

**WESTERN SNOWY PLOVER
(A FEDERALLY THREATENED SPECIES)
WINTERING POPULATION AND INTERACTION WITH HUMAN ACTIVITY
ON OCEAN BEACH, SAN FRANCISCO,
GOLDEN GATE NATIONAL RECREATION AREA,
1988 THROUGH 1996**

November 15, 1996

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Abstract

The Pacific coastal population of the Western Snowy Plover was listed as a federally threatened species in 1993. 15 to 85 non-breeding plovers frequent Ocean Beach for up to 10 months of the year, where they are subjected to intense recreational pressure. The National Park Service established a monitoring program in 1994 to determine numbers and distribution of plovers, people and dogs, and to document current levels of disturbance to plovers, and changes in disturbance levels following implementation of Snowy Plover protection measures, including enforcement of leash restrictions on a 2 mile stretch of Ocean Beach. 90 percent of Snowy Plover observations occur between Stairwell 20 on the north and Sloat Blvd. on the south. The highest numbers of people occur north of Lincoln, while dogs are more evenly distributed along the length of the beach. Of 5,692 dogs counted during surveys, only 10 percent were leashed, 50 percent were classified as roaming with potential to disturb birds, and 6 percent (362 dogs) were observed chasing birds. 19 dogs were observed chasing at least 62 Snowy Plovers in approximately 40 hours of direct plover observations. Roaming dogs inadvertently disturbed at least another 100 plovers during that time period. Plovers tend to take flight more readily, and expend more energy, when approached by dogs than by people on foot. Snowy Plovers were also unintentionally disturbed by sand excavation, people, helicopters, bicycles, vehicles, kite-flying, and a recent oil spill. These disturbances will be addressed in a Snowy Plover management plan under development for Ocean Beach. Control of unleashed pets in areas frequented by Snowy Plovers will increase protection of plovers, and provide benefits to migratory shorebirds that depend on the sandy beach habitat of Ocean Beach for feeding and resting.

$$\begin{array}{r} 62/wk \quad 1500 \\ \underline{52} \quad = 52 \\ 124 \quad 7500 \\ \underline{310} \quad 7500 \\ 3224 \quad + \end{array}$$

Table of Contents

	page
Abstract	ii
Introduction	i
Methods	3
Recent Non-NPS Data	3
GGNRA Monitoring Program	4
Results and Discussion	5
Numbers and Seasonal Occurrence of Western Snowy Plovers	5
Spatial Distribution of Snowy Plovers on Ocean Beach	8
Patterns of Use by People and Dogs on Ocean Beach	9
Relationship Between Number of People and Dogs and Number of Plovers	10
Disturbances to Snowy Plovers on Ocean Beach	11
Conclusions	12
Literature Cited	14
Tables and Figures	15

Special thanks to all the dedicated National Park Service volunteers and interns who have made this monitoring program possible, and in particular to Nola Chow, Mike Small, Tom Carlin and Tami Piccone who have so ably coordinated these volunteer efforts.

Cover Photo: Western Snowy Plover in winter plumage on Ocean Beach by Gary Nichols

Introduction

The Western Snowy Plover is a small, pale colored shorebird with dark patches on either side of the upper breast that breeds on coastal beaches from southern Washington to southern Baja California, Mexico. A total of 28 Snowy Plover breeding areas occur along the Pacific Coast. The majority of birds winter south of Bodega Bay in habitats similar to those used during breeding season including sand spits, dune-backed beaches, unvegetated beach strands, open areas around estuaries, and beaches at river mouths. Prior to 1970, Western Snowy Plovers bred at 53 locations in California. A 62 percent decline in California breeding sites occurred by 1981. Snowy Plovers also suffered at least an 11 percent decline in its adult breeding population between 1981 and 1989. Encroachment of European beach grass, human activity (e.g., walking, jogging, running pets, horseback riding, off-road vehicle use, and beach raking), and predation by mammalian and avian predators are key factors in the decline of Snowy Plover coastal breeding sites and its breeding population (USFWS, 1995).

Based on the concerns identified above, the US Fish and Wildlife Service (USFWS) listed the coastal population of the Western Snowy Plover as a federally threatened species, under the Endangered Species Act (16 USC 1531 et. seq.), on March 5, 1993. Under the Endangered Species Act it is unlawful to "take" a listed species without a permit issued pursuant to requirements of the Endangered Species Act. "Take," as defined in the Act, means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

The Endangered Species Act, as well as National Park Service (NPS) management policies (NPS, 1988), declare that Federal agencies must conserve endangered and threatened species and utilize their authorities in furtherance of the Act. Actions by Federal agencies that may adversely affect threatened and endangered species or their habitat require formal consultation with the USFWS.

With regard to the Snowy Plover, the USFWS clarified what actions may adversely affect Western Snowy Plovers and their habitat in its proposed designation of critical habitat in 1995 (USFWS, 1995). While many types of projects and activities were identified that could adversely

affect Western Snowy Plover habitat, only a few of those apply to wintering (non-breeding) habitat including the following:

- Human-associated disturbances including:
 - beach cleaning that removes surfcast kelp and driftwood
 - dogs off leash
 - off-road vehicles driven at night
 - falcon flying (prohibited on NPS lands)
- Actions that would promote invasion of non-native vegetation
- Shoreline erosion control projects and activities that may alter the topography of the beach
- Contamination events like oil spills or chemical releases that could contaminate Snowy Plovers or their food sources.

NPS management policies state that active management programs will be conducted as necessary to perpetuate the natural distribution and abundance of threatened or endangered species and the ecosystems upon which they depend (NPS, 1988). NPS Natural Resources Management Guidelines (NPS, 1991) further direct parks to inventory and monitor threatened and endangered species to determine the number of individuals, threats to the species, condition, and population trends. The management guidelines also require parks to manage threatened and endangered species in conformance with the Endangered Species Act, recovery plans, and other appurtenant documents, and to ensure that park operations do not adversely impact these species.

Golden Gate National Recreation Area (GGNRA) is currently developing a Western Snowy Plover management plan that will address all of the issues identified by USFWS as concerns for wintering Snowy Plovers (listed above). In accordance with NPS management policies and guidelines, and to provide data necessary for development of an appropriate management plan that is based upon an understanding of the number and distribution of Western Snowy Plovers on Ocean Beach and their interactions with human activity, GGNRA established a Snowy Plover monitoring program in cooperation with the Point Reyes Bird Observatory (PRBO) in late 1994.

Objectives of the park's Western Snowy Plover monitoring program are to:

- determine the current and long-term population status and trend in Snowy Plover use of Ocean Beach;
- determine spatial distribution of Snowy Plovers on Ocean Beach;
- determine current levels and patterns of use by people and dogs on Ocean Beach;
- document current levels of disturbance to Snowy Plovers on Ocean Beach; and,
- document changes in behavior by people and dogs, and changes in disturbance levels following implementation of Snowy Plover protection measures.

The data on distribution of Snowy Plovers along the beach were used by the USFWS, through formal Endangered Species Act consultation with the NPS, to determine where dogs would be required to be leashed on Ocean Beach.

Field Survey Methods

Recent Non-NPS Data

Two non-Park Service sources of data on Western Snowy Plover numbers and distribution on Ocean Beach were available and have been included here to provide as much information as possible on Snowy Plover use of Ocean Beach (Lieurance, unpublished data; Baye, unpublished data). The Point Reyes Bird Observatory has coordinated year round efforts to count Snowy Plovers along the California coast. Monthly counts of Snowy Plovers were conducted on Ocean Beach, and all Snowy Plover color leg bands were recorded by PRBO volunteers from 1988 through 1994. The volunteers generally walked Ocean Beach from Lincoln St. to Noriega St. or Sloat Blvd. (or some point in between).

The other data on plover numbers was provided by an interested citizen also involved in coastal erosion projects with the Army Corps of Engineers in San Francisco. The individual walked the beach irregularly between late 1992 and early 1994, and recorded observations for the area between Lincoln St. and Judah or Noriega Streets, and sometimes as far south as Rivera Street.

Annual median and maximum Western Snowy Plover numbers for 1988 through 1994 from the two non-NPS sources are combined and graphed beside NPS data from December 1994 through May 1996 in Figure 1. Although methods through 1994 were not standardized, the data

do provide a comparative index of plover use of Ocean Beach prior to the start of the NPS monitoring program in December 1994.

Golden Gate National Recreation Area Monitoring Program

Methods for the GGNRA monitoring program are documented in the park's Snowy Plover monitoring plan developed in conjunction with PRBO (Stenzel, et al., 1995). The monitoring program includes two elements: 1) twice weekly censuses of numbers and distribution of Snowy Plovers, people and dogs along the length of Ocean Beach from the Cliff House on the north, to the Bank Swallow colony site on the south; and 2) focused one hour observations of disturbance to Snowy Plovers. This report does not include analysis of the focused Snowy Plover disturbance observations because of the complex data analysis requirements. Analysis of disturbance study data will be completed under contract with PRBO over the next year.

The Snowy Plover survey year coincides with the pattern of plover breeding and non-breeding activity. The survey year for Ocean Beach is defined as June 1 through May 31, since no plovers are present during the month of June. Fall is defined as the first date plovers are seen through October 31 (the period when birds are leaving breeding areas and expected to be increasing in numbers on Ocean Beach). Winter, or the period of most stable wintering plover numbers, is defined as November 1 through February 28. Spring, March 1 through the last date plovers are seen, represents the period when their numbers are declining on Ocean Beach as they move to breeding areas.

Weather permitting, two surveys are conducted per week, one on a weekend afternoon (high visitation), and one on a weekday morning (low visitation), for comparative purposes. All surveys are conducted by trained volunteers led by a full-time NPS intern responsible for coordination of the monitoring program. Two teams of volunteers begin surveying at the same time opposite Noriega St. on the beach. One team walks north to the Cliff House and one team walks south to the Bank Swallow colony. The use of two survey teams reduces the time required to survey the 3.7 miles of beach and minimizes double counting of plovers, people and dogs. A typical survey takes approximately two hours to complete. Data are recorded by two-city-block sectors (sectors 1-14) as shown in Figure 2. Data collected are summarized in Table 1.

Crissy Field, on the Presidio of San Francisco, was also surveyed for Western Snowy Plovers, using similar methods, once every other week, mid-day on a weekday, throughout the 1995-1996 survey year. No plovers were observed on Crissy Field, and it will not be discussed further in this report.

All data are entered into dBase III+ database files. Data for each season and year are summarized by executing dBase III+ summary program files written by PRBO for GGNRA. Most of the survey data collected are intended to be presented in summary form. Results are presented graphically and discussed in the text. Statistical analysis would be appropriate only after several years of data are available and might be used, for example, to evaluate success in implementation of leash restrictions. Several simple regression analyses were conducted to determine whether a relationship exists between numbers of people or dogs observed per hour and numbers of plovers counted on surveys. These regression analyses were conducted to address the reasonable hypothesis that more plovers would be predicted to use the beach when fewer people and dogs are present (or vice versa).

