

Waterbird Survey Central San Diego Bay, 1994

Prepared for
U.S. Department of the Navy
Naval Air Station North Island

August 1995

Waterbird Survey Central San Diego Bay, 1994

**Prepared for
U.S. Department of the Navy
Naval Air Station North Island**

**Prepared by
U.S. Department of the Navy
SOUTHWEST Division
Naval Facilities Engineering Command**

**August 1995
Project No. 211601000**

TABLE OF CONTENTS

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
1.0	INTRODUCTION	1
2.0	METHODS	5
2.1	Survey Areas	5
2.2	Survey Protocol	7
2.3	Data Analysis	9
3.0	RESULTS	15
3.1	Species Richness and Survey Counts	15
3.1.1	Target Species	17
3.1.2	Foraging Guilds	26
3.2	Habitat and Spatial Use of Central San Diego Bay	26
3.2.1	All Waterbird Species Combined	26
3.2.2	Target Species	34
3.2.3	Foraging Guilds	46
3.2.4	Eelgrass Abundance and Waterbird Spatial Use	62
3.3	Boat Traffic	65
3.4	Bird Avoidance	66
4.0	DISCUSSION	71
4.1	Species Richness and Survey Counts	71
4.2	Habitat Use, Behavior, and Spatial Use of North and Central San Diego Bay	77
4.3	Boat Traffic and Bird Avoidance	82
5.0	REFERENCES	83
6.0	REPORT PREPARERS	85

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

<u>NUMBER</u>	<u>TITLE</u>	<u>PAGE</u>
1	San Diego Bay and Vicinity 1994 Waterbird Study Area	3
2	Central San Diego Bay Survey Area and Habitat Types	6
3	Mean (\pm SEM) Monthly Species Richness in Central San Diego Bay During 1994	16
4	Mean (\pm SEM) Monthly Abundance of All Waterbird Species in the Central San Diego Bay Study Area	18
5	Mean (\pm SEM) Monthly Abundance of Plunge Diving Foraging Guild and Select Species in the Central San Diego Bay During 1994	19
6	Mean (\pm SEM) Monthly Abundance of Wader/Shallow Water and Prober Forager Guilds in the Central San Diego Bay During 1994	20
7	Mean (\pm SEM) Monthly Abundance of Bottom Feeding and Water Column Foraging Guilds and Select Species in Central San Diego Bay During 1994	21
8	Mean Monthly Abundance of California Brown Pelican Age Classes in Central San Diego Bay During 1994	22
9	Mean Monthly Abundance of Waterbird Foraging Guilds in Central San Diego Bay During 1994	27
10	Relative Habitat Utilization by All Waterbird Species in Central San Diego Bay During 1994	28
11	Relative Habitat Utilization by All Waterbird Species While Foraging (a) and Resting (b) in Central San Diego Bay During 1994	30
12	Spatial Use of Central San Diego Bay by All Waterbird Species During 1994	31
13	Spatial Use of Central San Diego Bay by All Waterbird Species Foraging During 1994	32
14	Spatial Use of Central San Diego Bay by All Waterbird Species Resting on Water During 1994	33
15	Spatial Use of Central San Diego Bay by All Waterbird Species on Shore During 1994	35
16	Spatial Use of Central San Diego Bay by All Waterbird Species Roosting on Structures During 1994	36
17	Relative Habitat Utilization by Foraging (a) and Resting (b) California Brown Pelicans in Central San Diego Bay During 1994	37
18	Spatial Use of Central San Diego Bay by Brown Pelicans During 1994	39

TABLE OF CONTENTS (Continued)

LIST OF FIGURES (Continued)

<u>NUMBER</u>	<u>TITLE</u>	<u>PAGE</u>
19	Relative Habitat Utilization by Foraging (a) and Resting (b) California Least Terns in Central San Diego Bay During 1994	40
20	Spatial Use of Central San Diego Bay by California Least Terns During 1994	41
21	Relative Habitat Utilization by Foraging (a) and Resting (b) Elegant Terns in Central San Diego Bay During 1994	43
22	Spatial Use of Central San Diego Bay by Elegant Terns During 1994	44
23	Relative Habitat Utilization by Foraging (a) and Resting (b) Scaup Species in Central San Diego Bay During 1994	45
24	Spatial Use of Central San Diego Bay by Lesser and Greater Scaup During 1994	47
25	Relative Habitat Utilization by Foraging (a) and Resting (b) Surf Scoters in Central San Diego Bay During 1994	48
26	Spatial Use of Central San Diego Bay by Surf Scoters During 1994	49
27	Relative Habitat Utilization by Foraging (a) and Resting (b) 1 Wader/Shallow Water Foraging Guild in Central San Diego Bay During 1994	50
28	Spatial Use of Central San Diego Bay by Wader Shallow Water Foraging Guild During 1994	51
29	Relative Habitat Utilization by Foraging (a) and Resting (b) Prober Foraging Guild in Central San Diego Bay During 1994	53
30	Spatial Use of Central San Diego Bay by Prober Foraging Guild During 1994	54
31	Relative Habitat Utilization by Foraging (a) and Resting (b) Bottom Feeding Foraging Guild in Central San Diego Bay During 1994	55
32	Spatial Use of Central San Diego Bay by the Bottom Feeding Foraging Guild During 1994	56
33	Relative Habitat Utilization by Foraging (a) and Resting (b) Water Column Diving Guild in Central San Diego Bay During 1994	58
34	Spatial Use of Central San Diego Bay by the Water Column Diving Foraging Guild During 1994	59
35	Relative Habitat Utilization by Foraging (a) and Resting (b) Plunge Diving Foraging Guild in Central San Diego Bay During 1994	60

TABLE OF CONTENTS (Continued)

LIST OF FIGURES (Continued)

<u>NUMBER</u>	<u>TITLE</u>	<u>PAGE</u>
36	Spatial Use of Central San Diego Bay by the Plunge Diving Foraging Guild During 1994	61
37	Relative Habitat Utilization by Foraging (a) and Resting (b) Generalist Foraging Guild in Central San Diego Bay During 1994	63
38	Spatial Use of Central San Diego Bay by the Generalist Foraging Guild During 1994	64
39	Eelgrass Distribution and High Use Areas by Foraging Least Terns in North and Central San Diego Bay	65
40	Relative Levels of Boat Traffic in North and Central San Diego Bay	69
41	Percent Composition of Central San Diego Bay Waterbird Assemblage Documented by (a) USFWS in 1993-94 and (b) Ogden in 1994	72
42	Percent Composition of Waterbird Assemblage in (a) North, (b) Central, and (c) South San Diego Bay During 1993 and 1994	76

LIST OF TABLES

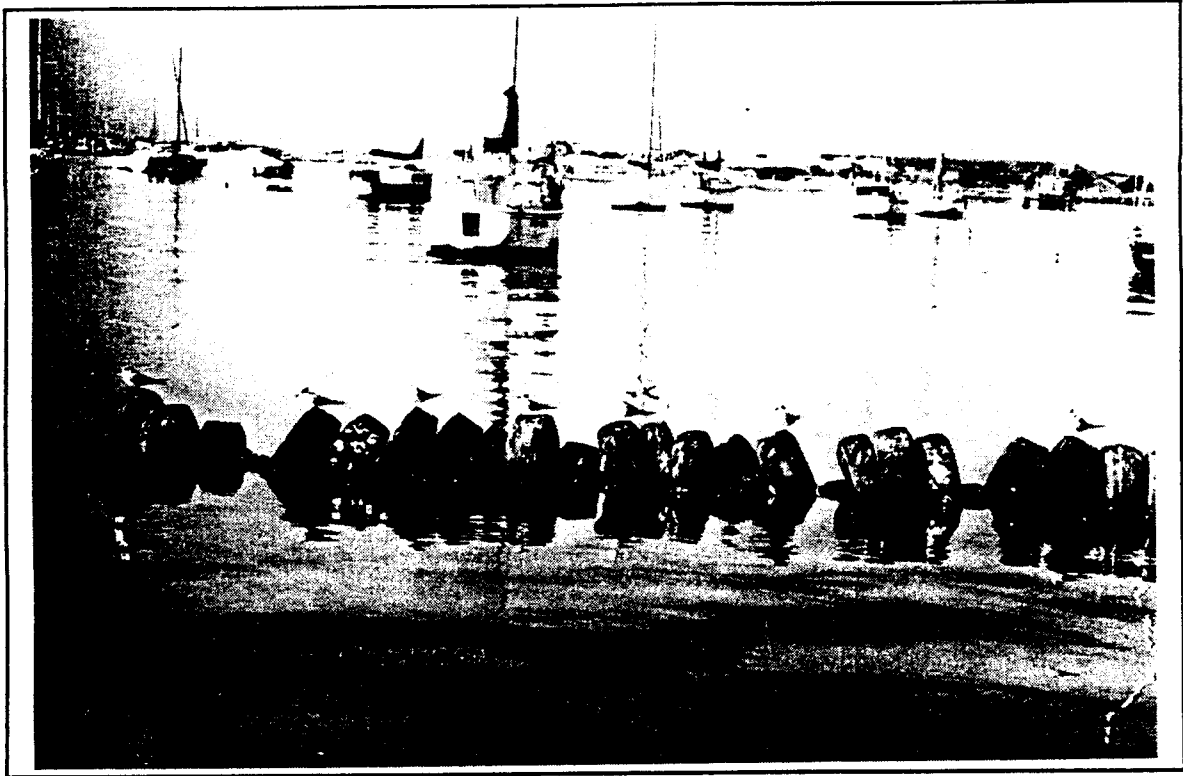
<u>NUMBER</u>	<u>TITLE</u>	<u>PAGE</u>
1	Cumulative Counts of 26 Most Abundant Waterbird Species Observed in Central San Diego Bay in 1994	23
2	Proportion of Waterbirds Sampled Avoiding Survey Boat by Distance Category	66
3	Comparison of Indices of Waterbird Species Evenness, Richness, and Diversity for Three Areas of San Diego Bay	78
4	Significant Habitat Preferences for Waterbird Foraging Guilds in North and Central San Diego Bay	79
5	Comparison of Behaviors of Target Waterbird Species and Foraging Guilds in North San Diego Bay During 1993 and Central San Diego Bay During 1994	80

TABLE OF CONTENTS (Continued)

LIST OF APPENDICES

<u>LETTER</u>	<u>TITLE</u>	<u>PAGE</u>
A	Waterbird Species Observed at Central San Diego Bay in 1994	A-1
B	Central San Diego Bay Waterbird Study Species Accounts	B-1
C	Cumulative Totals by Species for Three Waterbird Survey Areas in San Diego Bay	C-1

This Page Intentionally Left Blank



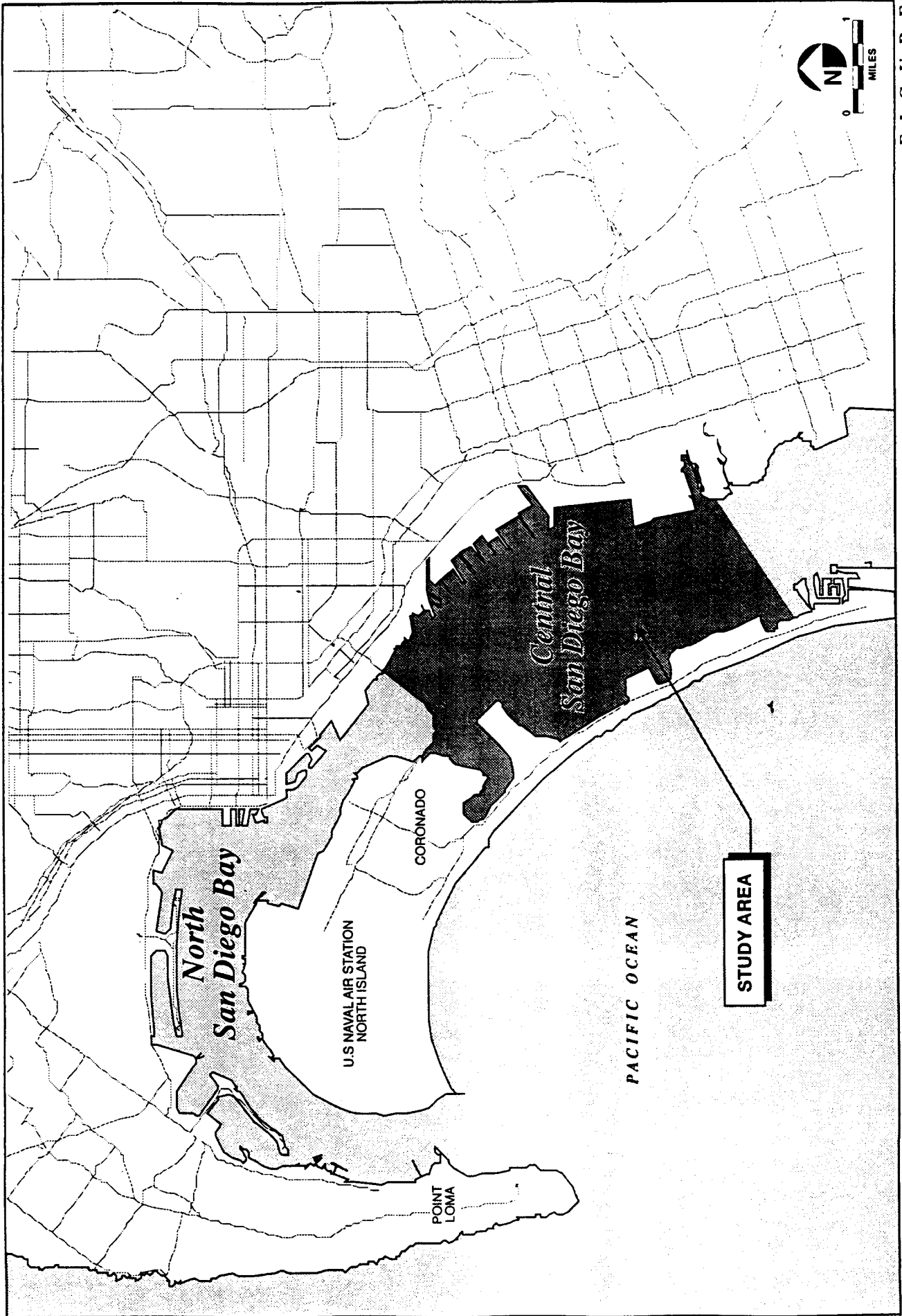
1.0 INTRODUCTION

Coastal bays provide important resources for wintering and breeding waterbirds. Wintering waterbirds that breed far to the north constitute the majority of species and abundance of birds that use the Southern California coast (Briggs et al. 1987). A very different assemblage of waterbird species occurs in San Diego Bay during the spring and summer. Both wintering and nesting waterbirds vary their spatial and temporal use of the Bay due to the dynamic movements of prey resources, such as schools of small fish. Other resources are more stable and are often restricted in distribution, such as roosting and nesting areas. Daily and seasonal factors can affect the distribution and composition of the waterbird community of an area. As a result of these factors, waterbird abundance and distribution at San Diego Bay is highly variable in time and space. This study of Central San Diego Bay has been designed to take into account this temporal and spatial heterogeneity and to be comparable to the survey data collected for North San Diego Bay (Ogden 1994).

In 1993 the Navy began a study of waterbird abundance and patterns of habitat and spatial use in North and Central San Diego Bay (Figure 1). North Bay was surveyed four times a month from January through December 1993 and Central Bay was surveyed once a month (Ogden 1994). The 1993 North Bay study was designed to provide a comprehensive survey of sensitive migratory waterbird species occurring in North San Diego Bay. This information provides a database to allow the Navy to assess potential impacts of future projects that involve dredging, shipping channel maintenance, shoreline construction, and boat traffic in the Bay. In 1994, the study of Central San Diego Bay intensified to four surveys each month to be comparable with the North Bay survey effort. The U.S. Fish and Wildlife Service (USFWS) recently reported the results of waterbird surveys of Central and South San Diego Bay conducted during 1993-1994 (Manning 1995). These 1993 and 1994 survey efforts provide an extensive database to comprehensively evaluate waterbird use of San Diego Bay. For a review of previous studies in San Diego Bay and a discussion of the regional biogeography of the area refer to Ogden (1994) and Macdonald et al (1990a and 1990b).

This report documents the results of the 1994 waterbird study of Central San Diego Bay. Data on boat traffic and bird avoidance in the Bay was also collected in 1993 and 1994 and are reported here. Information on eelgrass distribution was provided by Navy Southwest Division (M. Perdue pers. comm.) and used for an analysis of potential waterbird preference for eelgrass dominated areas.

Waterbirds are defined as those bird species dependent on water-associated areas for roosting, nesting, and foraging and includes the water surface, natural shoreline, docks, piers, jetties, and vessels found within the study area. Waterbirds do not include upland species found at the bay, such as rock doves (*Columba livia*), European starling (*Sturnus vulgaris*), house finch (*Carpodacus mexicanus*), and house sparrow (*Passer domesticus*).



FIGURE

1

San Diego Bay and Vicinity
1994 Waterbird Study Area

This Page Intentionally Left Blank

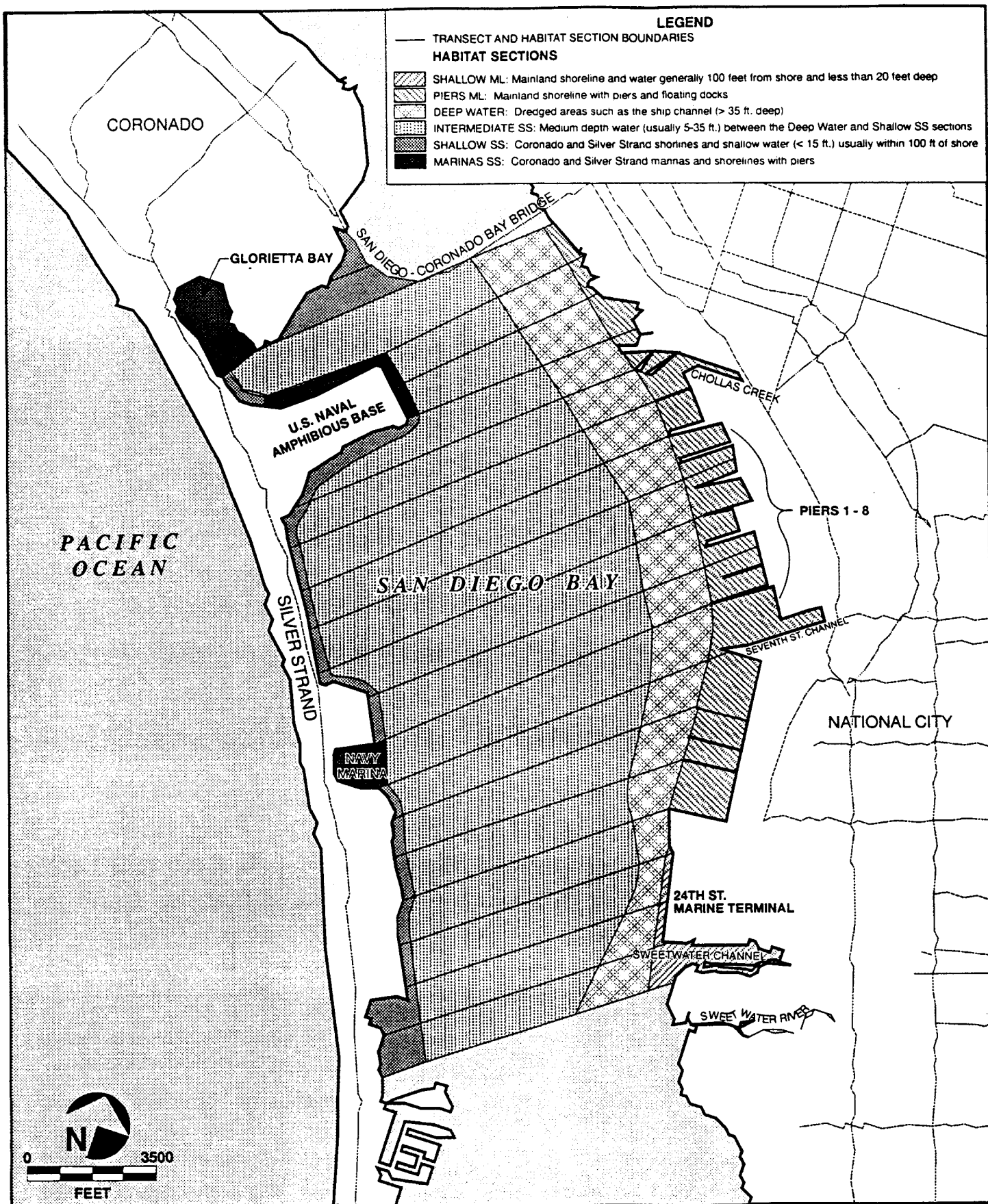


2.0 METHODS

2.1 SURVEY AREA

This study surveyed for waterbird species in Central San Diego Bay during 1994. The Central Bay survey area extended south from the Coronado Bridge to the southern side of the Sweetwater River Channel, along the northern shore of Sweetwater Marsh and to an area of the Silver Strand north of Crown Isle (Figure 2). Central San Diego Bay encompassed 4,298 acres of water and shoreline habitat. During 1993, a similar study was conducted in North San Diego Bay with a reduced survey effort for Central San Diego Bay (Ogden 1994). The 1993 study area did not include the southern most transect surveyed in 1994.

The study area was divided into approximately 1000-foot wide transects, which were subdivided into 4 cells defined by water depth (Figure 2). The Shallow Mainland (ML)



Central San Diego Bay Survey Area and Habitat Types

FIGURE

2

section included the mainland shoreline and water surface within 100 feet of shore. This habitat type is a small proportion (1.4 percent) of the study area located in the southern end of the survey area. This section also encompasses the Sweetwater River Channel and the northern shore of the Sweetwater Marsh. Water depth in the Shallow ML is typically less than 10 feet deep except for the Sweetwater River Channel, which is dredged to 35 feet deep.

The Piers ML section is the predominant shoreline habitat type along the mainland side of the survey area, encompassing 10.5 percent of the study area. This habitat type is 20 to 35 feet deep and is maintained by dredging. The Piers ML section is dominated by Navy and commercial piers, docks, drydocks, and buildings with little undeveloped shoreline. The Deep Water section is the dredged shipping channel adjacent to the Piers ML section and is 30 to 40 feet deep, encompassing about 14.6 percent of the study area. The Intermediate Silver Strand (SS) section extends from the shipping channel west to approximately 100 feet from the Silver Strand shoreline. The Intermediate SS section is a wide expanse of water that varies from 5 to 30 feet in depth with 10 feet being a typical depth. The Intermediate SS section is the largest portion of Central Bay (64.1 percent).

The Shallow SS habitat is the shoreline and water 100 feet from shore from south of Coronado to north of Crown Isle on the Silver Strand. This section encompasses 6.2 percent of the study area and includes shoreline water less than 10 feet deep. Shoreline survey areas included areas along the water's edge that were easily visible from the boat, such as tidal mudflats, dirt embankments, sandy beaches, jetties, and rip-rap. Shoreline areas visible from the boat between the water and the top of adjacent seawall or to the closest manmade structures (e.g., roads, homes, buildings) or landscaped area (e.g., yards, parks) are included in this section. The Marinas SS section includes shoreline dominated by marinas and piers on the Coronado and Silver Strand side of Central Bay. Water depth in the Marina SS section ranged from 10 to 20 feet deep. Marina SS encompasses about 3.1 percent of the study area.

