniped populations of California prior to that of Scammon (1874). Unfortunately his account does not provide detailed descriptions of rookery sites, but focuses instead on the species' life history and techniques for hunting sea lions. Much of the information is as generalized as his assessment of the population size:

> A few years ago great numbers of Sea Lions were taken along the coast of Upper and Lower California, and thousands of barrels of oil obtained. The number of seals slain exclusively for their oil would appear fabulous, when we realize the fact that it requires on an average, throughout the season, the blubber of three or four Sea Lions to produce a barrel of oil (Scammon 1874).

Scammon's account also provides the first written description of any rookery along coastal California: a portion of the rookery on Santa Barbara Island.

In response to concerns raised by fishermen about increasing problems with sea lions, the California Board of Fish Commissioners asked the United States Fish Commission (Treasury Department) to conduct studies on the status and biology of sea lions along the California coast during the 1901 summer season. Mr. Cloudsley Rutter (U.S. Fish Comm.), Mr. Robert E. Snodgrass (Calif. Fish Comm.) and Mr. Edwin C. Starks (Calif. Acad. Sciences) were appointed to conduct investigations of sea lion species distribution, abundance, food habits, and damage to fishing apparatus (Smith 1902). The three men began their observations on July 10, traveling along the coast from San Francisco to Ano Nuevo. The party divided at this location and Professor Starks traveled south. Sometime between July 16 and early August, Starks wrote:

> [I] visited Santa Cruz Island, where a number of specimens were obtained, and also other islands of the vicinity, all the rookeries being located with the aid of seal hunters, although most of the rookeries were deserted at that time (Smith 1902).

The three man commission submitted a report of their findings to the U.S. Commission of Fish and Fisheries (Rutter et al. 1902). Unfortunately the published account only excerpts those portions of the report that discuss food habits and fisheries interactions, "the description of rookery sites and data on the general habits of the sea lions being omitted (Smith 1902)." To date, efforts to locate the Commission's original manuscript have been unsuccessful. If such a report existed, it is likely that the original copy was lost in the transfer of holdings between agency libraries as fisheries management shifted from one Federal agency to another (Kenn Hollingshead and Rene Jaussaud pers. comm.). It is possible also that if a copy was held at the California Academy of Sciences, it was destroyed in the San Francisco earthquake and fire of 1906. A table in Smith (1902) identifies those Channel Island sites where Starks collected sea lions for analysis of stomach contents. This information is incorporated into the following text.

The next thorough survey of sea lion abundance and distribution was undertaken by the California Department of Fish and Game (CDFG) (Bonnot 1928 a, b) in response to complaints from fishermen and requests from Oregon bounty hunters to hunt sea lions. Bonnot's survey provides the first systematic description of sea lion rookery sites along the California coast and serves as the basis of the following island-by-island review. The reader of Bonnot's accounts (1928 a, b) is cautioned that he does not provide a clear definition of what constitutes a "rookery" and that numerical presentations are not always consistent. The numbers of pups reported vary from publication to publication and it is often unclear if pups were included in total counts, or were even present. Unless otherwise noted, we assume that Bonnot identified an area as a "rookery" only when he believed the pups observed were born at the site. We use the term "haulout" to refer to a site used by sea lions for resting, but not for pupping and breeding activities. In most of the following accounts of specific islands we begin our review with the 1927-1928 surveys of Bonnot (1928 b).

Anacapa

> At Santa Barbara County the hair-seal is killed principally for its oil, as is the sea lion, both of which animals, if distinct species, are extremely abundant on Anacapa and the other islands. They breed in June and July, and are chiefly killed from May to July. Only the pups are shot in winter (Elliott 1887).

Using the relationship of barrels of oil sold and number of seals required per barrel (Elliott 1887), we calculated that between 750 and 2,250 sea lions were rendered into oil in 1886 by Roger Brothers of Santa Barbara.

During the June surveys of 1927 and 1928, Bonnot found a small colony of about 30 Zalophus present; he made no mention of pups. No photographs or drawings of the site were presented.

> The rookery on Anacapa lies on the north side of the East Rock. It is situated on two small beaches, one of which runs back into a cave . . . This place is rather favorable for a rookery and seems to have the required amount of shelter demanded by the Californias (Bonnot 1928 b).

Based on one of the authors (DJS) experience, Bonnot's description most likely refers to a location now known as Cathedral Cove (Figure 1). The only other topographically similar haulout site on this side of the islet is at Landing Cove. Coast Guard personnel had begun construction of a steel stairway, a new lighthouse, and associated buildings at this site in 1928 (N. Whelan pers. comm.), so it is unlikely that any sea lions would have remained in Landing Cove.

The California Department of Fish and Game conducted coastwide breeding season censuses of sea lions in 1930, 1936, 1938, 1946, 1947, 1958, 1961, 1965, 1969 and 1970 (Bonnot 1931 and 1937, Bonnot et al. 1938, Bureau of Marine Fisheries 1947, Bonnot and Ripley 1948, Ripley et al. 1962, Carlisle and Aplin 1966, Frey and Aplin 1970, Carlisle and Aplin 1971; henceforth referred to collectively as "CDFG surveys"). Part of the 1946 and most all of the 1947 survey was made from a blimp; photographs taken from the blimp were used for some of the counts. Following 1947, the CDFG counted sea lions from the photographs taken on their coastwide aerial surveys. Pups were excluded from the numbers reported. These reports provide counts of sea lions at Anacapa but do not provide descriptions of how sea lions used specific sites at this Island. Further characterization of sea lion haulouts on Anacapa, as well as the other sites surveyed, may be possible if CDFG photographs can be located and reanalyzed. In general, according to CDFG surveys sea lions (presumably Zalophus) occupied Anacapa variably with between zero and 81

animals present. Given the small numbers observed and variable use of the Island, it is unlikely that sea lions used this site as a rookery during this period.

Bartholomew and Boolootian's (1960) aerial surveys of the Channel Islands during 1958 included February and June counts at Anacapa. No pups were observed; 28 females were counted in the June survey. No sea lions were observed there during a survey flown in early June, 1964 (Odell 1971). In an aerial survey of the entire west coast (Mate 1977), three Zalophus (no pups) were counted at Anacapa in July 1975. None of these three surveys provided information on the beach-by-beach level of detail for island sites. Reexamination of the photographs taken on these surveys could provide a more detailed understanding of the exact areas occupied (Odell and Mate pers. comm.).

Aerial surveys of pinnipeds in the Southern California Bight were conducted throughout 1975-1978 by personnel from the University of California, Santa Cruz (Bonnell et al. 1980), on contract to the Department of Interior, Bureau of Land Management (renamed in 1982 as the Minerals Management Service). Counts of pinnipeds, divided into age and sex classes, were made for discretely delineated and numbered island areas (Figure 2). The authors characterized Anacapa Island as a haulout:

> California sea lions use the south side of the east island as a hauling ground during the post-breeding season; aggregations in the winter occasionally exceed 500 animals. During the breeding season, the south sides of the east and west islands are irregularly occupied by less than 50 non-breeding males.

In June 1979, a single adult male was observed patrolling an aquatic territory on the southeasternmost tip of East Anacapa below the lighthouse tower. Between 12-15 females and juveniles were counted, but no pups or attempted copulations were seen (Seagars 1981). No sea lion surveys of Anacapa Island were made between 1979 and 1983.

Santa Cruz Island

Capt. R. Vasquez of Santa Barbara, a professional sealer, informed John Rowley of the Los Angeles County Museum of Natural History that "up to 1901 there were five distinct rookeries of black [California] sea lions on Santa Cruz Island . . . (Rowley 1929)."

Starks (Rutter et al. 1902) visited Santa Cruz Island in late July 1901 and collected 22 Zalophus (nine males, 13 females) for food habit studies. Collections were made at China Harbor, Gull Island, and East End Cove. The exact location of East End Cove is uncertain; it is possibly another name for the cove adjacent to Coche Point. Sea lions were repeatedly observed near

Coche Point over the next 70 years; no other colonies were ever reported along this northeastern portion of the Island.

By Rowley's first visit to Santa Cruz in the 1908 breeding season, the only surviving rookery (of five) was at Coche Point. The herd consisted of one bull, 100 females and pups, and some immatures. On a return visit in July 1911, Rowley counted eight mature bulls and about the same numbers of other age classes. However, around 1927, this rookery was reportedly wiped out by hunters for sea lion genitalia and whiskers ("trimmings") (Bonnot 1928 b) or abandoned due to frequent disturbance associated with capturing animals (under permit) for public display (Rowley 1929). In his 1927 and 1928 surveys, Bonnot did not find any sea lions at the Coche Point site (Bonnot 1928 a, b). However, a small group (75) was found at the site in the 1938 survey. No mention of sea lion occurrence at this site is made for the 1946 survey and no animals were observed here in 1947. Subsequent CDFG surveys did not provide counts or descriptions for specific sites, and thus sea lion use of the site is unknown for this period.

Bonnot (1928 b) found two rookery sites on Santa Cruz in his 1927 and 1928 surveys: Frazer Point and Gull Island. The site at Frazer Point was in the lee of the Point at the west end of the island; Bonnot included a photograph of the site. "It is on a flat ledge of volcanic rock, which is very rough, with bluffs behind it. It is very difficult to approach from either land or water." Bonnot identified the site as a rookery for Zalophus and a haulout for Eumetopias even though he did not mention pups for 1927 and did not see any pups in 1928. Between 8 to 12 Zalophus bulls and 50 to 75 females were using the site at this time.

On his 1930 breeding season survey, Bonnot (1931) noted that the Frazer Point . . .

> rookery two years ago was occupied exclusively by Californias. This year there was a mixed rookery of both species. This observation moves the southern end of the breeding range of the Stellars from the west end of Santa Rosa Island to the west end of Santa Cruz Island. The rookery was formerly located in the cove under the point, but it is now around the point facing Santa Rosa Island at the base of basalt bluffs. The situation is not as sheltered from the sea as the other [previous site].

Bonnot (1937) noted that the rookery at Frazer Point was completely deserted in the 1936 survey. A small mixed group was present in 1938: 15 Eumetopias,

25 Zalophus. Thirty Zalophus were present in 1946 (Bureau of Marine Fisheries 1947). The small size and inconsistent occupation of this site during these years is more indicative of use as a haulout than as a rookery.

Bonnot (1928b) provided the first description of the Gull Island site; a photograph and a map (Figure 3) were also provided. Based on our visit to the site, we believe Bonnot's figure is misoriented. The figure should be rotated 90° to the right; north should be located where west is labeled on the figure.

> Gull Island is a high mass of rocks at the southwest side of Santa Cruz Island. It lies a mile offshore and is surrounded by heavy beds of kelp. The main body of the rookery is on the east side of the rock.

The 1927 colony consisted of 35 bulls and 110 female Zalophus; no mention was made of pups. The 1928 count included 20 bulls, 85 females and 20 pups. A few Eumetopias were observed hauled out in both years.

Rowley (1929) identified Gull Island as a rookery for California sea lions but provided no description of the site. It is unclear if he based this identification on his visits to Santa Cruz in 1908 and 1911 or on an account from an informant from Santa Barbara, R.C. Ord.

California sea lions were found on Gull Island during the CDFG surveys from 1930 to 1947 but it was not indicated whether pups were present. Those surveys conducted after 1947 did not provide specific counts or descriptions for Gull Island.

The U.S. Coast Guard established a light on Gull Island in 1934 and it was rebuilt in 1944 (W.A. Donough pers. comm.). The Coast Guard has made periodic trips to the Island to service the beacon. Such visits were made during breeding season months (May-August) in 1967, 1970-1980, and 1982. The degree of disturbance to sea lions associated with those maintenance trips is unknown.

In aerial surveys flown in June of 1958 (Bartholomew and Boolootian 1960) and 1964 (Odell 1971), 137 and 220 California sea lions respectively were counted at Santa Cruz Island. No pups were observed. Three northern sea lions were counted on the Island in 1958. In the 1975 west coast pinniped survey (Mate 1977), 250 Zalophus were counted on the north side of Santa Cruz and 4 animals on "sea lion rock south of Santa Cruz Island" (presumably Gull Island). Further identification of specific sites occupied by the sea lions counted was not provided by any of these survey reports.

The 1975-1978 Bureau of Land Management (BLM) aerial surveys (Bonnell et al. 1980) described several locations around Santa Cruz Island which were used sporadically by small numbers of Zalophus as haulouts (numbers in parentheses refer to BLM area codes, Figure 4). These include Frazer Point (642), east side of West Point (643), Diablo Point (645/646), and Cavern Point (649). Two

sites were reported to be occupied on a consistent year-round basis: Gull Island (635) and Coche Point (649). Gull Island was described as "an incipient rookery."

> Gull Island, a small rock located about one km off the south side of Santa Cruz Island, was a major hauling ground for sea lions in the 1920's and presumably also served as a rookery. In the summer of 1976, we observed two California sea lion pups in aerial photographs of Gull Island. Pups were not observed here in 1975 or 1977; the status of this location as a rookery is, therefore, somewhat in doubt. Unless consistent and regular use of Gull Is. as a pupping ground can be substantiated in the future, we will continue to list this location as simply a hauling ground (Bonnell et al. 1980).

The rock ledge near Coche Point was reported to be consistently occupied by female and juvenile Zalophus; the total number present was variable with a maximum count of 364 animals. No pups were reported.

Three students from the University of California, Santa Barbara, studied the colony at West Point from April to July, 1979. They reported one Zalophus birth on May 31 at this site. Although adult bulls were present throughout the study, none maintained territories and successful copulations were not observed (Hodgson, Ross and Crumly unpub. ms.[3]).

Santa Rosa Island

There are few reports of sea lions using Santa Rosa Island for breeding or as a haulout. Bonnot (1928 a, b) provided a photograph and the only written description of the Stellar sea lion rookery offshore the island.

> Sandy Point is at the extreme west end of the Santa Rosa Island. The rookery is on two small rocks, about two hundred yards from the point (Bonnot 1928a).
>
> The place is very unfavorable for a rookery, inasmuch as it is on the windward side of the Channel and during heavy weather would get the full force of the wind and sea. The Stellar sea lions seem to like this sort of situation, however, in preference to a more sheltered one (Bonnot 1928 b).

[3] Hodgson G., M.A. Ross, and M. Crumly. Underwater and territorial haul-out behavior of the California sea lion, Zalophus californianus. Unpub. ms. on file at NMFS, Southwest Region, 300 S. Ferry St., Terminal Island, CA 90731. 23pgs.

From 1927-1938 the use of this site by Stellar sea lions was variable; between 20-52 individuals were observed. No pups were observed. In the CDFG surveys, no sea lions were seen on Santa Rosa Island during the 1946, 1947, 1961, and 1969 surveys. Unidentified sea lions were observed here in 1958, 1965, and 1970; these counts ranged between 125-295 individuals. Further descriptions of the specific sites were not provided.

In the 1958 aerial survey of the Channel Islands, Bartholomew and Boolootian (1960) counted 154 Zalophus and 17 Eumetopias on June 11 at Santa Rosa Island. No pups of either species were observed. No sea lions of either species were seen here during the June 20, 1964, aerial survey (Odell 1971) or the July 18, 1975, survey (Mate 1977). Site descriptions were not provided in these reports.

In the 1975-1978 BLM survey (Bonnell et al. 1980) two areas were found that could be described as Zalophus hauling grounds: Brockway Point (615) and Ford Point (621, Figure 5). No breeding or pups were reported. No Eumetopias were observed on Santa Rosa by these surveys.

San Miguel Island

Bonnot (1928 a) provided five photographs and a sketched map of the rookeries and haulout areas on or near San Miguel Island (Figure 6). He noted that most Zalophus breeding was occurring on Flea Island (now named Castle Rock). Stellar sea lions bred primarily on Flea, Richardson, Wilson, Lion, and Offshore Rock(s). The south side of Point Bennett was classified as a haulout; Bonnot observed only the old or sick of both species to be present and never counted any pups in this area. He apparently did not observe any sea lions in the sand flats adjacent to Adams or Northwest Coves, or elsewhere along the Island.

Bonnot's censuses of 1927, 1928, and 1930 documented the impact of hunting on sea lion distribution and abundance around San Miguel Island.

> A large number of sea lions were killed at San Miguel Island . . . The beach at Flea Island contained a mixed rookery of nearly 400 sea lions when I visited it on June 13 [1927]. Two days later I again landed there. In the meantime the sea lion hunter had done his work. Every pup on the rookery was dead and of the 400 animals which I counted on my first visit, a pitiful remnant of 30 or 40 was swimming timidly about in the surf (Bonnot 1928 b).

Richardson Rock supported a large rookery of Stellars in 1930. Bonnot (1931) describes it: "This rock comes straight up from deep water and it is a hazardous undertaking to land on it." He saw no evidence of trimmings hunters at this site.