Results and Discussion

Numbers and Seasonal Occurrence of Western Snowy Plovers

Annual median¹ and maximum numbers of Western Snowy Plovers counted (by all sources) on Ocean Beach between 1988 and June 1996 are shown in Figure 1. The mean annual median observed over the entire period is 28 plovers, but ranges from 20 to 40. Figure 3 shows plover counts, from non-standardized variable-length surveys, over each survey year prior to the start of the NPS monitoring program. Non-NPS data were omitted if another close date covered a longer portion of the beach, or if low numbers occurred without explanation within a few days of dates with higher numbers, which were assumed to represent more thorough surveys. High counts occurred in most years between October and December. In general, numbers were variable both within and between years. Snowy Plover censuses conducted as part of the NPS monitoring program for the 1994-95 and 1995-96 survey years are shown in Figure 4. NPS surveys began in December 1994.

¹ The median is defined as the middle value in a distribution, above and below which lie an equal number of values. Use of the median rather than the average or mean removes the influence of extreme values.

A median of 60 plovers occupied Ocean Beach from December 1994 until late February 1995. Numbers declined steadily in March and April with the last plover seen on May 13, approximately one month later than expected in normal years. Late spring storms delayed movement of birds to breeding areas in 1995.

The first Snowy Plovers of the 1995-96 survey year were observed on July 4. Numbers increased rapidly and reached 35 by early September, remaining fairly stable around the winter median number of 27 plovers, then slowly declined beginning in early February. The last plovers of the 1995-96 survey year were seen on April 20, three weeks earlier than the previous year. Surveys were suspended during the government shutdown in December 1995 and early January 1996.

Several factors probably account for the variability in plover counts during 1994-95, including changes in actual plover numbers on the beach, possible double-counting (and/or under-counting) of birds that flew from one part of the beach to another, difficulty in identifying plovers in flight, and potential influence of disturbance on plover numbers or behavior. On both the February 25, 1995 shipwreck survey date (when an ATV transported archeological survey equipment up and down the high tide line of the beach continuously throughout the plover survey), and on March 25, 1995 when nearly 2,000 people were counted on the beach, several scenarios for reduced plover counts are possible. More plovers may have been flying than usual due to an increase in frequency of disturbance; some plovers may have departed temporarily from Ocean Beach; and/or the number of people on March 25 may have made it physically impossible to detect plovers that roosted on the most protected areas of the beach.

The median number of plovers using Ocean Beach in winter was 60 in 1994-95, but declined to 27 during the 1995-96 survey year. Several explanations are possible: 1) the City of San Francisco sand excavation project in December 1995 and January 1996 and the increased disturbance it created may have reduced plover numbers; 2) the presence of Peregrine Falcons in December 1995 and January 1996 may have influenced the local numbers and distribution of plovers; and/or 3) the narrower beach width during the 1995-96 survey year may have reduced plover habitat quality or quantity.

The sand excavation project (conducted following formal consultation with the USFWS as required under the Endangered Species Act) did create a significant amount of additional

disturbance in the preferred plover roosting area along the seawall between Noriega St. and Santiago St. (GGNRA, 1996). In addition, the re-contouring of the beach may have resulted in changes in the beach profile² that may have influenced plover microhabitat, making it less attractive to them. However, plover numbers on Ocean Beach were similar before, and for approximately a month after, the sand movement operation although their distribution shifted north to the Lincoln to Lawton roost area. Plover numbers began to decline much earlier in 1996 than in 1995, as would be expected under normal breeding season conditions.

Peregrine Falcons (federally listed as endangered) were observed during Snowy Plover surveys on December 6, 1995 and on January 17, 1996, both times attacking and harassing larger shorebirds over the water and beach. Peregrines had not been observed on previous surveys although there is a known winter roost site nearby. Lynne Stenzel, of PRBO (personal communication), has observed that the presence of Peregrines can have a profound effect on the local distribution and abundance of shorebirds. Peregrines undoubtedly influence Snowy Plover numbers and use of Ocean Beach to some degree, and they are expected to forage irregularly in the area.

Beach profile is suspected to be one of the most significant factors influencing Snowy Plover habitat suitability and availability on Ocean Beach. Data from aerial photos and cross-sectional measurements of the beach need to be analyzed to substantiate such a relationship, and to document how beach width and profile change between years. At the start of GGNRA plover monitoring in December 1994 when 60 Snowy Plovers were present on Ocean Beach, Gary Page, PRBO, noted the extreme width of the beach compared to his observations in earlier years. Casual observations made during plover surveys in 1995-96 indicated a significant narrowing of the beach profile over the previous year (concurrent with a 50% decline in median winter plover numbers), presumably as a result of the severe storms that occurred during the Spring, and in December, of 1995.

The annual median number of Western Snowy Plovers documented to use Ocean Beach since 1988 represents a 100% mean increase over estimates from statewide censuses in California and Oregon conducted between 1979 and 1985 (Page et al. 1986). 26 counts over that 6 year period yielded median counts of from 2 to 14 Snowy Plovers on Ocean Beach. The wintering

² The beach profile is defined by the width and slope of the beach.

population on Ocean Beach was estimated to be 14 Snowy Plovers for the 9.3 km of sand beach in San Francisco County. All plovers encountered during the census period occurred on Ocean Beach. Maximum Snowy Plover counts for the 1979 to 1985 period ranged from 4 to 16, compared to maximum counts since 1988 of from 38 to 85 birds.

Two possible explanations for the dramatic changes in plover numbers between 1979-1985 and 1988-1996 are: 1) factors that reduced Snowy Plover habitat suitability or availability elsewhere, possibly associated with changes in salt pond management in San Francisco Bay, causing them to shift to other locations; and/or 2) changes in beach width, which was undoubtedly extremely narrow during the early 1980's when severe coastal erosion occurred in the Bay Area. Rainfall between 1979 and 1985 averaged well above normal and included an *el niño* event.

A few color-banded Western Snowy Plovers reside on Ocean Beach each winter. Ocean Beach plovers have been banded in Monterey Bay as breeding adults, at Moss Landing as newly-fledged chicks, as well as in Oregon.

Spatial Distribution of Snowy Plovers on Ocean Beach

Western Snowy Plovers consistently roost (or rest) in two primary areas on Ocean Beach, the first is between Lincoln and Lawton Streets, and the second is between Noriega and Rivera Streets (the promenade sea wall). Plovers occasionally roost in other areas and they tend to be more spread out along the beach when feeding. Figures 5, 6 and 8 show the median and maximum numbers of Snowy Plovers that occurred within each of the 14 survey sectors during fall, winter and spring of 1994-95 and 1995-96 (no data for fall 1994). Figures 5, 7 and 9 show the percent of surveys on which Snowy Plovers were encountered within each sector during each season. All seasons show approximately the same patterns of use, with variation between years in numbers of plovers and preferred resting areas.

Since the surveys began, over 90 percent of Snowy Plover occurrences have been between Stairwell 20 (south of Fulton St.) on the north and Sloat Blvd. on the south. The highest number of plovers has generally been observed between Noriega and Rivera Streets, except in spring when they have been more evenly split between the two primary roost sites. Smaller numbers of plovers are regularly seen along the length of the beach from Stairwell 20 to Sloat Blvd., with 1-2 plovers occasionally seen north and south of this core area.

The distribution of Snowy Plovers in the winter of 1995-96 appears to be more restricted to the primary roost areas than in 1994-95 (Figures 6 and 7). Narrower beach width following intense storms in December may explain these differences. Figure 9 also shows a shift during spring 1996 to the Lincoln to Lawton roost area possibly as a consequence of winter sand excavation by the City of San Francisco that changed the beach profile within the Noriega to Rivera roost area.

Patterns of Use by People and Dogs on Ocean Beach

The median and maximum numbers of people encountered on surveys largely reflects the location of parking lots along Ocean Beach (Figure 10) with the highest number of people counted north of Lincoln St., followed by high numbers of people on the beach near Sloat Blvd., with the lowest number of people encountered between Lawton and Vicente Streets. High numbers of people use the beach in the vicinity of the Lincoln to Kirkham plover roost area, while the lowest numbers of people frequent the primary plover area between Noriega and Rivera Streets. Although no data are collected on what part of the beach profile is most actively used, a significant portion of human activity occurs along the water's edge where walking is easiest. A previous analysis of only the winter and spring 1994-95 data showed a more even distribution of people along the length of the beach. The fall survey period (from July through October) includes two summer months, as well as the period of warmest weather in the fall. The addition of this high beach use period into the analysis demonstrates that the area north of Lincoln receives the highest proportion of beach activity year round.

The median and maximum number of dogs encountered on surveys reflects a different pattern of beach use by dogs and their owners (Figure 11). The median number of dogs per survey sector is fairly even from Fulton St. south, a reflection of use by local neighborhood dog owners who regularly walk their dogs on the beach. Slightly higher median dog numbers occur near Lincoln St. and near Pacheco St., possibly due to the slightly greater proportion of time spent surveying those areas where the greatest numbers of Snowy Plovers occur. The high maximum numbers of dogs between Stairwell 20 and Lincoln, and at Sloat Blvd. probably reflects additional dog owners driving to the beach during periods of good weather. Relatively high numbers of dogs do occur in the same areas preferred by Snowy Plovers.

Ocean Beach receives significantly greater use on weekends than it does on weekdays (Figure 12). Beach use is also higher during the fall and spring survey periods, but exhibits extreme fluctuations, particularly on weekends. The number of people on the beach is influenced by whether it is a weekday or a weekend, and by the weather conditions on any given day. Days with the highest numbers of people are warm and sunny, with little wind. The number of dogs on the beach does not fluctuate as dramatically as the number of people. Figure 14 illustrates that as the number of people on the beach increases by as much as ten-fold, the number of dogs approximately doubles. This probably reflects a large influx of beach-goers from outside the local neighborhoods who drive to the beach on nice days, but usually leave their pets at home.

Relationship Between Numbers of People and Dogs and Numbers of Plovers

Regression analyses were conducted to determine whether a relationship exists between the number of people per hour, and the number of dogs per hour, encountered during surveys, and the number of Snowy Plovers on the beach at the same time. When the extreme value for number of people from each year is omitted, $R^2 = .11$ in 1994-95 and $.16$ in 1995-96. This indicates that the number of people per hour on the beach explained only 11% and 16% of the variation in Snowy Plover numbers, respectively. When the extreme value for 1994-95 (March 25, 1995) is included, R^2 increases to $.31$. Several possible explanations for the low number of plovers that day were described previously. Inclusion of the extreme value from 1995-96 had the opposite effect and resulted in a decrease in R^2 to $.07$. All results are significant at $p < .10$ (the probability is $<10\%$ that these results occurred by chance).

The number of dogs per hour on the beach explained only 10% and 12% of the variation in plover numbers for 1994-95 and 1995-96, respectively. Factors other than number of people or dogs, possibly beach slope and width, appear to exert greater influence over Snowy Plover numbers on Ocean Beach.