2.2 SURVEY PROTOCOL

Waterbird surveys in Central Bay were conducted four times each month from January 1, 1994 to December 31, 1994. Surveys were conducted from a 23-foot boat. The driver was responsible for following predetermined transect lines, relaying transect and section information, and recording weather conditions. An observer searched for and identified

birds and determined their behaviors. A recorder compiled the waterbird locations and behaviors, boat traffic, and bird avoidance data onto standard field forms.

Routes for the Central Bay surveys were along the edges of 1000 foot wide shore-to-shore transects (Figure 2). The driver followed a straight line from shore to shore using pre-established landmarks and compass readings to maintain course and keep on the northern boundary of the transect. At approximately 150 feet from the end of a transect, the driver turned and traveled parallel to the shore to the beginning of the next transect. A speed of 5 to 15 miles per hour was maintained through sections that had few birds. The boat was stopped when necessary to identify or count large flocks of birds in the transect. Data were collected as quickly as possible for each cell, but there was no limit to the time spent counting birds in each cell. For cells with large numbers of birds, especially cells with surf scoters, more than five minutes were required to count birds. When large numbers of birds were encountered in a cell, the number of birds in the adjacent cells were quickly estimated. These numbers were used to minimize double counting in subsequent cells. The movements of birds in and out of a cell during a count were monitored to minimize double counting. Once a species was fully counted within a cell of the transect, subsequent individuals of that species entering the cell were not counted. There were 18 shore-to-shore transects and two partial transects totaling 90 cells, including boat basins and harbors.

The same route was followed in a north to south direction for each survey. The starting point was alternated between two locations so that transects were counted at different times of the day during each month. Surveys typically began within an hour after sunrise, except when fog limited visibility. On days of dense fog, surveys began as soon as it was possible to identify birds over 1000 feet from the boat.

The entire width of the transect was surveyed on each crossing. Each of the 18 North Bay shore-to-shore transects was divided into four sections as describe above (Figure 2). Since the Intermediate SS section was especially large, it was subdivided into two sections for data recording. There were also two partial transects between Coronado Bridge and the Coronado Shoreline at the north end of the survey area. These partial transects were categorized as one habitat section. Marinas were recorded as single survey cells.

Each observation included the following information: transect, section, species, time of observation, number of individuals, and behavior. Behaviors were categorized as foraging

or resting on water, roosting on structure, or occurring on shore. Waterbirds were identified to species level, except for most gulls and shorebirds. Gull and shorebird observations were recorded and analyzed as gull spp. and prober categories, respectively. Exceptions to these two lumped species groups were western snowy plover (*Charadrius alexandrinus nivosus*), Bonaparte's gull (*Larus philadelphia*), and Heermann's gull (*Larus heermanni*), which were recorded at the species level. A species list of all identifiable shorebirds and gulls was maintained for each survey. The two scaup species were recorded as scaup spp. since there was insufficient time to accurately distinguish all individuals to species level. Birds flying overhead but not exhibiting foraging behavior were not counted unless they were rare sensitive species, such as least tern or peregrine falcon. The age class of brown pelican (adult, subadult, and juvenile) and peregrine falcon (adult and subadult) were also noted. Age classes were defined using the Humphrey and Parkes (1959) method.

Information on boat traffic was recorded for 30 seconds at the beginning of each transect and included the type and number of boats within each section of the transect. Anecdotal observations of birds avoidance of boats was also recorded, including species, type of avoidance behavior (fly, swim, dive), distance from the boat when the avoidance behavior was initiated, and type and relative speed of boat causing the avoidance behavior. Distance and speed data were grouped into broad categories due to the difficulty in obtaining accurate estimates for these two variables. Gathering information on boat traffic and bird avoidance behavior was a secondary objective of the study and was done only when time permitted.

Weather conditions were recorded at the start of the survey, every fifth transect thereafter, and in all basins and harbors. Weather variables included air and water temperature, wind direction, wind speed and wave characteristics (Beaufort scale), percent cloud cover, and general visibility.

2.3 DATA ANALYSIS

All observation data were entered into computer spreadsheets and later imported into relational database, statistical, and graphics programs for data reduction, summarization and presentation. The study area and survey cell boundaries were digitized into a Geographical Information System to produce figures showing spatial use of the study area and to calculate the size of survey cell. Data were analyzed in three ways: by grouping all

observations of waterbirds into an "all waterbirds" summary; analyzing selected sensitive target species individually; and by grouping waterbird species into guilds based on foraging behavior.

Target species were selected based on their federal sensitivity status or due to concerns expressed by the United States Fish and Wildlife Service (M. Kinney pers. comm.) in regard to their status in San Diego Bay. Target species included California brown pelican (*Pelecanus occidentalis californicus*), brant (*Branta bernicla*), lesser scaup (*Aythya affinis*), greater scaup (*Aythya marilla*), surf scoter (*Melanitta perspicillata*), American peregrine falcon (*Falco peregrinus anatum*); western snowy plover, elegant tern (*Sterna elegans*), and California least tern (*Sterna antillarum browni*).

The listing of species assigned to each foraging guild is provided in Appendix A. Foraging guilds were characterized as follows:

The *wader/shallow water* guild includes birds that use the intertidal zone and forage for invertebrates, fish, and other small vertebrates. The wader guild includes mainly egrets and herons.

The *prober* guild is characterized by birds (primarily shorebirds) that probe with their bills in the substrate for invertebrates on exposed sandy beaches and tidal mudflats.

Bottom feeders dive underwater and forage on the bottom substrate for invertebrates and submerged vegetation. The bottom feeding guild includes brant, surf scoter, bufflehead (*Bucephala albeola*), and scaup species.

The *water column diver* guild is composed of loons, cormorants, and grebes that dive under the surface of the water to various depths and forage primarily on fish.

Members of the *plunge diver* guild search for fish while flying and dive to just below the surface to capture their prey. The plunge diving guild includes brown pelican, osprey (*Pandion haliaetus*), and tern species.

The *predator* guild is represented by peregrine falcon, and northern harrier (*Circus cyaneus*) which often prey upon waterbirds.

The generalist guild includes gull species, mallards (*Anas platyrhynchos*), and American coots (*Fulica americana*), which use a wide variety of food sources and employ various foraging techniques on shore and in the water. Other dabbling duck species were classified in this group as they often forage similar to mallards.

Analyses of habitat preferences were performed for all waterbird species combined, individual target species, and foraging guilds. The combined waterbird data set was analyzed using the following categories: all behaviors combined, foraging, and resting. Resting was the combination of resting on water, structure, and shore. Foraging and resting habitat use were examined for target species and guilds. The proportion of birds within each habitat type were calculated for the selected behavior type (all behaviors, resting, and foraging). These proportions were compared to the relative availability of each habitat type in the Central Bay study area. Positive or negative preferences for each habitat type were determined using the Neu test (Neu et al. 1974, Hanley and Solow 1992). An alpha value of $p \leq 0.05$ was assumed to be statistically significant.

To analyze the spatial use of waterbirds on Central San Diego Bay in 1994, a relative use index and ranking system was developed to identify the importance of different areas. This analysis were done in same manner as for the 1993 North Bay analysis (Ogden 1994). Methods of analysis of spatial use varied slightly for the "all waterbirds" group compared with analyses for target species and guilds. For each comparison, a density was calculated for each survey cell by dividing the cumulative number of observations within the cell by the area of that cell. Cells were then indexed and ranked.

Spatial analyses were performed separately, by behavior, for the "all waterbirds" group. Behavior categories analyzed included: all behaviors, foraging, resting, on structure, and on shore. Cumulative totals for each cell were compiled by behavior category for all waterbirds and densities were calculated. Cells were indexed to assign a relative value to each cell for each behavior. All cell densities were divided by the indexing cell density to assign index values. For the all waterbird analyses, the highest density cell for each behavior was initially evaluated for use as the indexing cell. In some cases, the highest one or two density cells were outliers being more than 30 percent greater than the next highest density cell. If these outliers were used as indexing cells, other cells would be unrealistically devalued. In these cases, the indexing cell was chosen so that 10 to 15 percent of cells would be ranked as high to very high in value. Typically this resulted

in the highest or second highest density cell being approximately two times greater than the indexing cell. After indexing, each cell was ranked for its relative value for each type of behavior category. The standardized ranking scheme presented below was used to rank cells for each analysis.

To determine spatial use by target species and guilds similar analyses were used. However, cell index values were based on the total density of birds (for all behaviors combined). The cell with the highest density at which foraging was the predominant activity (>50 percent of observations) was chosen as the indexing cell. This indexing ensured that important foraging areas were included in the very high value category. Without considering foraging, cells could be undervalued due to one or a few cells with very high densities of roosting birds. If the highest density cell with foraging the dominant activity were either the highest or second highest density cell, then the indexing system used above for the all waterbird analyses was adopted. If the highest density cell with foraging a dominant activity were in the lower 60 percent of cell densities, then the all waterbird method of determining the index cell was also used.

The following standardized ranking scheme was formulated to categorize the relative value of each indexed cell for waterbird spatial use:

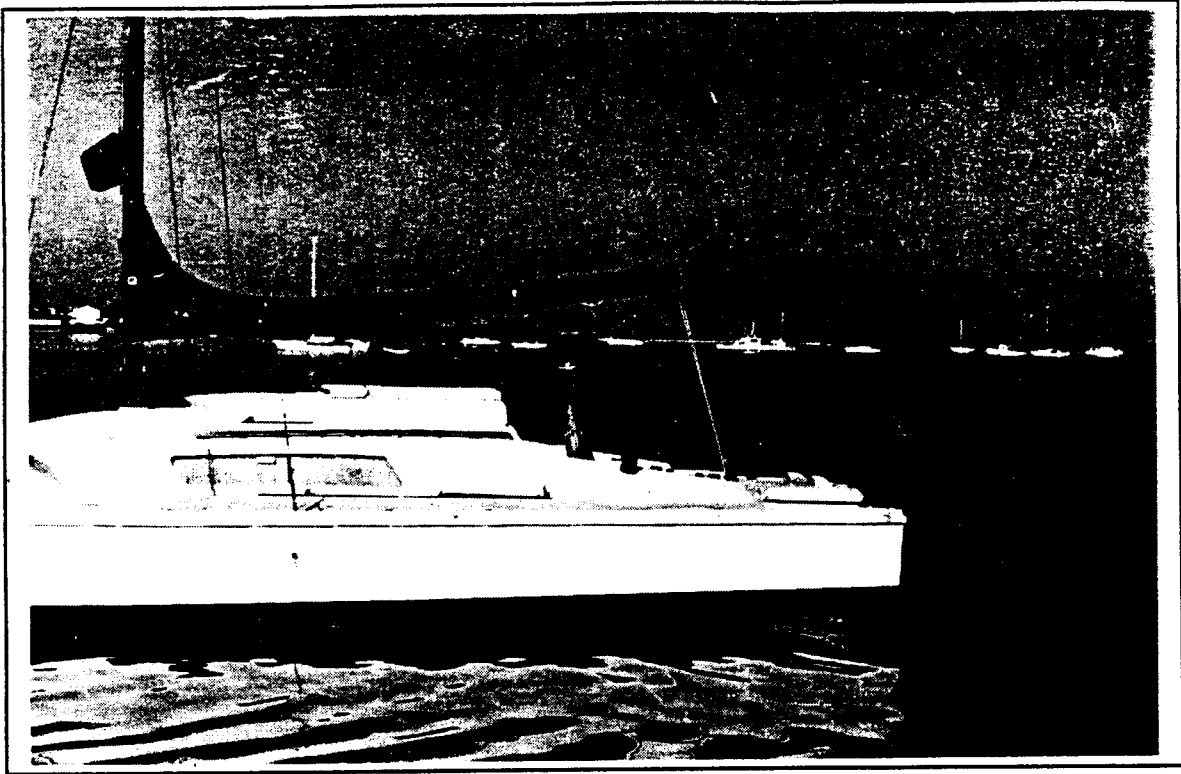
<u>Density Index Value</u>	<u>Relative Waterbird Use</u>
greater than 0.75	Very High
0.51 to 0.75	High
0.26 to 0.50	Medium
less than 0.25	Low
Zero	No Use

Boat traffic data for North Bay (1993) and Central Bay (1994) were analyzed in a similar manner. The cumulative number of boats observed in each cell was divided by the area of that cell to determine a boat density for each cell. An indexing cell was chosen that was approximately one-half the density of the highest density cell. All cell densities were then divided by this indexing cell and ranked. The ranking scheme used above for analyzing waterbird spatial use of the Bay was used for ranking the relative level of boat traffic for each cell. Relative boat traffic cell values were compared with the spatial use of San Diego Bay by all waterbirds.

Eelgrass distribution data provided by the Navy in a Geographical Information Systems (GIS) database was evaluated relative to least tern and the plunge diver foraging areas. The eelgrass database was overlaid with the transect and sections defining cells in the North and Central San Diego Bay study areas. The two analyses involved calculating foraging densities for least tern and the plunge divers for all cells in North and Central Bay. These foraging densities were then indexed and ranked according to the all waterbird group method of indexing cells (see above). The number of cells within different categories of percent eelgrass cover were then calculated for each relative habitat value category for both least terns and plunge divers.

Bird avoidance data were analyzed for species with over 30 recorded incidences of avoiding the survey boat. This data set was opportunistically collected when feasible in both the 1993 and 1994 studies. The percentage of avoidance, by species, was calculated for distance categories where the avoid was initiated at less than 10 feet, 10 to 100 feet and greater than 100 feet from the boat. Since there were insufficient data on bird avoidance from other types of boats (due to difficulty in collecting this data), only data on avoidance caused by our survey boat were analyzed.

This Page Intentionally Left Blank

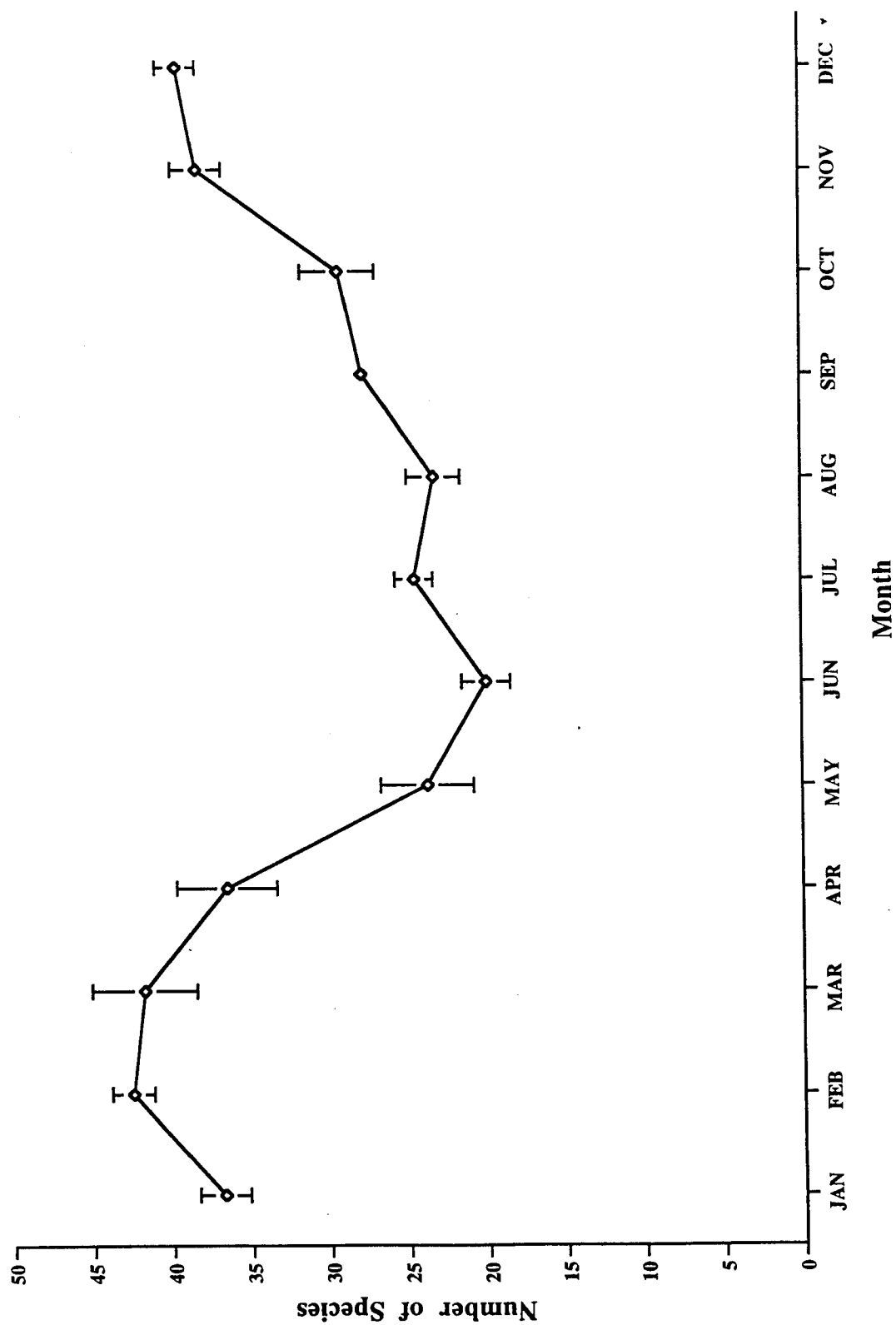


3.0 RESULTS

3.1 SPECIES RICHNESS AND SURVEY COUNTS

Ogden conducted 48 surveys of Central San Diego Bay between January 1, 1994 and December 31, 1994. A single survey on June 6, 1994 was terminated at the midpoint because of boat malfunction, otherwise the study area was completely surveyed 47 times. On December 20, 1994, fog in the early afternoon required that the survey effort be completed the following day. In 1994, Ogden spent 290 team hours in actual data collection at Central Bay.

A total of 70 waterbird species were observed in Central Bay during the 1994 study (Appendix A). Species richness (i.e., the number of waterbird species) peaked in early March with 49 species observed. The average number of species observed per month was highest in late fall/early winter and in late winter/early spring (Figure 3). These peaks correspond to periods of waterbird migration. Species richness was lowest in the summer



FIGURE

Mean (\pm SEM) Monthly Species Richness in Central San Diego Bay During 1994

3

months, with a low of 17 species observed in early June. Species Accounts provided in Appendix B characterize each waterbird species in regard to their sensitivity status, regional distribution, residency status, relative abundance, foraging guild, preferred habitats, and high use areas in Central San Diego Bay.

Highest mean monthly waterbird counts for Central Bay occurred from November through February, with a peak in December (12,116 individuals/survey; Figure 4). The lowest waterbird counts were in May and June (<500 individuals/survey). Total counts for individual Central Bay surveys ranged from 307 birds (first week of May) to 13,676 birds (third week of December).

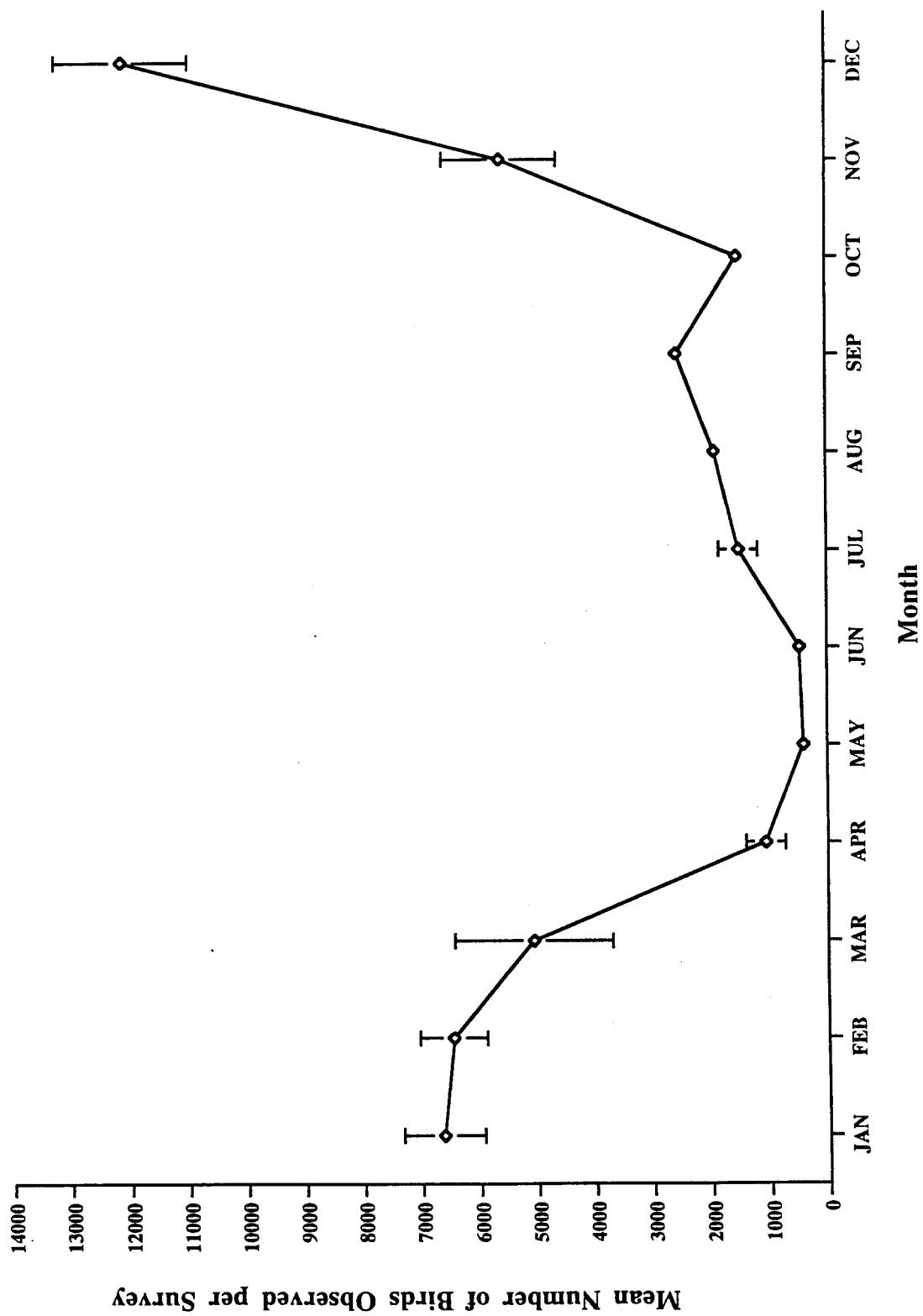
Mean monthly counts of target species and guilds are presented in Figures 5, 6, and 7. Table 1 shows cumulative counts and ranks the 25 most abundant waterbird species in Central San Diego Bay in 1994. Surf scoter was the most abundant species in Central Bay with over 78,000 cumulative observations in 1994. Scaup species and bufflehead were second and third in abundance. Gulls, with the exceptions of Bonaparte's and Heermann's gulls, and shorebird species are not included in these cumulative counts as data were not collected to species level for most gulls and shorebirds.

3.1.1 Target Species

California Brown Pelican

California brown pelican was the sixth most abundant species in Central San Diego Bay (Table 1), reaching highest population levels from July through November 1994 (Figure 5). Brown pelicans ranked lower in Central Bay during 1994 than they did for Central Bay in 1993. In 1993, brown pelicans were the third most abundant species observed in the twelve monthly surveys (Ogden 1994). Dividing brown pelican cumulative counts for both years by the number of surveys per year, to get survey averages for 1993 and 1994, shows brown pelican numbers in 1993 were 75 percent higher than in 1994.