The censuses of 1930, 1938, 1946, and 1947 provide no further descriptions of sea lion distribution on San Miguel Island, but document changes in overall abundance. Stellar sea lions increased until 1938, and then began a decline that continues today. Collyer and Baxter (1951) counted pinnipeds on a portion of San Miguel Island on May 26, 1951. In a "small area around Point Bennett, which contains the Island's principal rookery" the authors reported 830 northern sea lions with several pups and 1,117 California sea lions (no pups). In subsequent CDFG surveys sea lions were not distinguished by species and pups were not counted, so these reports do not provide data useful for accurate descriptions of distribution or abundance.

An aerial survey of San Miguel Island was made on June 11, 1958 (Bartholomew and Boolootian 1960). From an analysis of photographs, 8,179 California sea lions, including 170 pups, were counted. Thirty-four northern sea lions were counted: "three newborn pups were seen and a rudimentary harem organization existed." The sea lions were found at "the extreme west end of San Miguel;" no further description of distribution on the island was provided.

Surveys of San Miguel Island conducted in 1964 (Odell 1971) and 1975 (Mate 1977) documented increasing number of California sea lions and stable, but small, numbers of northern sea lions. However, neither of these accounts provides rookery site descriptions. Reanalysis of the aerial photographs from which these counts were made could provide an indication of any specific changes in distribution.

The 1975-1977 BLM survey (Bonnell et al. 1980) provided the first detailed description of the pinniped rookeries and haulouts on San Miguel Island since Bonnot's work. As a result of these surveys, it was found that the area on San Miguel Island used as a rookery for California sea lions had expanded considerably (Figures 7 and 8), accounting "for well over half of the pups produced in the SCB each year." Bonnell et al. (1980) describe California sea lion use of San Miguel Island:

> Castle Rock (Spec. loc. 102) - Used as both a rookery and a hauling ground. The population of Castle Rock numbers between 1,000 and 1,500 during the breeding season, and includes about 250 to 500 pups; during the winter, the population declines to 200 to 600 animals. Most California sea lions are found along the eastern side of the large rock closest to San Miguel Island near the surf or splash zone. The animals also use the outer rock, to a lesser extent, and must share this area with northern fur seals and Stellar sea lions.
>
> Richardson Rock (spec. loc. 103) - Used by 200 to 400 animals as a resting place during feeding forays in the westernmost part of Santa Barbara Channel. Not used regularly as a pupping ground.

Adam's Cove (spec. loc. 111) - Used as both a rookery and hauling ground by 2,500 to 5,000 California sea lions during the breeding season. Reproductive aggregations are located near the water and produce 400 to 700 pups; non-breeding animals haul out on the inland sand flats.

Cormorant Rock (spec. loc. 112) - Used as both a rookery and hauling ground by 300 to 500 California sea lions during the summer breeding season and by 150 to 400 animals during other times of year. The spit to Cormorant Rock is a locus of major pup production; many pups play on or near Cormorant Rock. Pup counts vary from 30 to 200, but few are probably born on Cormorant Rock itself.

South Cove (spec. loc. 113) - Used by 2,000 to 3,000 California sea lions as a rookery during the breeding season and produces over 1,000 pups. Reproductive aggregations are found near the water; many non-breeders haul-out on the inland sand flats.

Point Bennett Spit (spec. loc. 114) - Used as both a rookery and a hauling ground by California sea lions. Reproductive aggregations are found at the distal end near Point Bennett bluff; they produce about 1,500 pups. The middle and inshore portions of the spit are used as a hauling ground for 1,000 - 3,000 yearling and juvenile animals. The total number of animals on the Point Bennett spit during the breeding season varies from 1,000 to over 3,000 animals.

Point Bennett (spec. loc. 115) - Used as both a rookery and hauling ground by California sea lions during the summer breeding season. The population on land numbers 3,500 to 5,000 during the breeding season and produces 500 to 1,000 pups exclusive of those found on the Point Bennett spit. Reproductive activities occur on the rock margin near the water; the top of the bluff is used primarily by non-breeding animals.

West Cove (spec. loc. 116) - The area near Caliche Dome and Point Bennett spit is a hauling ground for non-breeding adult males ("bachelor bulls"); the area near West Headlands is a pupping ground and rookery producing 200 to 500 pups. The number of animals on land in West Cove is about 1,000 during the breeding season . . . .

West Headlands (spec. loc. 117) - Used as a rookery during the breeding season, producing 600 to 1,200 pups. Reproductive activities occur near the water. The population varies from 2,500 to 4,500 in the breeding season . . .

Northwest Cove (spec. loc. 118) - Used as both a rookery and a non-breeding hauling ground. The pup count varies from 200 to 1,100 some of which may have been born on the West Headlands rookery. The population of all animals on land numbers 800 to 2,500 in the breeding season . . . .

Northwest Headlands (spec. loc. 119) - Used as both rookery and hauling ground, producing 200 to 400 pups during the breeding season with a population of 700 to 1,500 animals.

Springside (spec. loc. 120) - Serves occasionally as a hauling ground for non-breeding males during the breeding season; rarely occupied after the breeding season.

Tyler Bight (spec. locs. 159 to 151) - Used as a hauling ground for 1,500 to 3,000 yearlings, juveniles, and non-breeding males during the breeding season; the population is less than 500 animals after the breeding season. Most animals are found aggregated on beach J1 ("Sandslide Beach" - specific location 151).

West Judith Beach (spec. loc. 161) - Used as both rookery and hauling ground. Produces about 10 pups with a population of 300 to 600 animals on land in the breeding season.

Tyler Point (spec. loc. 160) - Used as both rookery and hauling ground. Use as a rookery is variable; produces less than 50 pups per year. During the breeding season, the population is less than 100 animals . . . .

Landing Cove (spec. locs. 171 and 172) - Used as both rookery and hauling ground. Landing Cove produces about 100 pups per year. Population during the breeding season is about 250 animals . . . .

Lobster Cove (spec. loc. 173) - Used as both rookery and hauling ground. Use as a rookery is variable; produces less than 50 pups per year.

Recently DeMaster et al. (1982) reviewed trends in California sea lion abundance at San Miguel Island. They reported that the number of pups, and logically the total population, has increased at an average rate of five percent per year from 1967 to 1981. They further reported that this rate of increase is slowing and the population may be approaching its upper asymptote. From aerial (Stewart and Yochem 1983) and ground (DeLong and Antonelis unpublished data) surveys, biologists have found that some California sea lion pupping regularly occurs along the beaches of the south shore from Landing Cove to Judith Rock, and occasionally into eastern Tyler Bight. From a preliminary examination of these surveys, it seems that there has been a gradual increase in the number of pups born in these southern areas (Antonelis pers. comm.). The breeding season density of sea lions has also increased on those beaches traditionally used for breeding: Northwest Cove (118), West Headland (117), West Cove (116), Pt. Bennett (115), and South Cove (113).

The number of northern sea lions that pup and breed on West Headland (Northwest Point) has decreased most years since 1969. The highest pup count was 12 recorded in 1970; since that time, the number of pups born has decreased until no pups were recorded in 1982 and 1983 (DeLong and Antonelis unpublished data). The continued decline in northern sea lion abundance at San Miguel Island also was reported during the 1975-1978 BLM surveys (Bonnell et al. 1980). Northern sea lions were observed to haulout on the rocky areas of Pt. Bennett (BLM areas 115, 117, and 119), on Castle Rock (102), and on Richardson Rock (103). Three pups were counted on both Richardson and Castle Rocks in 1975; 1 pup was observed on Castle Rock in 1976. Loughlin et al. (1984) reported there were less than 20 breeding northern sea lions at San Miguel Island by 1980.

Santa Barbara Island

Although Scammon's (1874) descriptions of sea lions at Santa Barbara Island are largely anecdotal, they do provide some insight into the extent of sea lion (presumably Zalophus) breeding and resting use of this area.

> As the time of "hauling out" drew near, the island became one mass of animation; every beach, rock and cliff where a seal could find foot-hold, became its resting place, while a countless herd of old males capped the summit, and the united clamorings of the vast assemblage could be heard, on a calm day, for miles at sea.
>
> On the south of Santa Barbara Island was a plateau, elevated less than a hundred feet above the sea, stretching to the brink of a cliff that overhung the shore, and a narrow gorge leading up from the beach, through which the animals crawled to their favorite resting place. As the sun dipped behind the hills, fifty to a hundred males would congregate upon the spot . . .

Allen's early description was apparently based on Scammon's account: "'a herd of many thousands' (Allen 1884) . . . which in former years, annually assembled at the small island of Santa Barbara" (Scammon 1874). This was apparently in reference to the decline of the population (in Scammon's time) due to the hunting activities of which he had been a participant.

Bonnot (1929 b) provides a description and sketched map of the California sea lion rookeries at Santa Barbara Island; however, the account is unclear. The rookery was located on the northwest side of the island on

> two small, rocky beaches, opposite a large offshore rock. The rock has no name on the charts. It is surrounded by heavy beds of kelp which extend in toward the beaches to the breaker line. The beaches are composed of coarse gravel and rocks, and are backed by high bluffs.

The orientation of Bonnot's map (Figure 9a) does not appear to be accurate, at least not when compared with the island topography of recent years. It is possible that the offshore islet referred to by Bonnot is either Shag Rock or Sutil Islet (refer to figure 10). Shag Rock is on the northwest side of the Island. The rookery identified in the map may be on the beaches adjacent to Elephant Seal Cove. However, based on our experience with the islands' topography, current location of the dense nearshore kelp beds, and current sea lion distribution, it seems more likely that Bonnot's map refers to the Sutil Islet area off the southwestern side of Santa Barbara Island. If so, then the map should be rotated 90 to the left (east on the map is actually north) for the correct orientation. Unfortunately, he was unable to obtain good photographs of the area. Bonnot observed between 125 and 325 adults and "a good many" pups at Santa Barbara Island during 1927 and 1928.

The colony was abandoned in 1930 due to the activities of the trimmings trade collectors (Bonnot 1931). By the 1936 survey the Santa Barbara Island rookeries had become the largest counted in the state with approximately 600 individuals. Surveys by CDFG documented a general but irregular increase in sea lion numbers at Santa Barbara Island over the next two and a half decades.

No further site descriptions are available until June 1950 when Bartholomew, Collyer, and Dawson (1951) employed a grid system to survey the island (Figure 9b).

> Although at the time of the earlier censuses by the Division of Fish and Game (Bonnot 1928) the sea lions on Santa Barbara were confined to a small area on the northwest part of the island, during our visit the suitable beaches on all sides of the island were occupied by at least a few animals.

Most pups were observed on the north and west facing shorelines in areas 4,5,7,8, and 9. The total pup count was 647; the total count was 2,534 sea lions (Zalophus).

Surveys by the CDFG between 1958 and 1970 showed a persistent decline in the numbers of sea lions on Santa Barbara Island. By June 1970, the total count had declined to 484 individuals. Counts from specific rookery sites were not provided by these reports.

Aerial surveys flown in June 1958 (Bartholomew and Boolootian 1960) and 1964 (Odell 1971) provide counts that agree with CDFG data within the limits of variation due to technique and timing. Pups were observed at both Webster Point and Southeast rookery (Odell pers. comm.); however, data for specific sites were not presented.

Mate (1977) surveyed Santa Barbara Island in July 1975 but did not report seeing any pups.

Main (unpub. ms.[4]) surveyed Santa Barbara Island for sea lions from the bluff tops and offshore aboard a National Park Service patrol vessel. Main's counts of 1973, 1974, and 1975 were made between the third week of June and the first week of July, during the period when maximum numbers of pups were expected. Counts for specific sites for the 1975 season show that pupping occurred at Southeast Rookery, along the western shores, around Webster Point, and west of Shag Rock.

In the 1975-1978 BLM pinniped surveys (Bonnell et al. 1980), biologists examined the rookery sites at Santa Barbara Island by aerial surveys and frequent daily ground counts. They provided the following (figure 10):

> Santa Barbara Is. is used by California sea lions during the breeding season both as a rookery producing about 500 pups and as a hauling ground.
>
> California sea lions use the entire periphery of Santa Barbara Is., except specific locations 315 and 316 near Landing Cove and Sutil Is., a steep offshore rock on the southwest side of the island. The largest hauling groundin terms of population numbers is Southeast Rookery (spec. loc. 317) . . . occupied nearly exclusively by non-breeding and immature animals. The remaining hauling grounds, located along the southern end, the windward west side, and the northern end of the island, are all used as rookeries for the birth of pups. The population size of each rookery at the peak of the breeding season is usually

[4] Main, R.E. Preliminary report of a marine mammal survey of Santa Barbara Island. Unpubl. ms. on file (#29) at NMFS, Southwest Region, 300 S. Ferry St., Terminal Island, CA 90731.

usually less than 200 animals; animals are distributed among ten small coves separated by talus or rock barriers. The coves are generally narrow and provide little room for animals to retreat from high tide or storm-generated surf. The most important rookery coves in terms of pup production are specific locations 307 to 312 on the north side of the island, 302 to 304 on the west side of the island, and 325 on the southeast side of the island adjacent to the hauling ground at Southeast Rookery (317).

Few pups are seen on the eastern side, which is not only the lee side of the island, but is the area most accessible to visitors to the Channel Islands National Monument.

Total numbers of California sea lions and pup production varied considerably between 1975-1983 (Heath 1980; Bonnell et al. 1980; Heath and Francis 1983; Hansen, pers. comm.). The locations where sea lion pupping and breeding occur have contracted somewhat with the fluctuation in pup production. In 1982 and 1983 most pupping was concentrated in areas 311, 317, and 325. During this period the number of pups born at Southeast Rookery (325) has gradually increased (Hansen pers. comm.).

San Nicolas Island

This island was not surveyed for pinnipeds until 1946. Although the island was included in all subsequent CDFG surveys, observations of pups were never included in the reports and no site description was provided.

Bartholomew (1951) surveyed San Nicolas Island in 1949 and 1950. He divided the island into five geographic subareas, counted all species present, and divided counts into adults and pups. During these summers, California sea lions bred in three areas. The main rookery was located along the western most portion of the south shore (Area 1, figure 11A) in what is now identified as areas 211-213 (BLM codes, figure 12). An occasional pup was born in Area 3 (BLM 232); however this site and Area 4 (BLM 233) were used primarily as haulouts for large numbers of subadult and nonbreeding males.

In the 1958 breeding season survey of San Nicolas Island, Bartholomew and Boolootian (1960) found eight breeding groups and reported 281 pups. (The survey was conducted in early June so the number of pups is not representative of total annual pup production.) No maps or site descriptions of the aggregations were provided. A reanalysis of the aerial photographs from which the count was made (Odell, pers. comm.) could provide detailed information on distribution of sea lions along specific beaches.

California sea lion distribution on San Nicolas Island by age and sex classes changed between 1964-1965 surveys (Peterson and Bartholomew 1967, Odell 1971) and the surveys of 1969-1971 (Odell 1972, 1975). Increases in the numbers of breeding animals were reported for areas 2B (222), 3B (232), 4B-C

(242-243), and 6A (261), although areas 1A (211), 1B (212), and 6B (262) (figures 11B and 12) showed a marked decrease (numbers in parentheses refer to BLM codes). Odell (1972, 1975) speculated that the changes in sea lion distribution, abundance, and age and sex composition may have been a response to an observed increase in human recreational activities along beaches 1A-1B (figure 11C). However, he noted that some of these changes also could have been influenced by an overall increase in population density.

Mate's (1977) aerial survey of San Nicolas Island on July 18, 1975, did not provide pup counts for specific sites on the island. Review of the photographs could augment the following findings.

In the 1975-1978 BLM surveys (Bonnell et al. 1980) California sea lions were found to be distributed (Figure 12) in essentially the same areas as described previously by Bartholomew, Odell, and Peterson. Even though Bonnell et al. (1980) reported slight increases in total Zalophus population and pup production, some continued redistribution was noted. The following description is a compilation from Bonnell et al. (1980):

> The rookery on San Nicolas Is. consists of a series of adjacent beaches and rocky points on the windward west side of the island. The greatest number of California sea lions on land, as well as the greatest population density, is found in the center of the rookery or hauling ground area on San Nicolas Island. Most pups are counted in Areas 3 and 4 (specific locations 230 and 240) in the central part of the rookery. These areas can be reached only by a four-wheel drive vehicle or on-foot, and are probably least affected by the activities of Navy personnel on the island. No California sea lions are found south of Area 6B (Twin Rivers Beach - spec. location 262). We do not know if this is due to the increased frequency of human disturbance beyond this point, or to the fact that the beaches are more protected from the essential exposure to prevailing winds. It may be due to a combination of factors. Historically, the rookery has extended from Dutch Harbor to the northwest point of land. Few pups are born in Area 1 (spec. loc. 210) at the northernmost end of the rookery; this area was the most important pupping ground in the late 1960's, but has shown a steady decline in use since that time, presumably due to human activity on the roads that parallel the shoreline.