Disturbances³ to Snowy Plovers on Ocean Beach

The degree of dog control on Ocean Beach was also evaluated during surveys (Figure 13). An average of 10 percent of dogs were leashed. Of the 90 percent of unleashed dogs, 34 percent were within 10 feet of their owners when observed and appeared to be under "voice control" at the time. Fifty percent of dogs were classified as roaming, and 6 percent (362 dogs) were observed chasing birds. Any unleashed dog, but particularly those identified as roaming, has the potential to chase birds or plovers. In most cases, dogs chased gulls and shorebirds other than plovers.

Wintering Snowy Plovers are not susceptible to the same frequency of chasing and disturbance as Sanderlings and other shorebirds that spend most of their time along the water's edge. The Snowy Plover's cryptic coloration and their habit of roosting, sometimes nearly invisibly, in footprints, tire tracks and other depressions in the sand, protect them to a limited degree. Nevertheless, during the 111 surveys conducted between December 1994 and May 1996 (approximately 40 total hours of direct Snowy Plover observation), 19 dogs were observed deliberately chasing Snowy Plovers. At least 62 Snowy Plovers were disturbed by these 19 dogs (from 1 to 34 Snowy Plovers disturbed per event) over a time period equal to less than one week of daylight hours. On another 15 occasions, at least 100 additional Snowy Plovers were inadvertently disturbed by roaming dogs or dogs chasing other birds. (The actual number of plovers disturbed was not consistently recorded until 1995-96.) Chasing of plovers by dogs constitutes harassment, and consequently "take" of a threatened species under the Endangered Species Act and as defined under the activities determined to adversely affect Snowy Plovers (USFWS, 1995).

People also frequently and inadvertently disturb plovers, but plovers appear more likely to walk or run, than fly, when disturbed by people as compared to dogs. Flying has the greatest energy cost to plovers and is the most disruptive to their feeding and resting activities.

During the 70 surveys conducted in 1995-96 (approximately 24 total hours of direct plover observation), 48 Snowy Plovers were inadvertently disturbed by people, including joggers.

³ A disturbance event is defined here as an obvious change in plover activity that was clearly elicited by an observed disturbance agent like a person, a dog, vehicles, helicopters, etc. Plover activities include roosting, standing, walking, running, and flying. A change, elicited by an observed disturbance agent, from a less energetic activity to one that requires more energy is classified as a disturbance.

surfers, and beach walkers. Another 21 plovers were disturbed by low-flying helicopters or airplanes, 15 by bulldozers excavating sand, 5 by bicycles and vehicles, and 6 by a kite flying nearby. Although not part of the survey years included in this report, in November 1996 at least 10 Snowy Plovers were contaminated by oil from the Cape Mohican spill in San Francisco Bay.

Western Snowy Plover disturbance associated with the City of San Francisco sand excavation project during December 1995 and January 1996 is described in a separate report to the USFWS (GGNRA, 1996).

Conclusions

The Western Snowy Plover was federally-listed as a threatened species in 1993. By law, the NPS is required to actively manage its lands to perpetuate the natural distribution and abundance of threatened and endangered species and the ecosystems upon which they depend. NPS management guidelines also direct parks to monitor threatened and endangered species to determine their numbers, threats to the species, condition, and population trend. GGNRA established its Snowy Plover monitoring program in December 1994.

GGNRA monitoring results, and surveys conducted since 1988 by PRBO and others, indicate that approximately 15 to 85 Western Snowy Plovers occur on Ocean Beach between July 1 and May 15. 25 to 60 Snowy Plovers regularly reside on the beach in mid-winter. These numbers represent a 100 percent increase over the 1979 to 1985 period, possibly due to habitat loss elsewhere or recent increased average beach width. Only extreme levels of disturbance (constant ATV traffic or presence of 2000 people per hour on surveys) corresponded to greatly reduced numbers of plovers, possibly due to departure from Ocean Beach, increased flight, or greater difficulty in locating plovers.

Western Snowy Plovers regularly occupy two primary roost areas-- from Noriega to Rivera Streets, and from Lincoln to Lawton Streets. Approximately 90 percent of plover occurrences since December 1994 were between Stairwell 20 on the north and Sloat Blvd. on the south. These data on distribution of Snowy Plovers along the beach were used by the USFWS to determine where dogs would be required to be leashed on Ocean Beach.

Number of people on the beach is directly related to day of the week and weather conditions, with the greatest number of people occurring north of Lincoln St. Dogs are more

evenly distributed along the length of the beach, indicating regular local neighborhood use of the beach for dog walking. The number of Snowy Plovers occurring on the beach is not closely related to the number of people or dogs using the beach at the same time.

5,692 dogs were counted during surveys, of which 10 percent were leashed, 50 percent were roaming (with potential to chase birds), and 6 percent were chasing birds. 19 dogs were observed chasing a total of 62 Snowy Plovers (in approximately 40 hours of direct observation). Chasing of plovers clearly meets the definition of harassment and "take" under the Endangered Species Act and as specifically defined for Western Snowy Plovers. Roaming dogs inadvertently disturbed at least another 100 plovers.

Plovers, as well as other shorebirds, appear to be more prone to taking flight, and consequently expending more energy, when approached by dogs than by people on foot. Disturbance results in lost energy intake due to reduced foraging and feeding efficiency, and increased energy expenditure as a result of fleeing from disturbance. Little research has been conducted on the energetic effects of disturbance, and on whether individuals can compensate for this lost energy intake and increased energy expenditure. It is thought that small species (like plovers) are more energetically stressed than larger species if they are repeatedly forced to take flight, because of their greater surface area to body weight ratio. These species may exhibit a greater tolerance for human activity in order to minimize energy expenditure (Knight, et. al 1995).

Snowy Plovers have also been inadvertently disturbed by sand excavation, people, helicopters, airplanes, bicycles, vehicles, kite-flying, and the recent oil spill. Each of these issues will be addressed in the management plan which is currently being written. The plan may recommend additional constraints that are appropriate and feasible to apply to other activities, including park operations, that may have adverse impacts on Western Snowy Plovers on Ocean Beach.

Control of unleashed pets in areas frequented by Snowy Plovers will increase protection of plovers, and will provide even greater benefits to the large numbers of migratory shorebirds, gulls and terns that also depend on the vast expanse of sandy beach habitat on Ocean Beach for feeding and resting.

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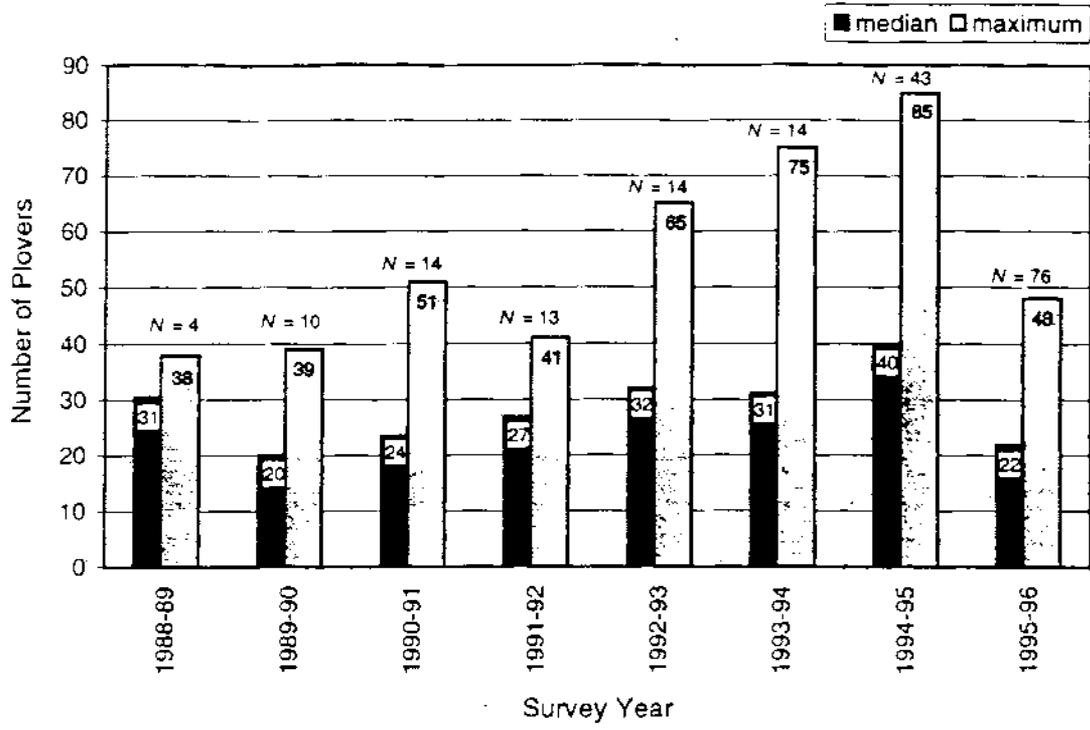
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Table 1. Data Collected on Snowy Plover Surveys

Snowy Plovers	People and Dogs
weather	sector
tide height and flow	number of people
sector	number of dogs leashed
number of plovers	number of dogs unleashed (within 10 ft. of owner)
feeding or not-feeding	number of dogs roaming
flying and direction of flight	number of dogs chasing birds
beach zone	number of dogs chasing plovers
microhabitat	number of horses, vehicles, airplanes, helicopters, raptors
color leg bands	plover response to disturbance

Figure 1. Annual Median and Maximum Numbers of Western Snowy Plovers on Ocean Beach, 1988 through 1996, Golden Gate National Recreation Area