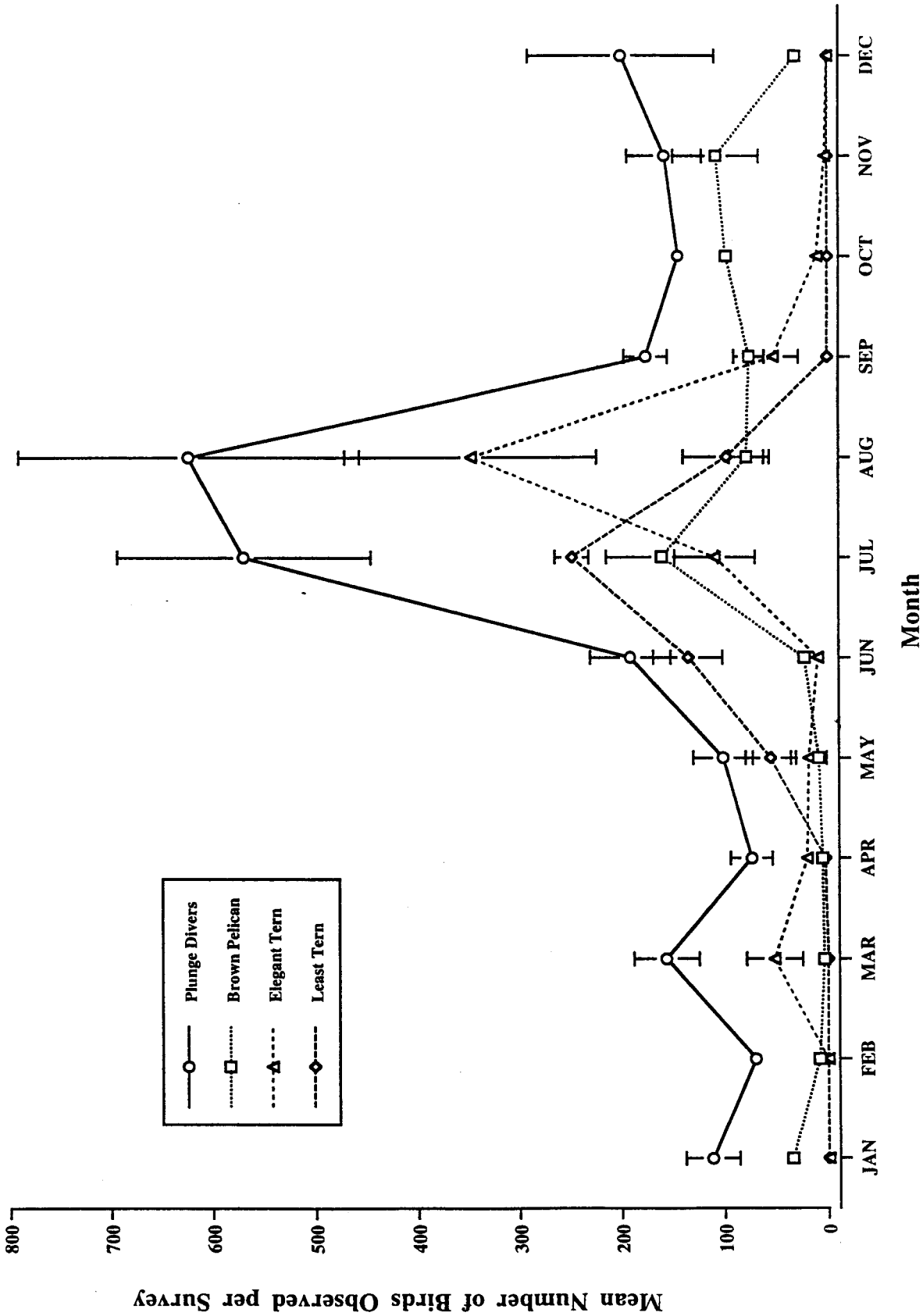
Brown pelican age class structure in Central Bay varied dramatically over the year long study (Figure 8). The adult age class made up 39.8 percent of the 2,512 age confirmed pelican sightings. The subadult age class was second most numerous (36.9 percent) followed by the juveniles (23.3 percent). Adults were most abundant September through December and seldom seen in July and August. Subadults were most abundant in July, remaining fairly numerous through August and September. Outside of these three months



FIGURE

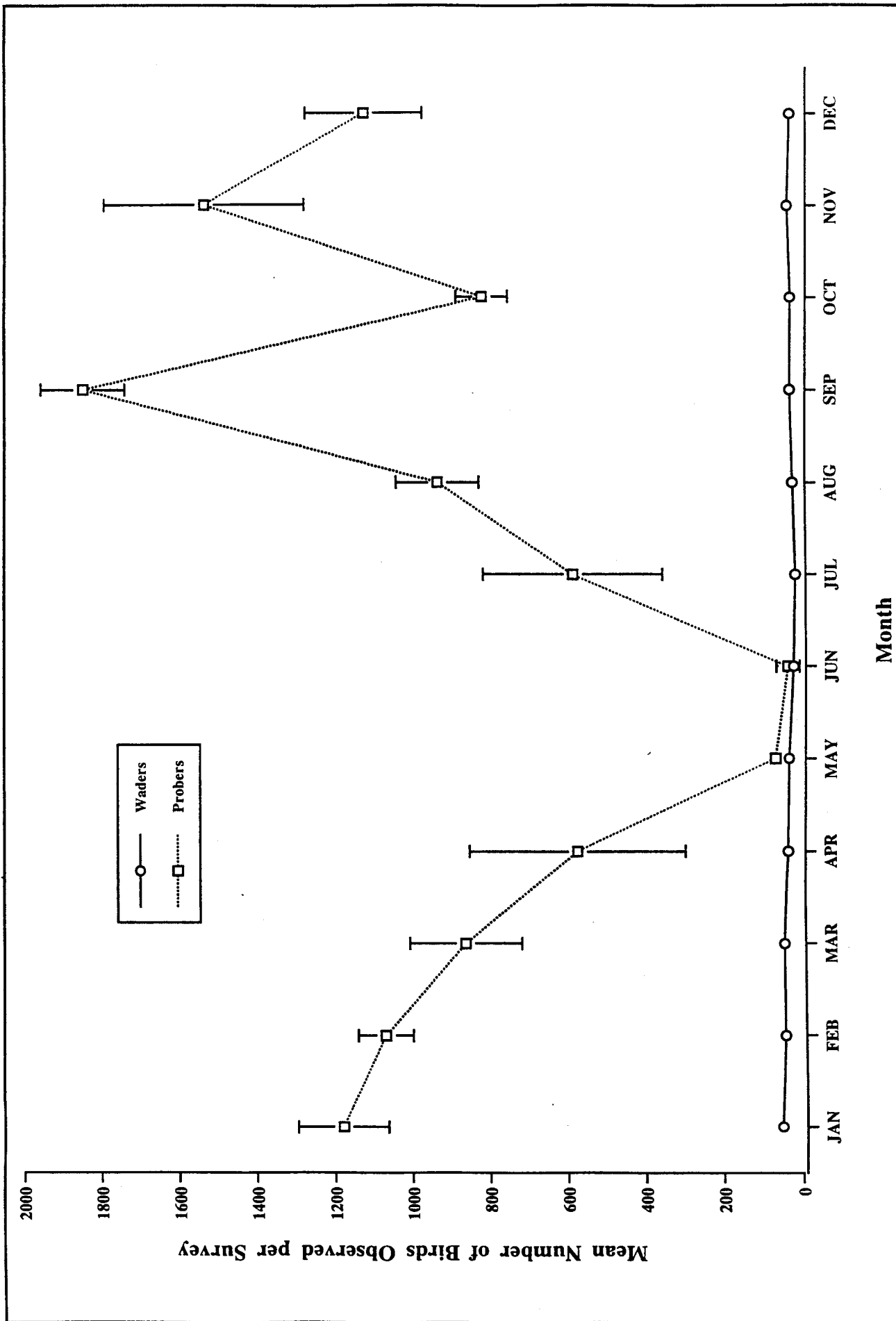
Mean (\pm SEM) Monthly Abundance of All Waterbird Species in the Central San Diego Bay Study Area

4



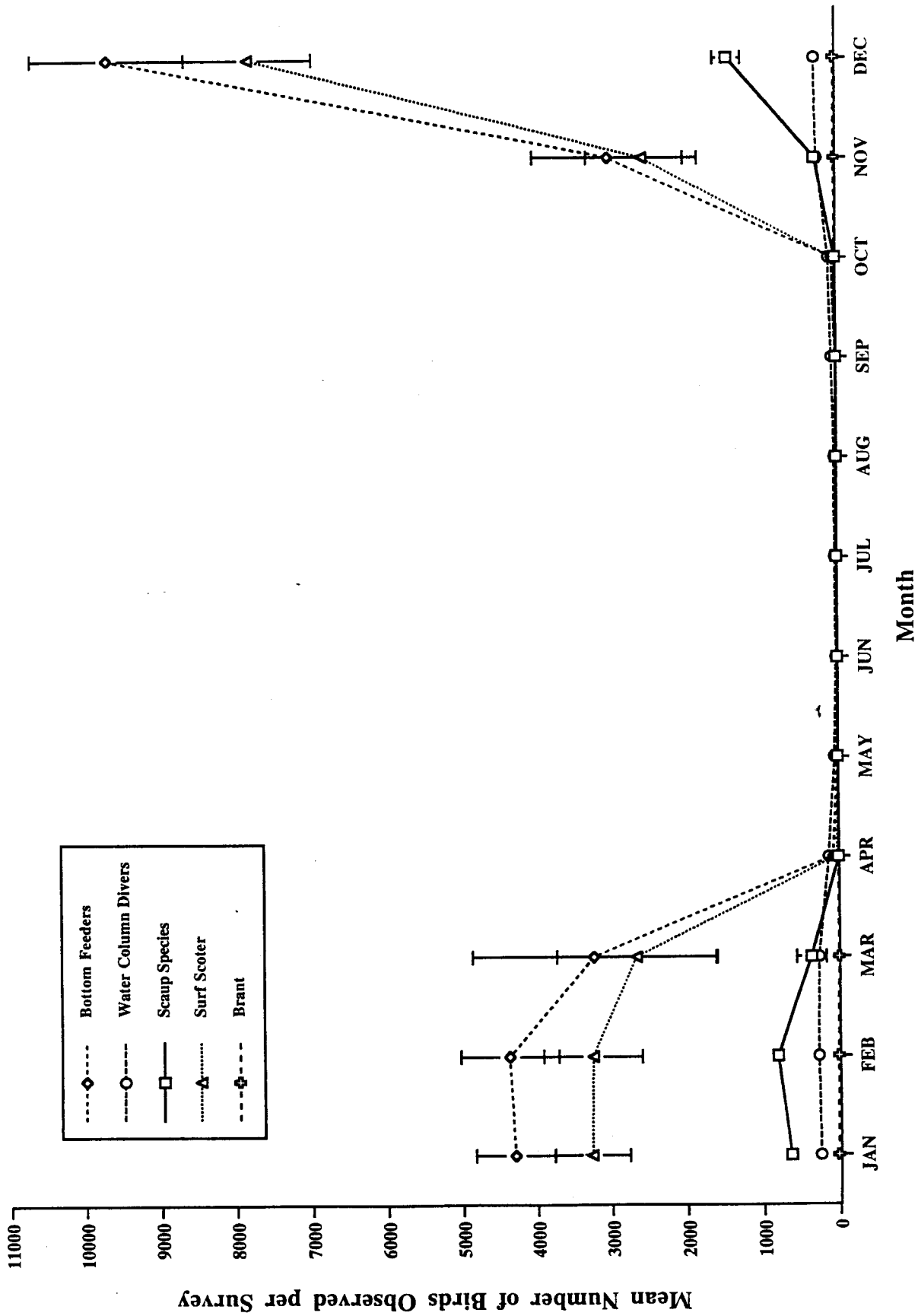
FIGURE

Mean (\pm SEM) Monthly Abundance of Plunge Diving Foraging Guild and Select Species in the Central San Diego Bay During 1994



FIGURE

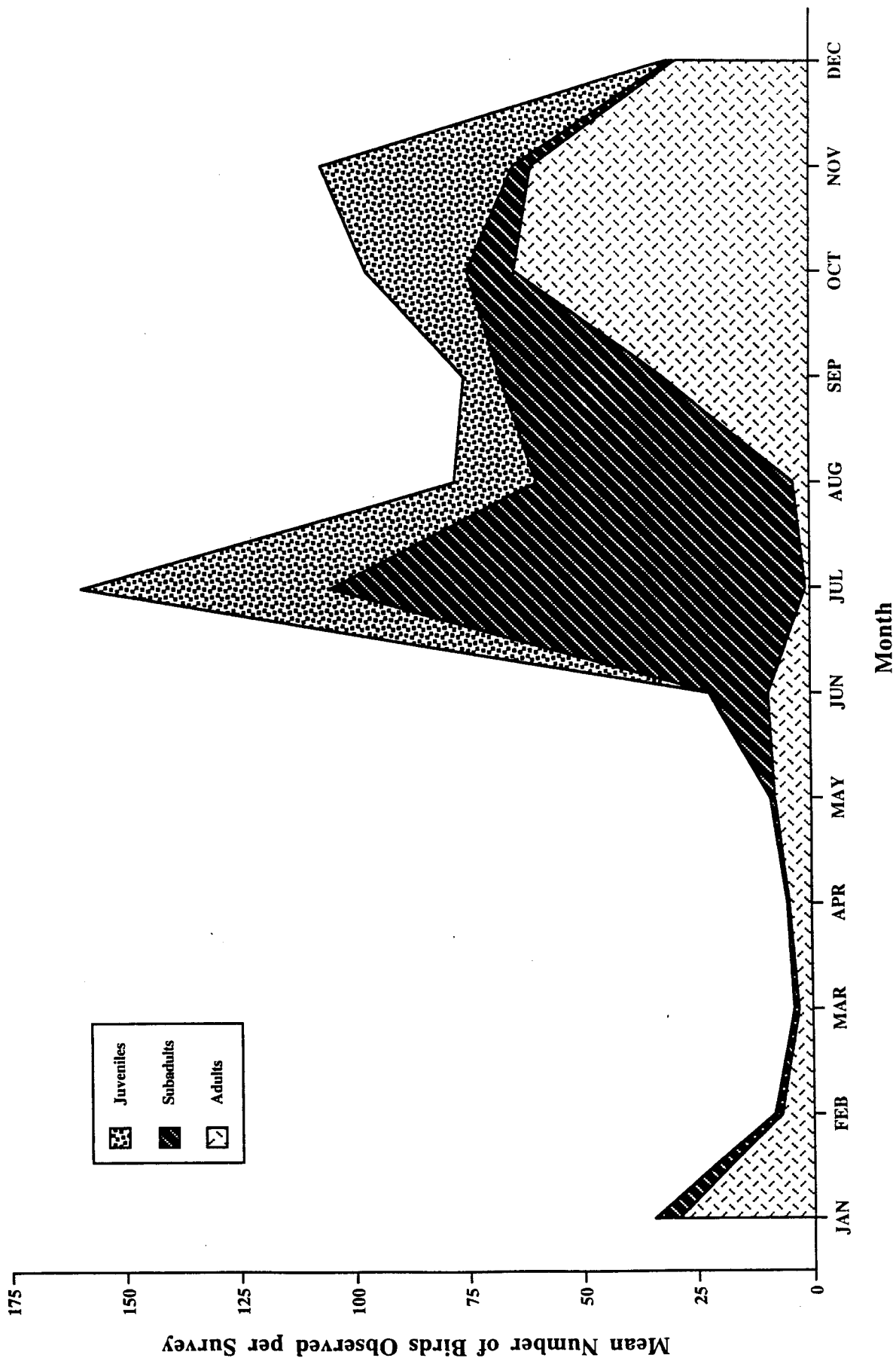
Mean (\pm SEM) Monthly Abundance of Wader/Shallow Water and Prober Foraging Guilds in the Central San Diego Bay During 1994



FIGURE

7

Mean (\pm SEM) Monthly Abundance of Bottom Feeding and Water Column Foraging Guilds and Select Species in Central San Diego Bay During 1994



FIGURE

Mean Monthly Abundance of California Brown Pelican Age Classes in Central San Diego Bay During 1994

Table 1

**CUMULATIVE COUNTS OF 26 MOST ABUNDANT WATERBIRD SPECIES
OBSERVED IN CENTRAL SAN DIEGO BAY IN 1994**

Rank	Species	Total Count
1	Surf Scoter	78,309
2	Scaup Species*	13,976
3	Bufflehead	6,476
4	Eared Grebe	3,013
5	Forster's Tern	2,910
6	California Brown Pelican	2,530
7	Elegant Tern	2,481
8	Heermann's Gull	2,216
9	California Least Tern	2,150
10	Double-Crested Cormorant	1,475
11	Mallard	1,380
12	Great Blue Heron	1,001
13	Brandt's-Cormorant	619
14	Western Grebe	420
15	American Coot	411
16	Snowy Egret	353
17	Royal Tern	288
18	Red-Breasted Merganser	281
19	Brant	280
20	American Wigeon	232
21	Common Loon	195
22	Bonaparte's Gull	156
23	Clark's Grebe	106
24	Great Egret	92
25	Horned Grebe	82
26	Pied-Billed Grebe	82
Total 26 Most Abundant Species		121,514
Shorebirds **		42,502
Gulls **		16,700
Miscellaneous Species and Unidentified Birds ***		772
Total Waterbirds Observed		181,488

* Lesser and greater scaup were lumped into a single group because of the difficulty and time required to differentiate to species level.

** Most shorebirds and gulls were not identified to species level and were not ranked for abundance.

*** Miscellaneous species include 19 species with less than 82 cumulative observations and those individuals that were only identified to taxonomic group (e.g., tern, loon, grebe).

there were not many subadult pelicans observed in Central Bay. Juveniles (young of the year) began arriving in the Central Bay in July, and then declined with a small secondary peak in November. Overall, there was a strong pattern of juveniles and subadults arriving in Central Bay in summer, before the adults had returned from the breeding grounds to the south. Once the adults had reappeared in the fall, the number of juveniles and subadults decreased and remained at relatively low levels through winter and spring.

California Least Tern

California least terns were first observed in Central Bay on April 19, 1994 and last seen August 24th. Least terns were the ninth most abundant species observed in Central Bay (Table 1) during 1994, and in 1993 were the eighth most abundant species (Ogden 1994). The survey average for least terns from April through August 1993 (113.6 birds/survey) was very close to that of 1994 (107.5 birds/survey). The least tern population in Central Bay peaked in July 1994 (Figure 5). The Silver Strand (Delta Beach) nesting colony was active along the Bay side of the Silver Strand, south of the Naval Amphibious Base, Coronado. Least tern chicks were first observed away from their nests, scurrying around on the Bay shoreline in late June. Fledglings were first observed in flight in early July while some members of the colony appeared to be still attending nests.

American Peregrine Falcon

American peregrine falcons were observed on 28 of the 48 1994 Central Bay surveys. Seventy-one percent of these sightings included one or more positively identified adults. The vast majority of peregrine observations were at the southwest end of the study area. Typically one or two adults were observed perched on a very large crane at the 24th Street Marine Terminal. For the second year in a row, a pair nested on this crane. Two fledglings were observed during the first two surveys in May. There were also indications a second pair was still using the Coronado Bridge to nest. Peregrines started nesting at the bridge in 1989 (Pavelka 1990) and in a December 1994 survey we saw a pair on the bridge as well as a third adult at the southwest end of the survey area.

Elegant Tern

Elegant tern was the seventh most abundant species observed in Central Bay during 1994 (Table 1). In 1993, it was the tenth most abundant species in Central Bay (Ogden 1994). In 1994 there was an average of 40 percent more individuals observed per survey compared with 1993. In Central Bay, elegant terns were most numerous in August (Figure 5). A high count of 665 individuals was made in the second week of August.

Elegant terns were not observed in Central Bay in January and February and were observed sporadically in very small numbers in November and December.

Western Snowy Plover

Snowy plover were seen on only 3 of the 48 Central Bay surveys in 1994. Two individuals were seen in the second week of September along the shoreline between Coronado Bridge and Glorietta Bay. Ten individuals were observed foraging the last week of November along the Silver Strand, just south of Delta Beach, and seven were seen the last week of December foraging along Delta Beach. It is likely that some snowy plovers were missed due to the difficulty in identifying small shorebirds at a distance from the survey boat. Often the water depth in Central Bay was too shallow to maneuver a boat close to areas likely to support snowy plover.

Brant

There were a total of 280 brant observed in Central Bay during 1994, making this species the 19 most abundant species (Table 1). Brant were present from November to March (Figure 7). Brant were most abundant in January followed by February and December.

Scaup Species

A significant amount of effort was required to identify lesser scaup from greater scaup, and these species were often lumped as scaup species. Lesser and greater scaup combined were the second most abundant species in Central Bay during 1994 (Table 1). This is the same ranking for scaup in Central Bay in 1993 (Ogden 1994). Highest scaup counts were in December and February (Figure 7). Scaup were absent from Central Bay in May and September and one individual was seen sporadically from April through August. The average number of scaup observed per survey in 1994 was 50 percent greater than in 1993.

Surf Scoter

Surf scoter was the most abundant species in Central San Diego Bay during 1994, with a total of 78,309 observations (Table 1). In 1993, surf scoter was also ranked as the most abundant species in Central Bay. Surf scoters peaked in abundance in December 1994 with an average of 7,795 individuals per survey (Figure 7) and were not present in Central Bay from May to September 1994. The highest survey count was in the last week of December when 8,878 individuals were observed.