Pupping in areas 211-213 continued to decline from 1975 to 1978. Between 50-75 pups were counted here in 1975-1976; no pups were born on these beaches in 1977 (Bonnell et al. 1980). Consequently, the Naval Command closed entry into sea lion areas during the pupping and breeding season to nonauthorized personnel in 1978 (R. Dow pers. comm.). Despite this order, some recreational fishing and tidepooling continued in these areas (DJS personal observation).

Survey work on San Nicolas Island in 1981-1983 (Heath and Francis 1983, 1984) and in 1980-1982 (Stewart and Yochem 1984) has shown a redistribution into those areas at the northern end of the rookery that had been used previously for pupping. In 1980-1982, about 200 pups were reported for both areas 211 and 212, at the northwest end of the island. However only a few (15-30) pups were counted in area 213 during the same period. (Area 213 is adjacent to a major dirt road intersection and continues to be frequented by base personnel conducting military operations or seeking recreational fishing and wildlife viewing experiences [DJS personal observation]). Although pupping on San Nicolas Island declined 37 percent in 1983 from the 1982 count, presumably due to the prevailing El Nino weather condition (Heath and Francis 1984), the overall distribution and density of each pupping site remained unchanged from that observed 1980-1982 (Heath and Francis pers. comm.).

San Clemente Island

Starks collected two adult female Zalophus from San Clemente Island on August 6, 1901, for food habit studies. Although this trip was part of a coastwide survey, the account does not provide a description of the collection site or further discussion of the area (Rutter et al. 1902).

Bonnot (1928 b) surveyed the island and found that two areas were used by Zalophus.

> Seal Harbor lies on the west side of San Clement[e] Island. It is a shallow bay, with a large rock setting in the center. The rookery is scattered along the edge of the bay for half a mile, on ledges of rock and rubble beaches.
>
> Castle Rock Rookery is a large saddle shaped rock a mile offshore, at the northwest end of San Clement[e] Island. The situation is fairly good for a rookery, though it would not allow a large one . . . A close approach to the rock is very dangerous . . . (Bonnot 1929 b).

He counted 235 Zalophus in 1927 and 228 in 1928 at the Seal Cove area. Neither of these counts included pups: no mention of pups was made for the 1927 count; at least 50 pups, 10 of which were on the offshore rock in the cove, were counted in the 1928 survey. One adult male Eumetopias was observed in 1928. The Seal Cove area described by Bonnot (Figure 13) is within BLM area 407 (Figure 14). His account included five photographs.

Although the Castle Rock area was identified by Bonnot (1929 a, b) as a rookery, he did not see pups in either 1927 or 1928. This area is designated as 410 (Figure 14).

Even though the San Clemente Zalophus count for 1928 was smaller than the Santa Barbara Island count, Bonnot (1928 b:27) states that the "rookery at Seal Harbor is the largest California sea lion rookery in California."

Because of extensive commercial fishing in this region and the large numbers of sea lions present, he advocated "the killing of the surplus bulls (about half the total number of bulls) at Seal Harbor. This would remove a great many animals without injury to the herd."

Bonnot (1931) resurveyed San Clemente in late June 1930 and found that the Seal Harbor

> rookery has increased in size, no doubt receiving the animals from the rookery on Santa Barbara Island which is abandoned this year [due to activities of trimming collectors]. The animals were distributed about the crescent shaped harbor as usual. Some of the smaller beaches which two years ago were occupied by only a half dozen animals were inhabited by thirty or forty. There were a number of young bulls on a rock to the southeast, not used in 1928.

The above reference to the rock to the southeast may be a reference to the Mail Point area (Figure 14). Bonnot reported counting at least 170 pups, and more animals were probably present in rocky areas that he could not count from his vessel. Only seven individuals were counted at Castle Rock.

Military activities on San Clemente Island likely have influenced sea lion distribution since the Navy took over management of San Clemente Island in 1934 (J. Larson pers. comm.). An airfield was built on the plateau in the middle of the Island shortly thereafter and a new airfield was constructed on the Island's north end between West Cove and Northwest Harbor during 1952-1954. Aircraft going to and from these sites practice maneuvers and bombardments over sea lion rookeries and haulouts. The southern portion of the island from Middle Ranch to Pyramid Head was used often as a shore bombardment range from 1942-1946. During 1972-1973, the Naval Ocean Systems Center identified the Seal Cove - Mail Point region as a target area. Curren Head, continues to be used as a shore bombardment range (J. Larson pers. comm.).

The number of Zalophus at Seal Harbor increased during the 1930, 1936, 1938 and 1946 census periods from 229 to 883. Although no sea lions were observed at either Castle Rock or Seal Harbor during the 1947 survey, 250 Zalophus were counted "south of Seal Harbor," presumably at Mail Point (Bonnot and Ripley 1948). No further descriptions of rookery sites were provided during this period.

The 1958 Channel Island pinniped survey conducted by Bartholomew and Boolootian (1960) did not include data for San Clemente Island. The 1958 and 1961 CDFG surveys reported an increase of Zalophus on the Island (1,507 - 2,361) but did not include any additional site descriptions.

During the 12 June 1964 aerial survey flown by Odell and Bartholomew (Odell 1971), 183 Zalophus pups (3,820 total animals) were counted on San

Clemente Island. Although the count was not broken down by subarea, a reexamination of the photographs could provide data on specific rookeries (Odell pers. comm.).

According to censuses made by the CDFG in 1965, 1969, and 1970, the numbers of Zalophus at San Clemente Island generally declined; the areas were not described. However, reanalysis of the photographs taken on the July 17, 1975 aerial survey by Mate (1977) could provide information on specific rookeries.

Surveys conducted for the BLM during the 1975-1977 sea lion breeding season provide the first detailed description of rookery sites for this island since the Bonnot (1928 a, b) survey. Bonnell et al. (1980) provide an island map (Figure 14) and notes that:

> All California sea lion pupping on San Clemente Island occurs in the vicinity of Seal Cove on the windward west side. This Cove is bounded on the south by Mail Point and on the north by Seal Point. Most pups are seen on or near Mail Point (spec. loc. 407) and on several small, cobbled beaches in Seal Cove (also spec. loc. 407).
>
> Seal Cove/Mail Point Rookery (spec. locations 406 and 407). This area on the windward west side of the island is about 2.6 nm (5 km) in length and is used by California sea lions as both a hauling ground and a rookery. During the summer breeding season, it is occupied by 1,350 to 1,750 animals, including 350 to 600 pups of the year. Area 406 to the south of Mail Point is used primarily as a hauling ground for non-breeding animals during the breeding season and as a major hauling ground during the non-breeding season. On this beach, the count was over 1,500 animals in March 1978. The Mail Point area is primarily a rookery, producing about 50 percent of all pups, and is occupied by about 1,000 animals during the breeding season, especially in three shallow rocky coves. Seal Cove and several offshore rocks within Seal Cove serves primarily as a hauling ground for non-breeding animals.
>
> Northwest Harbor Islet (spec. location 411). This flat offshore rock is used as a hauling ground for non-breeding animals during the breeding season, and as a major hauling ground after the breeding season. During the summer, the rock generally is occupied by less than 100 California sea lions. . .

Under the auspices of the U.S. Navy, Natural Resources Branch, ground counts were conducted for sea lions and other pinnipeds from April 1976 to June 1977 (Cohen unpub. ms.[5]). Although the numbers counted were lower than reported by Bonnell et al. (1980), the report confirmed a similar distribution of pupping and breeding areas.

Surveys have been conducted on San Clemente Island since 1981 by the NMFS, Southwest Fisheries Center. California sea lion pup production varied considerably during this period, declining in 1983 to 353 pups from 941 counted in 1982 (Oliver pers. comm.). As was observed throughout the Channel Islands, these variations were probably related to the El Nino conditions of this period. Despite the fluctuations in pup production, the distribution of hauling sites and rookeries was essentially unchanged from the 1975-1978 surveys with the exception of the Northwest Harbor inlet area. On Bird Rock (area 411a) a few pups were recorded in June 1982 (M. Lowery pers. comm.). About 50 pups and 100 "other" California sea lions were observed from the air on this islet on June 3, 1983. However, during a subsequent aerial survey on July 11, no sea lions were present. It is believed that all individuals abandoned the Bird Rock area because of a military explosives training exercise that was conducted next to the site during the period between the surveys (C. Oliver pers. comm.). At this time human disturbance of sea lions in the Northwest Harbor Inlet is best described as chronic and is primarily due to frequent military activities and vessel moorings between Bird Rock and the sandy beach immediately north of the airfield (DJS pers. observation).

Santa Catalina Island

Bonnot (1929b) counted 15 Zalophus in 1927 and 40 in his 1928 survey at Catalina Island; pups were not observed. He describes the colony as a haulout for California sea lions. No maps or photographs were provided.

> Catalina Island once supported a rookery. There is much [human] activity on and around the island at present, and the sea lions have left for more peaceful localities. The former rookery could never have been very large, as the places used by the sea lions . . . in former times are small and not very well suited for rookery sites. The place frequented by the animals at present is at the southwest end of the island on several rocks and a small beach (Bonnot 1929b).

[5] Cohen, R.H. Population size, distribution, structure, and productivity of marine mammal populations on San Clemente Island. 19 pgs. On file with J.K. Larson, Natural Resources Manager, Code 1843, Naval Air Station, North Island.

Rowley (1929), however, implies that the "rookery" was larger and somewhat more substantial, although he does not provide any counts or references to the presence of pups.

> On Catalina Island, the California sea lion has been protected for many years by a Los Angeles County ordinance. The Catalina Beach rookery, situated on the shore about a mile from Avalon, has not been molested to any great extent for many years and some of the animals have grown quite tame and sociable, and are looked on as an attraction to the many tourists visiting the island. The Catalina rookery is therefore a fairly protected sanctuary for the California sea lion and as such will hold its own, and probably serve by its overflow to repopulate other less fortunate colonies of this species that are so remote from the protection of the law that poaching for trimmings will continue to keep down their male numbers (Rowley 1929).

Of these two accounts, Bonnot's is, if not more accurate, certainly more prophetic. The colony has never grown much. It has served primarily as a haulout site. The number of sea lions peaks in the winter and early spring; individuals use the site to rest as they move toward major offshore rookery islands. The 1946 breeding season peak in abundance (104 Zalophus) could have been related to the increase in sea lion collection activities which were reported by Bonnot and Ripley (1947) for the northern Channel Islands.

According to breeding season surveys conducted by the CDFG after 1946, the numbers of Zalophus at Catalina Island has fluctuated. These surveys did not indicate if pups were present or provide counts for specific sites. The 1958 survey conducted by Bartholomew and Boolootian (1960) did not include Catalina Island.

Odell (1971) conducted a census of Catalina Island in June 1964, and divided the count into age/sex classes. His count of 92 total animals and zero pups is comparable to the total numbers previously reported by other workers and indicates that Catalina was used as a haulout. No site description or photographs were provided.

Mate (1977) did not observe sea lions in his July 1975 aerial survey. No photographs of the island were taken.

In surveys flown during 1975-1978 sea lion breeding seasons, Bonnell et al. (1980) did not find sea lions breeding on Santa Catalina Island. Adults and several nursing yearlings at the Palisades (503) and on Bird Rock (522) were observed during a 3 June 1983 aerial survey flown by the NMFS. One pup may have been present at Bird Rock; however, no sea lions were observed here on a subsequent survey flown on 11 July 1983 (C. Oliver pers. comm.). Seal Rocks and the adjacent beach (523) are the principal hauling grounds on this

island; some animals may be present here throughout the year (Figure 15). Sea lion abundance peaks in late winter and early spring at this site as well as at other, smaller haulouts located at China Point (504), Ben Weston Point (505), Bird Rock in Isthmus Harbor (522), and at West End (527).

Sea lion use of Santa Catalina Island is limited by the marginal quality of the habitat and the frequency of human disturbance of animals on a haulout. This disturbance is associated with the activities of tour vessels (especially in the Avalon - Seal Rocks area), private yachts, commercial fishing, and recreational use of the islands' coves and shoreline. Most of these activities peak in the spring and summer months when sea lions would typically require a secure area for breeding activities.

Coastal sites

Historically California sea lions have been reported to haulout at several mainland sites in the Southern California Bight. California sea lions have reportedly used the following locations as haulout sites: Point Arguello, Point Dume (Bonnot 1929a), Point Vicente (B. Andrews, pers. comm.) and Point Loma (Bureau of Marine Fisheries 1947). Although census efforts traditionally have not included these sites and not much has been recorded concerning their importance, occupation by sea lions appears to only have been sporadic, at least since 1900.

Rutter et al. (1902) asserted that the rookeries near San Pedro were inspected by Professor E.C. Starks early in August as part of the 1901 sea lion investigation commission. There is a remote possibility that this was a reference to a sea lion rookery in the Point Vicente area. A small colony of up to 200 Zalophus has been using a small rocky beach at Long Point (Figure 16) as a year round haulout since 1977 (B. Andrews, pers. comm.). A few aborted pups as well as several large adult males have been observed during May and June; no breeding has been reported. However, as Starks was visiting the offshore island sites and San Pedro was the likely port of departure for Catalina, Santa Barbara and San Clemente Islands, it is more likely that Starks inspected the rookery sites on the offshore islands.

Rumors of "seal" rookeries at Goleta Slough, Seal Beach and Mission Bay are almost certainly observations of harbor seals, Phoca vitulina (for example see Bonnot 1929a).

We conclude that there is no evidence that California or northern sea lions have pupped or bred on the mainland coast of southern California, at least since Scammon's study of 1874.

SURVEY of JUNE 25-26, 1983

As part of a program to assess the population status of California and northern sea lions, the NMFS required current information on the breeding distribution of these species. In addition, the National Park Service and the NOAA Marine Sanctuary Program are required to monitor the status of resources within the Channel Islands National Park and Marine Sanctuary. In recent years, surveys of sea lions in the California Channel Islands have focused on the major breeding islands and they have been timed to coincide with the period when the peak number of pups are present. The data are used to assess relative trends in population size (DeMaster et al. 1982). These surveys focus on the major rookery islands; however, the islands (Santa Rosa, Santa Cruz, and Anacapa) with little or no known breeding may not have been included in all surveys. In order to examine closely the coastline of these "overlooked" islands and to examine specific sites reported to have been used for sea lion breeding in the past, the NMFS, NPS, and MSP conducted jointly a two day survey of the northern Channel Islands.

Large scale pinniped surveys usually are conducted by photographing rookeries from an airplane and later making pup counts from projected slides. Although it is possible to conduct a census of many sites and large numbers of animals with this technique, it is also possible to miss a small number of concealed animals. We chose to conduct a vessel survey because we wished to maximize our count of small and perhaps concealed pups. In addition, we scheduled the survey date shortly before the peak period of pupping because of the potential for an isolated female with a young pup to move away from the birth site at an incipient rookery.

Methods

On June 25-26, 1983, the three authors (DJS, DDM and RLD) surveyed the entire coastline and associated rocky islets of Santa Rosa, Santa Cruz and Anacapa Islands. Of the Channel Island sites where breeding has been reported in the past, sea lion breeding status is currently uncertain only at these islands.

We used two vessels to conduct the survey: an 8m "ratten" type fishing vessel (chartered) and a 12 m Hatteras patrol vessel (provided by the National Park Service). Both vessels have a relatively shallow draft; this allowed close approach to potential rookery sites bounded by shallow areas. Cruising speed was variable but averaged about 3 knots near rookeries. If we observed animals or if we came upon coves, caves, and boulder fields, we let the vessel drift so that we could survey the area thoroughly. Observers made independent counts with clicker counters of all sea lions observed through 10 X 40 and 8 X 35 binoculars. Counts of each haulout were repeated until all three tallies agreed or (for groups greater than 100 animals) were within about five percent of each other. We photographed sea lion groups greater than about 50 individuals with 35 mm SLR cameras, 100-300 mm or 400 mm lenses with motor drives, and used either 200 or 400 ASA color slide film. Counts were subdivided into adult males, females (includes subadult males, females, and

other "immatures"), and pups. Final counts presented below are either the average of direct counts or the count taken from the projected image of the 35 mm slides, whichever was highest. Field notes were made of the observers' impressions of a colony's overall social arrangement, including average numbers of females and adult males, territoriality of adult males, and presence or absence of nursing females and pups.

The survey route (Figure 16) around the islands covered approximately 155 Nm. Counts were made throughout the day as the survey progressed. Although the numbers of sea lions on land vary with the time of day, temperature, wind speed, and sea conditions (Odell 1971; Mate 1975; Ainley et al. 1982; Antonelis, pers. comm.), no attempt was made to account for these factors in the final counts. Weather throughout the survey was generally mild: the sky was mostly overcast with high fog; air temperature was about 18° C; and wind and sea conditions were calm.