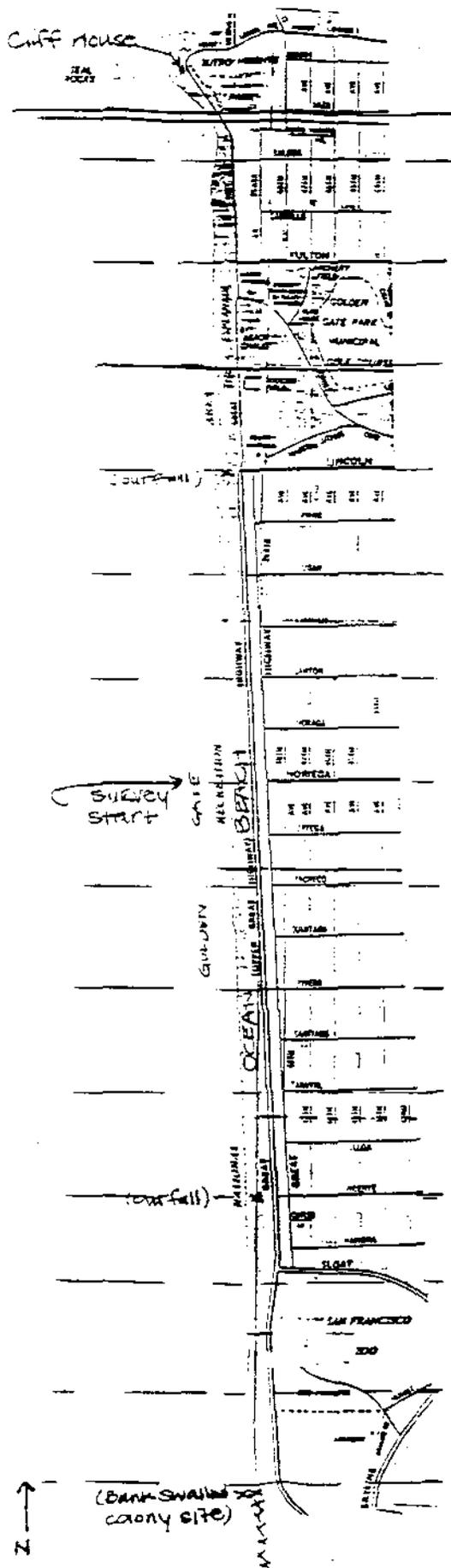
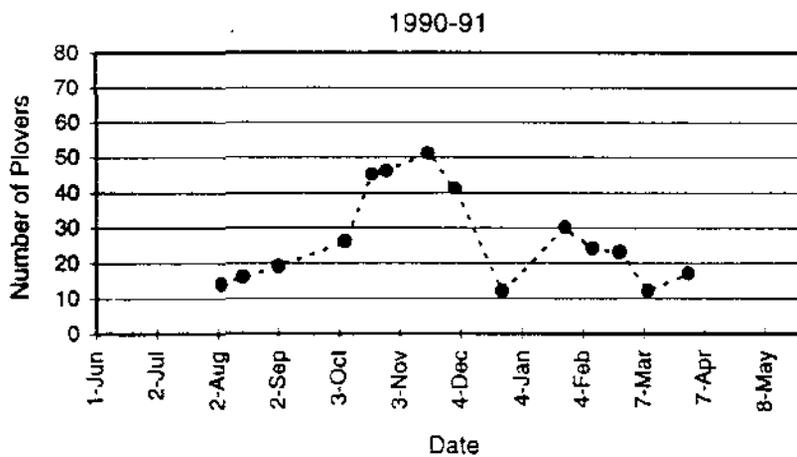
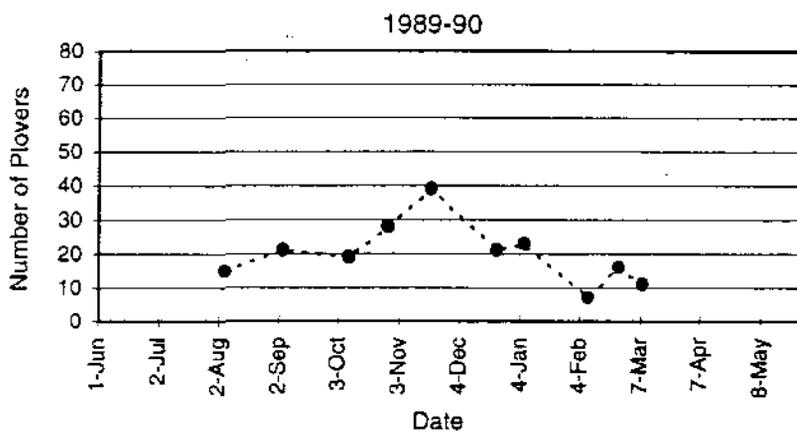
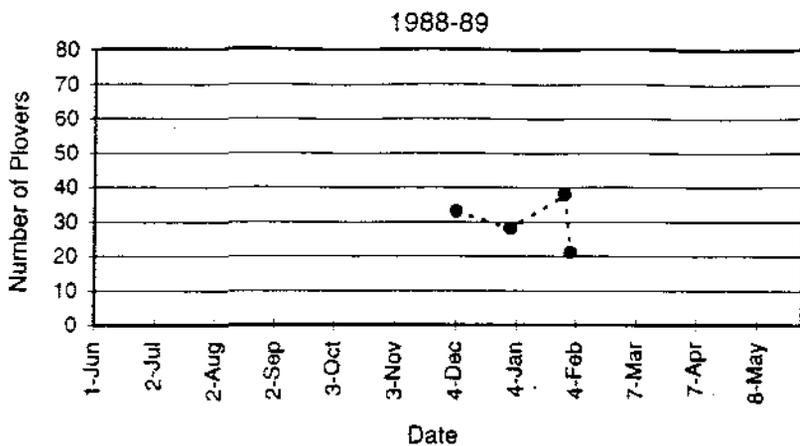


Figure 2. Western Snowy Plover Monitoring Plan
Ocean Beach Sector Map

area: 14 sections from Cliff House to bank swallow sites
section length: 1,420' for sections 2-11; *sections 1, 12-14 are slightly shorter

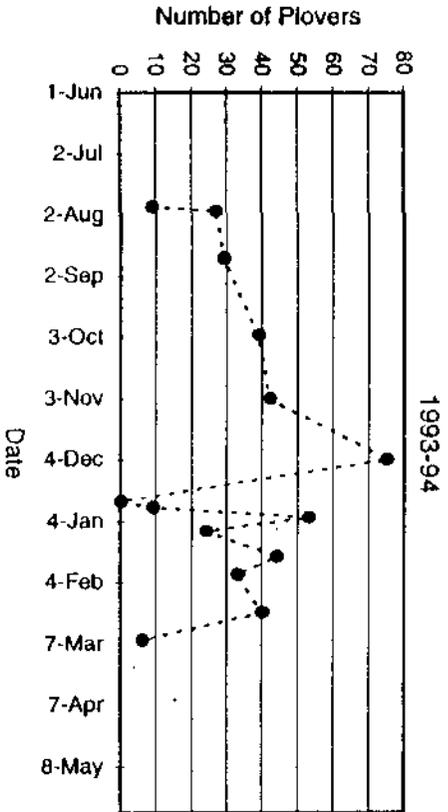
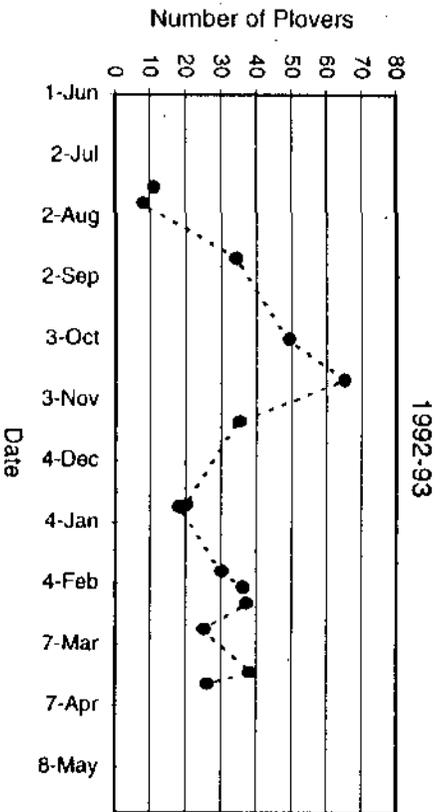
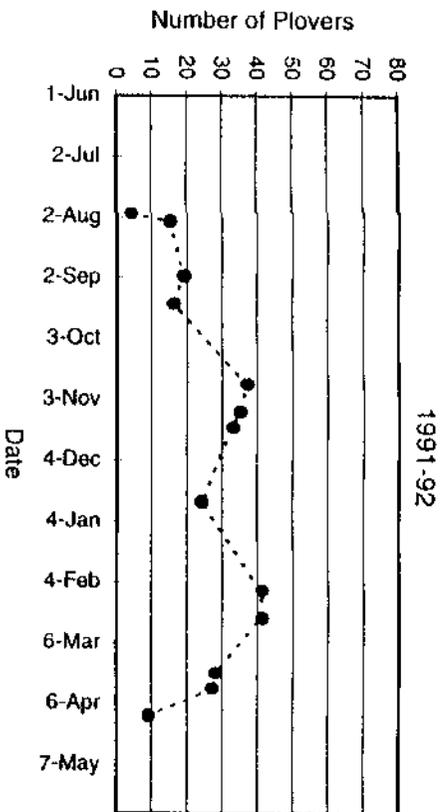
- 1 = seawall to stairwell #6 *
(north end - near Balboa St.)
- 2 = stairwell #6 to #13
(near Balboa St. - Fulton St.)
- 3 = stairwell #13 to #20
(Fulton St. - mid GGP)
- 4 = stairwell #20 to stormwater outfall
(mid GGP - Lincoln St.)
- 5 = stormwater outfall to Judah St. beach access trail
(Lincoln St. - Judah St.)
- 6 = Judah St. access to Lawton St. access
- 7 = Lawton St. access to Noriega St. access
- 8 = Noriega St. access to Pacheco St. access
- 9 = Pacheco St. access to Rivera St. access
- 10 = Rivera St. access to Taraval St. access
- 11 = Taraval St. access to stormwater outfall
(Taraval St. - Vicente St.)
- 12 = stormwater outfall to 3rd access of first overlook*
(Vicente St. - Sloat Blvd. overlook)
- 13 = 3rd access of first overlook to 1st access of second overlook*
(Sloat Blvd. overlook to 2nd overlook)
- 14 = 1st access of second overlook to Bank Swallow sign*

Figure 3. Historical Western Snowy Plover Population Data for Ocean Beach, San Francisco, 1988 through 1994. Variable Length Surveys from Lincoln South. (Data Sources: C. Lieurance, L. Lieurance for PRBO band surveys; and P. Baye)



(figure continues)

Figure 3. (continued)



US03082

Figure 4. Numbers of Western Snowy Plover by Date on Ocean Beach, San Francisco, 1994-95 and 1995-96 Survey Periods, Golden Gate National Recreation Area