3.1.2 Foraging Guilds

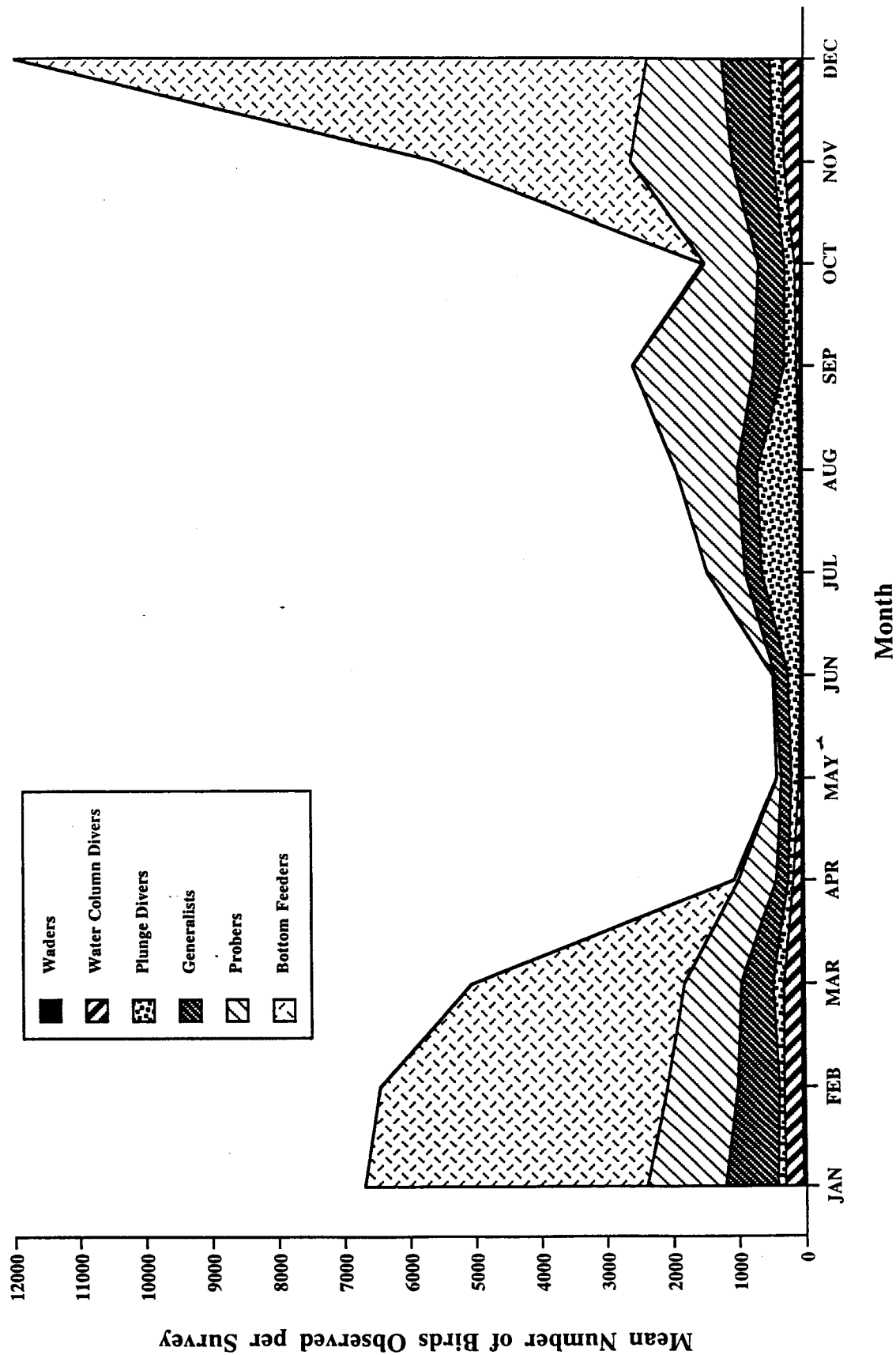
Mean monthly counts of the foraging guilds fluctuated widely throughout the year in Central San Diego Bay (Figure 9). There was a general trend for high guild counts from late summer through winter with lowest counts in the spring. This is similar to the trend seen for combined monthly counts in North and Central Bay in 1993 (Ogden 1994). Bottom feeders were the dominant foraging guild with 54.6 percent of the 180,803 guild sightings. The second most abundant foraging guild was probers with 23.5 percent of sightings followed by; generalists (11.6 percent), plunge divers (5.7 percent), water column divers (3.7 percent), and waders (0.9 percent). This composition of guilds is much different from 1993 North Bay where generalists were the most abundant guild (47.6 percent) and bottom feeders accounted for only 10.0 percent of the sightings (Ogden 1994).

Highest mean counts for bottom feeders were in December 1994 (Figures 7 and 9). The pattern of bottom feeder abundance is the same, but more pronounced, as that for water column divers. Bottom feeders and water column divers were most abundant from November to March and were largely absent from the Central Bay between April and October. Probers had two major peaks in abundance (September and November) with relatively high numbers from July through April (Figures 6 and 9). Waders, the least abundant foraging guild were fairly uniform in abundance, with small numbers occurring in Central Bay throughout the year (Figures 6 and 9). Generalists were most abundant September to March with a peak in December and January (Figure 9). Plunge divers had a pattern of abundance different than that of the other guilds. Plunge divers were most abundant in the summer months with a peak in July and August (Figures 5 and 9). Lowest numbers of plunge divers occurred in February and April with relatively stable numbers of 100 to 200 individuals in the remaining non-peak months.

3.2 HABITAT AND SPATIAL USE OF CENTRAL SAN DIEGO BAY

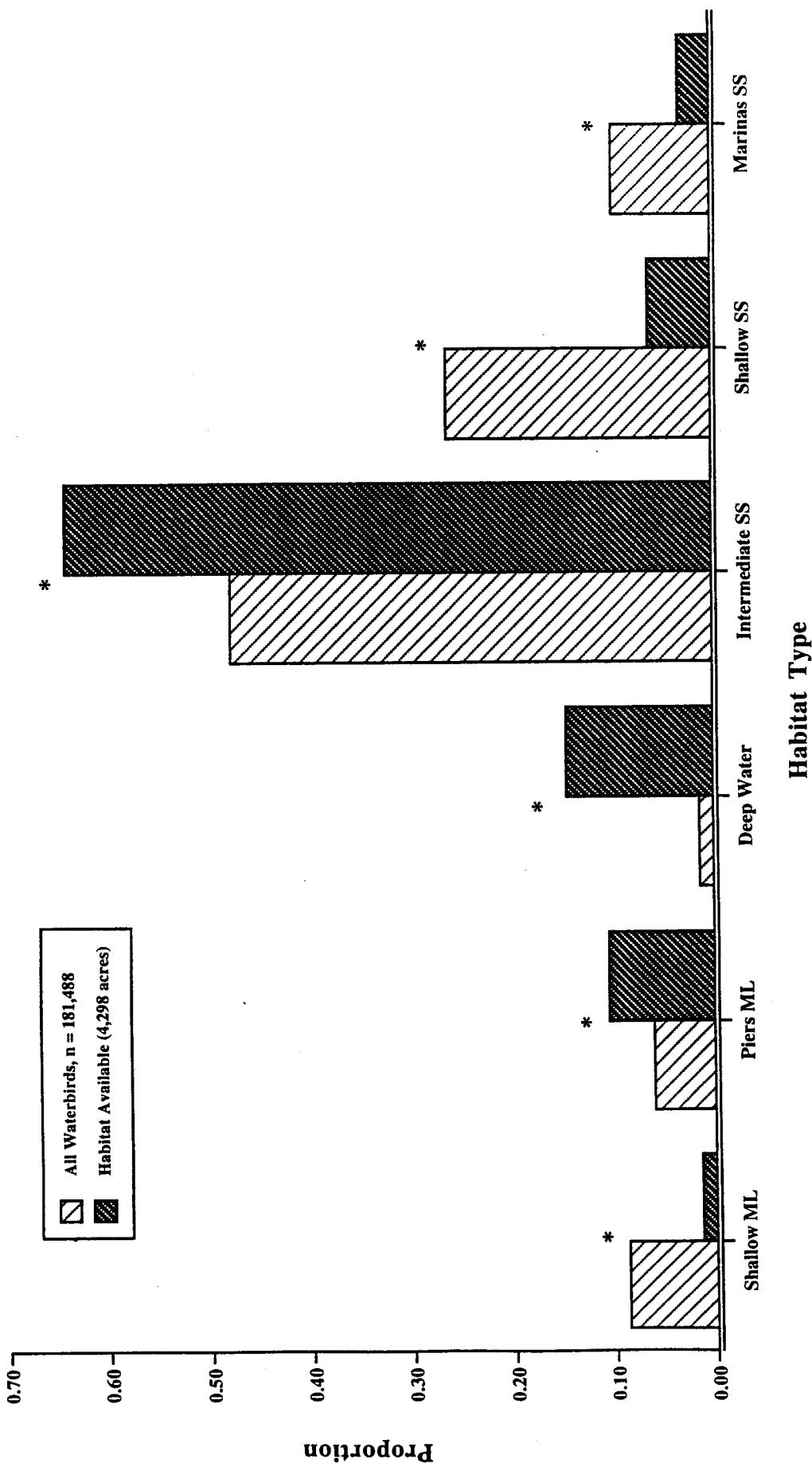
3.2.1 All Waterbird Species Combined

For all waterbird sightings combined, there was a significant positive preference for shallow water and Silver Strand Marina habitats (Shallow ML, Shallow SS, and Marinas SS; Figure 10). There were significant negative preferences for relatively deeper water habitats and for mainland pier areas (Piers ML, Deep Water, and Intermediate SS).



FIGURE

Mean Monthly Abundance of Waterbird Foraging Guilds in Central San Diego Bay During 1994



* $p \leq 0.05$

Habitat Type Definitions (see text for further description):

Shallow ML = Mainland shoreline and water generally within 100 feet of shore

Piers ML = Mainland shoreline with docks and piers

Deep Water = Dredged ship channel and water >35 feet deep

Intermediate SS = Shallow and medium depth water (5 to 35 feet) between the Shallow SS and Deep Water Sections

Shallow SS = Silver Strand and Coronado shorelines and water generally within 100 feet of shore

Marinas SS = Silver Strand and Coronado marinas and shoreline with docks and piers

FIGURE

Relative Habitat Utilization by All waterbird Species in Central San Diego Bay During 1994

10

These 1994 Central Bay waterbird habitat preferences are consistent with the 1993 North Bay study (Ogden 1994). The trend for preferring shallow water habitats and avoiding deeper water and mainland pier areas was also exhibited for foraging and resting waterbirds (Figures 11a and b).

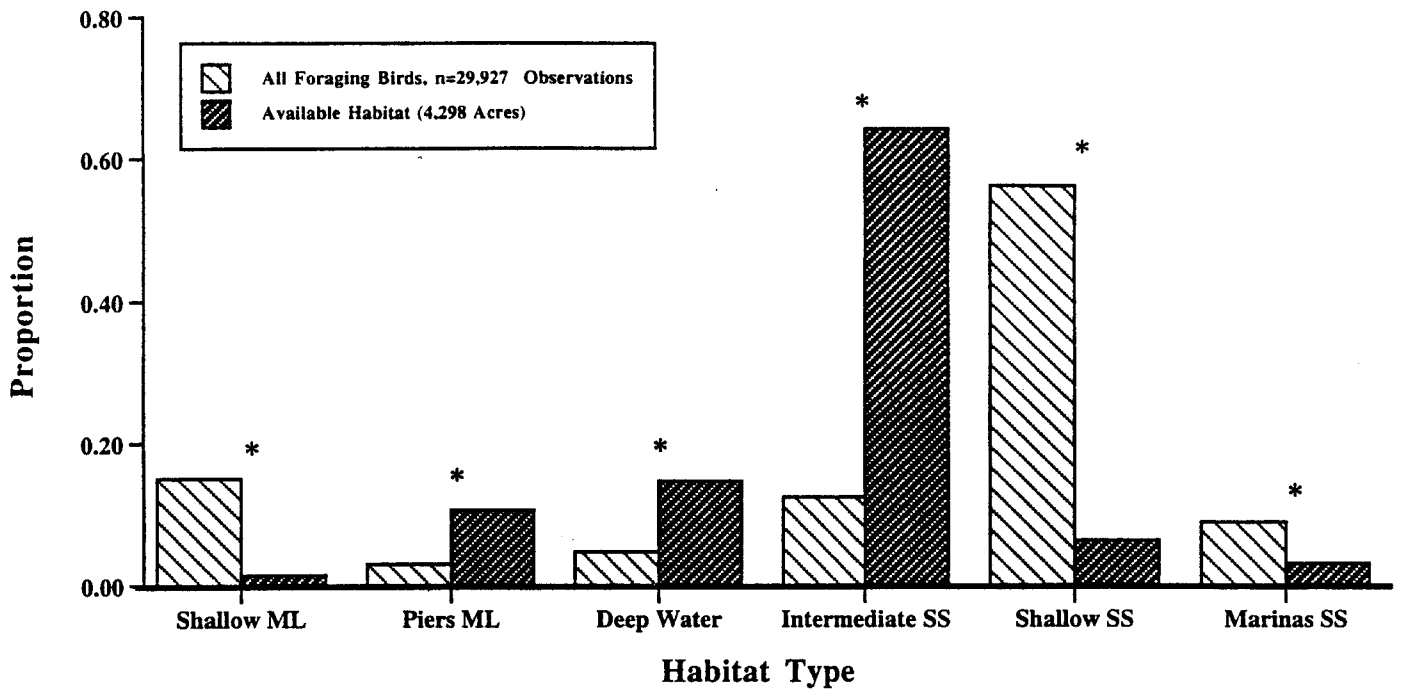
The indexing and ranking protocol developed for this study was based on cumulative waterbird densities for each cell and was calculated to show waterbird spatial preferences (see Methods, Section 2.3). Behavior categories (all behaviors, foraging, resting on water, on shore, and on structure) were indexed and ranked separately.

For all waterbird sightings, the cell with the fourth highest bird density (311.3 birds/acre) was used as the basis for the cell index and for ranking relative use areas (Figure 12). The highest density cell (1588.13 birds/acre) was considered an outlier, so the second highest density cell (666.23 birds/acre) was used instead in determining the index cell. The second highest cell was 2.1 times greater than the indexing cell. Areas of highest relative use by all waterbirds included the shoreline from the southern edge of the Naval Amphibious Base, Coronado, south along the Silver Strand to the cove area north of Fiddler's Cove Marina. Other high value areas include, the piers and shoreline along the north edge of the Naval Amphibious Base, the south end of Crown Cove, and the north edge of the Sweetwater Marsh and the Channel Area at the southwest corner of the study area.

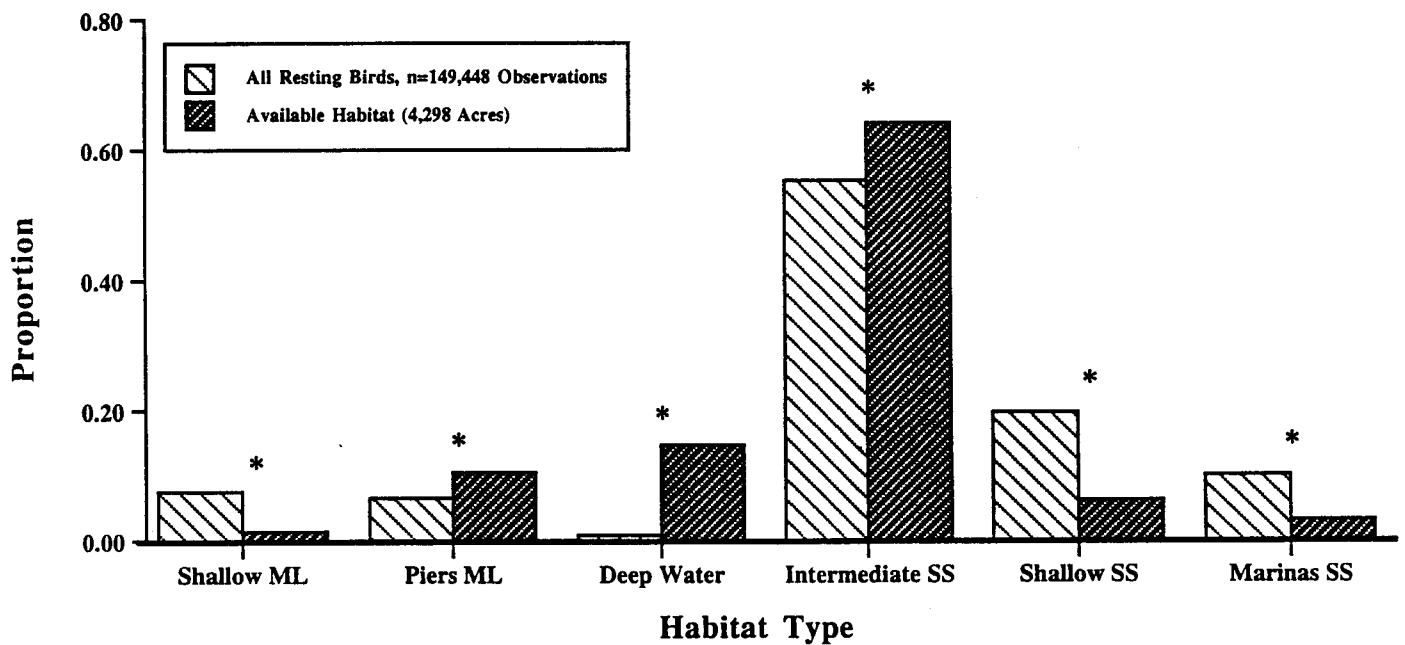
Important foraging areas for all waterbird species were shoreline areas along the south edge of the Naval Amphibious Base and south along the Silver Strand shoreline to the cove north of Fiddler's Cove Marina (Figure 13). Other high value foraging areas were Crown Cove and the northern edge of the Sweetwater Marsh with the adjacent Sweetwater Channel. The foraging cell index used in ranking cell use was based on the third highest foraging density cell (107.75 birds/acre). The highest foraging density cell was 512.65 birds/acre and was considered an outlier so the second highest density cell (222.29 birds/acre) was used to determine the indexing cell. The second highest density cell was 2.1 times larger than the indexing cell.

High value areas in Central Bay used by waterbirds resting on water included Glorietta Bay, the shorelines along the northwest corner and southern edge of the Naval Amphibious Base, and portions of shoreline and nearshore areas along the Silver Strand from the Naval Amphibious Base south to Fiddler's Cove Marina (Figure 14). Other high value areas for resting waterbirds included the south end of Crown Cove, intermediate depth water east of

a. Foraging Waterbirds



b. Resting Waterbirds



* $p \leq 0.05$

Habitat Type Definitions (see text for further description):

Shallow ML = Mainland shoreline and water generally within 100 feet of shore

Piers ML = Mainland shoreline with docks and piers

Deep Water = Dredged ship channel (water > 35 feet deep)

Intermediate SS = Shallow & medium depth water (5 to 35 feet) between the Shallow SS and Deep Water Sections

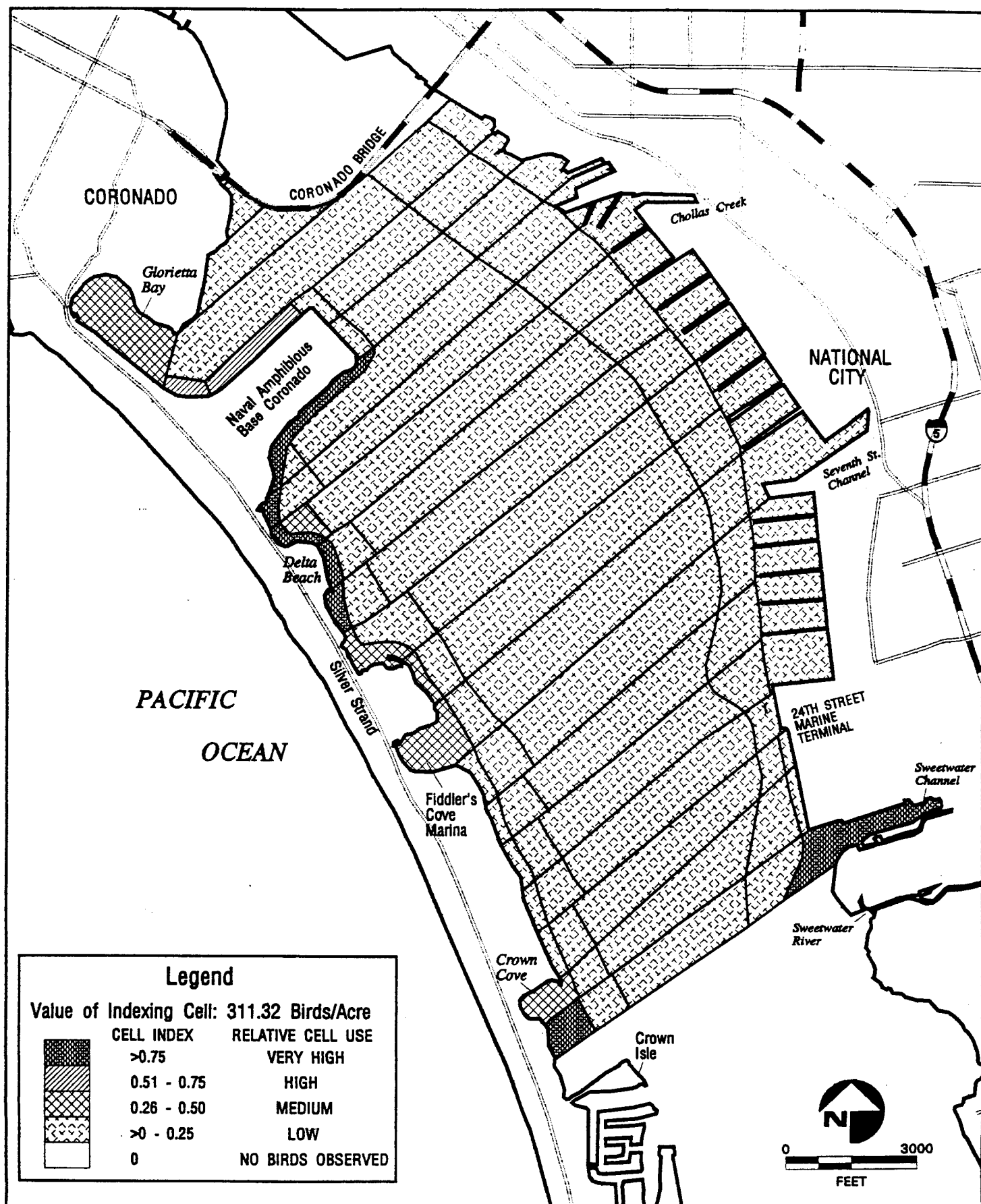
Shallow SS = Silver Strand and Coronado shorelines and water generally within 100 feet of shore

Marinas SS = Silver Strand and Coronado marinas and shoreline with docks and piers

Relative Habitat Utilization by All Waterbird Species While Foraging (a) and Resting (b) in Central San Diego Bay During 1994