Results

California sea lions. Of the 709 California sea lions we counted, 333 were seen on Anacapa Island, 376 on Santa Cruz Island, and none were seen on Santa Rosa Island (Table 1). One California sea lion pup was counted from photographs taken at the south side of East Anacapa Island, just below the lighthouse tower. Females and nursing yearlings were noted at Coche Point (Area 648), south of West Point (Area 641/643), and at Gull Island (Area 655) on Santa Cruz (Figure 17), and south of the East Anacapa lighthouse (Area 680S, Figure 18). Large adult male sea lions were observed patrolling aquatic and intertidal territories at Coche Point, Gull Island, and East Anacapa.

Northern sea lions. Despite a thorough search, no northern sea lions were observed on or around any of the three islands surveyed.

Comments

Sites identified as possible former California sea lion rookeries on the islands surveyed include: northside East Anacapa (possibly either Landing or Cathedral Coves), Coche Point, "East end cove" (location uncertain, may have been the cove at Coche Point), China Harbor (questionable, may have been used only a few seasons), Frazer Point, and Gull Island, Santa Cruz Island. There is no information that indicates that Santa Rosa Island was used at any time for breeding or for more than an occasional haulout by California sea lions.

The current California sea lion colonies at East Anacapa (south side), Coche Point, and Gull Island are occupied primarily by non-breeding individuals. However, the size, relative composition, presence of isolated pups (East Anacapa) and suckling yearlings, as well as observed social behavior are indicators that rookeries could become established at these three sites in the near future, provided the population continues to grow and remains protected from disturbance.

Table 1. Number of California sea lions counted on survey of June 26, 1984.

Area	BLM Code #	Zalophus Observed				Time of Day (hrs)
		Adult Males	Females/Juv.	P	Total	
East Anacapa (North Side)	680(N)	0	0	0	0	0810
East Anacapa (South Side)	680(S)	25	306	1	332	1556
Middle Anacapa (North Side)	670(N)	0	0	0	0	0830
Middle Anacapa (South Side)	670(S)	0	0	0	0	1530
West Anacapa (North Side)	660(N)	0	1	0	1	0900
West Anacapa (South Side)	660(S)	0	0	0	0	1515
TOTALS		25	307	1	**333**	
Santa Cruz Island						
First cove east of Coche Pt.	648	6	197	0	203	0959
First cove east of Painted Cave	643	0	2	0	2	1120
Point midway between West Pt. and Frazer Pt.	643/641	2	10	0	12	1149
Gull Island	655	9	150	0	159	1325
TOTALS		17	359	0	**376**	

The colony at East Anacapa is located on a site not previously identified as a rookery site. In 1979, a single adult male was observed holding a territory at this site ("Lighthouse Beach") with between 12-15 females present; however, no pups were observed (Seagars 1981). None of the other previously identified potential rookery sites for California sea lions are used currently for breeding; animals may occasionally haulout at these locations.

Sites formerly identified as northern sea lion rookeries include Frazer Point, Santa Cruz Island (temporary); offshore Sandy Point, Santa Rosa (Figure 5); and several locations on and adjacent to San Miguel (not included in this survey). No northern sea lions were observed at either of these two sites. This is not surprising as the numbers of northern sea lions at San Miguel, and in the Southern California Bight in general, have been minimal in recent years.

DISCUSSION

Our review of the available information indicates that California sea lions historically have pupped and bred on four islands in the Southern California Bight (SCB). These principal rookeries, which are consistently occupied, are located on or immediately adjacent to San Miguel, San Nicolas, San Clemente, and Santa Barbara Islands. Minor rookeries, which have been occupied sporadically by small numbers of Zalophus, have occurred at Santa Cruz and Anacapa. We found no evidence of California sea lions having used Santa Rosa Island, Santa Catalina Island, or the mainland southern California coast for pupping and breeding.

Northern sea lions in the SCB have traditionally used San Miguel Island, its associated islets (Castle, Wilson and Richardson Rocks), and perhaps the westernmost rocks offshore Santa Rosa Island as rookery sites. A marginal rookery may have been present on Santa Cruz Island.

The California sea lion population has increased considerably since the earliest CDFG surveys. Similarly, this review documents expanded occupation at virtually all sites historically identified to be California sea lion rookeries in the SCB. Unfortunately, due to the paucity of all pinniped data before the late 1920's, we cannot provide an assessment of rookery site distribution and density for the population prior to its exploitation by non-native Californians.

The number of northern sea lions breeding in the SCB has persistently declined over the past fifty years; the species has all but completely abandoned traditional rookery sites in the SCB. "Stranded" northern sea lions have been observed only rarely on the SCB mainland beaches (NMFS, Southwest Region unpub. data). Some of the historic rookery sites of northern sea lions have been used by increasing numbers of breeding and non-breeding California sea lions in recent years. This implies that there has been density-dependant competition between the species for these sites. However, in former breeding areas such as Santa Rosa Island or Richardson Rock, both species may be completely absent or occur only in very low numbers. The explanation for the absence of northern sea lions from these locales is not readily apparent.

Influencing Parameters

Both environmental and anthropogenic factors have influenced sea lion abundance and distribution. Of the two, man has had the greater long-term impact over the past two centuries. Hunting for oil, hides, and trimmings during the breeding season eliminated entire age-classes and in some cases whole colonies. Repeated hunting trips to these sites lead to a rapid decline in the numbers of breeding age animals that returned. Entire rookeries were quickly exterminated (Bonnot 1931; Starks 1921). Over many years several thousand animals were killed accidentally during the collection of several hundred sea lions for public display (Howorth, pers. comm.).

Disturbance to breeding colonies also may influence breeding success. Disturbance always occurs in the process of a directed take, but may occur as well due to innocent curiosity or naivete. Heath (1980) and Heath and Francis (1983) described several changes in pup production and rookery use at Santa Barbara Island associated with changes in trail use by visitors to Channel Islands National Park. Odell (1972, 1975) and Bonnell et al. (1980) documented declines in pupping at some beaches and increases at others on San Nicolas Island and speculated that these fluctuations were due to the presence or absence of human activity in or adjacent to a site. Bartholomew and Boolootian (1960) and Ripley et al. (1962) related fluctuations in sea lion rookery use at San Nicolas and San Clemente Islands to military bombardment of these islands.

If sea lions remained at a site despite prolonged or intense disturbance (strong site fidelity), mortality rates would increase and pup production would decline. However, sea lions appear to be somewhat flexible in choosing alternative rookery sites when disturbance becomes too great. Hunting and general disruption of rookeries at San Miguel and Santa Rosa Islands during the late 1920's and early 1930's corresponds with the appearance and increased usage of alternative "marginal" rookeries on Santa Cruz such as Chinese Harbor and Coche Points (Bonnot et al. 1938; Rutter et al. 1901). Bonnot (1931) noted that an increase in the numbers of breeding California sea lions on San Clemente Island corresponded with abandonment of the rookery at Santa Barbara Island "due to the activities of the collectors."

Scheffer (1958) noted that "fluctuations occur in the distribution limits of animals and rarely are these limits static boundaries." Climatic fluctuations may influence distribution of rookery sites on both a range-wide and local scale. Changes in the distribution and productivity of pinniped rookeries in relation to fluctuating water temperatures have been studied (Odell 1971, Ainley and Lewis 1974, Bonnell et al. 1980). Increases in pup mortality and decreased natality have been associated with anomalous warm water pulses such as an "El Nino" condition (Barber and Chavez 1983; Heath and Francis 1984; Boness pers. comm.). Unusually high pinniped pup mortality rates have coincided with abnormally high air temperatures during peak periods of pupping (Antonelis, Heath pers. comm.).

Changes in sea lion pup production and distribution may be more directly tied to fluctuations in the availability of prey species. Fluctuations in prey abundance may result from an "El Nino" event (Radovich 1961; Barber and Chavez 1983) and have been related to fisheries management practices (Ainely and Lewis 1974, Ainley et al. 1982).

The historic distribution of sea lion rookeries in the Southern California Bight has been influenced profoundly by hunting, general disturbance, fluctuating climatic conditions, and perhaps the harvesting of prey species (Table 2). Interpreting the influence of these parameters on sea lion rookery distribution is difficult because the population has grown considerably, and because sea lions are highly mobile, more or less

Table 2. Chronology of events influencing sea lion distribution and abundance.

pre 1800's	No information available. Aboriginal use persistent but not believed to have influenced distribution and abundance to any great degree.
pre-1860	"Sea lions extremely numerous along the California coast (Bonnot 1928 b)." Some use of sea lions for food by Aleutian sea otter hunters (Ogden 1933).
1860's	Sea lions "commercially valuable . . . numbers steadily decreased until late seventies . . . until it was unprofitable to hunt them (Bonnot 1928 b)." Scammon (1874) noted that the numbers previously slain for oil "appears fabulous."
1899	Fishing industry lobbies California Fish and Game Commission for reduction of herds. Commission directs deputies to hunt along the coast. Permission sought by Commission to hunt on Federal lighthouse reservations. Several thousand sea lions killed at Ano Nuevo before permission suspended (Merriam 1901). A "great many" killed elsewhere in the springs of 1899 and 1900. Dyche (1901) studies food habits along Monterey coast.
1900	Suspension of sea lion hunting on Federal reservations continued.
1901	Survey of sea lion abundance and distribution initiated by special commission. Rutter et al. (1902) find little damage to fisheries or gear due to sea lions. Recommend against a hunt.
1907-1908	As reported to Bonnot by H.B. Nidever of San Pedro, the unregulated systematic hunting at San Miguel Island for trimmings trade results in the kill of "practically all the bulls of breeding age (Bonnot 1928 b)."
1909	Herds so reduced that a bill to protect sea lions in Santa Barbara Channel region is introduced and passed by State Legislature. Remnant industry in trade of hides comes virtually to a stop due to this Legislation (Rowley 1929).
1909-1927	Small scale killing for trimmings trade continues. Some live capture for zoos and aquariums.
1926-1927	Complaints and petitions from Oregon sea lion hunters and California fishermen (Bonnot 1928b).
1927	Bills which are introduced to reduce herds by fishing industries of San Pedro and Santa Barbara are tabled. Bill introduced to afford protection to sea lions in southern California waters is passed. California Department of Fish and Game begins population surveys. Considerable trimmings hunting continues illegally.
1929-1930	Continued illegal "sport" hunting and trimmings trade results in abandonment of major rookeries. Some corresponding increases in numbers are seen at San Clemente and Santa Cruz Island sites.
1936	Bonnot found "no evidence of systematic hunting" as observed in the past in his coastwide sea lion survey.
1936-1939	Harvesting of sea lions for pet food and skins. Hunt conducted on rookeries of Mexico and probably California (Abbott 1939, Cass 1983).
1939-1945	World War II military training exercises bombard San Clemente, San Miguel, and San Nicolas Islands.
1946	In response to complaints from fishermen about an increasing sea lion herd, the California Department of Fish and Game began limited herd reduction measures in 1946 under a permit system. "Two such permits have been issued and to date [1946], one hundred sea lions have been taken north of Point Conception and one hundred ten south (Bureau of Marine Fisheries 1947)."
1972	Marine Mammal Protection Act passed by Congress. State management preempted by Federal Government. Moratorium placed on taking. Permit system established for incidental "take" pursuant to commercial fishing, collections for public display and research.

opportunistic feeders, and seem to be somewhat flexible in the selection of rookery sites. While our perception of trends in rookery distribution has been influenced by the quality of the data, we believe the variability in this data is far less than the variability inherent in the above parameters. Thus, the data available since 1927 appears to be of sufficient resolution to make assessments for specific islands. However, unless future workers clearly identify species, count by age and sex class, note pups, and describe occurrences at specified sites in an accurate and consistent manner, we will be unable to do more than describe generalized trends in the distribution of sea lion rookeries.

Assessment of Rookery Site Status

Anacapa Island. The 1927 report of a breeding site on the north of East Island is of doubtful accuracy. Small, narrow rocky beaches are used now as haulouts for California sea lions, and potentially only as a marginal breeding site. The amount of suitable sea lion haulout habitat is limited. Only a very few locations where sea lions would be likely to haulout remain unoccupied. Public visitation around this island is intense, as it is the closest Channel Island to the mainland and part of Channel Islands National Park. Thus, reoccupation of these few potential haulout sites is unlikely.

Santa Cruz Island. Historically used (marginal) rookery sites at Gull Island and Coche Point now could be incipient rookeries. Some breeding season disturbance at Gull Island by Coast Guard personnel and recreational divers could be influencing establishment of a rookery at Gull Island. Several other small, rocky sites are currently unoccupied or sporadically used. These sites possibly could support small breeding groups or serve as haulouts for non-breeders. Recreational and commercial vessels that visit the shore of this island could be influencing distribution and pup production at a few locations. However, as most anchorages are not good sea lion habitat and the few traditional rookery and haulout sites are not well protected anchorages, the potential for disturbance is not as great as at Anacapa Island.

Santa Rosa Island. The former Eumetopias breeding site off the west end is unoccupied. There is no indication that California sea lions have ever bred on Santa Rosa Island. However, habitat along the west-southwest facing shore seems to share many characteristics of rookery sites elsewhere. These sandy beaches are broad, extend well above the high tide line, are favorably exposed to northwest winds, are located fairly near to deep water, and are free from human disturbance. We are uncertain about the potential for future use of these beaches either as a rookery or for hauling areas.

San Miguel Island. The distribution of Eumetopias rookeries around Pt. Bennett, Castle Rock and Richardson Rock has declined considerably from the distributions that have been described in the past. These areas are now occupied by Zalophus and therefore may be unavailable for reoccupation if the numbers of Eumetopias begin to increase.

The numbers of Zalophus using the Island to haul out and breed is at an all time reported high. However, there appears to be considerable available space for continued rookery expansion on Point Bennett and for haulout of nonbreeding animals elsewhere on the Island. Castle Rock is probably close to the saturation point with Zalophus and northern fur seals, Callorhinus ursinus.

San Nicolas Island. California sea lions are pupping on all locations previously reported as rookery sites, although the full use of one site (213) is likely restricted by human disturbance. While many other accessible beaches remain unoccupied, it is clear that these beaches (the north side and southeastern coast) are less suitable for sea lion use, probably because they are more protected from the (cool) prevailing northwest winds. It is likely that sea lion use of some beaches is being influenced by the recreational activities of military personnel stationed on the island.

Santa Barbara Island. California sea lions are now breeding in most areas considered major rookery sites: northwestern shores just south of Webster Point, around Webster Point toward Shag Rock, and the Southeast Rookery. Influence of human disturbance on sea lion pupping has been reduced in recent years by the movement of trails away from rookery sites, better visitor education, and enforcement by the National Park Service. The use of the remaining rocky shoreline by reproductively active sea lions will probably be variable and influenced by parameters such as climate and prey availability.

San Clemente Island. California sea lion pupping occurs in all areas historically occupied. Breeding has expanded recently into locations south of Mail Point and on Northwest Harbor Inlet. Disturbance to the breeding areas in Northwest Harbor Inlet and along Seal Harbor Point south to Tiki Head Beach due to military exercises or the recreational activities of personnel on the island may have influenced pup production and caused some recent abandonment of these areas.

Santa Catalina Island. There are no reports that confirm previous breeding on this island. We do not believe that there is any current breeding on the island despite the possible observation of a single pup at Bird Rock. Most locations do not appear to provide good rookery habitat. The few isolated haulout sites are subject to wash from heavy surf or are not exposed to cooling winds. The Seal Rocks and Bird Rock haulouts are subject to frequent (daily) disturbance by private recreational yachts and tour vessels during the breeding season.

Conclusions

California sea lions are currently pupping and breeding at virtually all locations historically identified to be rookery sites. Many of these rookeries have expanded well beyond the boundaries described in the late

1920's. In addition, pupping has become established in several entirely new areas on adjacent beaches or nearby rocky islets.

Colonies previously identified as California sea lion rookeries that are not used for breeding at this time include Coche Point and Gull Island, Santa Cruz Island, north side of East Anacapa Island, and Santa Catalina Island. The current colonies at Coche Point and Gull Island, Santa Cruz Island, and the south side, East Anacapa Island may be incipient rookeries and should be monitored. Our review of the available information leads us to conclude that the sea lion colonies on the north side of East Anacapa and at Santa Catalina Islands may have been mistakenly identified as rookeries as pups were never positively reported from these locations.

At the same time as abundance declined in the southern portion of their range over the past 40 years, northern sea lions have all but abandoned pupping sites in the Southern California Bight. No pupping and virtually no northern sea lions occur at this time on Santa Cruz and Santa Rosa Islands. Less than five pups are born each year on Castle, Richardson and Wilson Rocks, adjacent to San Miguel Island.

Recommendations

1. The NMFS annual photographic aerial surveys should be expanded to include the following incipient rookeries and colonies: the south side "Lighthouse Beach" and Cathedral Cove, East Anacapa Island; Coche Point and Gull Island, Santa Cruz Island; Wilson and Richardson Rocks, offshore San Miguel Island; and Seal Cove Point to one km south of Mail Point and Northwest Harbor Islet, San Clemente Island.

2. A vessel survey of the northern island chain should be made every second year to validate the aerial survey results. This would provide accurate counts and behavioral observations in greater detail than is possible from aerial photography.