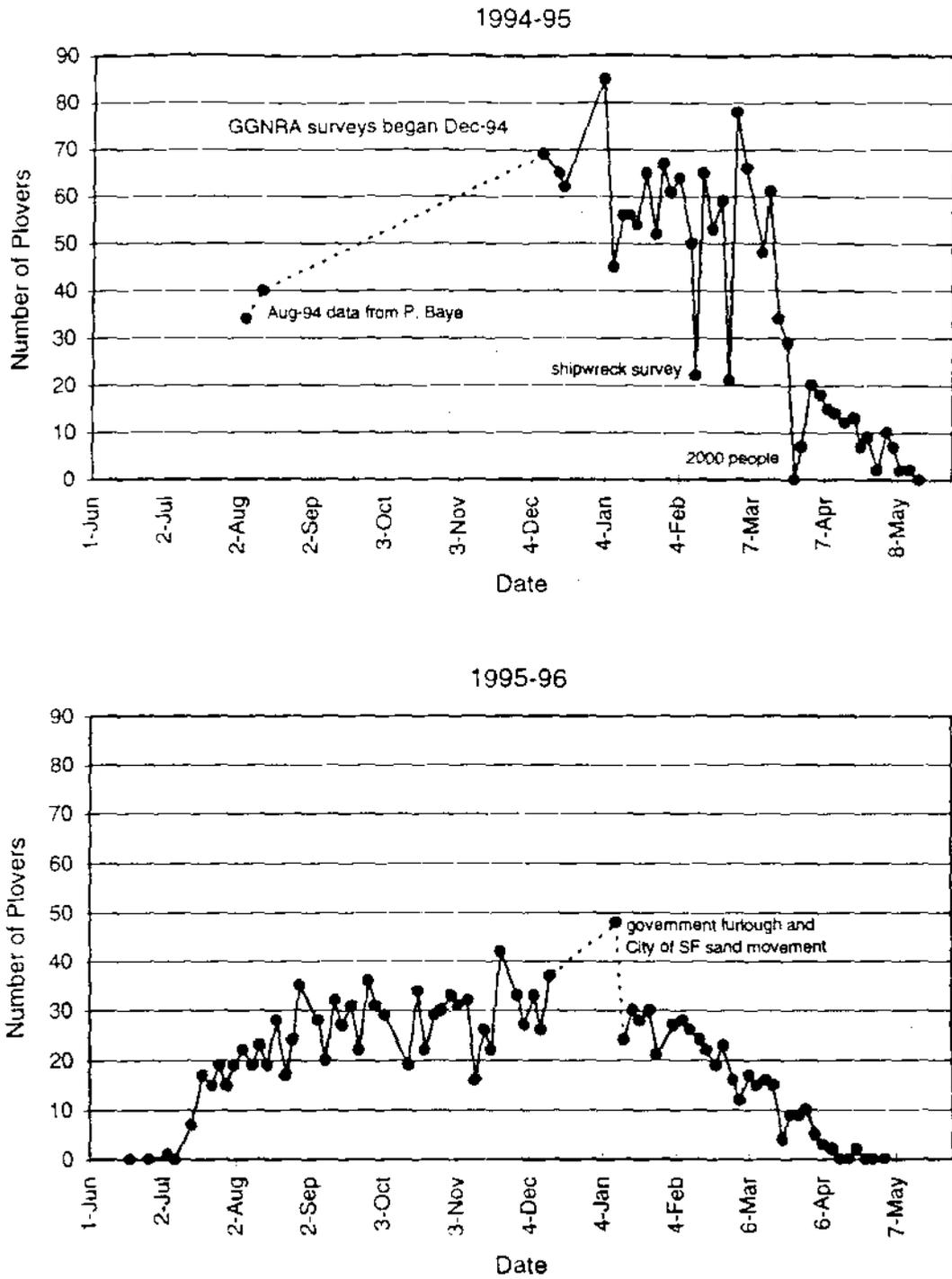


Figure 5. Median and Maximum Numbers of Western Snowy Plovers and Percent Occurrence on Surveys by Two-City-Block Sector on Ocean Beach, San Francisco, Fall 1995-96 ($N=27$), Golden Gate National Recreation Area

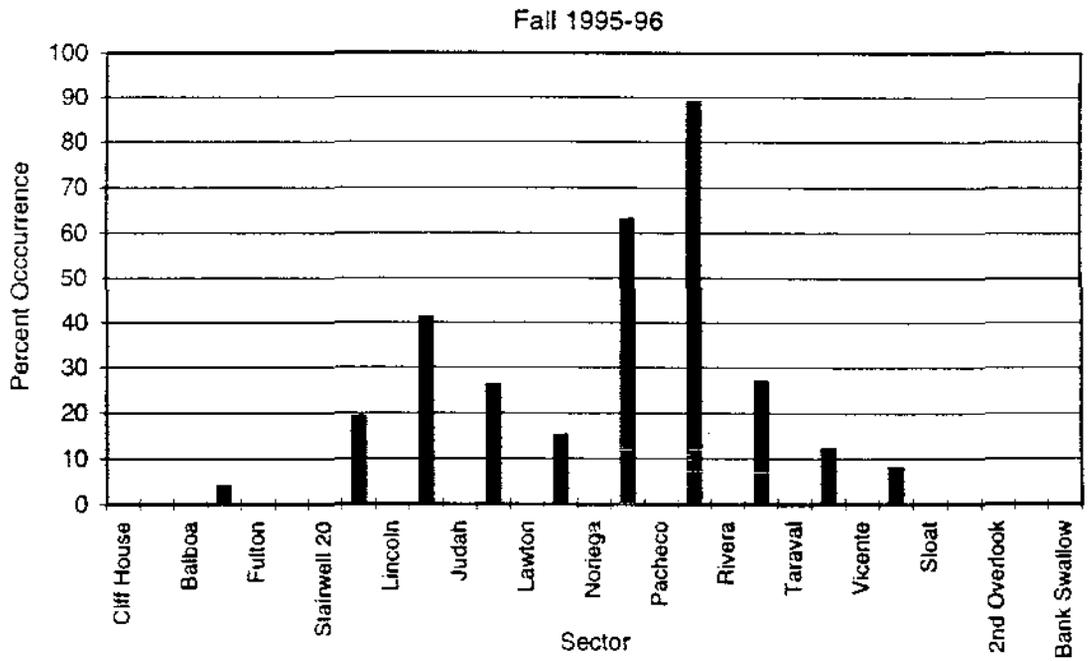
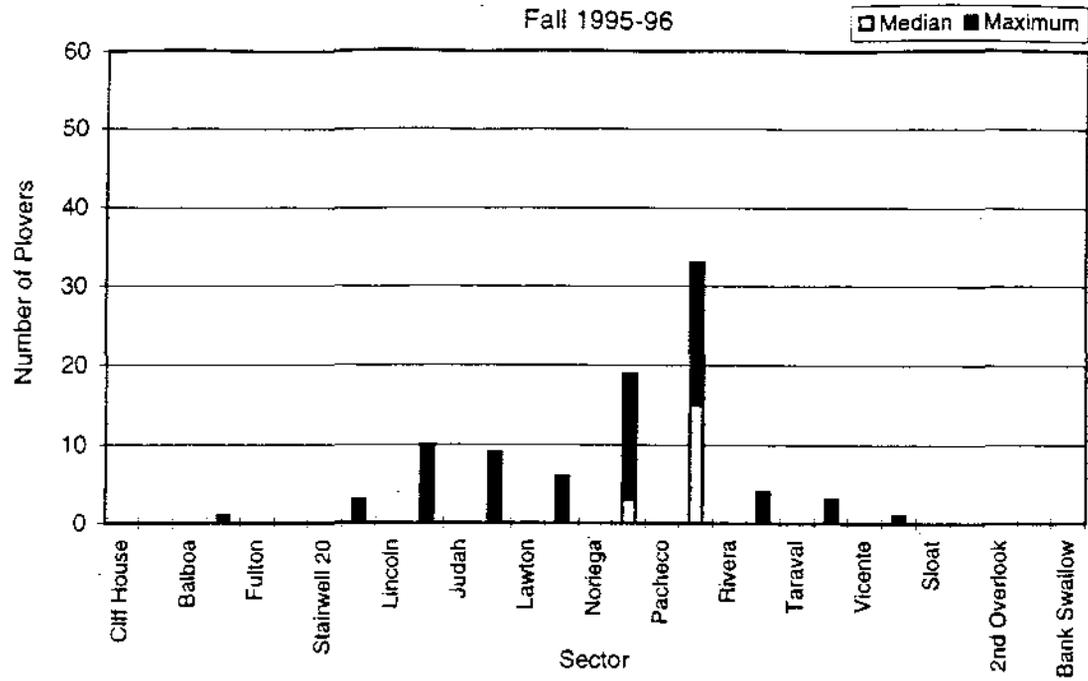


Figure 6. Median and Maximum Numbers of Western Snowy Plovers by Two-City-Block Sector on Ocean Beach, San Francisco, Winter 1994-95 ($N=20$) and Winter 1995-96 ($N=27$), Golden Gate National Recreation Area

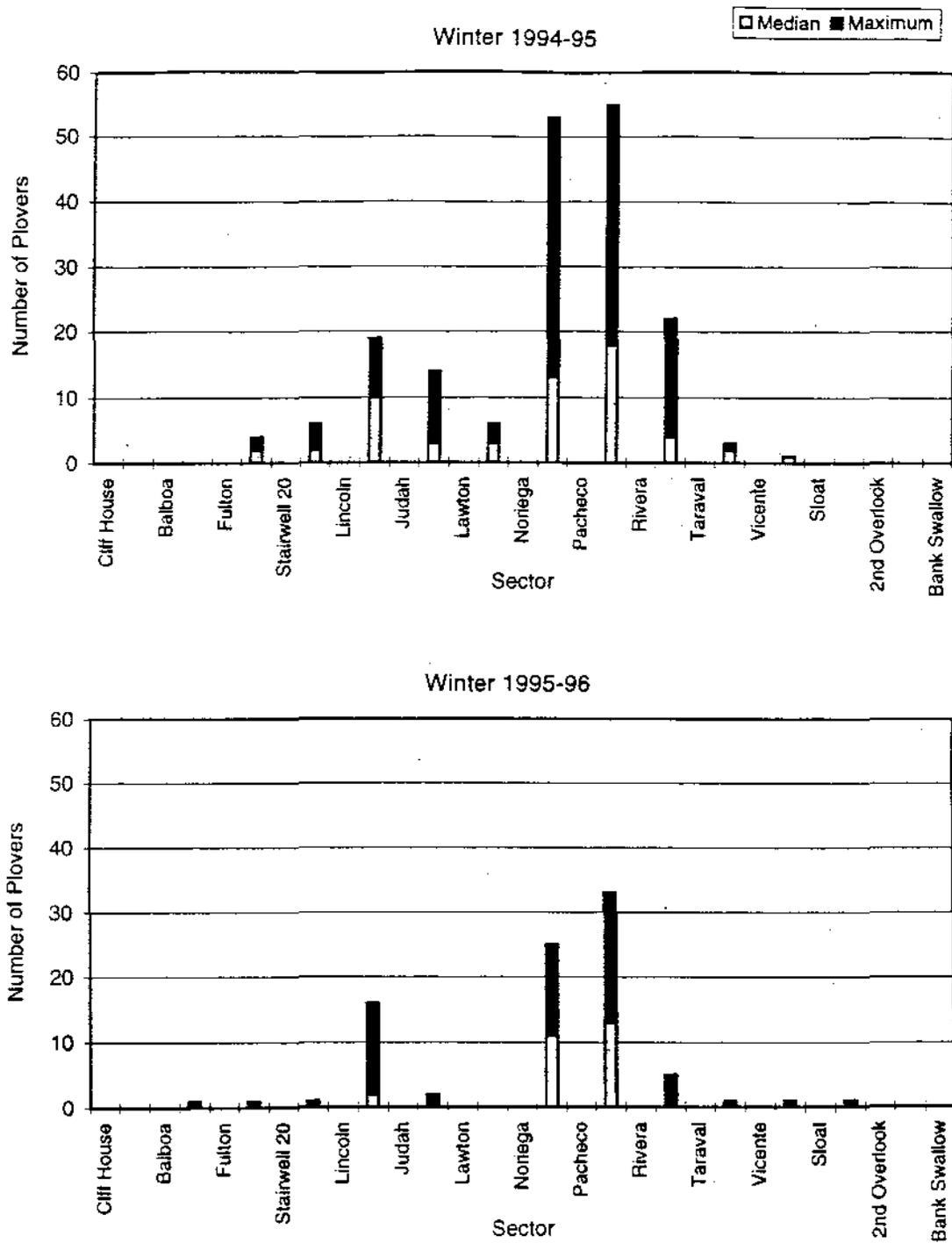


Figure 7. Percent Occurrence of Western Snowy Plovers by Two-City-Block Sector on Ocean Beach, San Francisco, Winter 1994-95 ($N=20$) and Winter 1995-96 ($N=27$), Golden Gate National Recreation Area