FIGURE

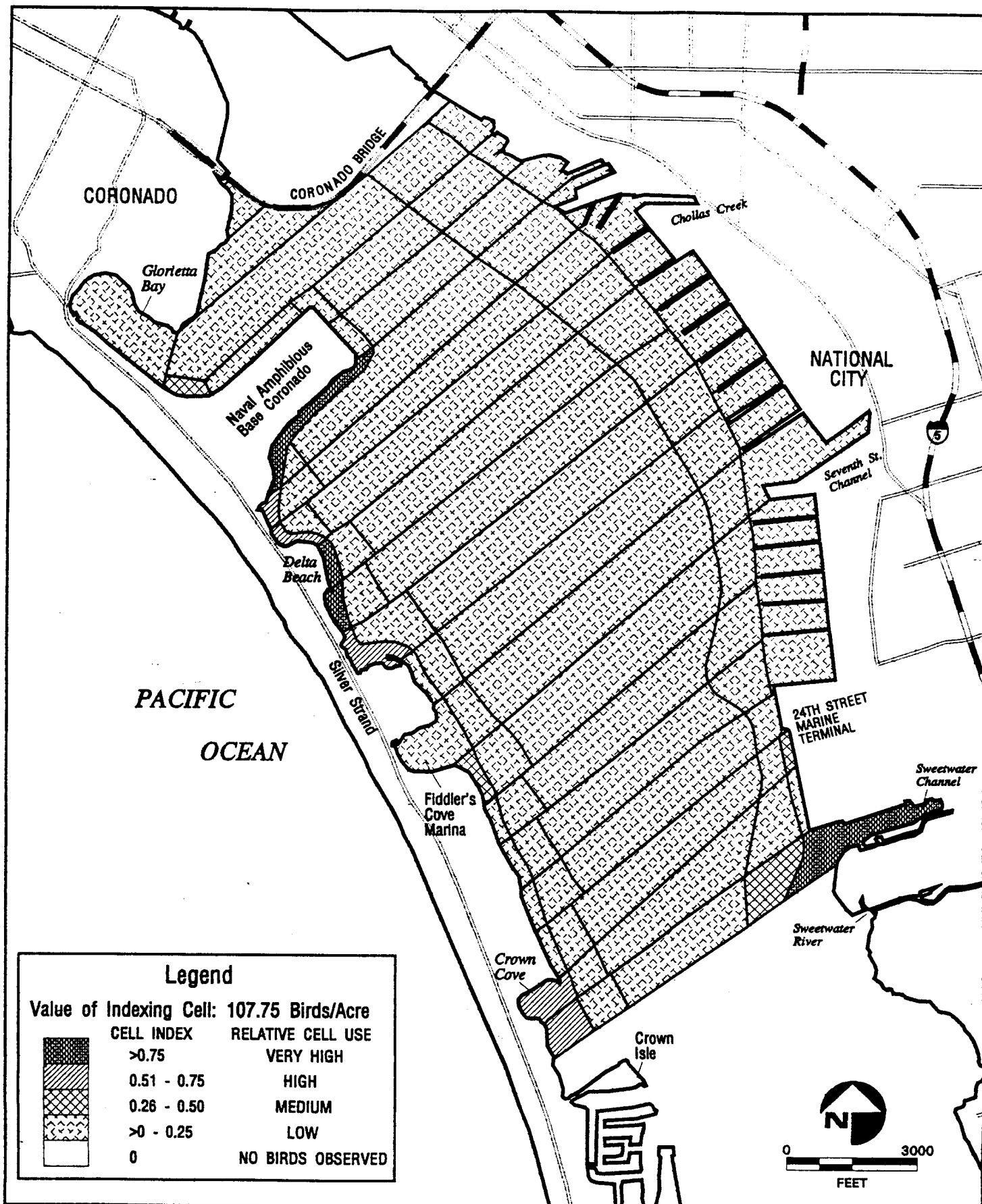
11



Spatial Use of Central San Diego Bay by
All Waterbird Species During 1994

FIGURE

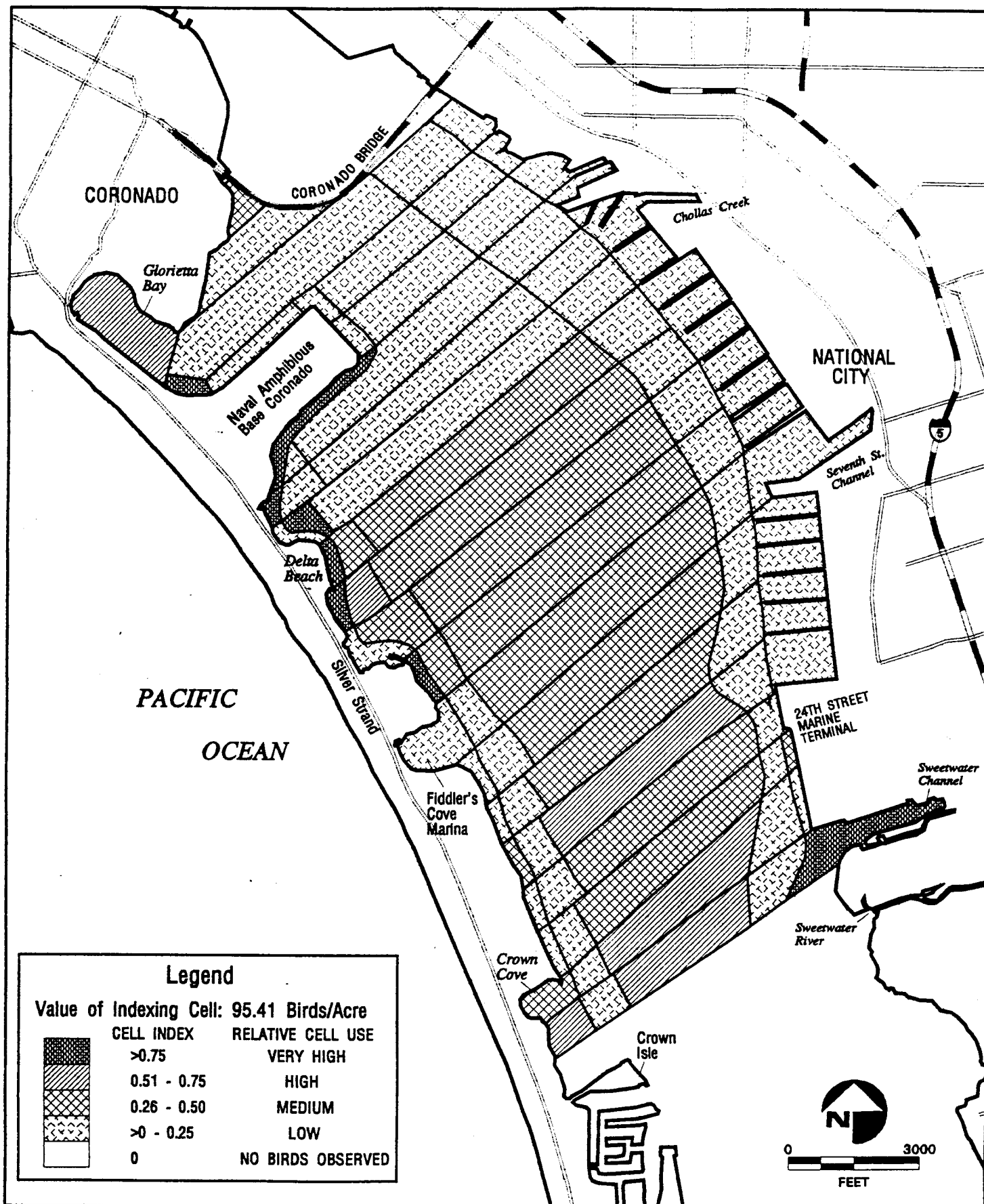
12



FIGURE

13

Spatial Use of Central San Diego Bay by
All Waterbird Species Foraging During 1994



**Spatial Use of Central San Diego Bay by
All Waterbird Species Resting on Water During 1994**

FIGURE

14

Crown Cove, intermediate depth water northwest of the 24th Street Marine Terminal, and the Sweetwater channel and northern edge of the Sweetwater Marsh. The second highest resting on water density cell (95.4 birds/acre) was used for creating the resting cell index. The highest density resting cell with 305.2 birds/acre was considered an outlier and was not used for indexing as it would have diluted the value of all other cells.

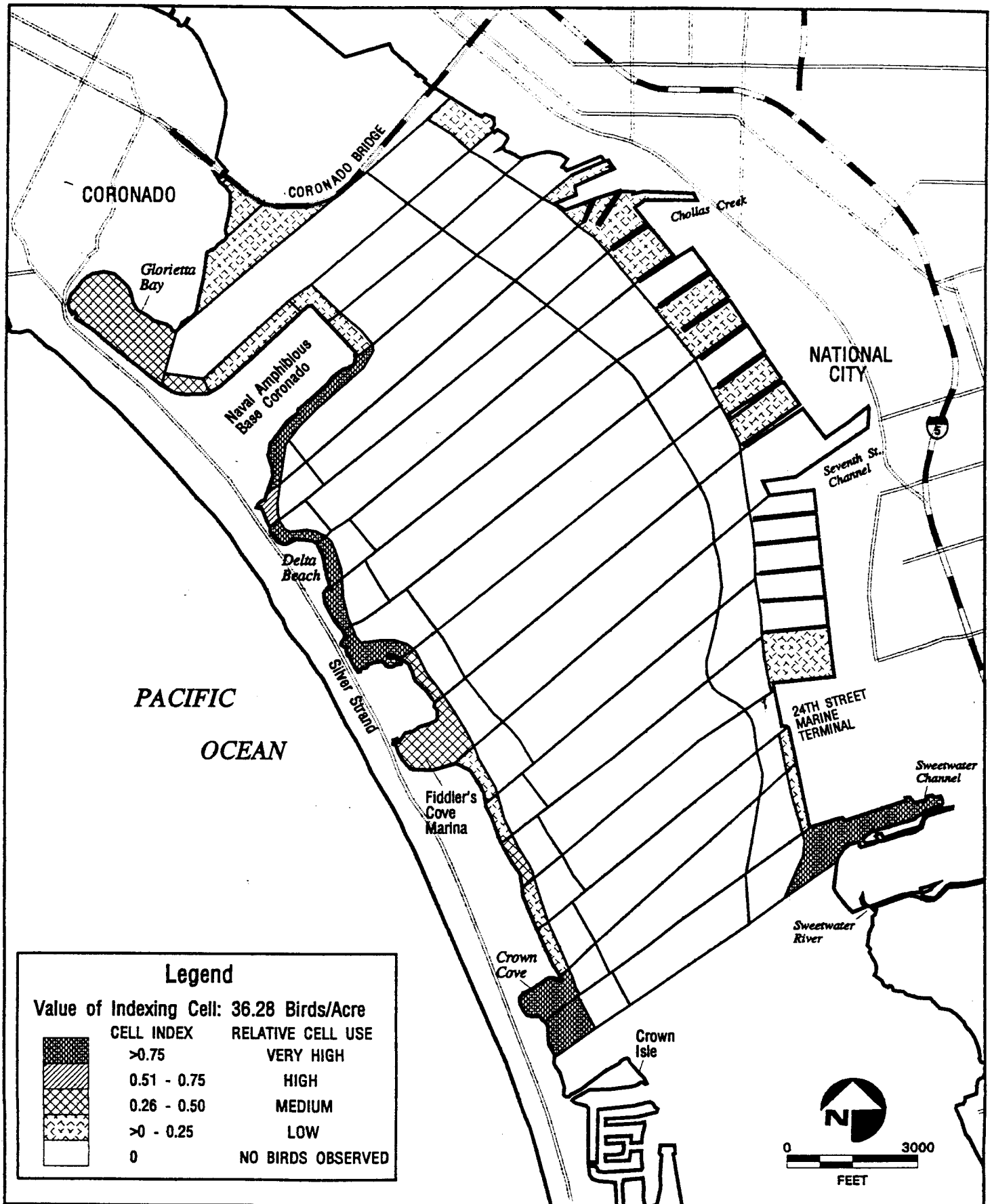
Shorelines preferred by waterbirds were along the south edge of the Naval Amphibious Base and south along the Silver Strand to the cove north of Fiddler's Cove Marina (Figure 15). Other high value shore areas were Crown Cove and the Sweetwater Marsh/Channel. The cell with the sixth highest density of birds on shore (36.3 birds/acre) was used to create this index. The five highest density shore cells (145 to 868 birds/acre) were so much larger than the remainder of the cells that the sixth cell was used as the indexing cell so other cells would not be undervalued.

The cells with the highest relative value for birds roosting on structure were piers along the north edge of the Naval Amphibious Base, Fiddler's Cove Marina, and several embayments with piers along the mainland shore (Figure 16). The intermediate water-depth cell, southeast of Fiddler's Cove Marina, had heavy localized use by waterbirds roosting on abandoned, unused, and shipwrecked boats, barges, and drydocks. The large size of this cell may have diluted its' relative importance to birds roosting on structure. The fifth highest density cell (25.0 birds/acre) was chosen as the basis for the on structure index. The highest density (167.8 birds/acre) and second highest density (80.2 birds/acre) cells were considered outliers and were not used in determining the indexing cell. The third highest density cell (40.4 birds/acre) was 1.6 times greater than the indexing cell.

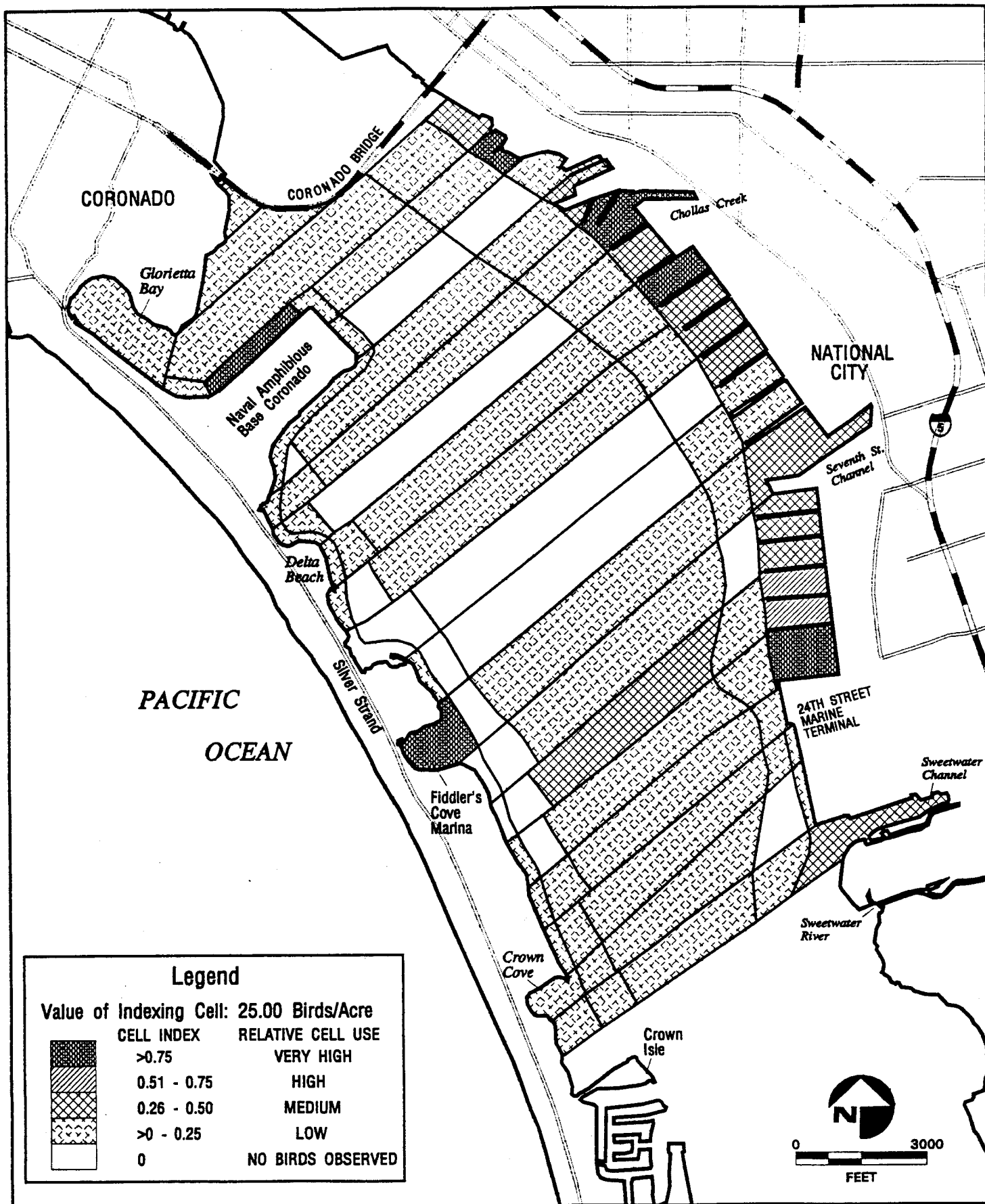
3.2.2 Target Species

California Brown Pelican

California brown pelicans showed a significant positive preference for foraging in shallow water habitats along both sides of the bay and in marinas along the Silver Strand (Figure 17a). Relatively deeper water habitats were significantly underused. There was no positive or negative preference for foraging in Navy and Commercial pier areas along the mainland shore. Resting pelicans strongly preferred piers and marinas along both sides of the Central Bay (Piers ML and Marinas SS; Figure 17b). There was a significant avoidance for resting in Deep Water, Intermediate SS, and Shallow SS habitats. There was no significant preference for shallow habitat (with few piers) along the mainland shore.



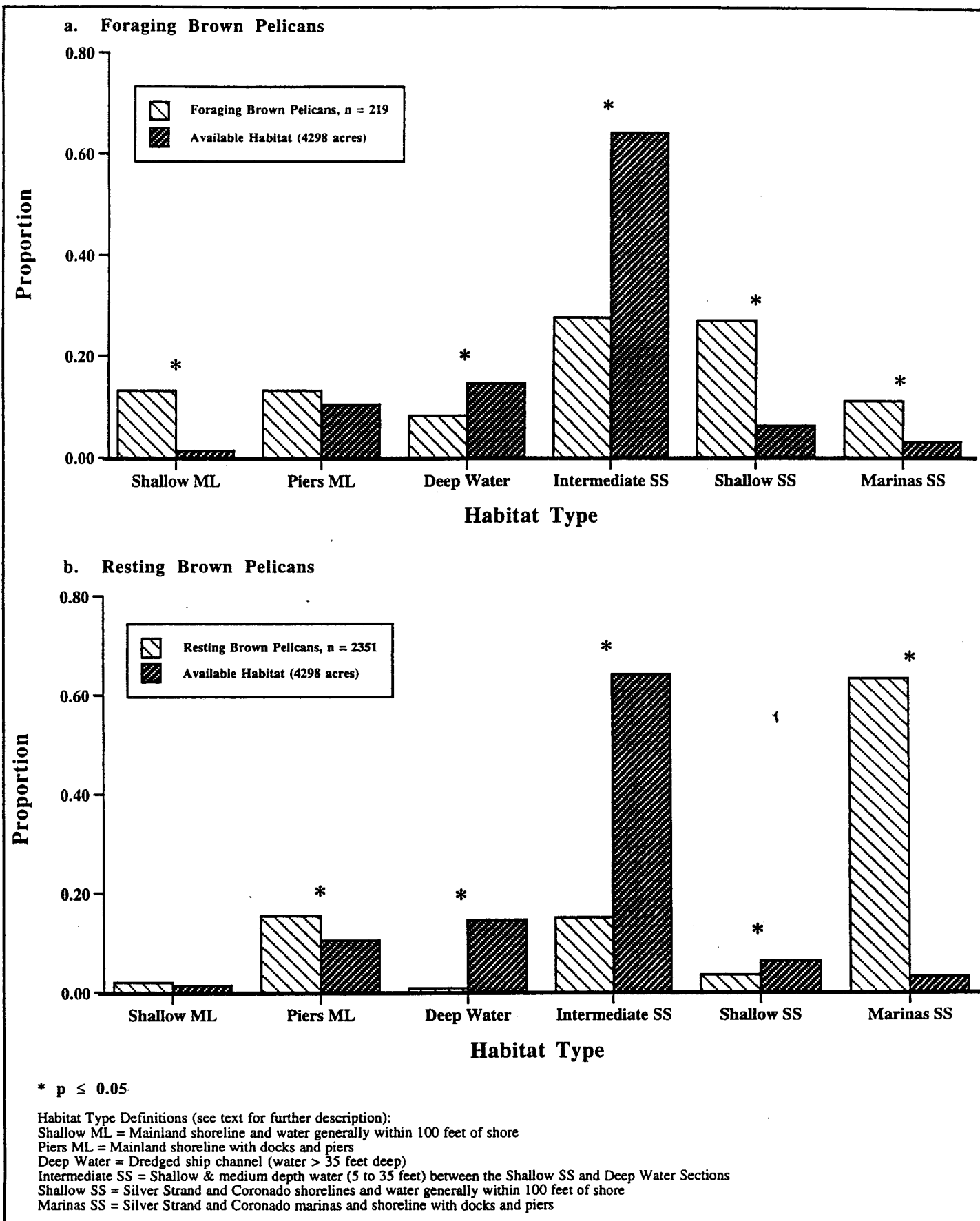
Spatial Use of Central San Diego Bay by
All Waterbird Species on Shore During 1994



Spatial Use of Central San Diego Bay by
All Waterbird Species Roosting on Structures During 1994

FIGURE

16



**Relative Habitat Utilization by Foraging (a) and Resting (b)
California Brown Pelicans in Central San Diego Bay During 1994**

FIGURE

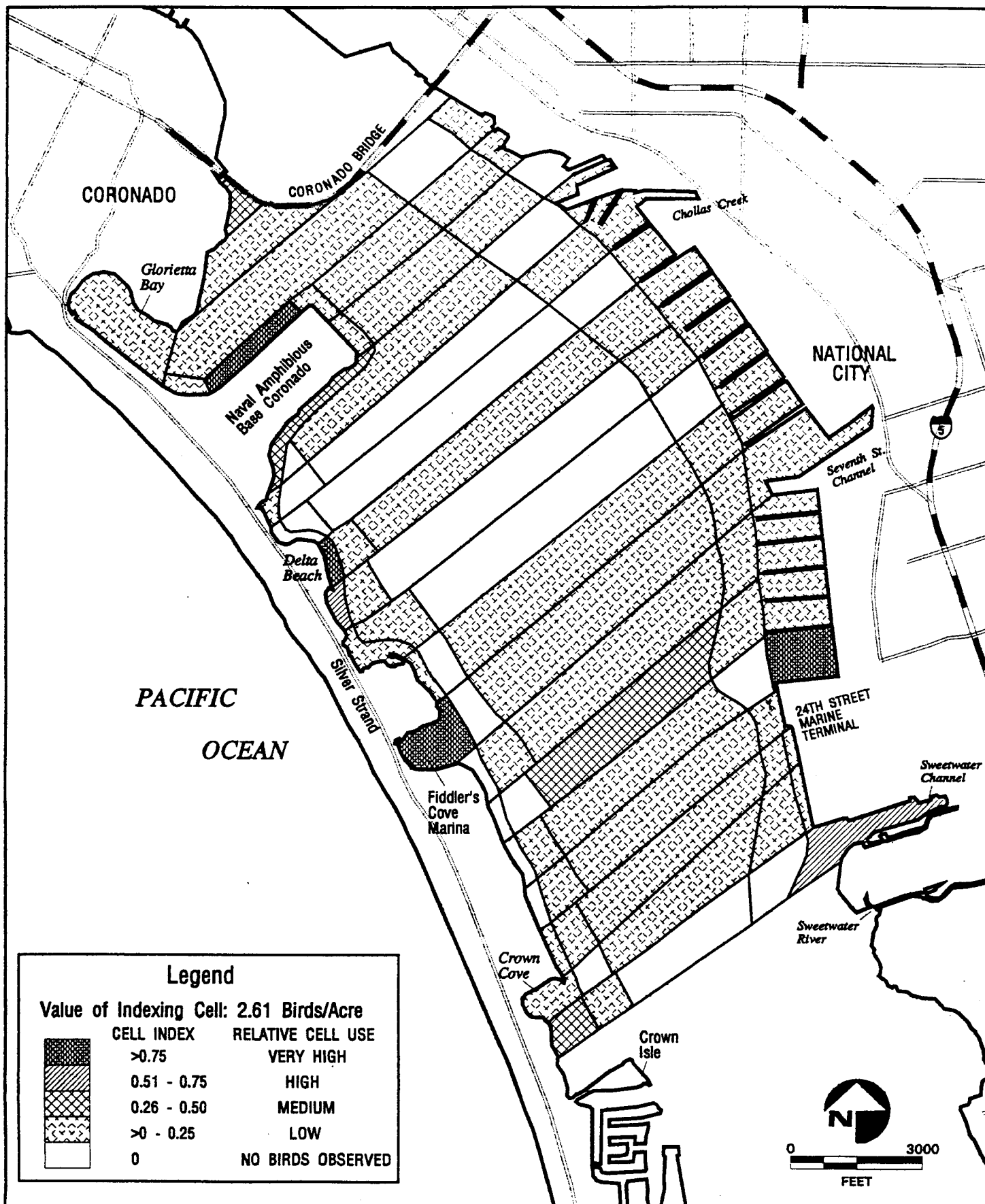
17

Pelicans occurred in highest numbers at roosting locations, especially where human access was restricted. The most important sites for roosting and foraging were relatively undisturbed piers at the north end of the Naval Amphibious Base, shoreline areas along the Silver Strand at Delta Beach, Fiddler's Cove Marina, the embayment with floating barges/docks just north of the 24th Street Marine Terminal, and the Sweetwater Marsh and Channel (Figure 18). The cell index used to rank the relative value of each Central Bay cell for brown pelicans was based on the 4th highest total density cell (2.61 birds/acre). This cell was the highest density cell in which foraging was the dominant activity. The highest density cell in Central Bay had 30.1 birds/acre and was 11.5 times larger than the indexing cell.