3. Periodic surveys of Santa Rosa Island should be made to monitor any potential colonization by either northern or California sea lions. The peak season harbor seal survey flown (currently under NMFS contract) in late June could be appropriate.

4. The California sea lion haulout site at Lighthouse Beach, East Anacapa Island should be monitored during the breeding season (15 May - 15 July). A weekly count could be made by National Park Service personnel after training by NMFS pinniped biologists. Surveys should identify the numbers of animals present by age class and look for behaviors associated with breeding activity.

5. Incipient rookery sites should be monitored for human disturbance. Analysis of the aerial surveys of visitors in Channel Islands National Park may provide some information. Wherever potential disturbance is indicated, a

time-lapse video survey should be conducted to further describe the extent of disturbance and to develop recommendations for management.

6. Studies of population dynamics and rookery distribution must be appropriately scheduled, based on accurate species identification, make counts by age and sex class and include pups. These data must be collected and presented for specific, discrete stretches of coast. We recommend continued use of the BLM area codes for site specific counts.

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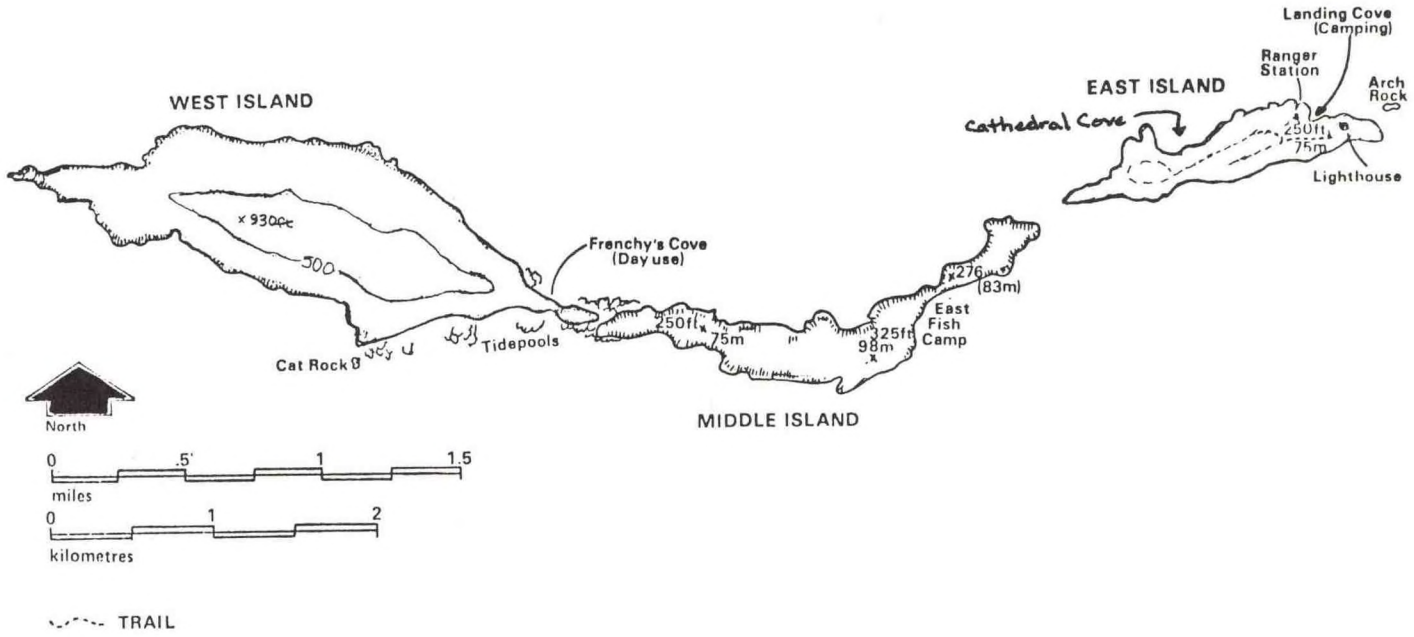


Anacapa Island

Figure 1. Place names of Anacapa Island.

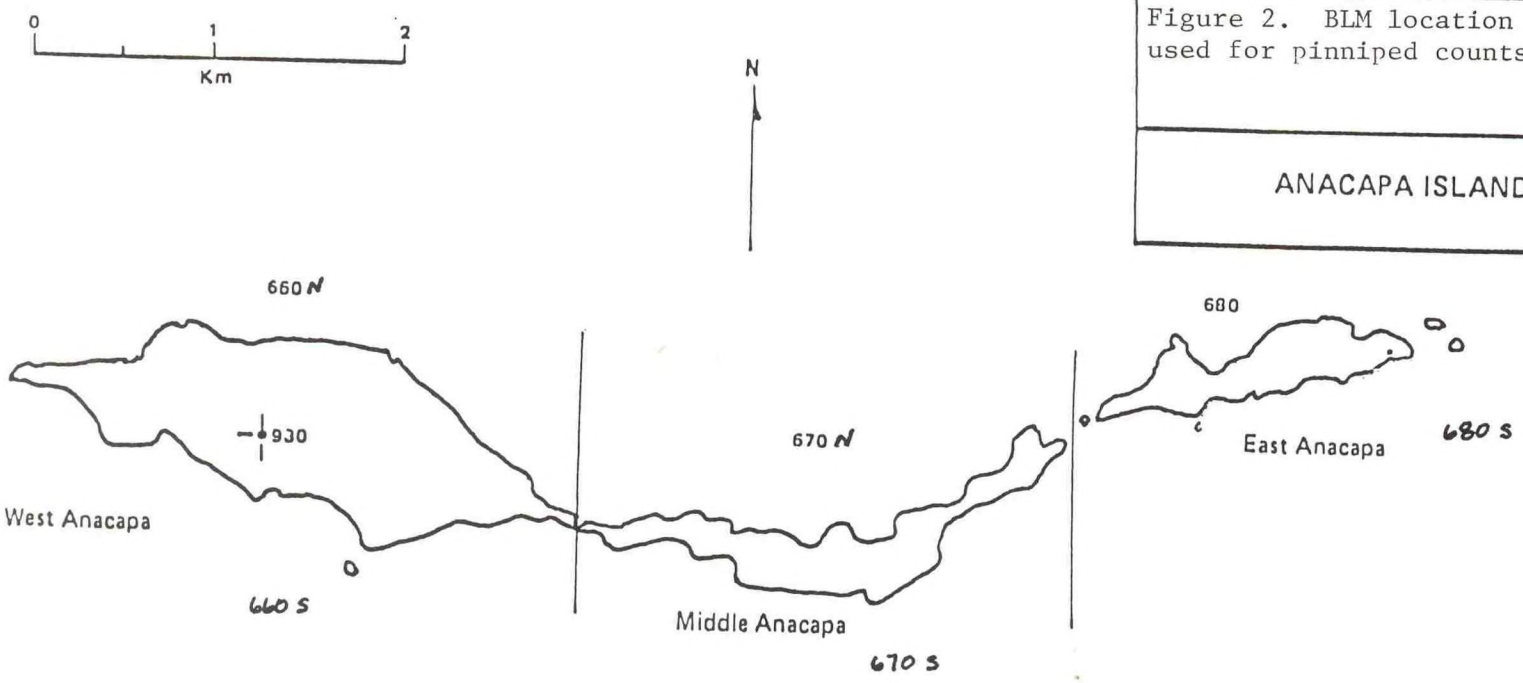


Figure 2. BLM location codes used for pinniped counts

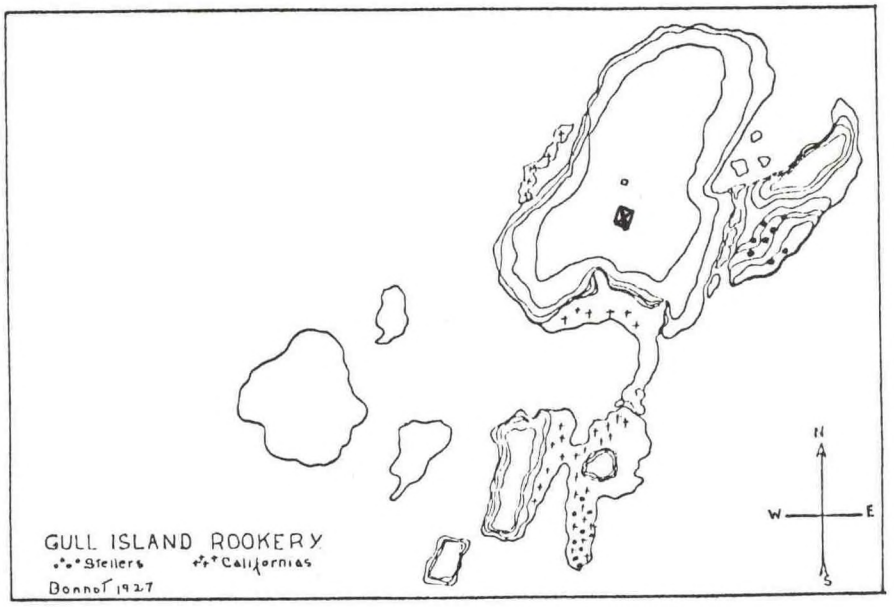


Figure 3. Gull Island Rookery from Bonnot (1928 b). Based on our site visit, the correct orientation of north is as indicated on the figure.

Figure 4. BLM location codes used for pinniped counts.

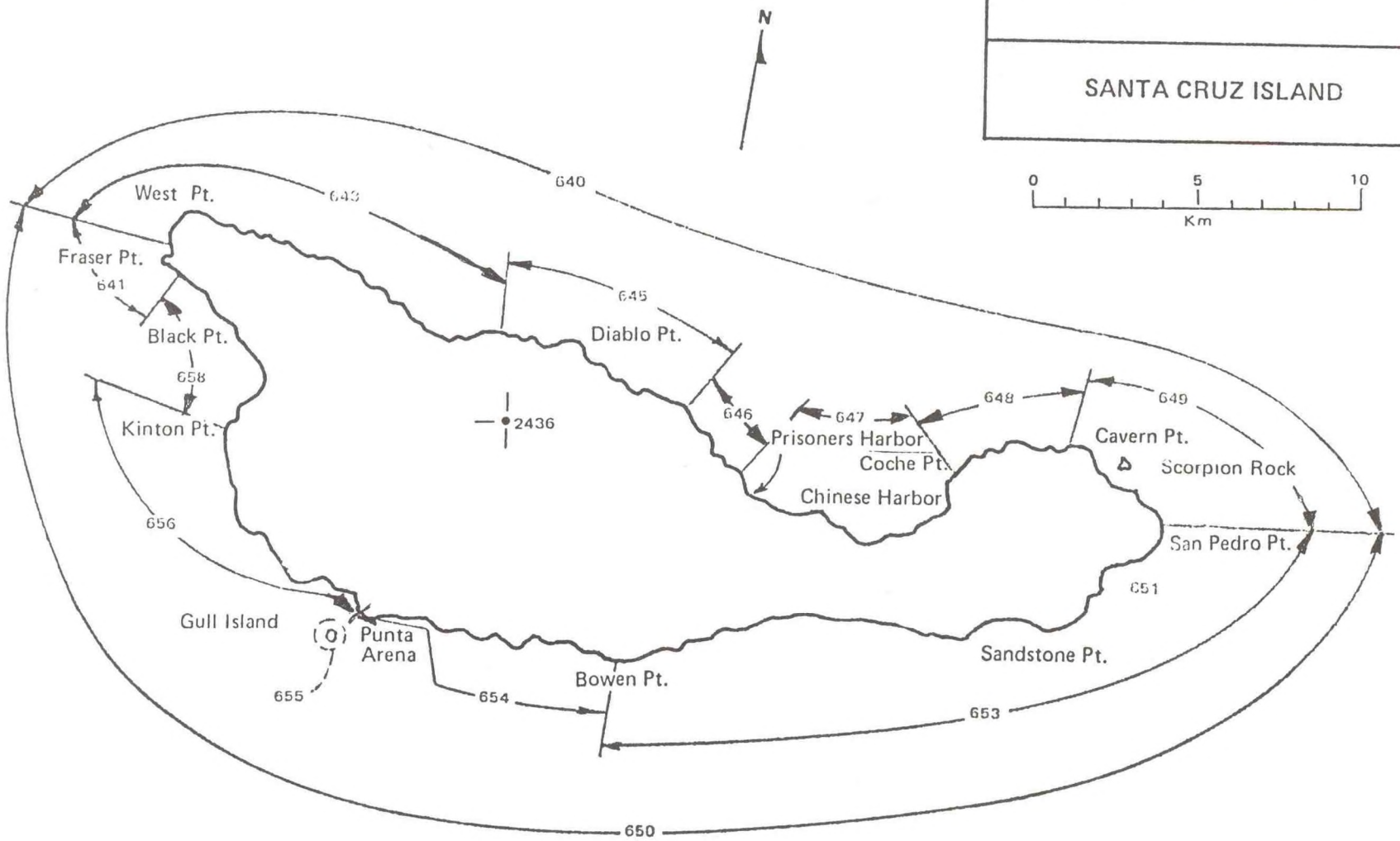
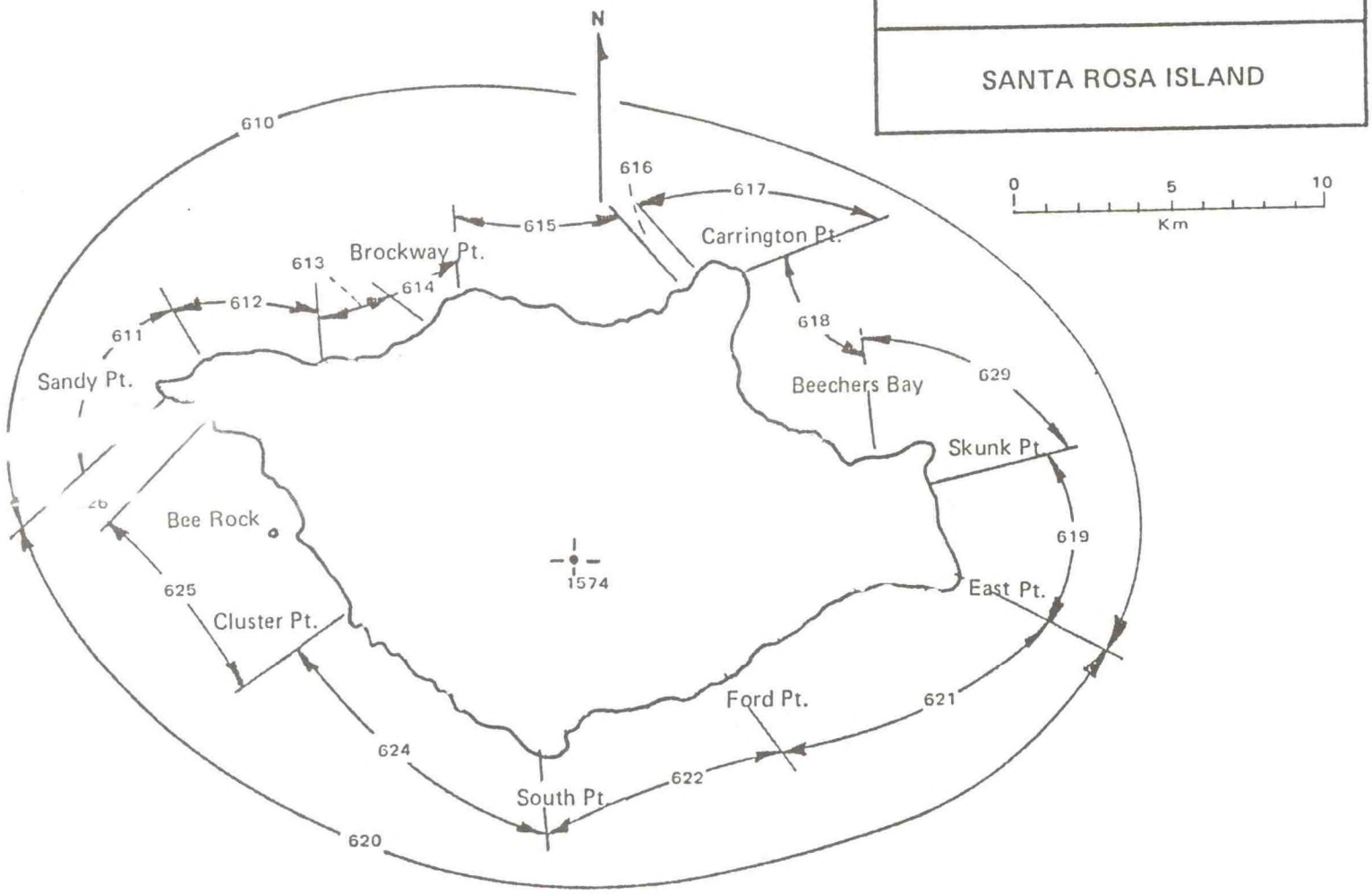


Figure 5. BLM location codes used for pinniped counts.