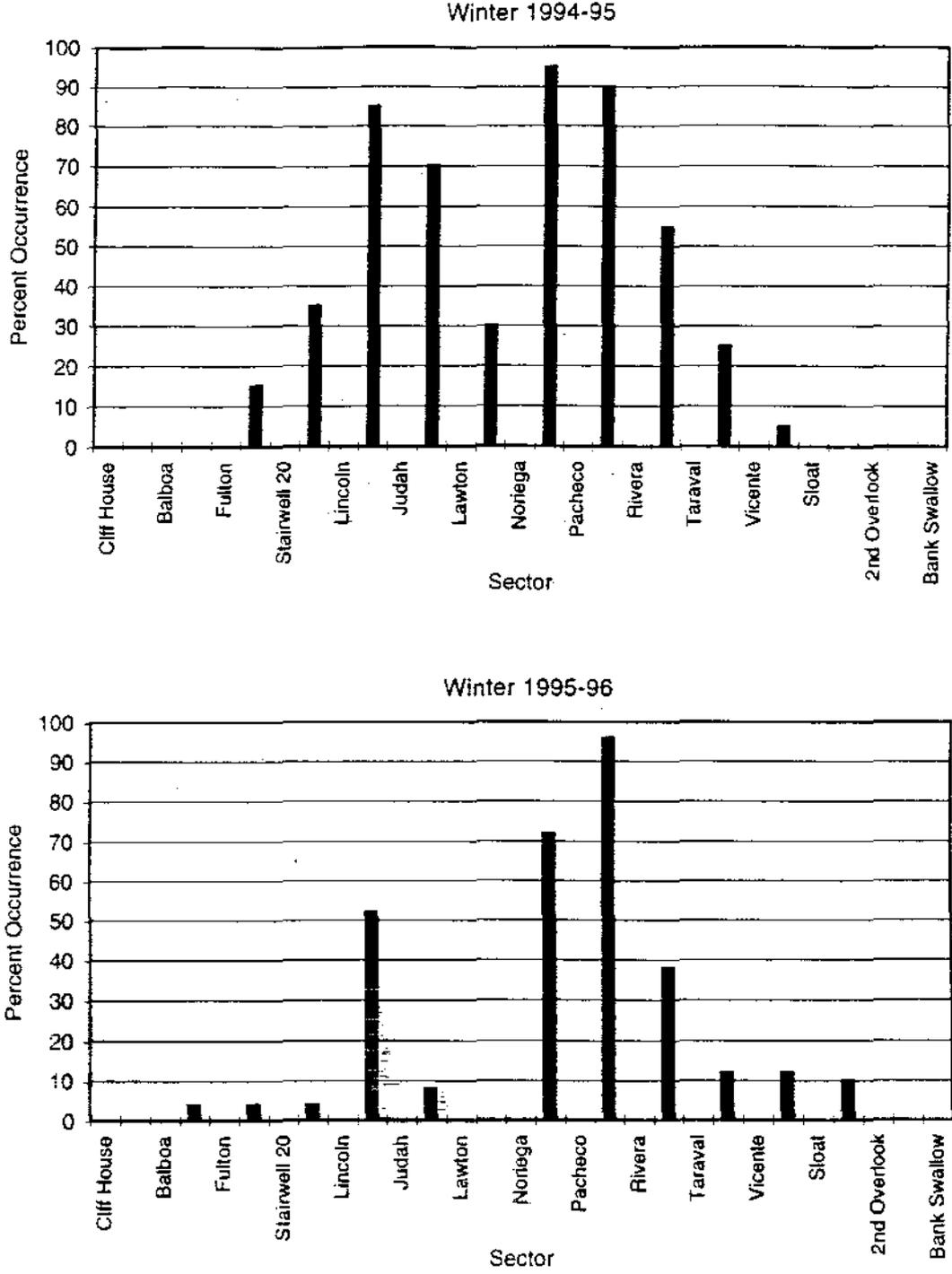


Figure 8. Median and Maximum Numbers of Western Snowy Plovers by Two-City-Block Sector on Ocean Beach, San Francisco, Spring 1994-95 ($N=21$) and Spring 1995-96 ($N=18$), Golden Gate National Recreation Area

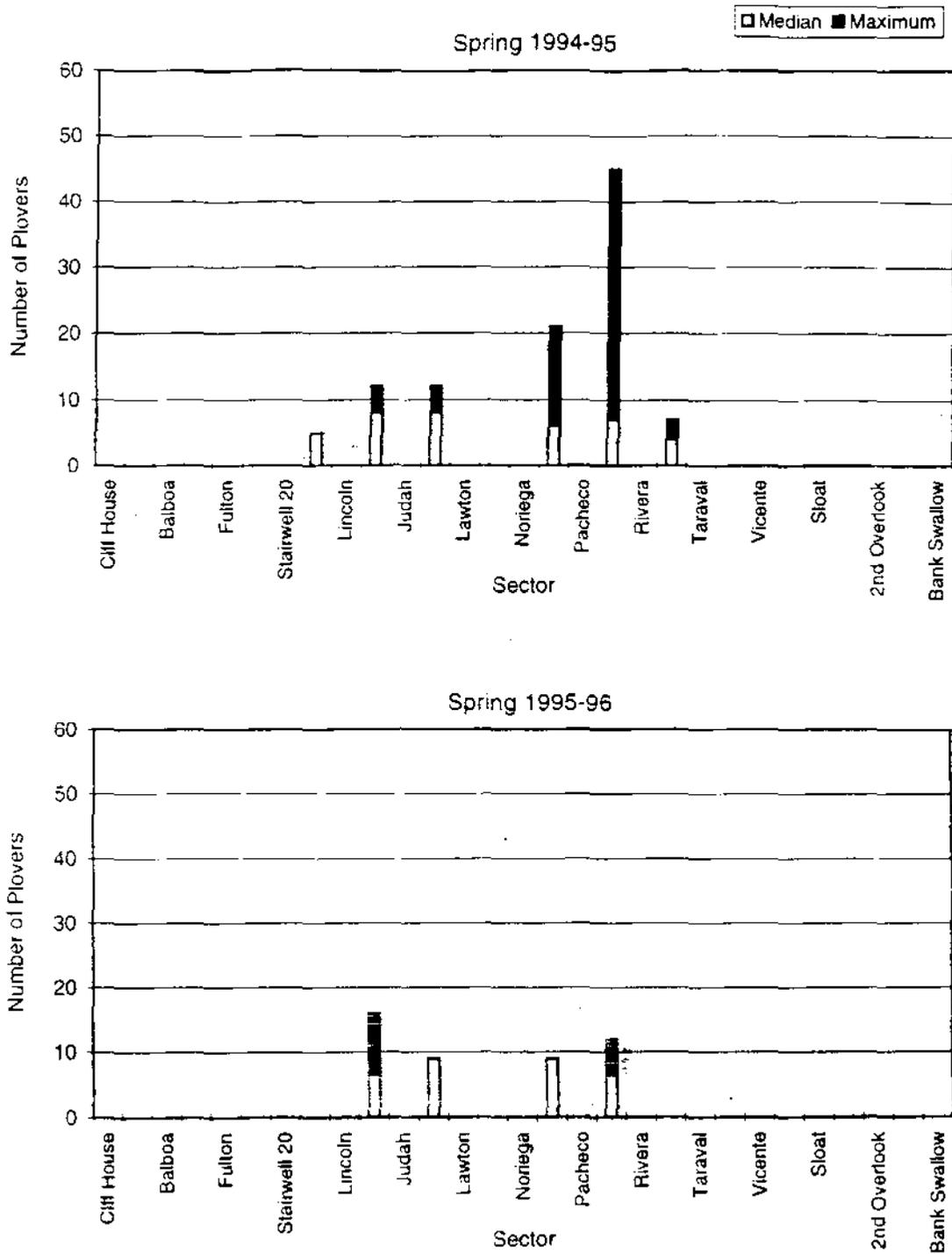


Figure 9. Percent Occurrence of Western Snowy Plovers by Two-City-Block Sector on Ocean Beach, San Francisco, Spring 1994-95 (N=20) and Spring 1995-96 (N=18) Golden Gate National Recreation Area