California Least Tern

California least terns showed a significant positive preference for foraging in shallow water and marina habitat along the Silver Strand shoreline and in Deep Water habitat in the center of the Bay (Figure 19a). Least terns exhibited a significant negative preference for intermediate water depth and mainland pier habitats. There was no significant preference by foraging least terns for shallow water habitat on the mainland side of Central Bay. Resting least terns had an extremely strong positive preference for using the shallow water and shoreline habitat on the Silver Strand side of the Bay (Figure 19b). There was a significant negative preference by resting least terns for all other habitats (Shallow ML, Piers ML, Deep Water, Intermediate SS, and Marinas SS).

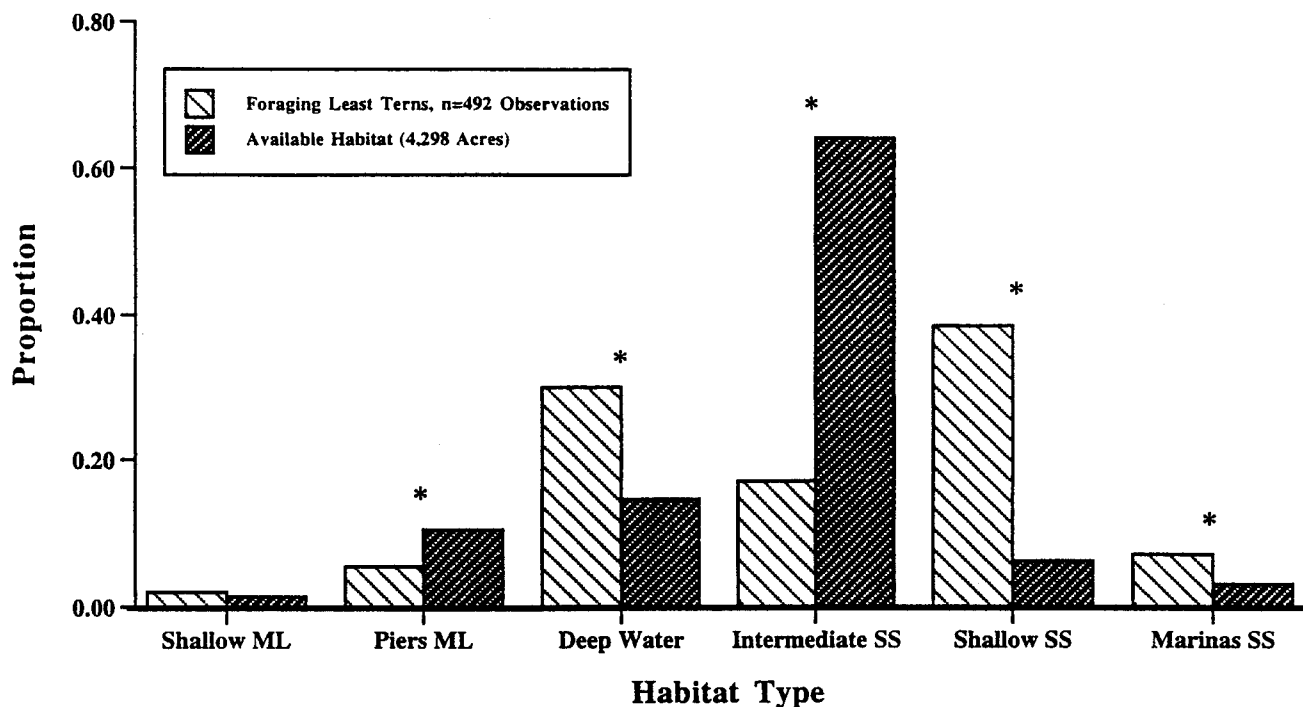
The most important area for California least terns in Central San Diego Bay was the nesting area at Delta Beach along the Silver Strand shoreline (Figure 20). This site accounted for 79.5 percent of the 2,150 least tern sightings in 1994. Least terns were at this site throughout the breeding season and were observed in courtship feeding, displaying, incubating, and caring for chicks. Foraging was also frequently observed. The remainder of cells where least terns occurred were used primarily by foraging terns. Most of these cells were used at relatively low levels. Exceptions were in the deep water channel in one cell located one transect south of the Coronado Bridge and in another cell west of the Seventh Street Channel. The fifth highest total density cell (1.69 birds/acre), where foraging was the dominant activity, was used to create the least tern cell index. The two highest density cells (99.1 and 82.0 birds/acre) were considered outliers. The third highest density cell (5.8 birds/acre) was 3.4 times larger than the indexing cell.



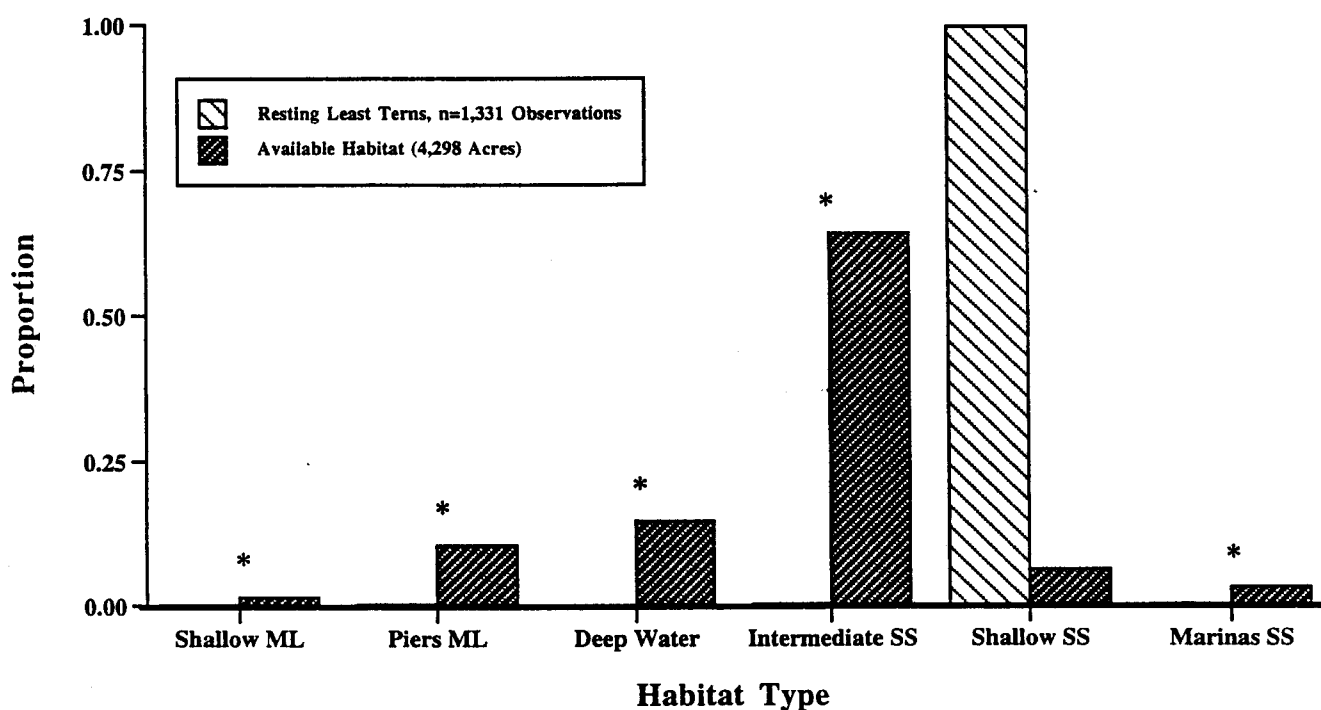
Spatial Use of Central San Diego Bay by
Brown Pelicans During 1994

18

a. Foraging Least Terns



b. Resting Least Terns



* $p \leq 0.05$

Habitat Type Definitions (see text for further description):

Shallow ML = Mainland shoreline and water generally within 100 feet of shore

Piers ML = Mainland shoreline with docks and piers

Deep Water = Dredged ship channel (water > 35 feet deep)

Intermediate SS = Shallow & medium depth water (5 to 35 feet) between the Shallow SS and Deep Water Sections

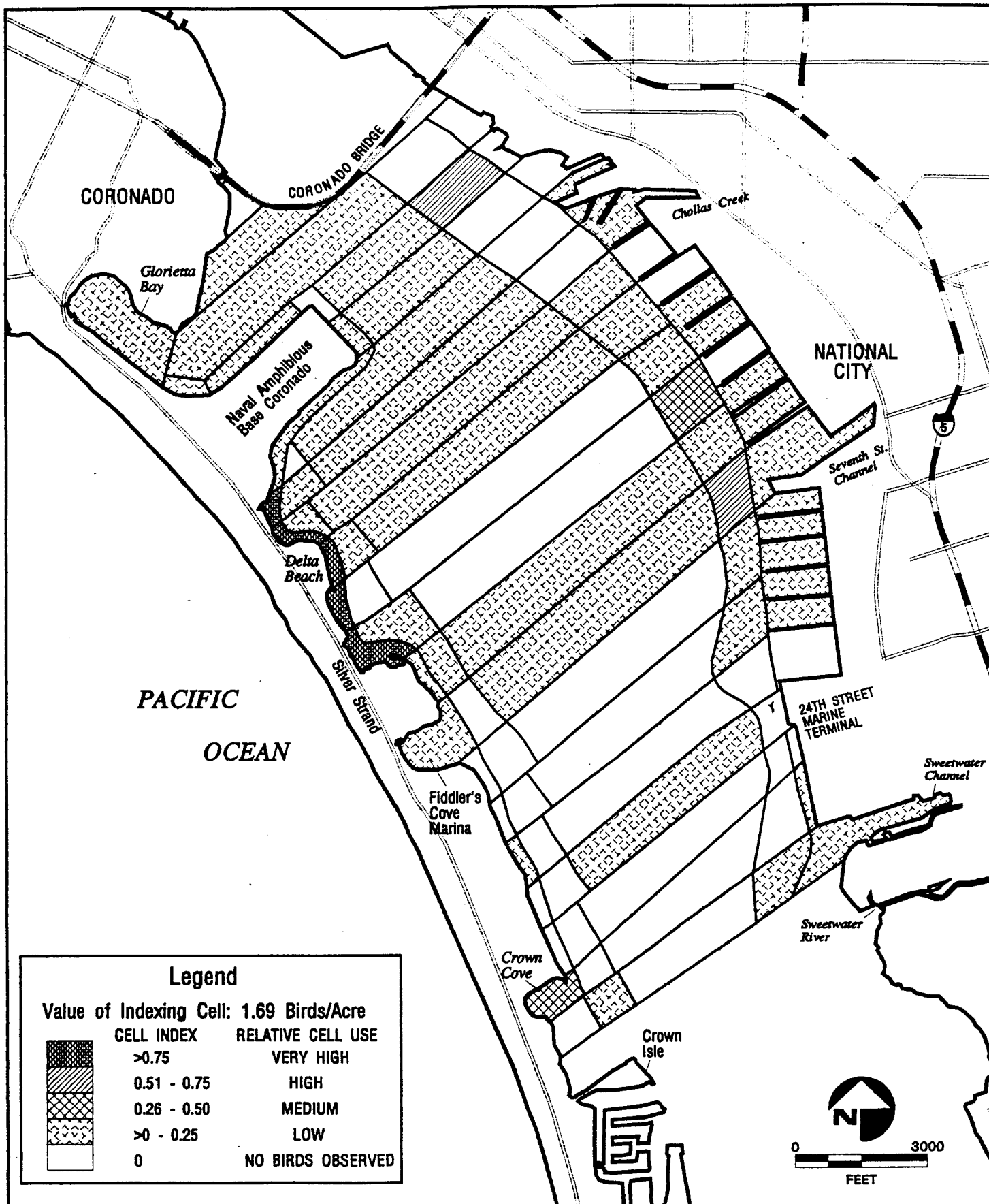
Shallow SS = Silver Strand and Coronado shorelines and water generally within 100 feet of shore

Marinas SS = Silver Strand and Coronado marinas and shoreline with docks and piers

**Relative Habitat Utilization by Foraging (a) and Resting (b)
California Least Terns in Central San Diego Bay During 1994**

FIGURE

19



Spatial Use of Central San Diego Bay by
California Least Terns During 1994

20

Elegant Tern

Elegant terns showed a significant positive preference for foraging in shallow water along the Silver Strand shoreline (Shallow SS; Figure 21a). Foraging elegant terns showed no significant preference for Marinas SS and significantly avoided all other habitat types (Shallow ML, Piers ML, Deep Water, and Intermediate SS). Resting elegant terns showed a strong preference for resting in shallow water and marina habitats along the Silver Strand shoreline and significantly underused the mainland shallow water, piers, and relatively deeper water habitats.

Important elegant roosting locations included natural shorelines along Delta Beach and at Crown Cove (Figure 22). Elegant terns also extensively roosted on an undisturbed ring of floating tires which delineated the Fiddler's Cove Marinas' boundary with the Bay. Elegant tern did not appear to forage much in any one location in Central Bay. Instead there were low levels of foraging throughout the cells they appeared in within the study area. The third highest total density cell (6.78 birds/acre) where foraging was the predominant activity, was used to create the elegant tern cell index. The highest density cell had 180.74 birds/acre and was 26.7 times larger than the indexing cell.

Brant

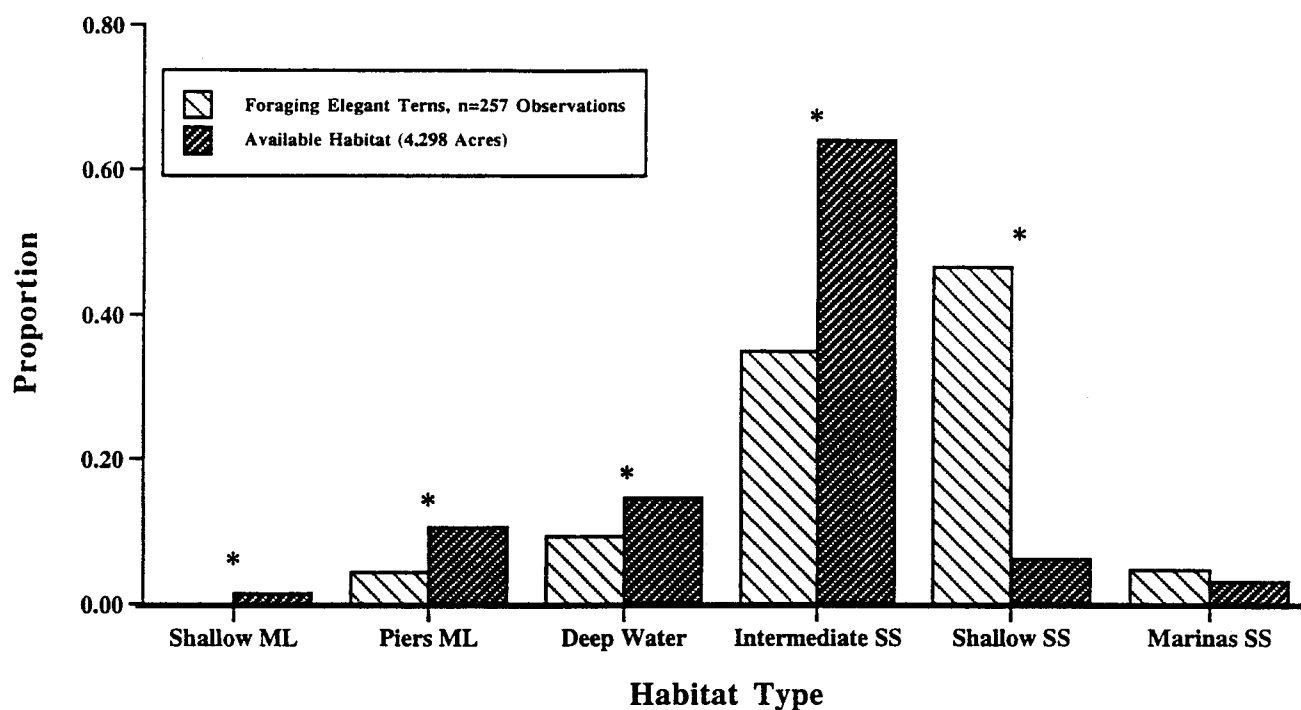
There were too few occurrences of Brant (280 observations) to statistically determine their habitat preference or spatial use patterns. The majority of sightings were in shallow water habitats along natural shorelines. Approximately 26 percent of observations were along the Delta Beach shoreline. Another 46 percent of sightings were at the Sweetwater Marsh shoreline or in the deep water channel adjacent to it, and 28 percent of the sightings were at Crown Cove.

Scaup Species

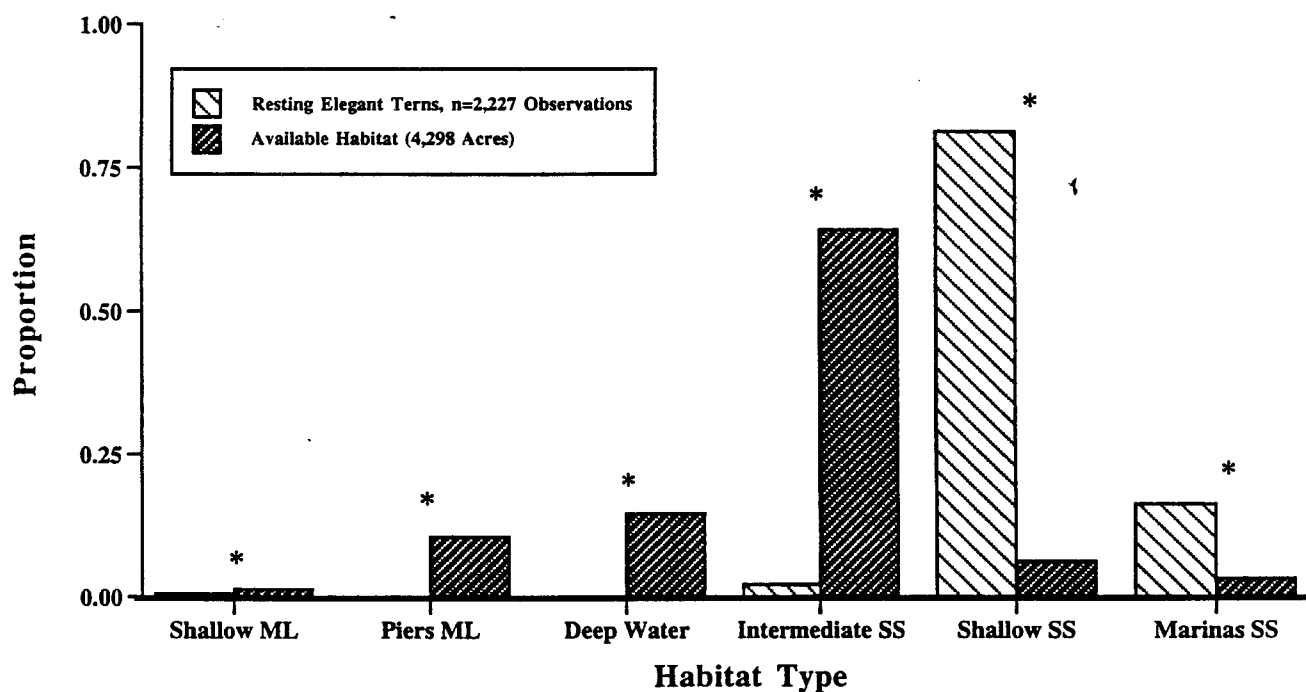
Lesser and greater scaup in North San Diego Bay showed a significant positive preference for foraging and resting in Silver Strand marinas, mainland pier areas, and in shallow water habitats on both sides of the Bay (Figures 23a and 23b). Intermediate and deep water habitats were significantly underused.

The highest use areas for scaup were dominated by resting birds. Foraging was not a dominant activity in any cell. This may be due to the fact that scaup species often forage at night. Important relative use areas include Glorietta Bay, natural shoreline at the northwest corner and the southern edge of the Naval Amphibious Base, Silver Strand shoreline just

a. Foraging Elegant Terns



b. Resting Elegant Terns



* $p \leq 0.05$

Habitat Type Definitions (see text for further description):

Shallow ML = Mainland shoreline and water generally within 100 feet of shore

Piers ML = Mainland shoreline with docks and piers

Deep Water = Dredged ship channel (water > 35 feet deep)

Intermediate SS = Shallow & medium depth water (5 to 35 feet) between the Shallow SS and Deep Water Sections

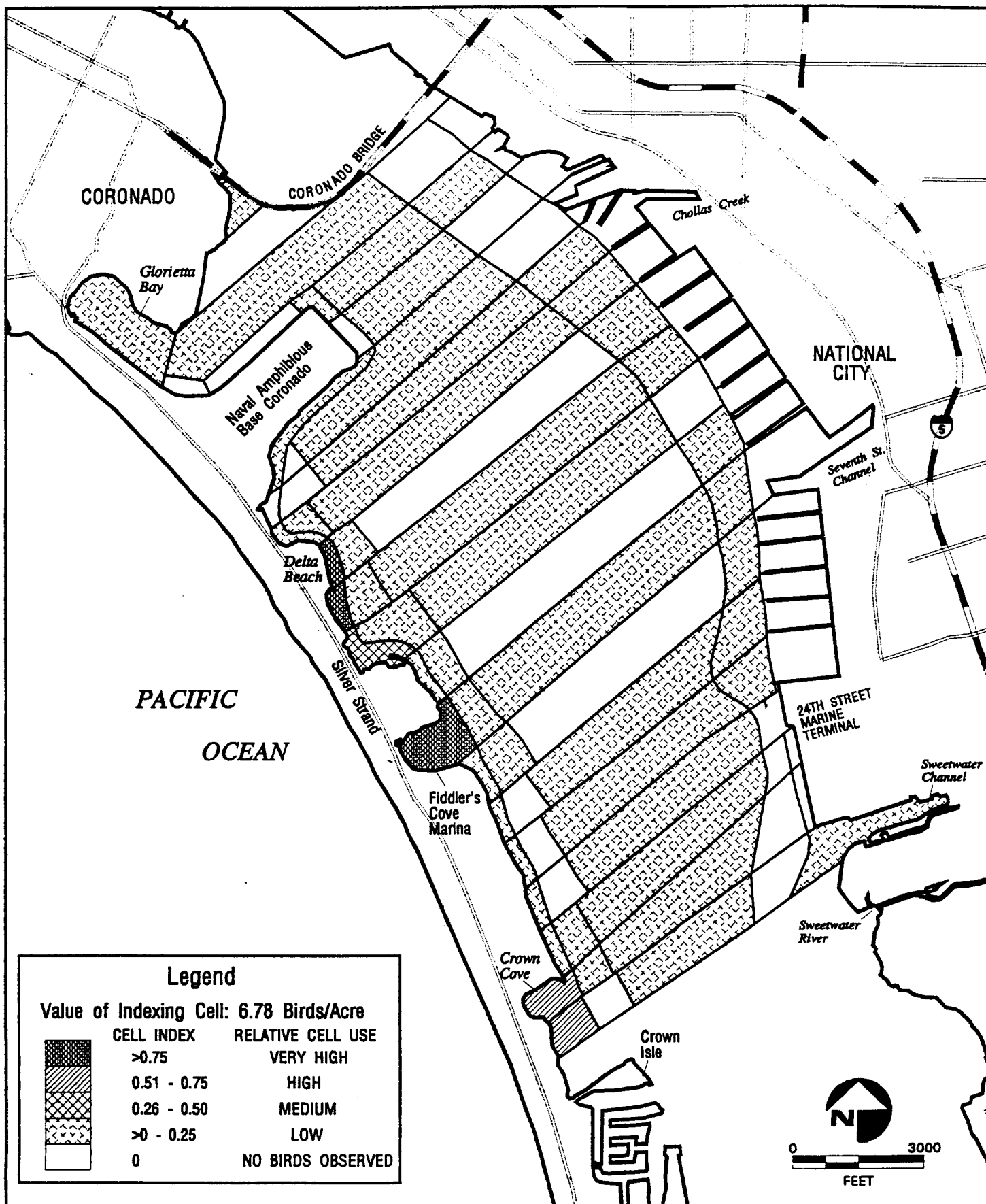
Shallow SS = Silver Strand and Coronado shorelines and water generally within 100 feet of shore