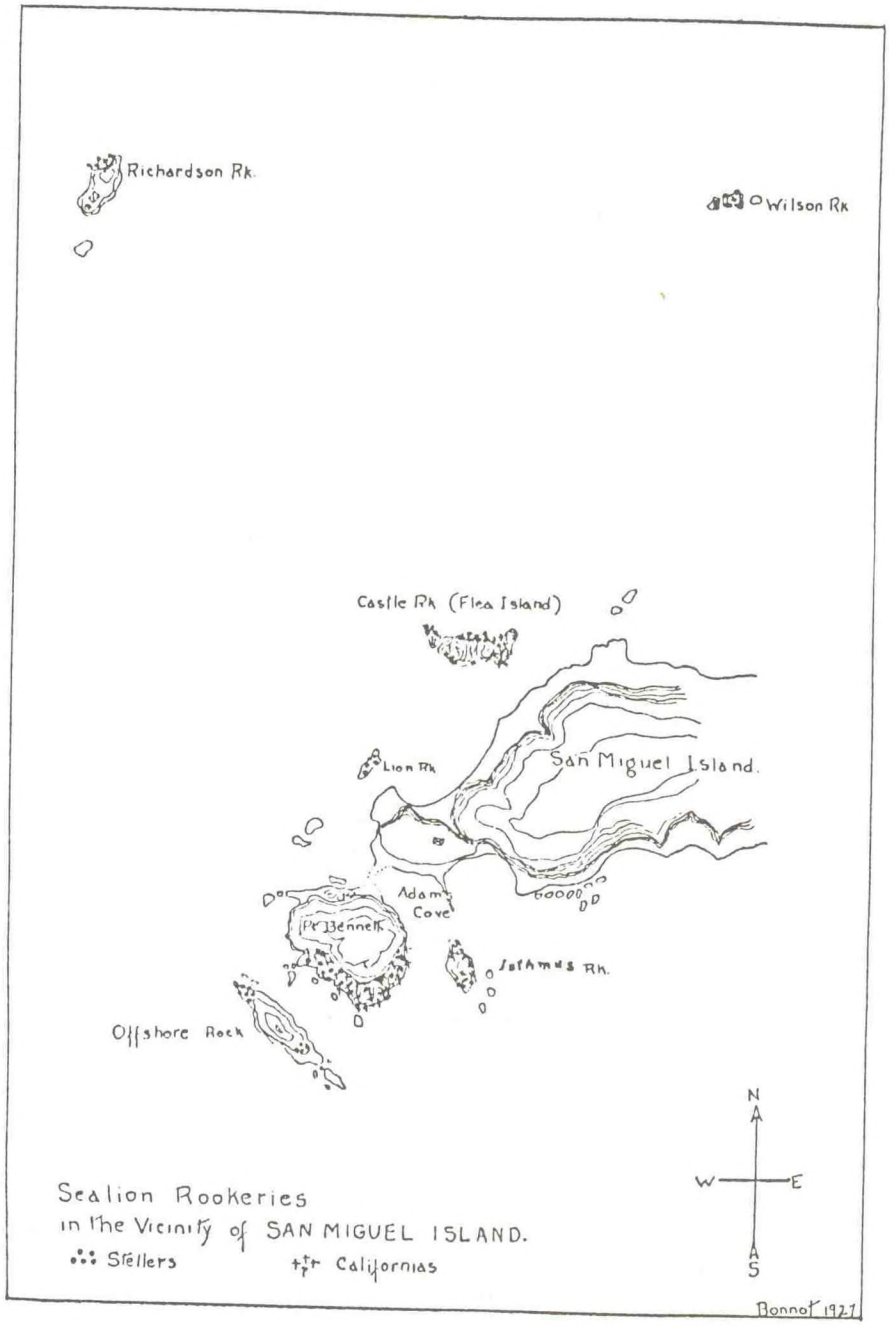
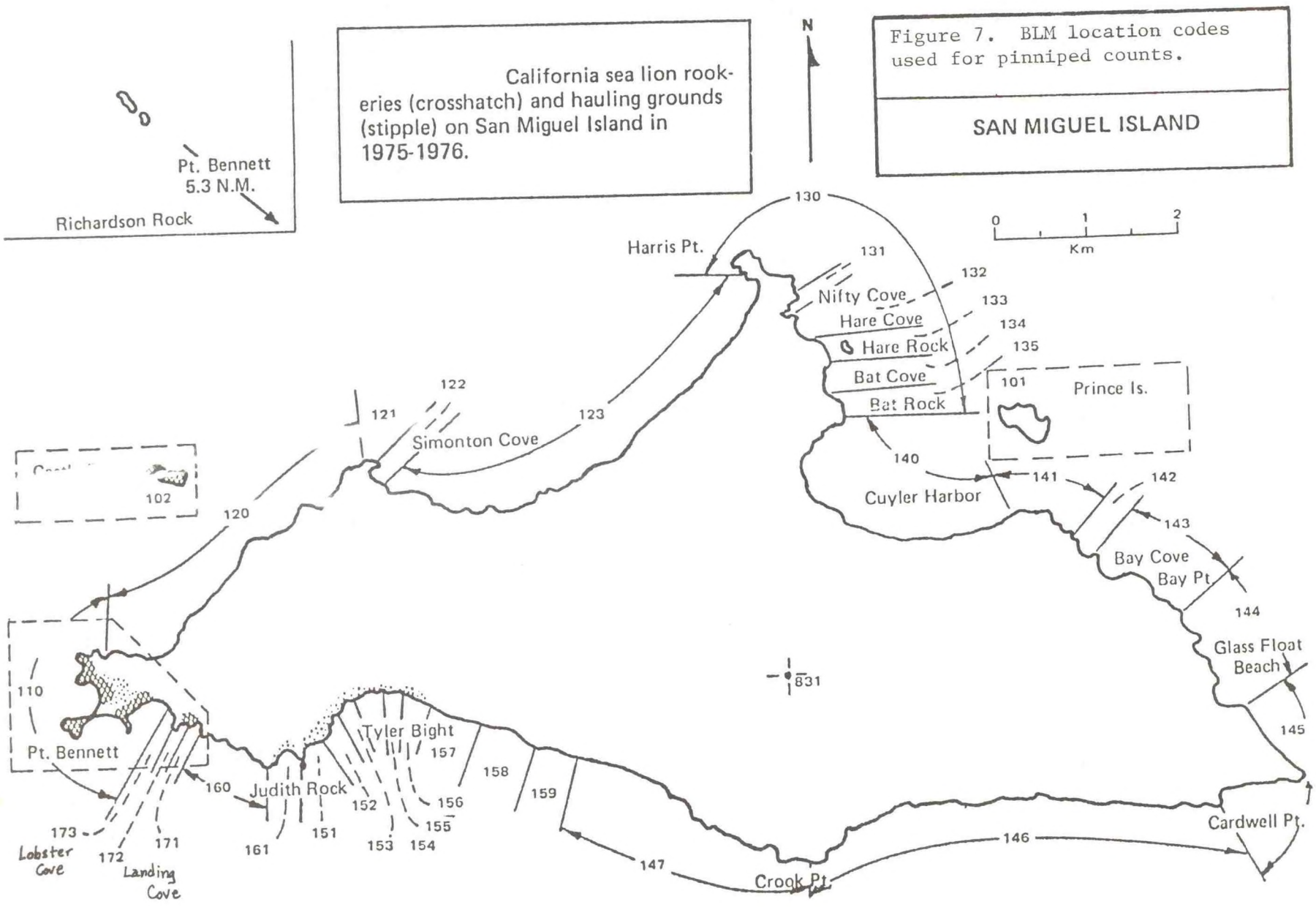
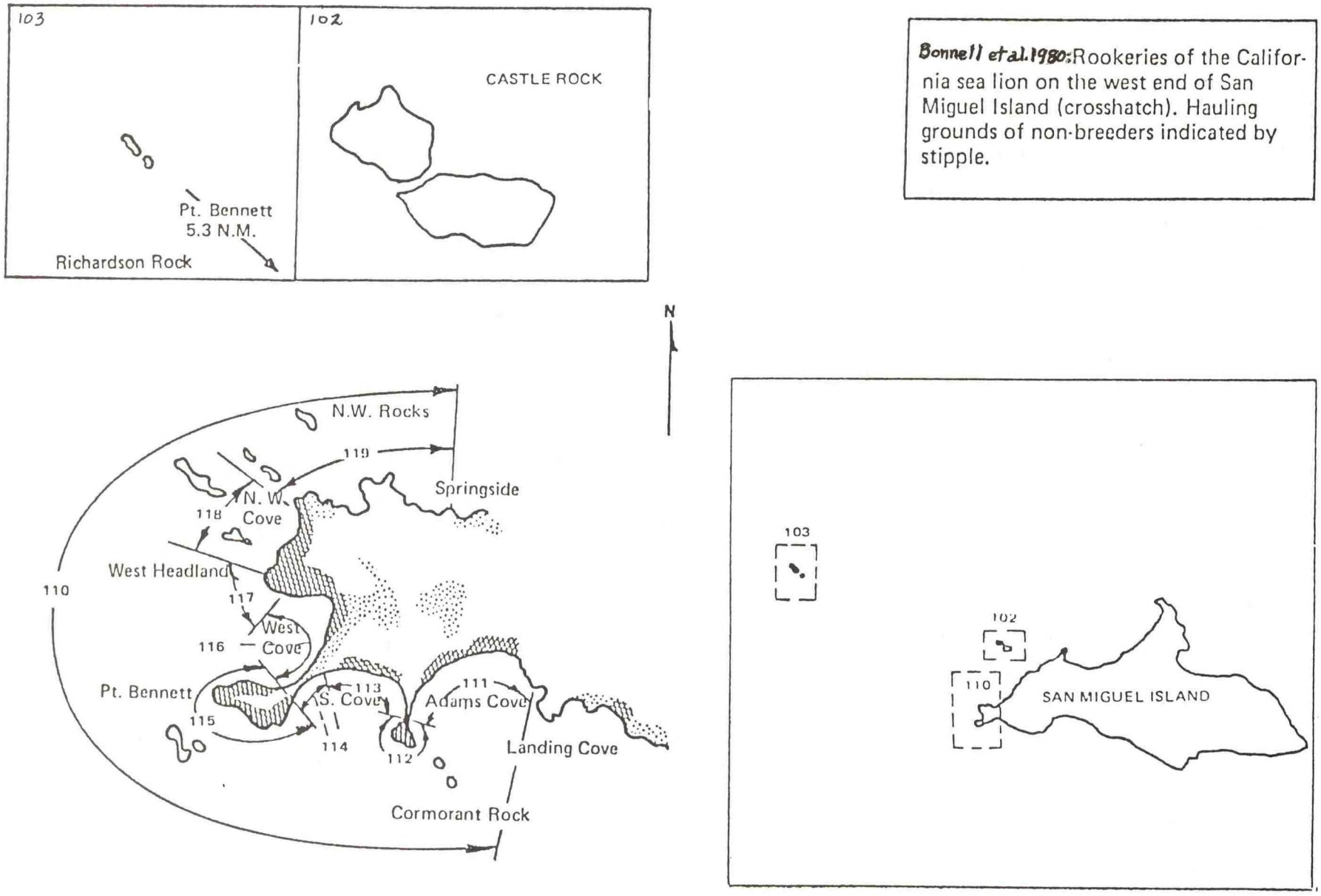


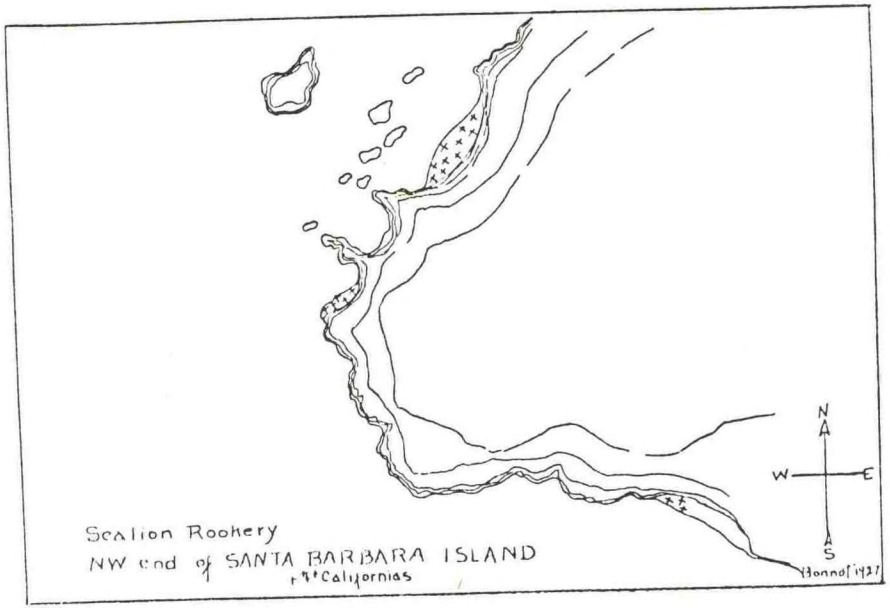
Figure 6. Sea lion rookeries in the vicinity of San Miguel Island (Bonnot 1928 b).


California sea lion rookeries (crosshatch) and hauling grounds (stipple) on San Miguel Island in 1975-1976.
N
Figure 7. BLM location codes used for pinniped counts.
SAN MIGUEL ISLAND
Pt. Bennett
5.3 N.M.
Richardson Rock
0 1 2
Km
Harris Pt.
130
131
132
133
134
135
Nifty Cove
Hare Cove
Hare Rock
Bat Cove
Bat Rock
101
Prince Is.
122
121
123
Simonton Cove
102
120
140
141
142
143
Cuyler Harbor
Bay Cove
Bay Pt.
144
Glass Float Beach
145
110
831
Pt. Bennett
Tyler Bight
157
158
159
160
Judith Rock
152
156
155
151
153
154
161
173
172
171
Lobster Cove
Landing Cove
147
Crook Pt.
146
Cardwell Pt.



Bonnell et al. 1980: Rookeries of the California sea lion on the west end of San Miguel Island (crosshatch). Hauling grounds of non-breeders indicated by stipple.

Figure 8. Detail of BLM location codes for Point Bennett, San Miguel Island.