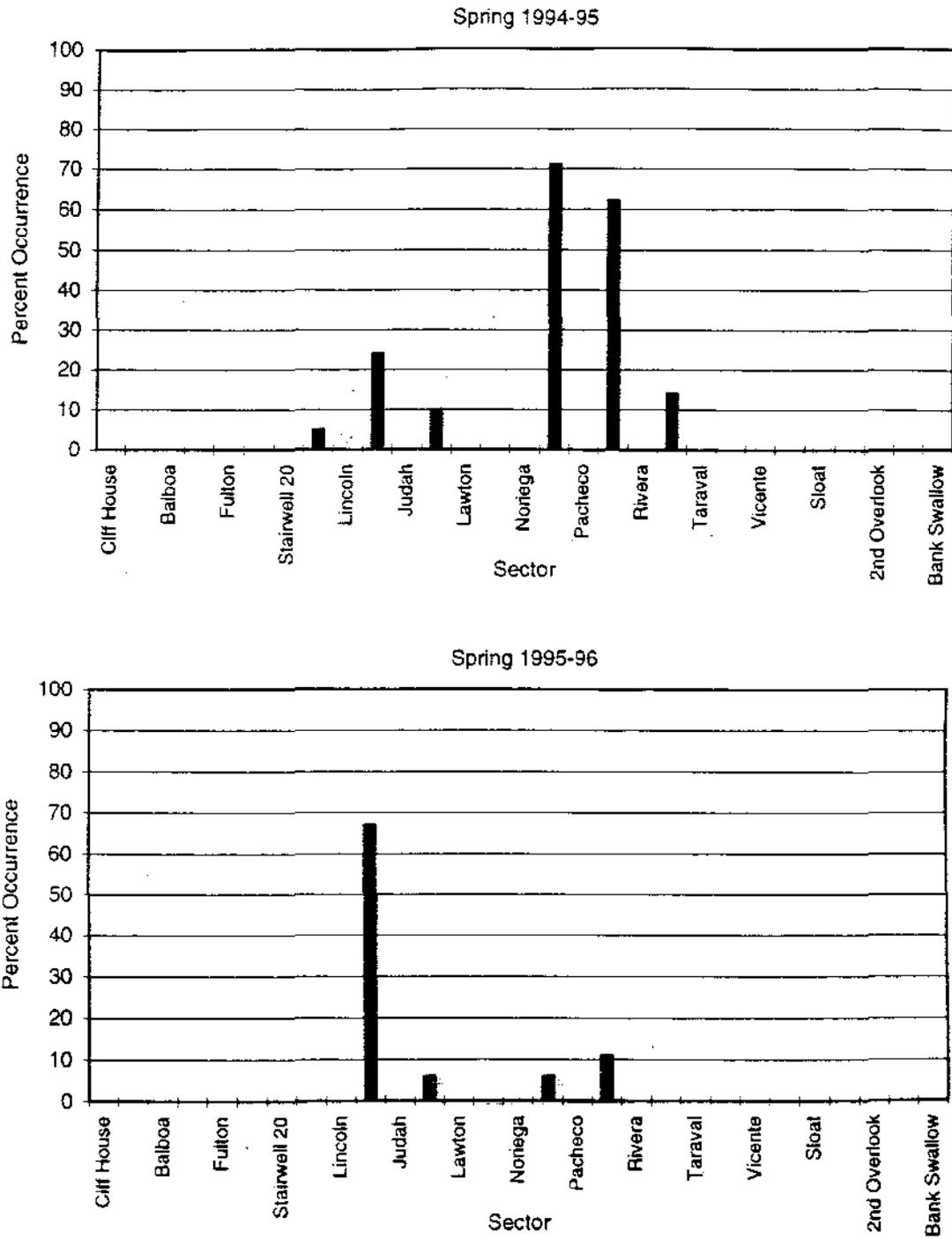


Figure 10. Median and Maximum Numbers of People Encountered on Surveys, by Two-City-Block Sector on Ocean Beach, San Francisco, July 1995 through April 1996, Golden Gate National Recreation Area

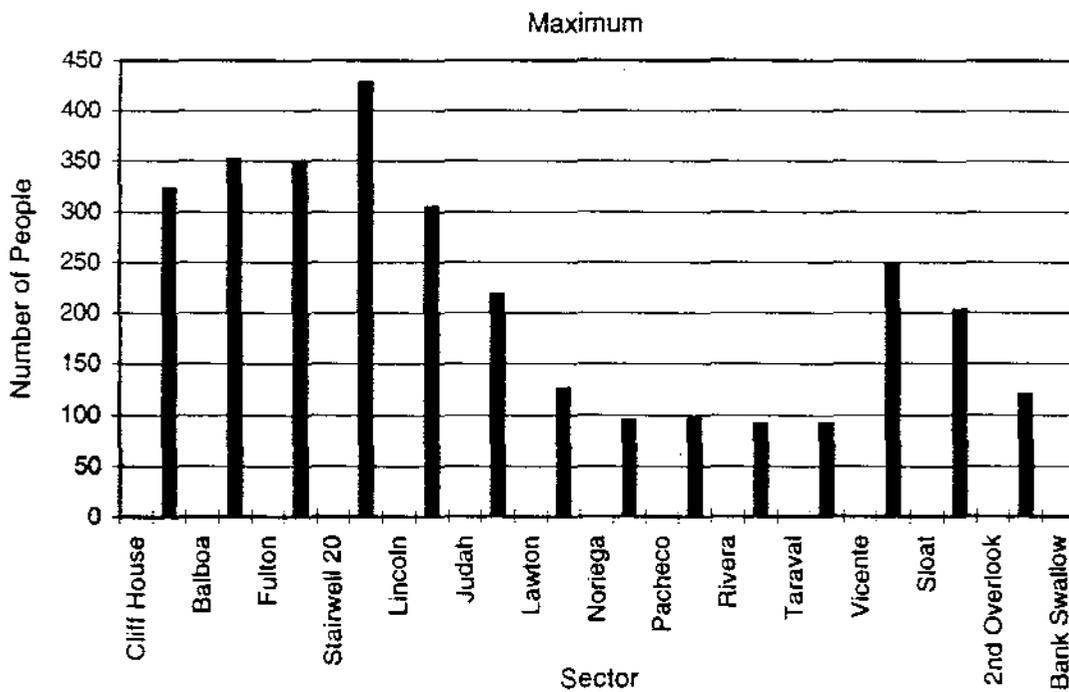
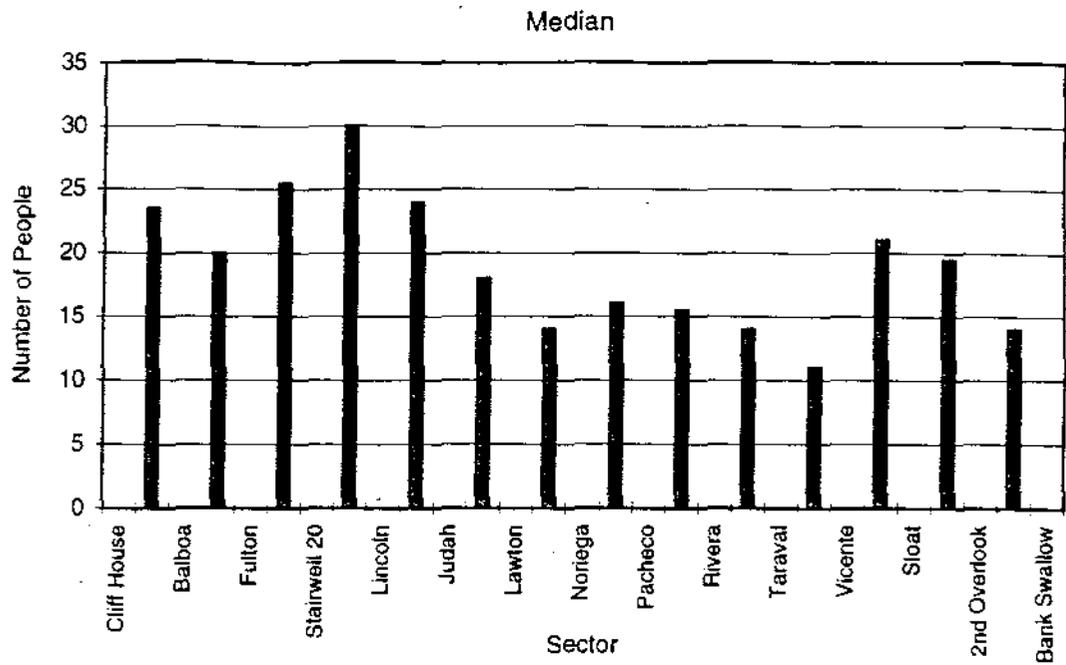


Figure 11. Median and Maximum Number of Dogs Encountered on Surveys, by Two-City-Block Sector on Ocean Beach, San Francisco, July 1995 through April 1996, Golden Gate National Recreation Area

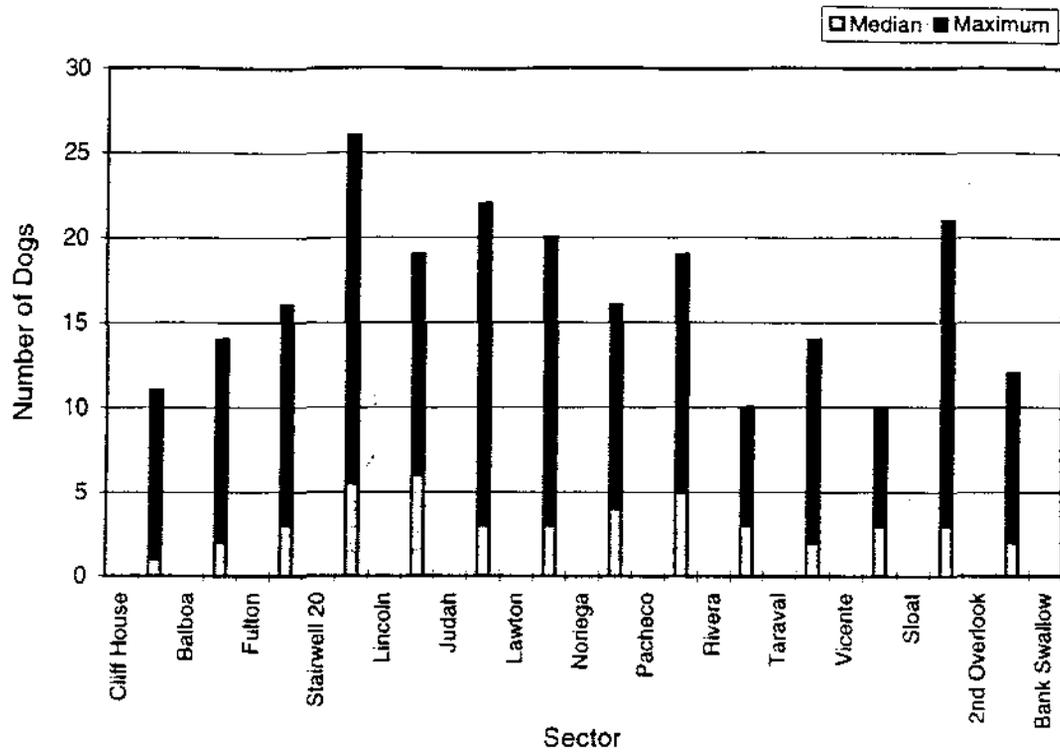


Figure 12. Number of People and Dogs Encountered Per Hour on Weekdays and Weekends on Ocean Beach, July 1995 through April 1996, Golden Gate National Recreation Area