Marinas SS = Silver Strand and Coronado marinas and shoreline with docks and piers

Relative Habitat Utilization by Foraging (a) and Resting (b)
Elegant Terns in Central San Diego Bay During 1994

F I G U R E

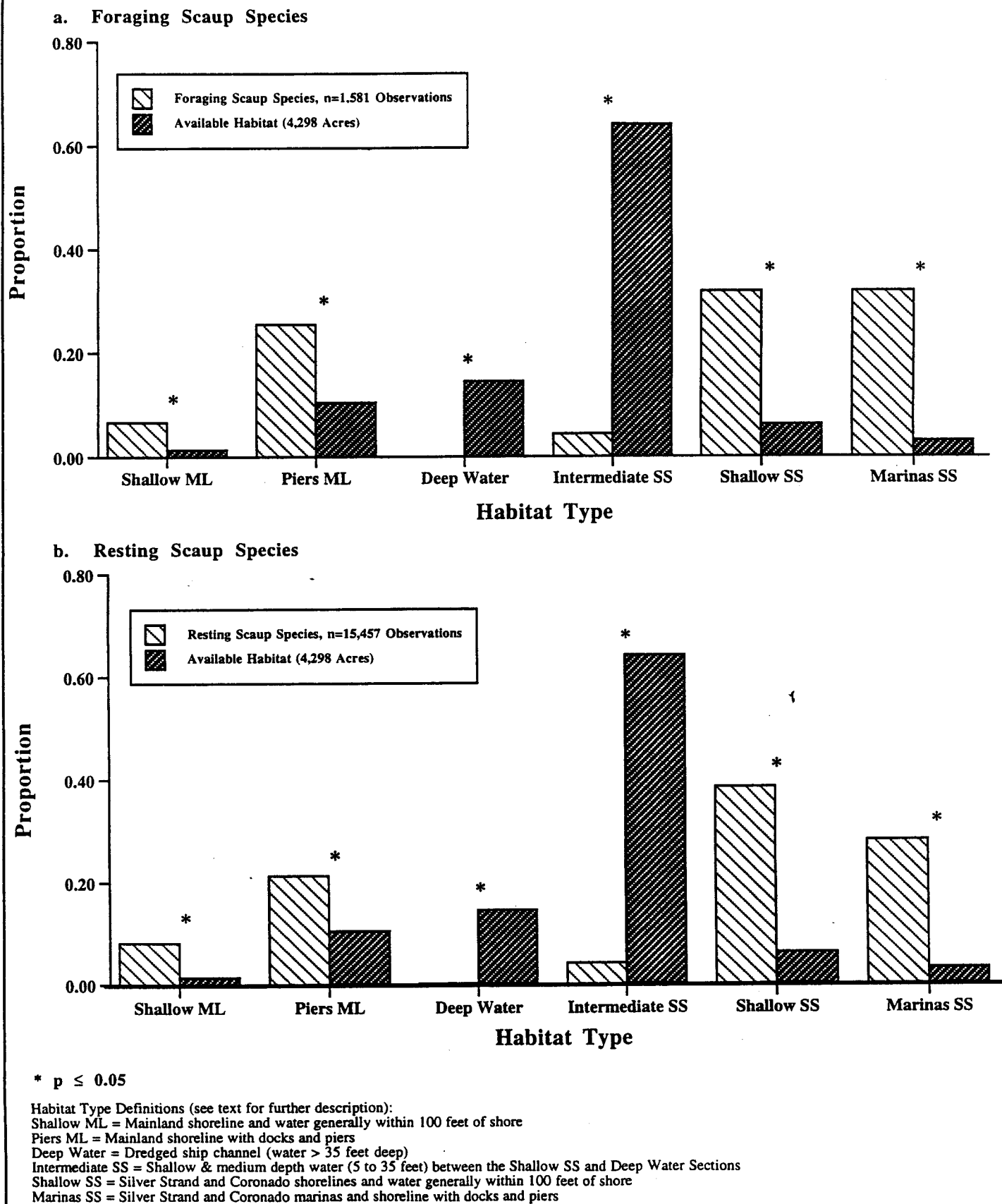
21



Spatial Use of Central San Diego Bay by
Elegant Terns During 1994

FIGURE

22



Relative Habitat Utilization by Foraging (a) and Resting (b)
Scaup Species in Central San Diego Bay During 1994

FIGURE

23

north of Fiddler's Cove Marina, Crown Cove, Sweetwater Marsh and Channel, and the shoreline just south of the 24th Street Marine Terminal (Figure 24). The fifth highest density cell (52.86 birds/acre) was used as the basis for scaup cell index. The highest density cell with 299.17 birds/acre was an outlier so the second highest density cell (103 birds/acre) was used to determine the indexing cell. The second highest density cell was 1.9 times greater than the indexing cell.

Surf Scoter

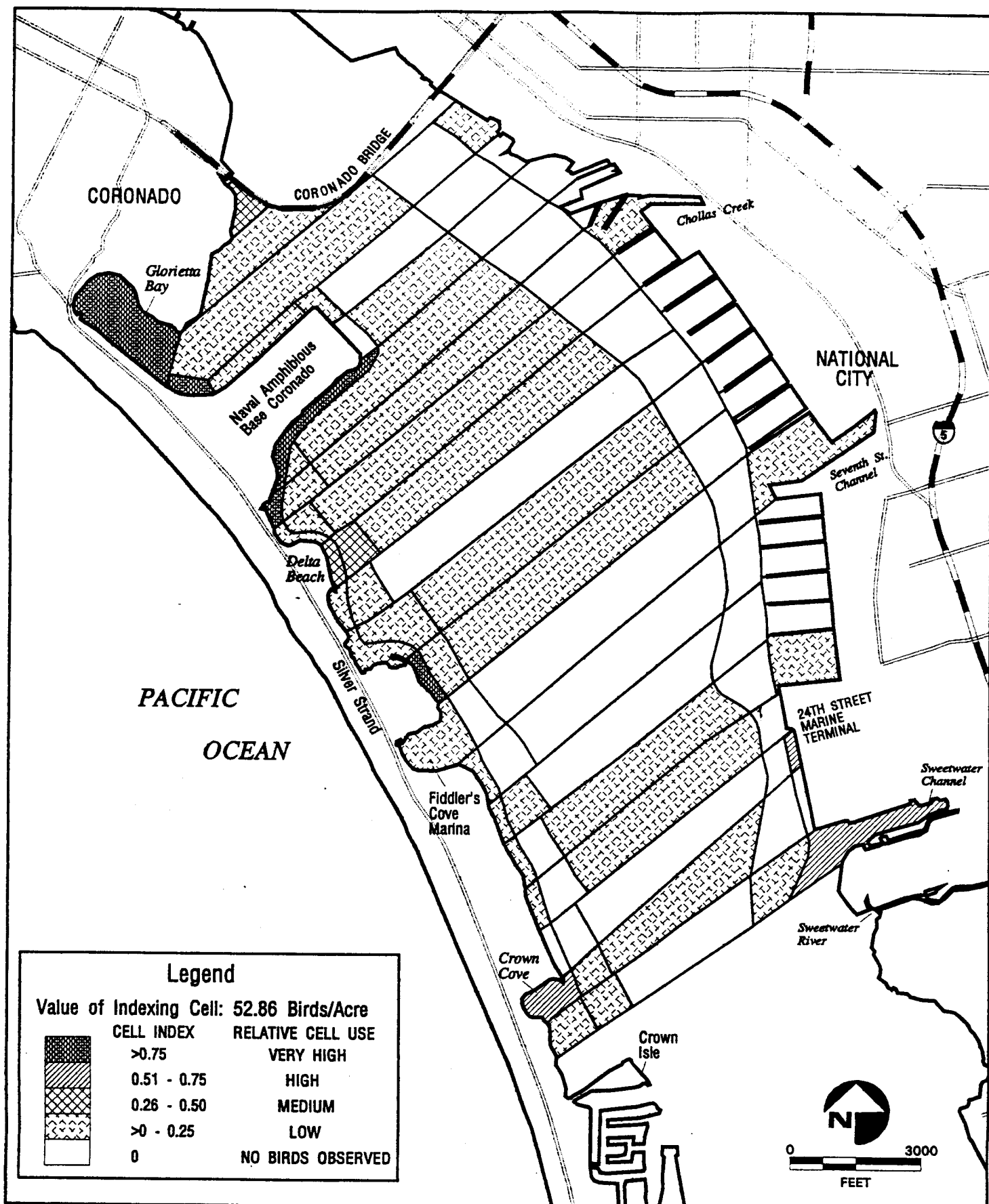
Foraging surf scoters preferentially used the intermediate depth water habitat (Figure 25a) and significantly underused all other habitat types. Resting scoters showed the same habitat preferences as foraging scoters (Figure 25b). High use areas for surf scoters were concentrated in intermediate depth water from east of Delta Beach south down the middle of Central Bay to the south end of the study area (Figure 26). The sixth highest density cell (44.25 birds/acre) was used as the basis of the surf scoter cell index. There were no cells where foraging was the dominant activity, so the indexing cell was chosen using the same method as for the all waterbirds group (see Methods, Section 2.3). The highest density cell (84.19 birds/acre) was 1.9 times larger than the indexing cell.

3.2.3 Foraging Guilds

Waders

The wader/shallow water foraging guild significantly preferred foraging in shallow water habitats on both sides of Central Bay and in marina habitats along the Silver Strand (Figure 27a). As would be expected, medium depth and deep water habitats were not used for foraging. Mainland pier habitats were also significantly underused for foraging. Resting waders showed a significant positive preference for Marinas SS and for shallow water habitats along both sides of the Bay (Figure 27b). There was no significant preference for resting in the intermediate depth water habitat. Waders avoided resting on mainland piers and in the deep water channel.

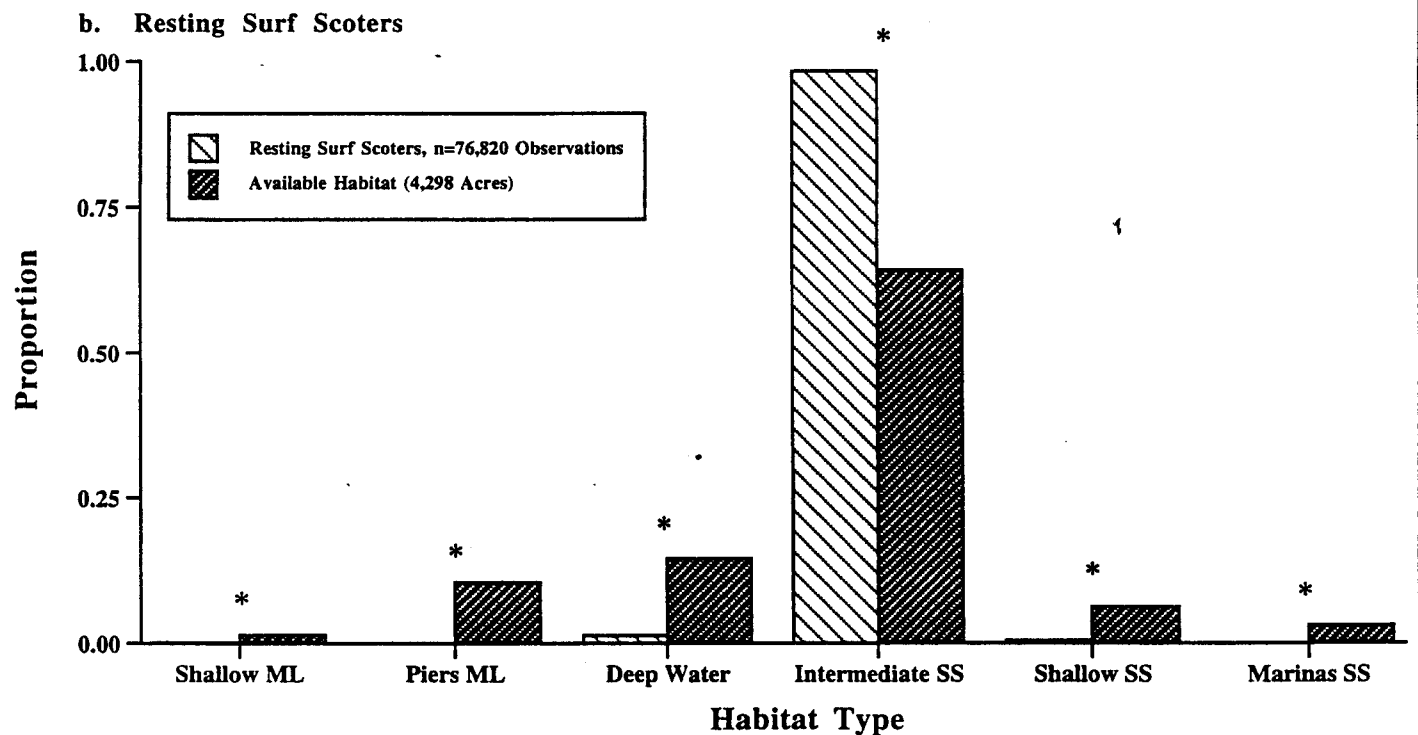
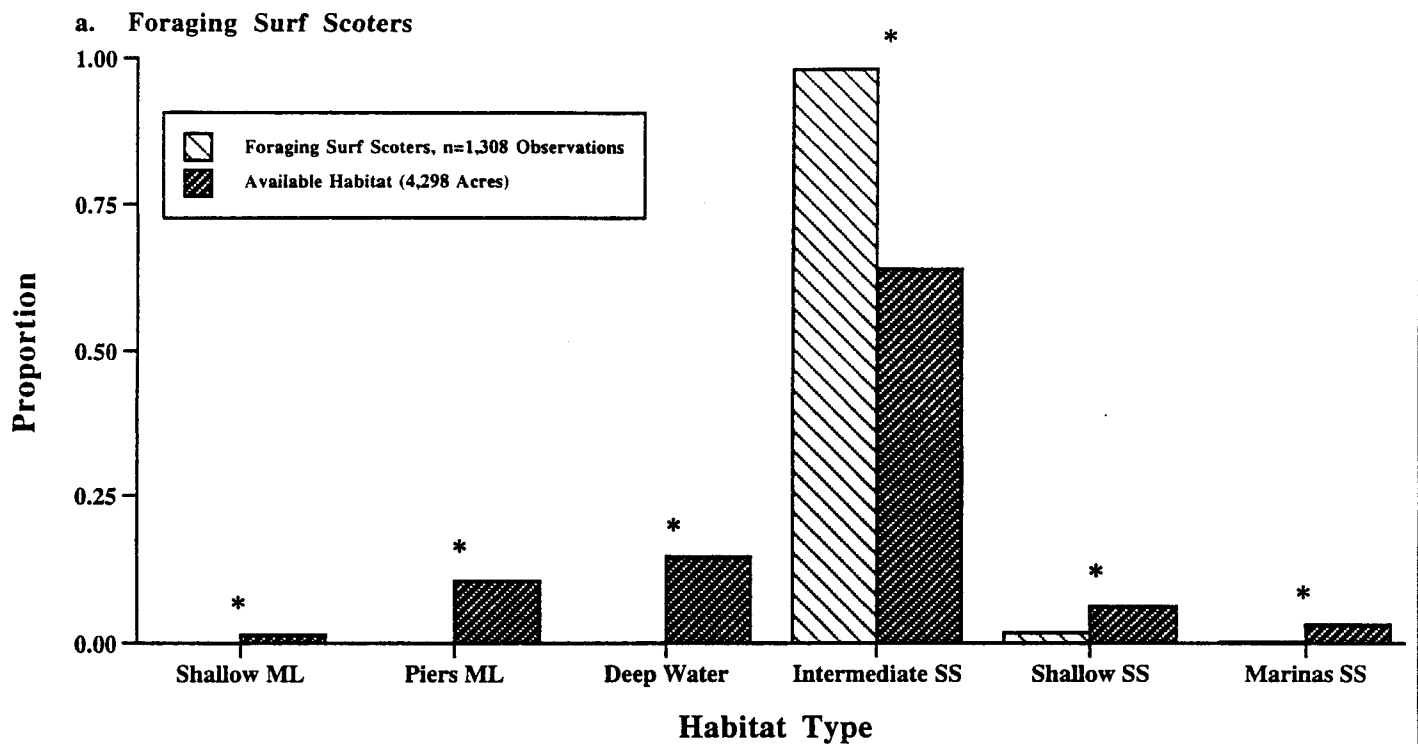
High use areas for foraging and resting waders included the north and south edges of the Naval Amphibious Base, the Silver Strand shoreline between Delta Beach and the cove north of Fiddler's Cove Marina (Figure 28). Other high use cells include intermediate depth water habitat northwest of the 24th Street Marine Terminal, and the Sweetwater Marsh and Channel. The intermediate depth water cells were of high value due to the relatively large numbers of great blue herons that consistently roosted and nested on



**Spatial Use of Central San Diego Bay by
Lesser and Greater Scaup During 1994**

FIGURE

24



* $p \leq 0.05$

Habitat Type Definitions (see text for further description):

Shallow ML = Mainland shoreline and water generally within 100 feet of shore

Piers ML = Mainland shoreline with docks and piers

Deep Water = Dredged ship channel (water > 35 feet deep)

Intermediate SS = Shallow & medium depth water (5 to 35 feet) between the Shallow SS and Deep Water Sections

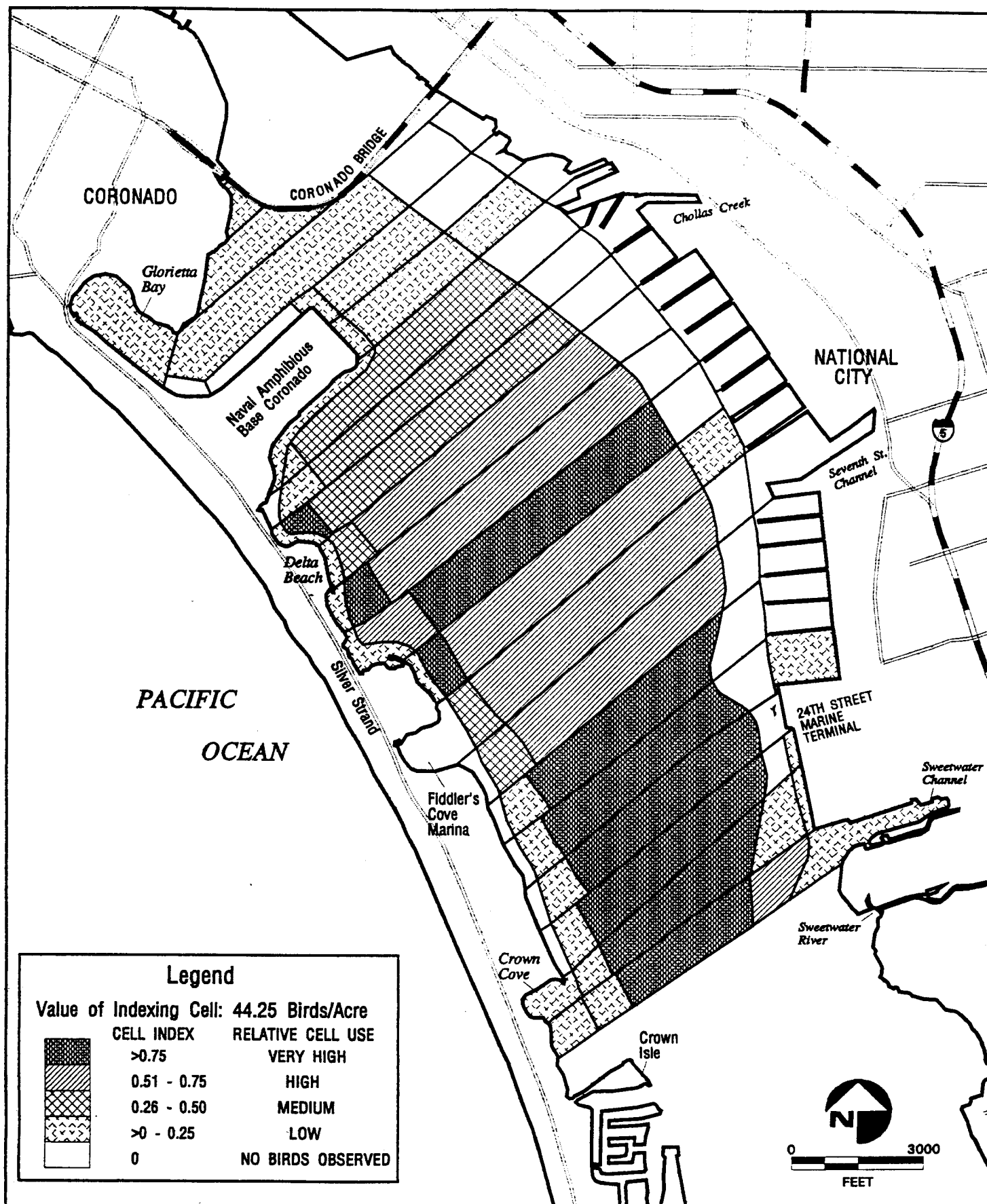
Shallow SS = Silver Strand and Coronado shorelines and water generally within 100 feet of shore

Marinas SS = Silver Strand and Coronado marinas and shoreline with docks and piers