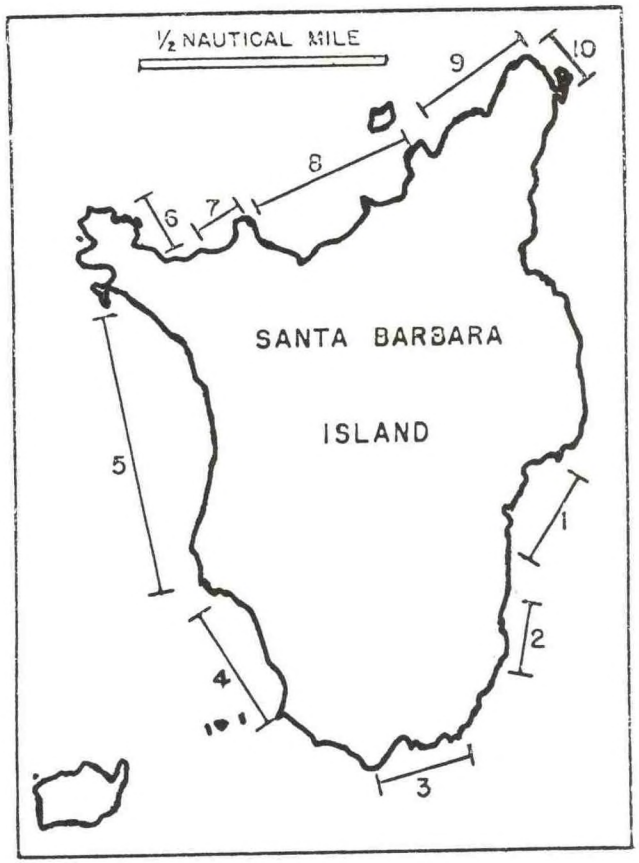
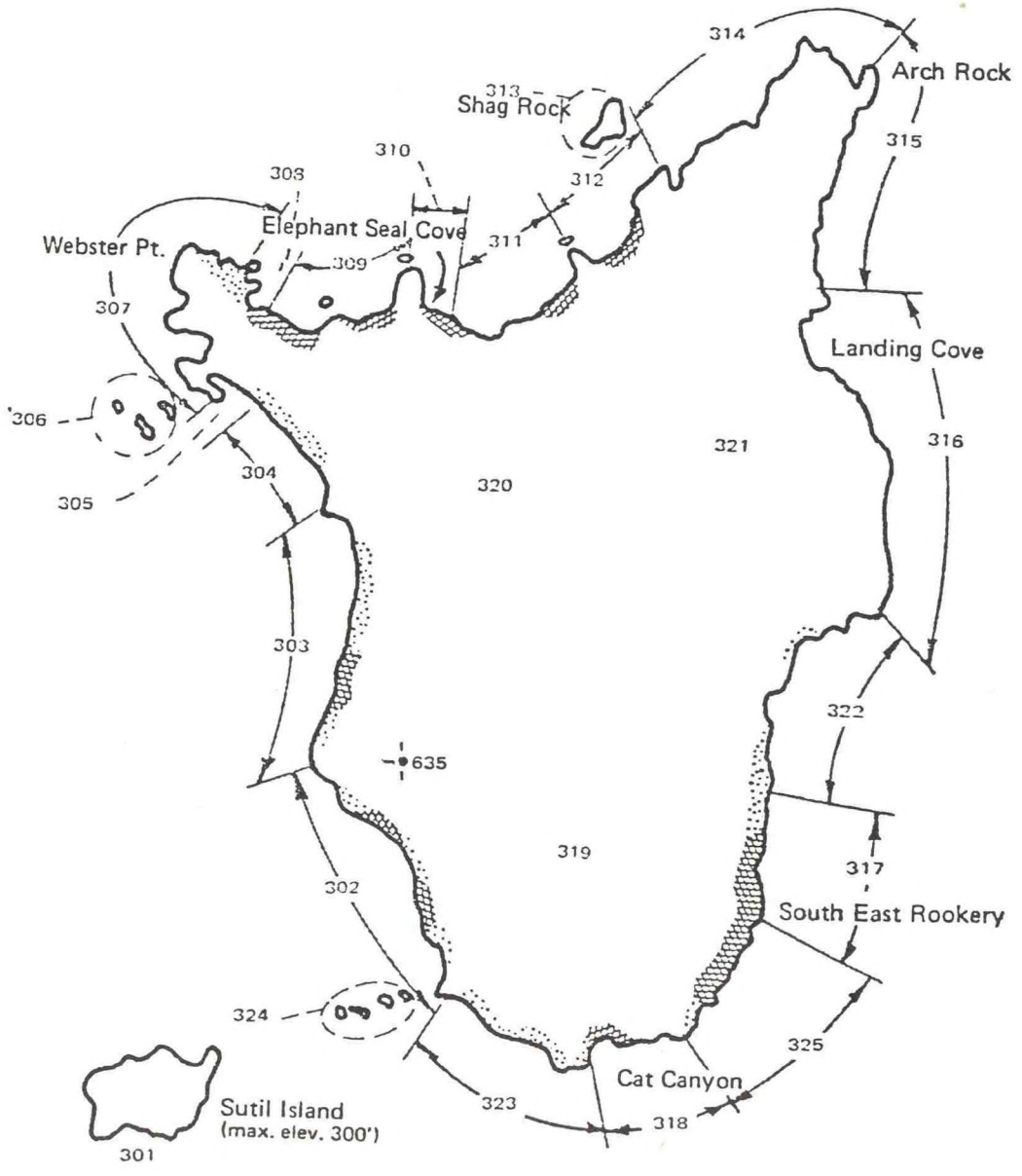


Figure 9. Early location maps for sea lions on Santa Barbara Island.

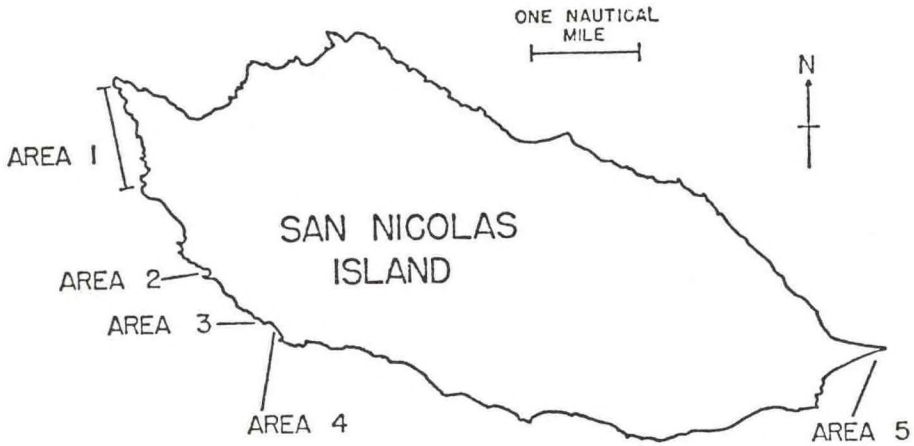
(A) from Bonnot (1928 b), orientation of map likely in error, correct orientation is with north at figured east, see text.

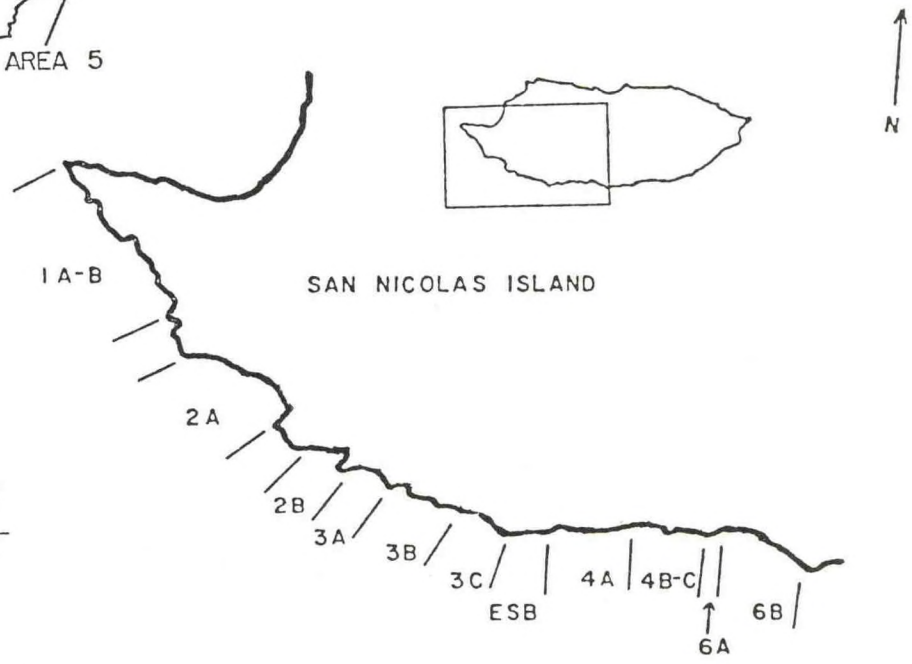
(B) from Bartholomew, Collyer, and Dawson (1951).

Figure 10. BLM location codes used for pinniped counts.



California sea lion rookeries (crosshatch) and hauling grounds (stipple) on Santa Barbara Island in 1975-1976.





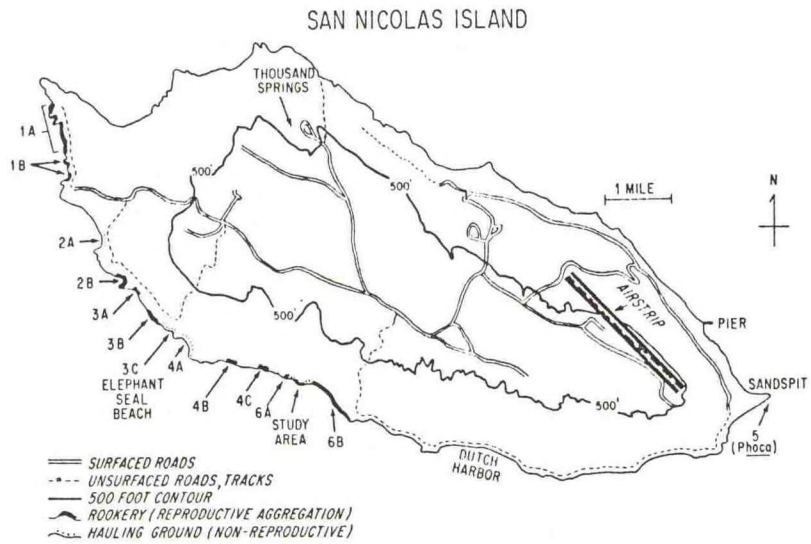
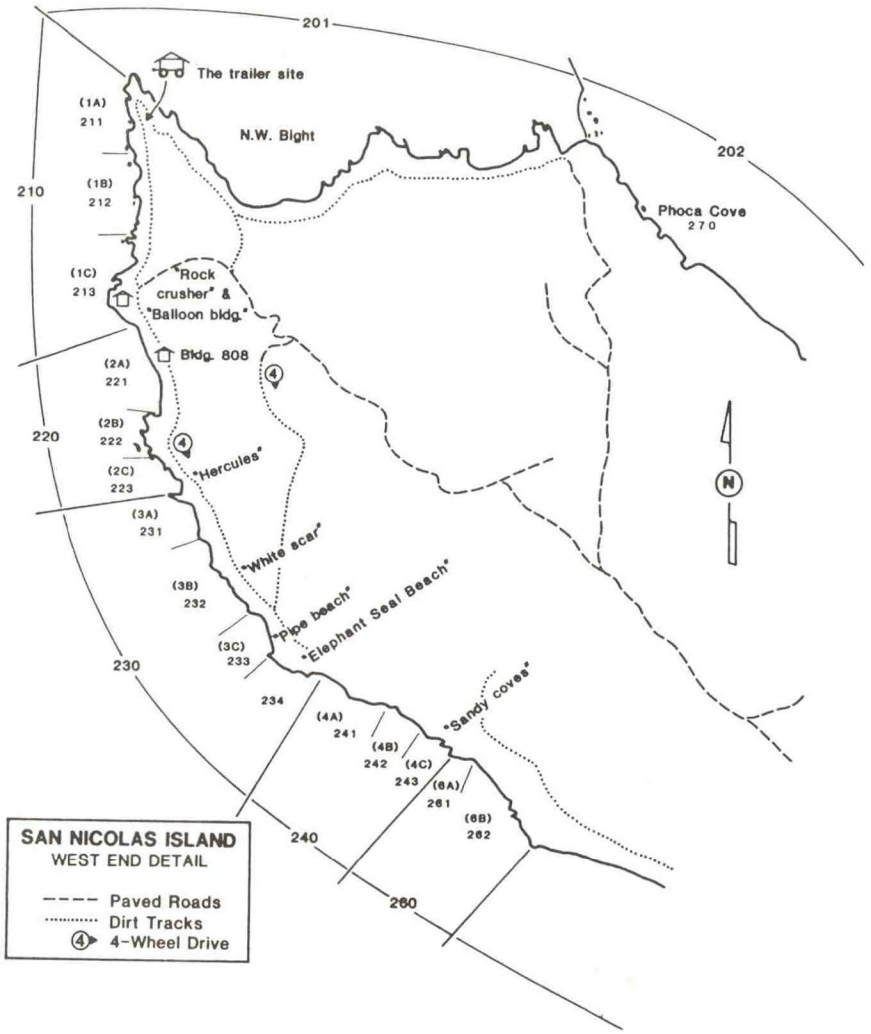


Figure 11. Location codes used at San Nicolas Island from (A) Bartholomew (1951), (B) Peterson and Bartholomew (1967), and (C) Odell (1974).



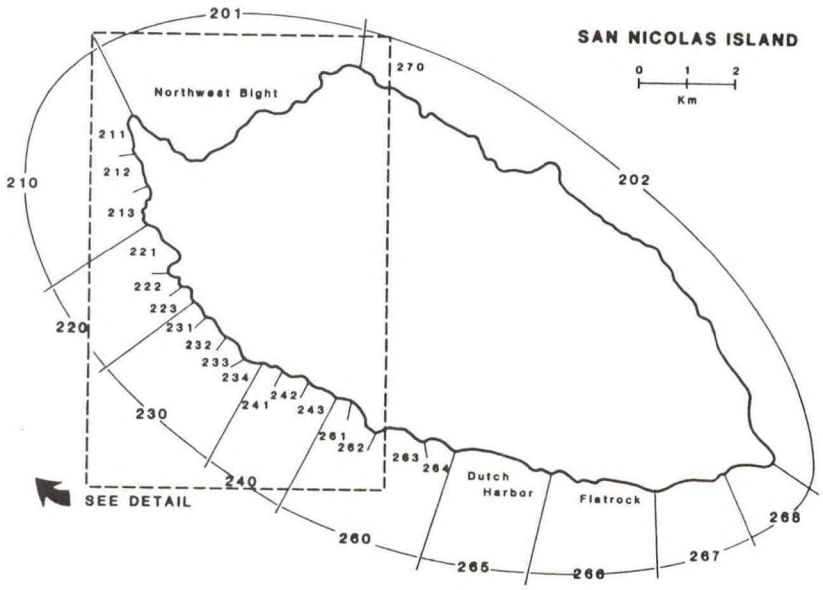


Figure 12. Location codes for pinniped counts at San Nicolas Island: (A) BLM codes, (B) Detail of northwest end showing relationship of BLM and Peterson and Bartholomew (1967) codes.

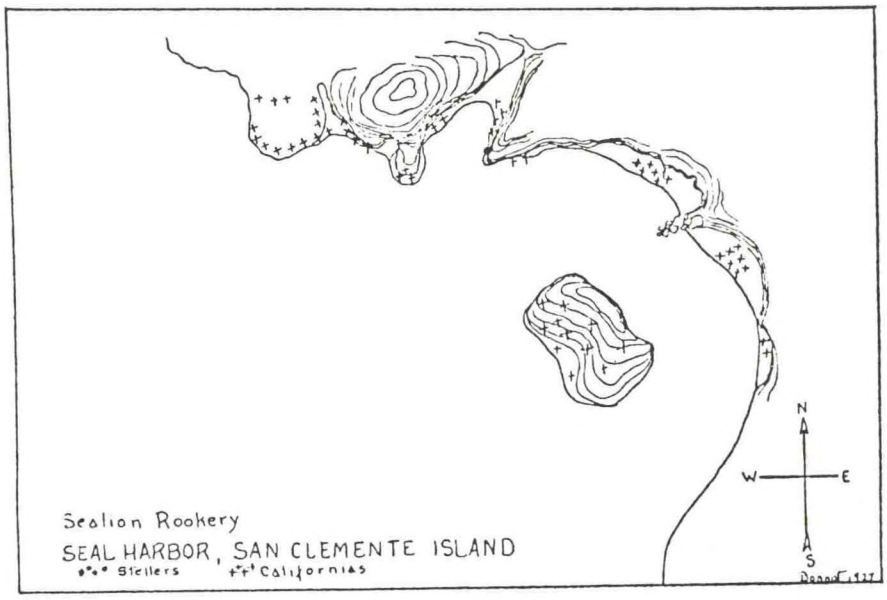
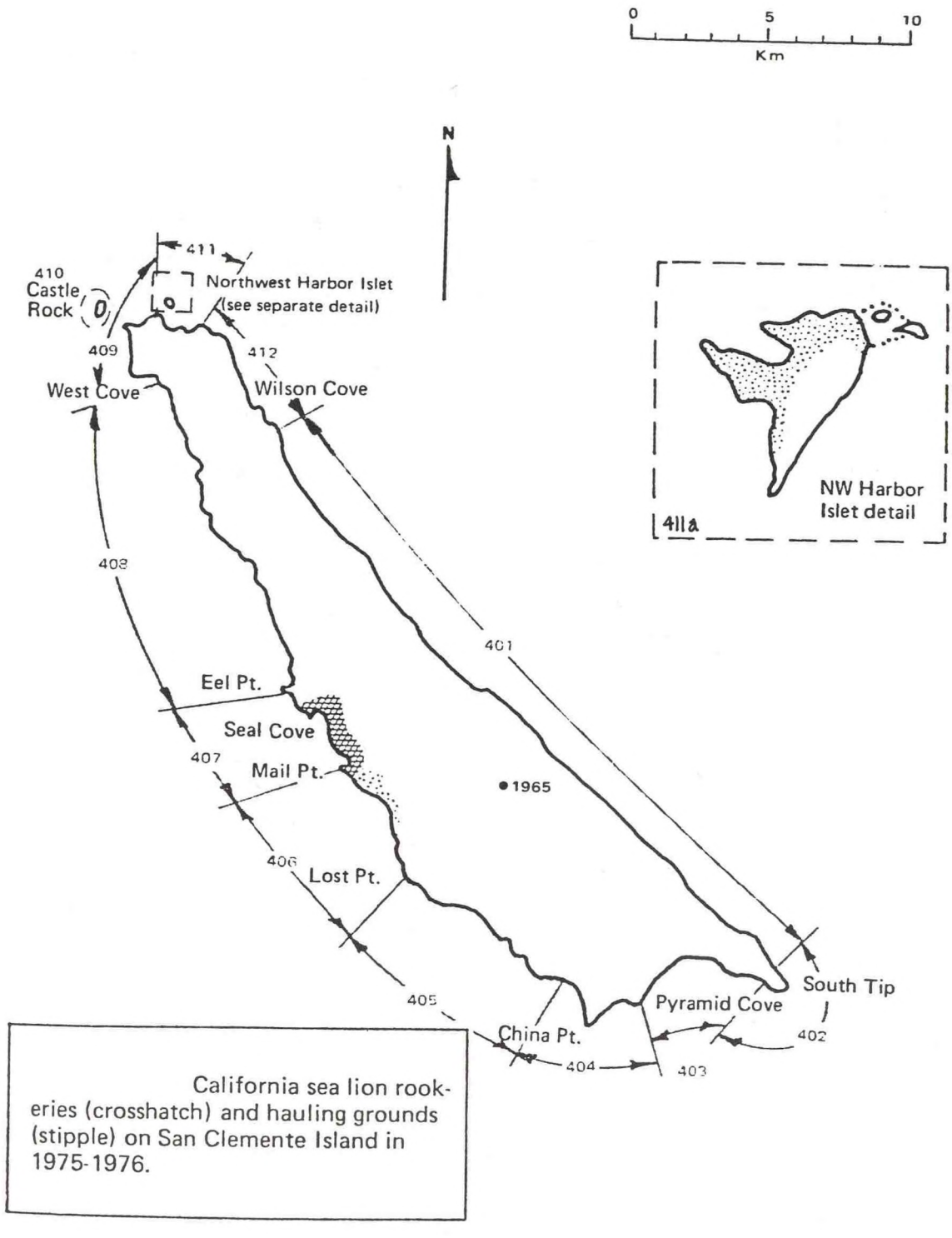


Figure 13. Seal Harbor, San Clemente Island map from Bonnot (1928 b).