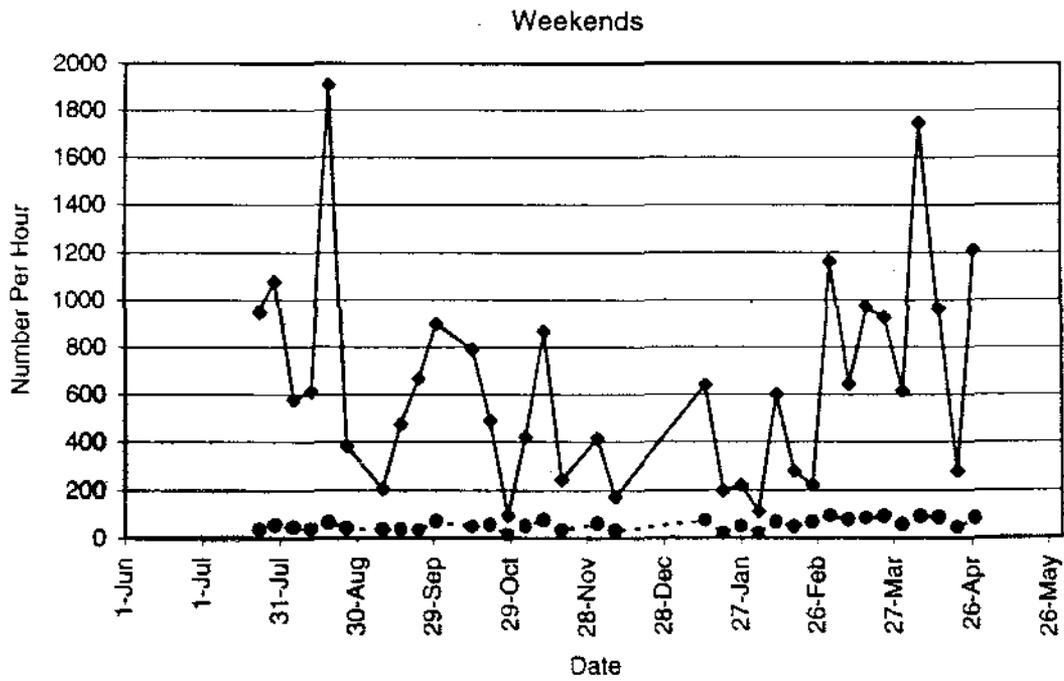
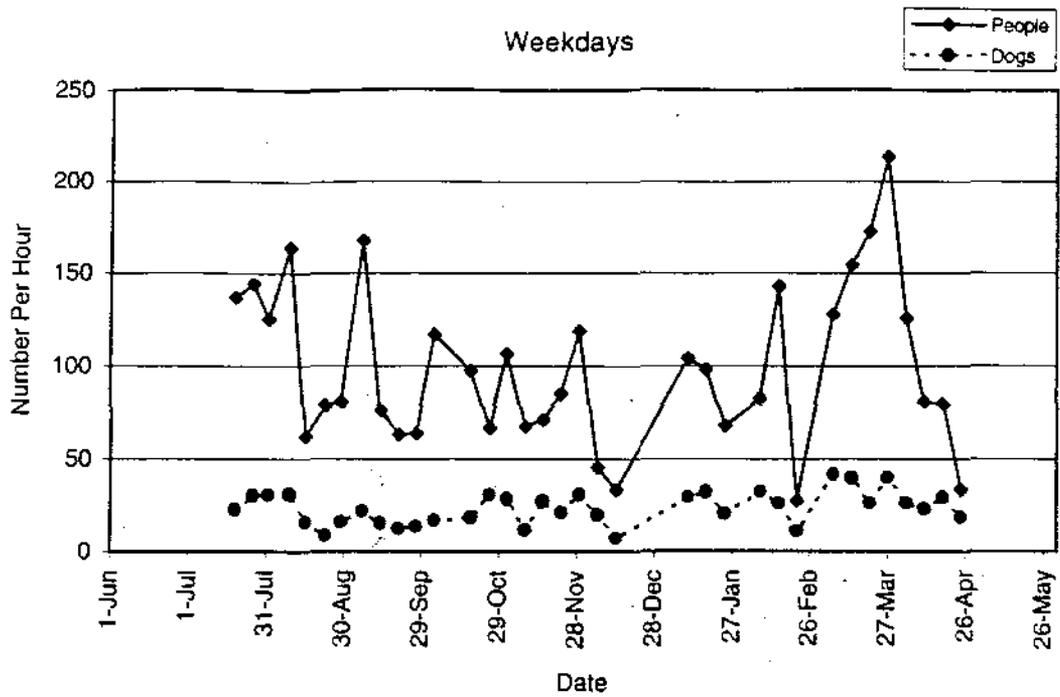


Figure 13. Degree of Dog Control on Ocean Beach, San Francisco, December 1994 through May 1996 ($N=111$), Golden Gate National Recreation Area

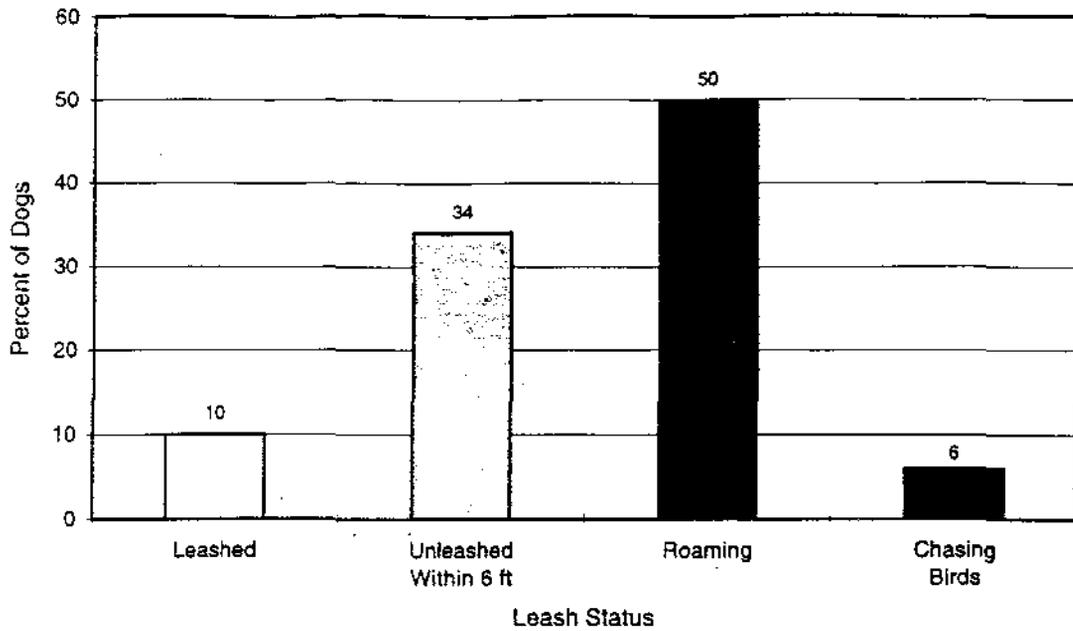
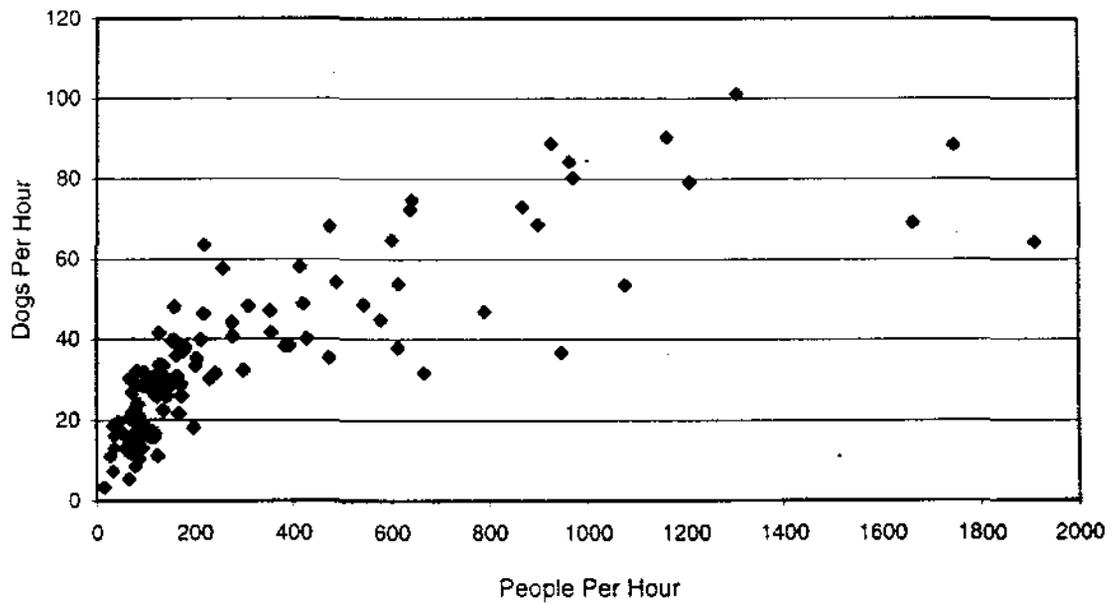


Figure 14. Number of Dogs versus Number of People, Ocean Beach, San Francisco, December 1994 through May 1996, Golden Gate National Recreation Area ($N=111$)



A PARTIAL LISTING OF FEDERAL LAWS HAVING AN INFLUENCE ON WILDLIFE

Wendell G. Swank

Name of the law is followed by Title number, United States Code, and section within that title. [two pages in length]

1. Administrative Procedures Act. 5 U S C 551-576
2. Anadromous Fish Conservation Act. 16 U S C 755-7601
3. Animal Welfare Act. 7 U S C 2131-2155
4. Bald and Golden Eagle Act. 16 U S C 668-668d
5. Budget Act of 1974. 31 U S C 1301-1353
6. Classification and Multiple Use Act. 43 U S C 1411-1418
7. Clean Water Act. 33 U S C 1251-1376
8. Coastal Zone Management Act. 16 U S C 1451-1464
9. Comprehensive Environmental Response, Compensation and Liability Act. 42 U S C 9601-9657
10. Cooperative Wildlife Program (with states) on Public Lands. 16 U S C 670g-670o
11. Endangered Species Act. 16 U S C 1531-1542
12. Environmental Pesticide Control Act. 7 U S C 136-136y
13. Federal Aid in Fish Restoration (Dingell-Johnson) Act. 16 U S C 777-777k
14. Federal Aid in Wildlife Restoration (Pittman-Robertson) Act. 16 U S C 669-669i
15. Federal Land Policy and Management Act. 43 U S C 1701-1782
16. Fish and Wildlife Coordination Act. 16 U S C 661-667
17. Fish and Wildlife Conservation (Non-Game) Act. 16 U S C 2901-2911
18. Fish and Wildlife Service (Agency) Act. 16 U S C 742a-757
19. Fishery Conservation and Management (200 Mile Limit) Act. 16 U S C 1801-1861
20. Forest and Rangeland Renewable Resources Planning Act. 16 U S C 1600-1687
21. Forest Service Organic Administrative Act. 16 U S C 475
22. Intervention On The High Seas (Oil Pollution) Act. 33 U S C 1471-1487
23. Lacey Act. 16 U S C 3371-3378
24. Land and Water Conservation Fund Act. 16 U S C 460 1-4 - 460 1-11
25. Marine Mammal Protection Act. 16 U S C 1361-1362, 1371-1384
26. Marine Protection (Ocean Dumping) Act. 33 U S C 1401-1444
27. Migratory Bird Treaty Act. 16 U S C 701-718
28. Multiple Use Sustained Yield Act. 16 U S C 528-531
29. National Aquaculture Policy, Planning and Development Act. 16 U S C 2801-2840
30. National Environmental Policy Act. 42 U S C 4321-4370a
31. National Park Service Act. 16 U S C 1
32. National Wildlife Refuge System Administration Act. 16 U S C 666 dd-666 jj

33. Rivers and Harbors Act. 33 U S C 401-403
34. Salmon and Steelhead Conservation Act. 16 U S C 3301-3345
35. Submerged Lands Act. 43 U S C 1301-1343
36. Surface Mine Control and Reclamation Act. 30 U S C 1201-1303
37. Taylor Grazing Act. 43 U S C 315-315 g, 315 h-315 n
38. Whaling Convention Act. 16 U S C 916-916 l
39. Wild and Scenic Rivers Act. 16 U S C 1271-1287
40. Wilderness Act. 16 U S C 1131-1136
41. Wild Free-Roaming Horses and Burros Act. 16 U S C 1331-1340