Figure 14. BLM location codes used for pinniped counts.

SAN CLEMENTE ISLAND



California sea lion rookeries (crosshatch) and hauling grounds (stipple) on San Clemente Island in 1975-1976.

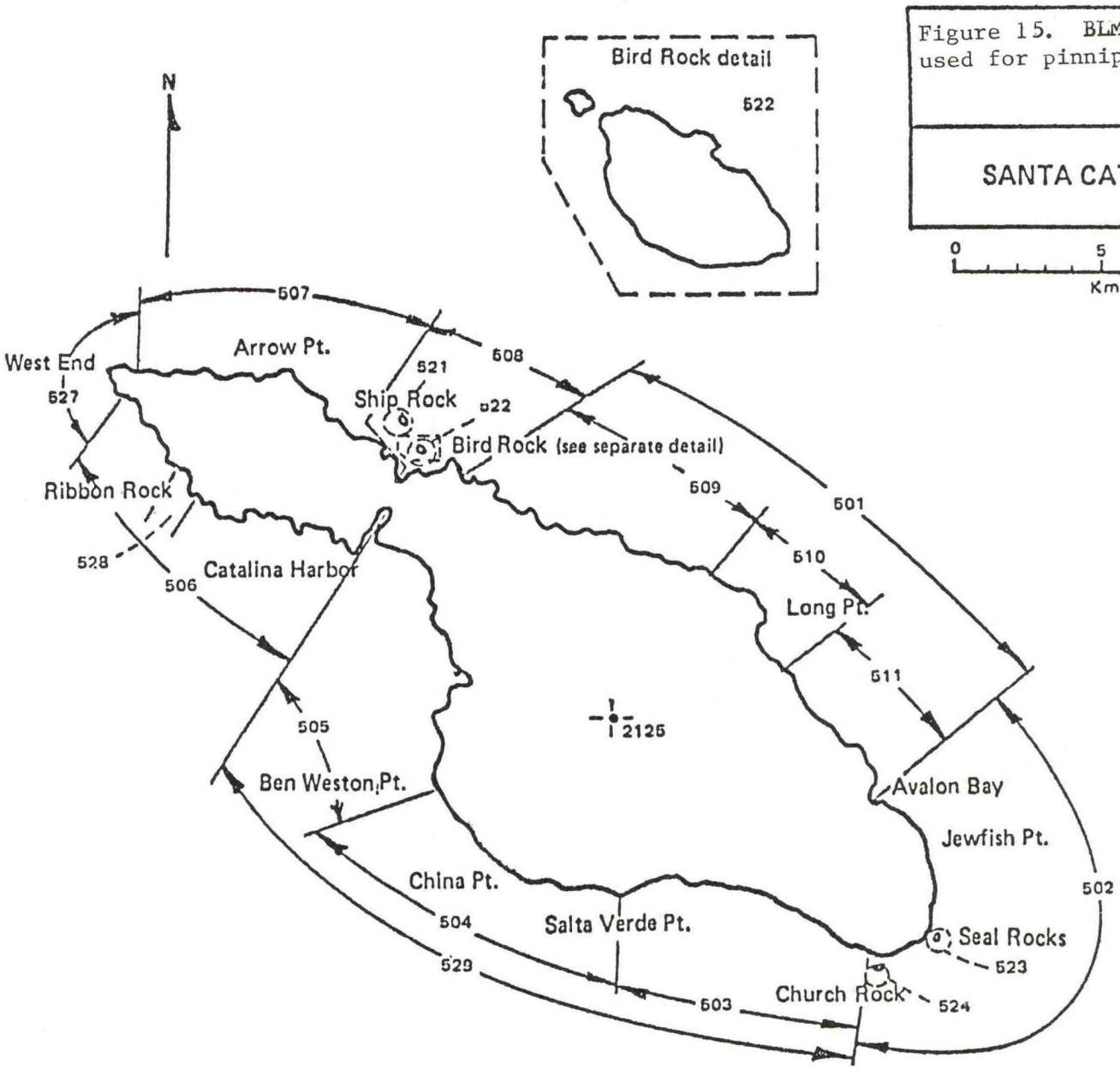


Figure 15. BLM location codes used for pinniped counts.

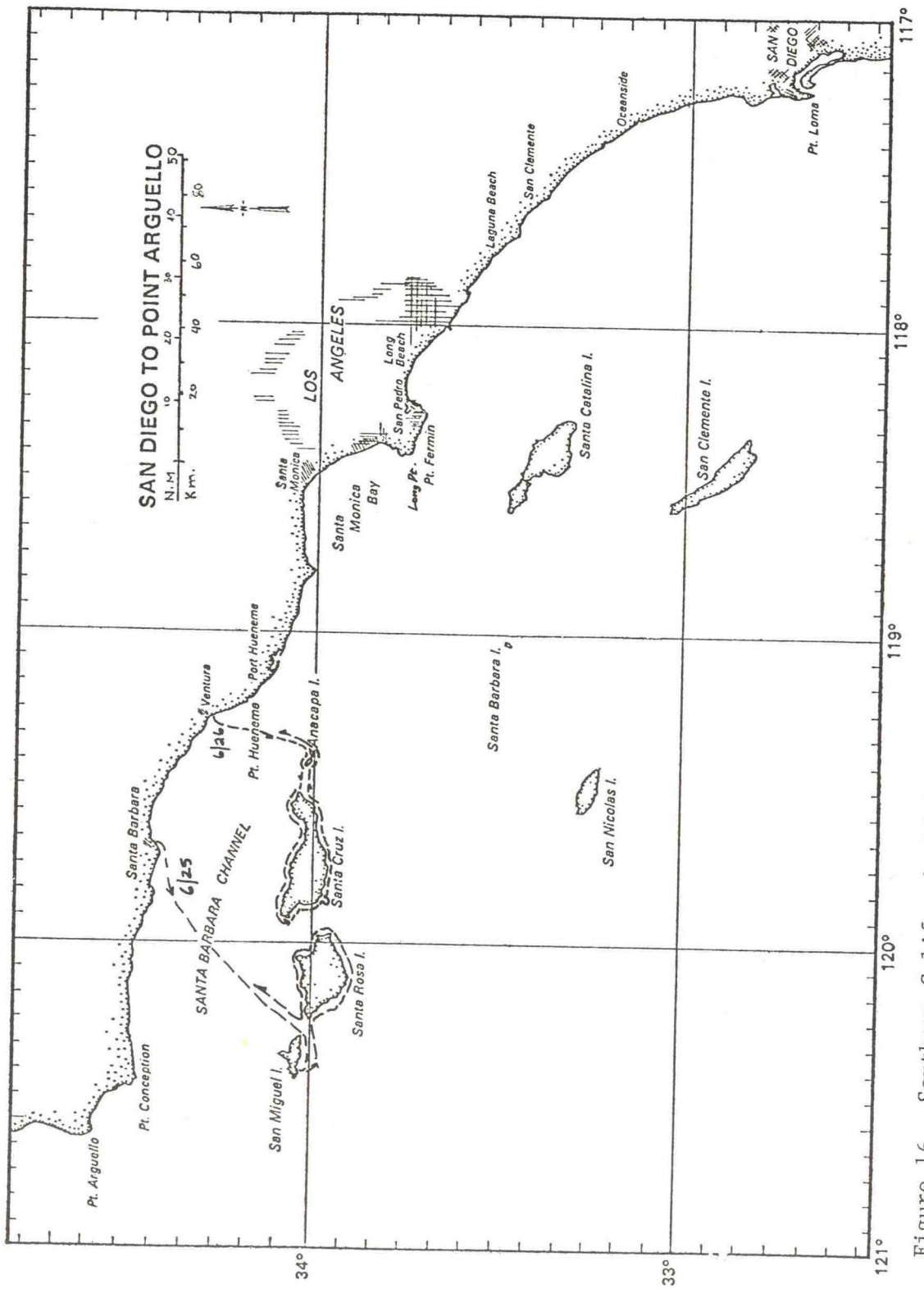
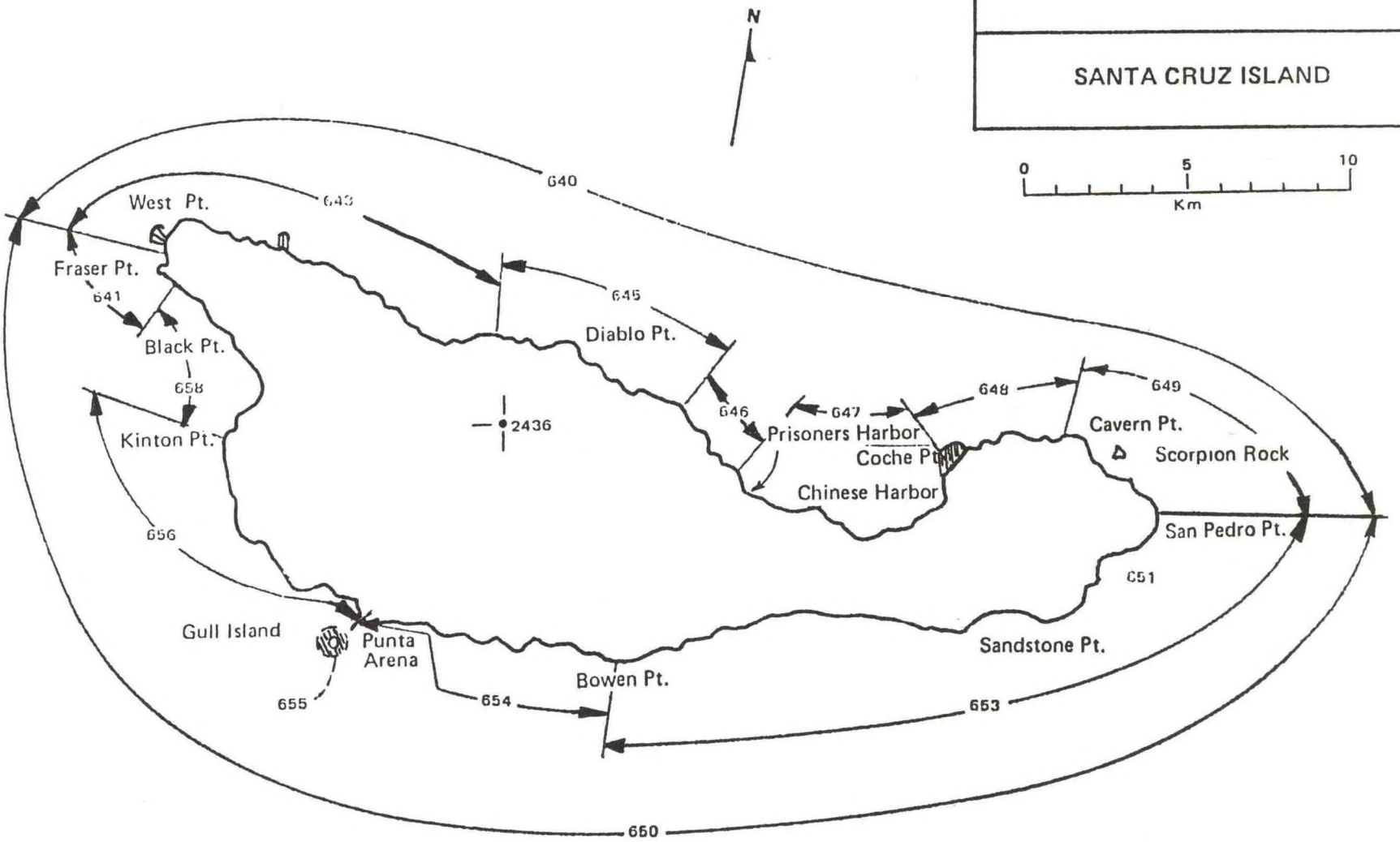


Figure 16. Southern California Bight area map. Survey route of June 25-26, 1983 shown.

Figure 17. California sea lions (hatched areas) counted 6/26/83.



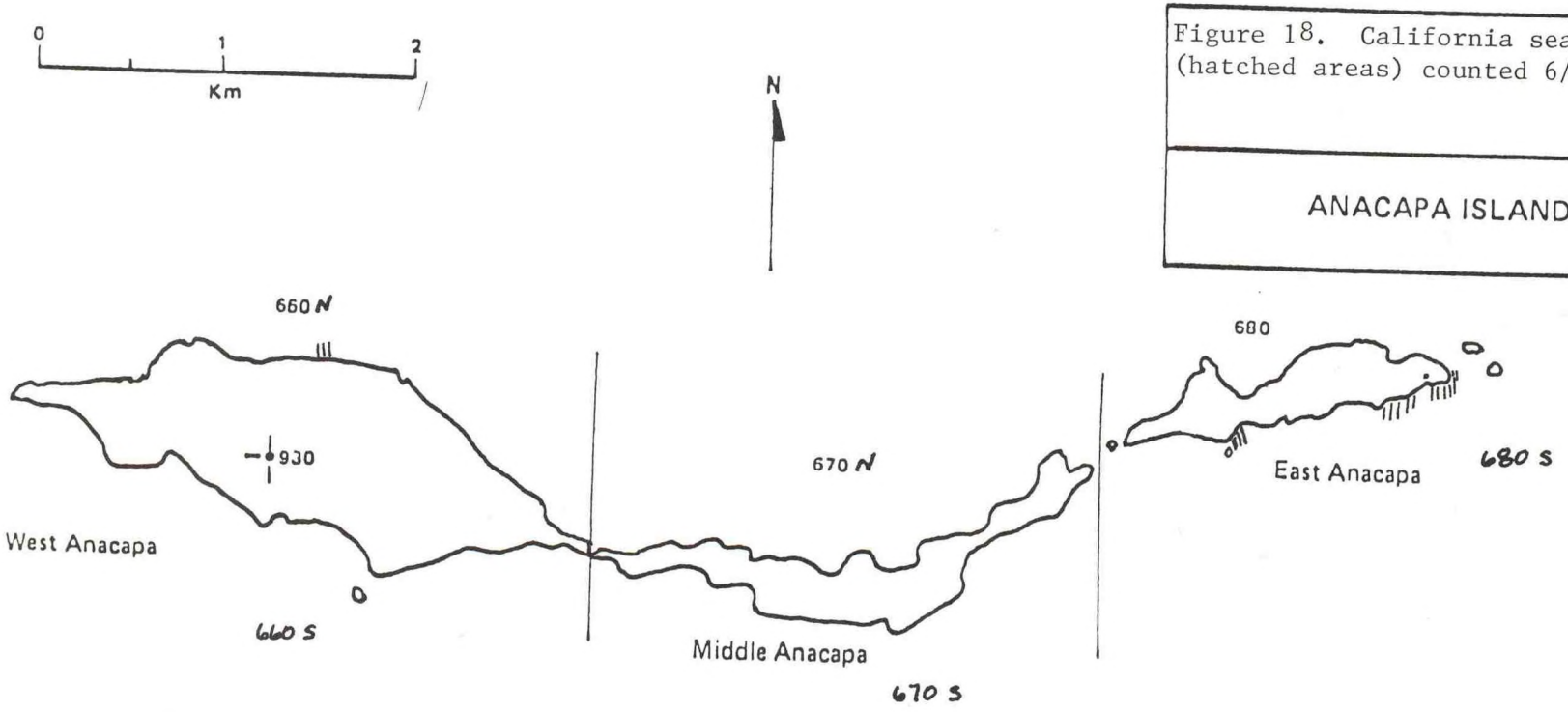


Figure 18. California sea lions (hatched areas) counted 6/26/83.

ANACAPA ISLAND