**Relative Habitat Utilization by Foraging (a) and Resting (b)
Surf Scoters in Central San Diego Bay During 1994**

FIGURE

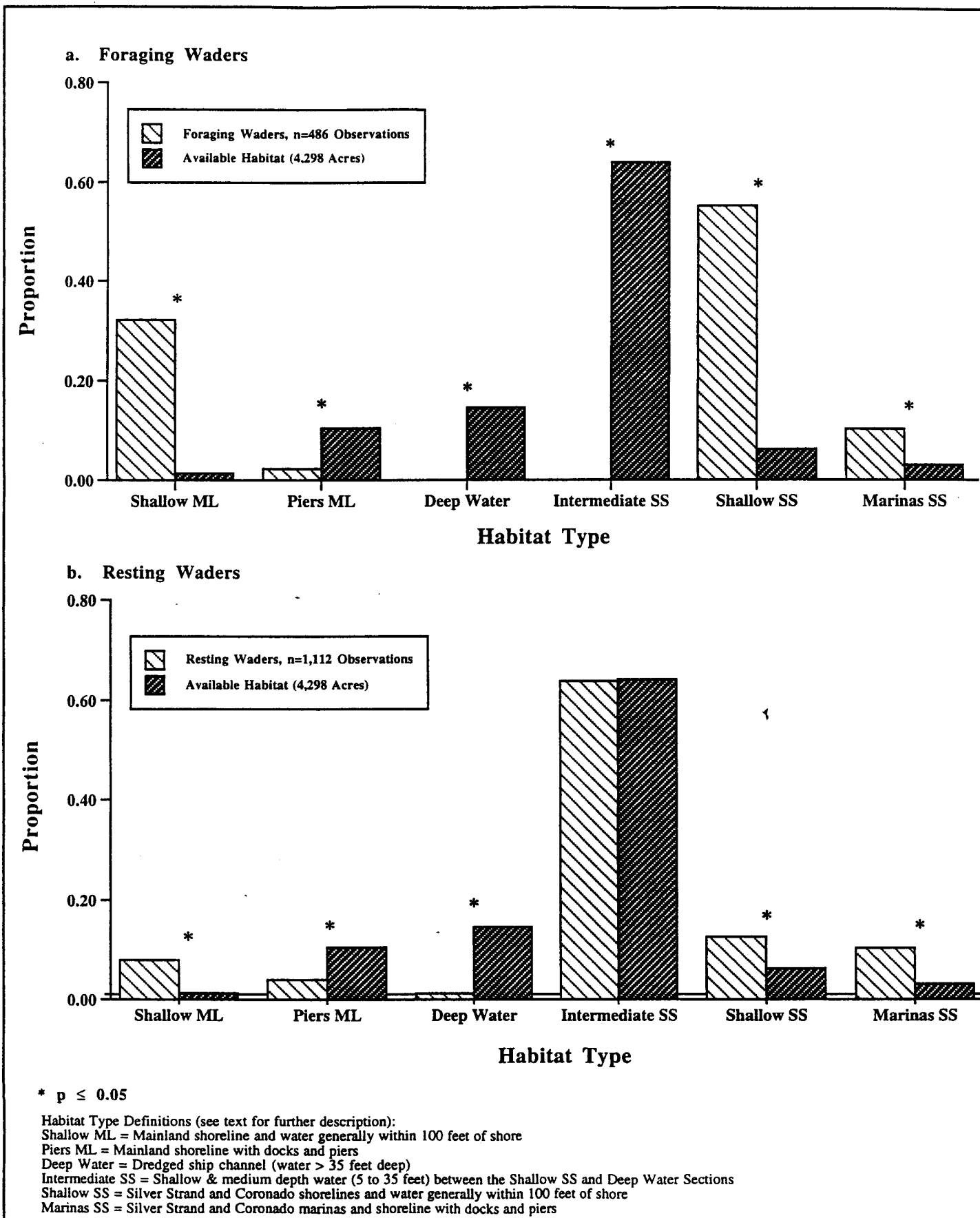
25



**Spatial Use of Central San Diego Bay by
Surf Scoters During 1994**

FIGURE

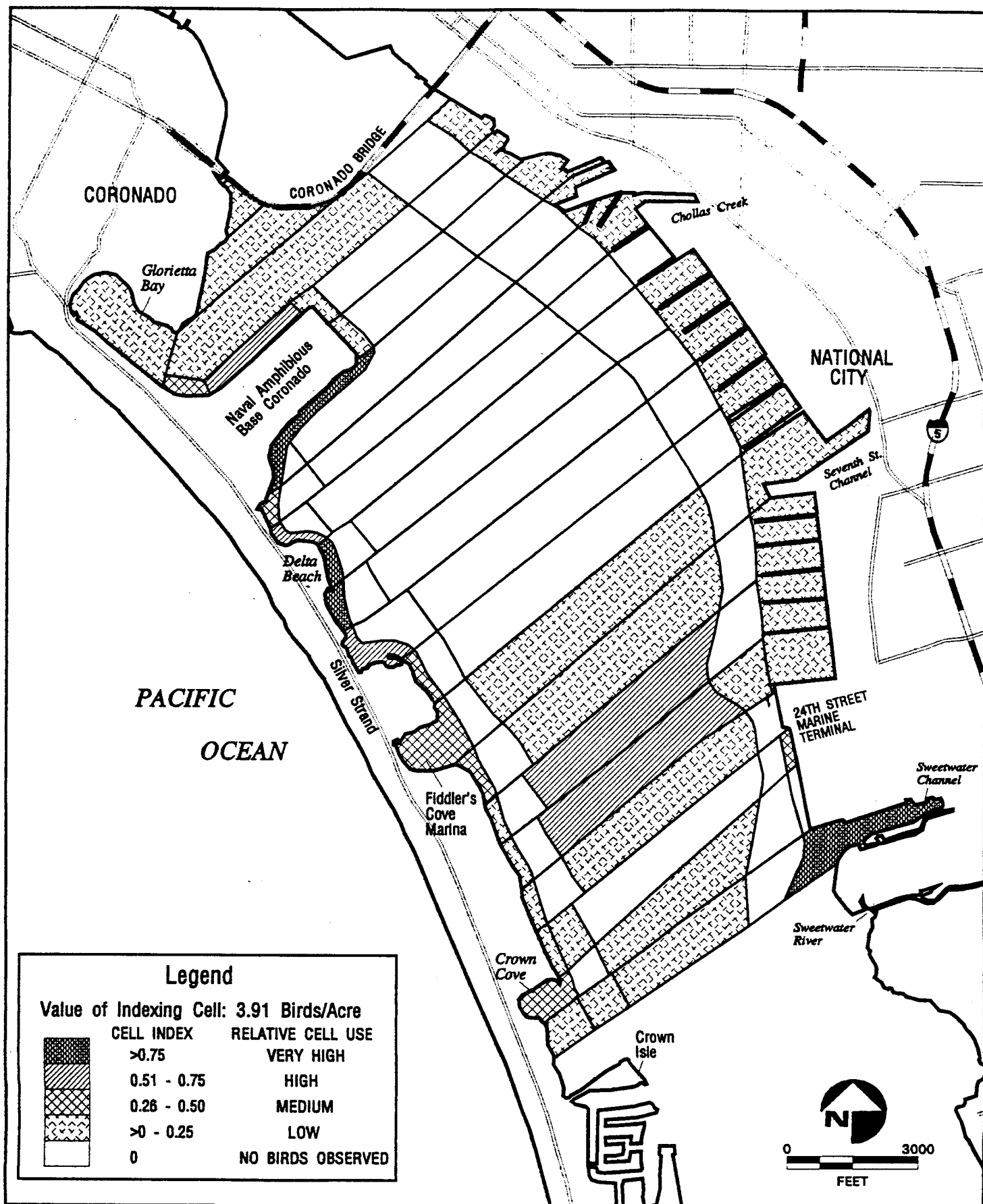
26



**Relative Habitat Utilization by Foraging (a) and Resting (b)
Wader/Shallow Water Foraging Guild in Central San Diego Bay During 1994**

F I G U R E

27



**Spatial Use of Central San Diego Bay by the
Wader Shallow Water Foraging Guild During 1994**

FIGURE

28

abandoned, unused, and shipwrecked boats, barges, and drydocks. The highest density cell had foraging as the predominant activity. For this reason, the indexing cell was chosen in the same manner as for all waterbirds (see Methods, Section 2.3). The fourth highest total density cell (3.91 birds/acre) was chosen to create the wader cell index. The highest density cell was 2.0 times greater than this indexing cell.

Probers

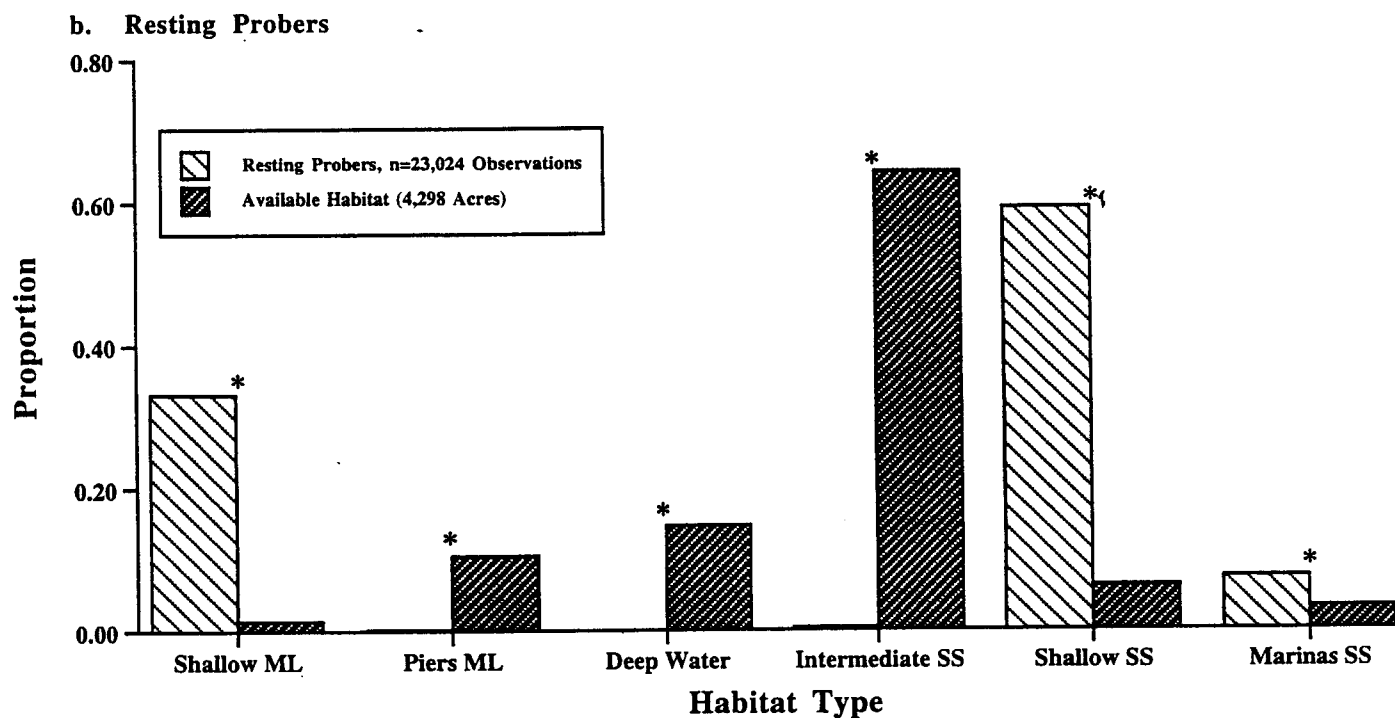
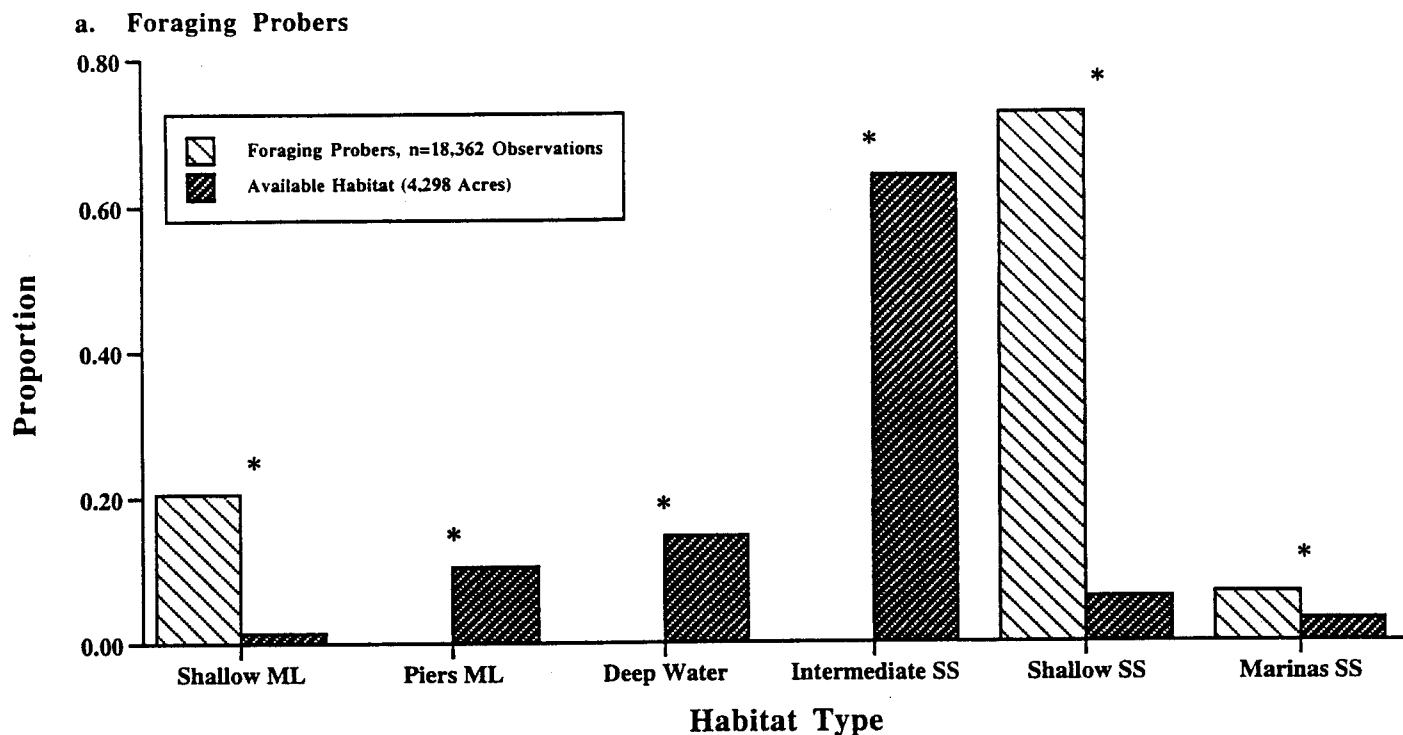
The Prober foraging guild showed a significant positive preference for foraging in shallow water habitats along both shorelines of Central Bay, and for foraging in marinas along the Silver Strand (Figure 29a). Similar to the waders, the mainland piers, intermediate and deep water habitats were not used for foraging. Resting probers preferred the same habitat types as foraging probers (Figure 29b).

High value cells for probers are distributed along the south edge of Naval Amphibious Base and along the Silver Strand from Delta Beach south to the cove north of Fiddler's Cove Marina (Figure 30). Other high value areas included Crown Cove and the Sweetwater Marsh northern shoreline. The sixth highest total density cell (107.27 birds/acre) was chosen to create the prober index, as it was the highest cell with foraging the dominant activity. The highest total density cell with 1234.60 birds/acre was 11.5 times larger than the indexing cell.

Bottom Feeders

Birds in the bottom feeding foraging guild showed a significant positive preference for foraging in shallow habitats along the mainland and Silver Strand shorelines and for marinas on the Silver Strand side of the Bay (Figure 31a). Intermediate and deep water habitats were significantly underused. Resting bottom feeders preferred the intermediate depth water habitats and shallow shoreline and marina habitat along the Silver Strand side of the Bay (Figure 31b). Resting bottom feeders had a negative preference for the deep water channel and mainland pier areas, and no significant preference for the mainland shallow water habitat.

High value areas for bottom feeders in Central San Diego Bay included Glorietta Bay, natural shorelines at the northwest corner and south edge of the Naval Amphibious Base, and several Silver Strand shoreline and near shore cells between the Amphibious Base and Fiddler's Cove Marina (Figure 32): A number of intermediate water depth cells from Delta Beach south to the end of the study area were of high value to bottom feeders as well as



* $p \leq 0.05$

Habitat Type Definitions (see text for further description):

Shallow ML = Mainland shoreline and water generally within 100 feet of shore

Piers ML = Mainland shoreline with docks and piers

Deep Water = Dredged ship channel (water > 35 feet deep)

Intermediate SS = Shallow & medium depth water (5 to 35 feet) between the Shallow SS and Deep Water Sections

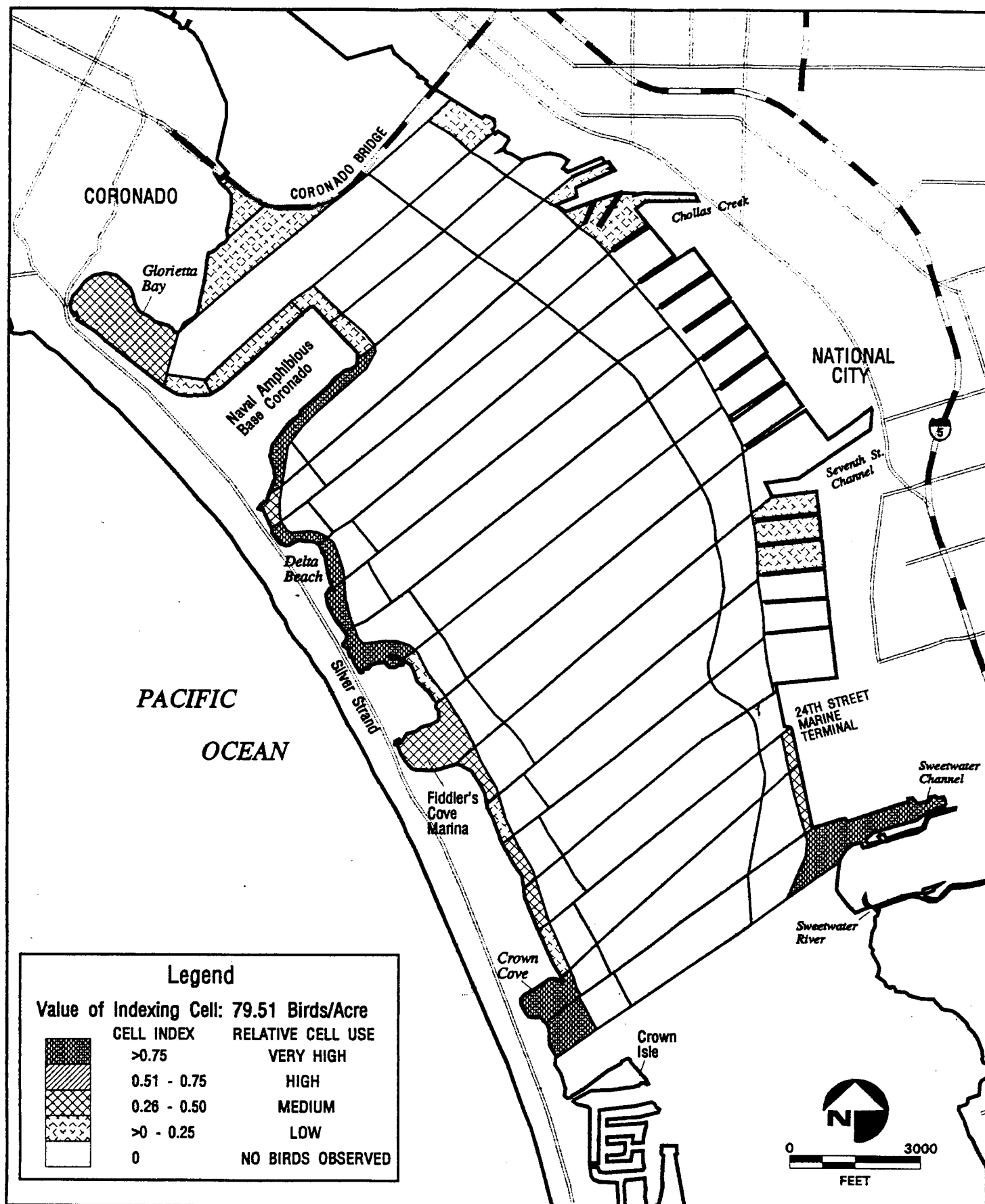
Shallow SS = Silver Strand and Coronado shorelines and water generally within 100 feet of shore

Marinas SS = Silver Strand and Coronado marinas and shoreline with docks and piers

**Relative Habitat Utilization by Foraging (a) and Resting (b)
Prober Foraging Guild in Central San Diego Bay During 1994**

FIGURE

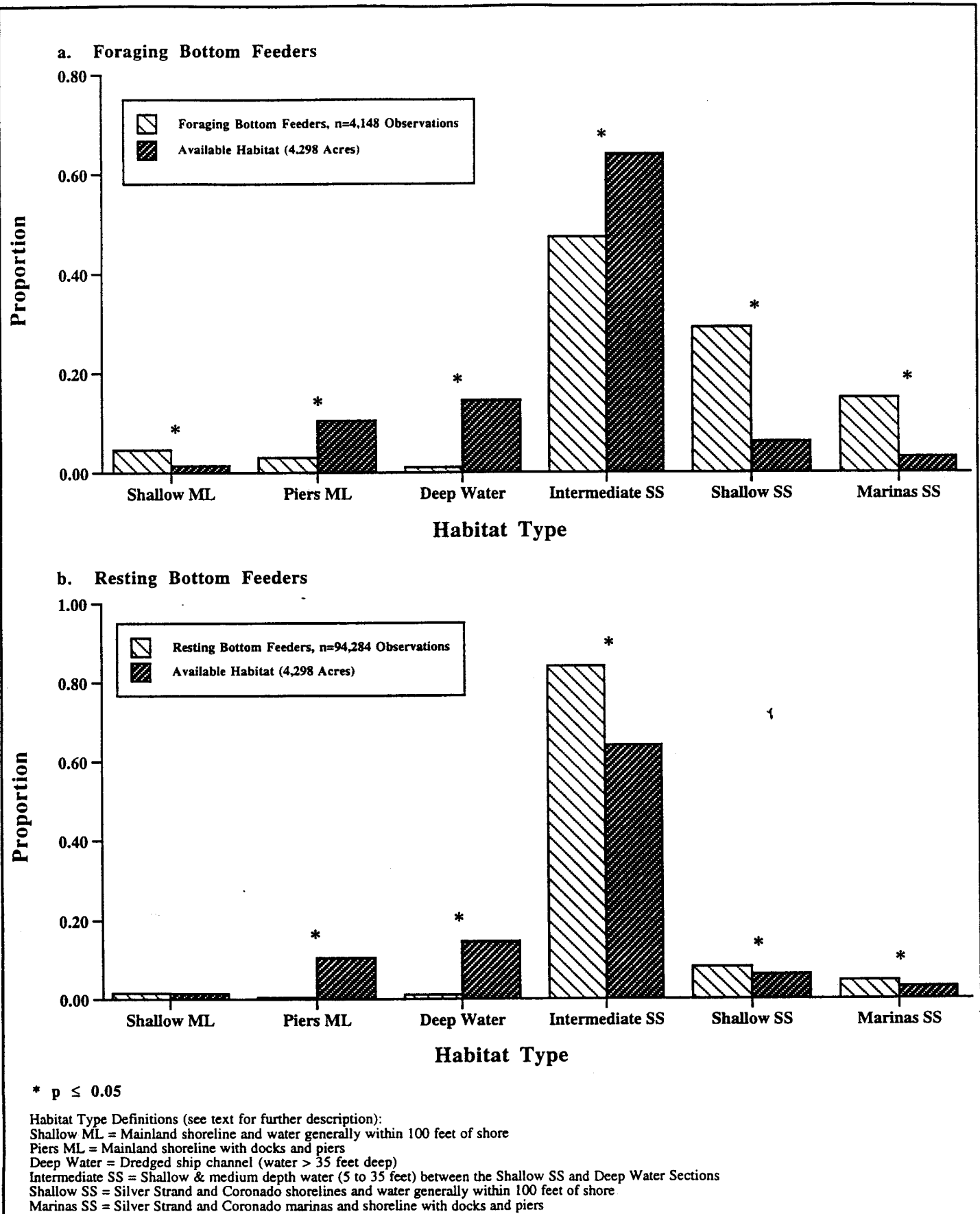
29



Spatial Use of Central San Diego Bay by the Prober Foraging Guild During 1994

FIGURE

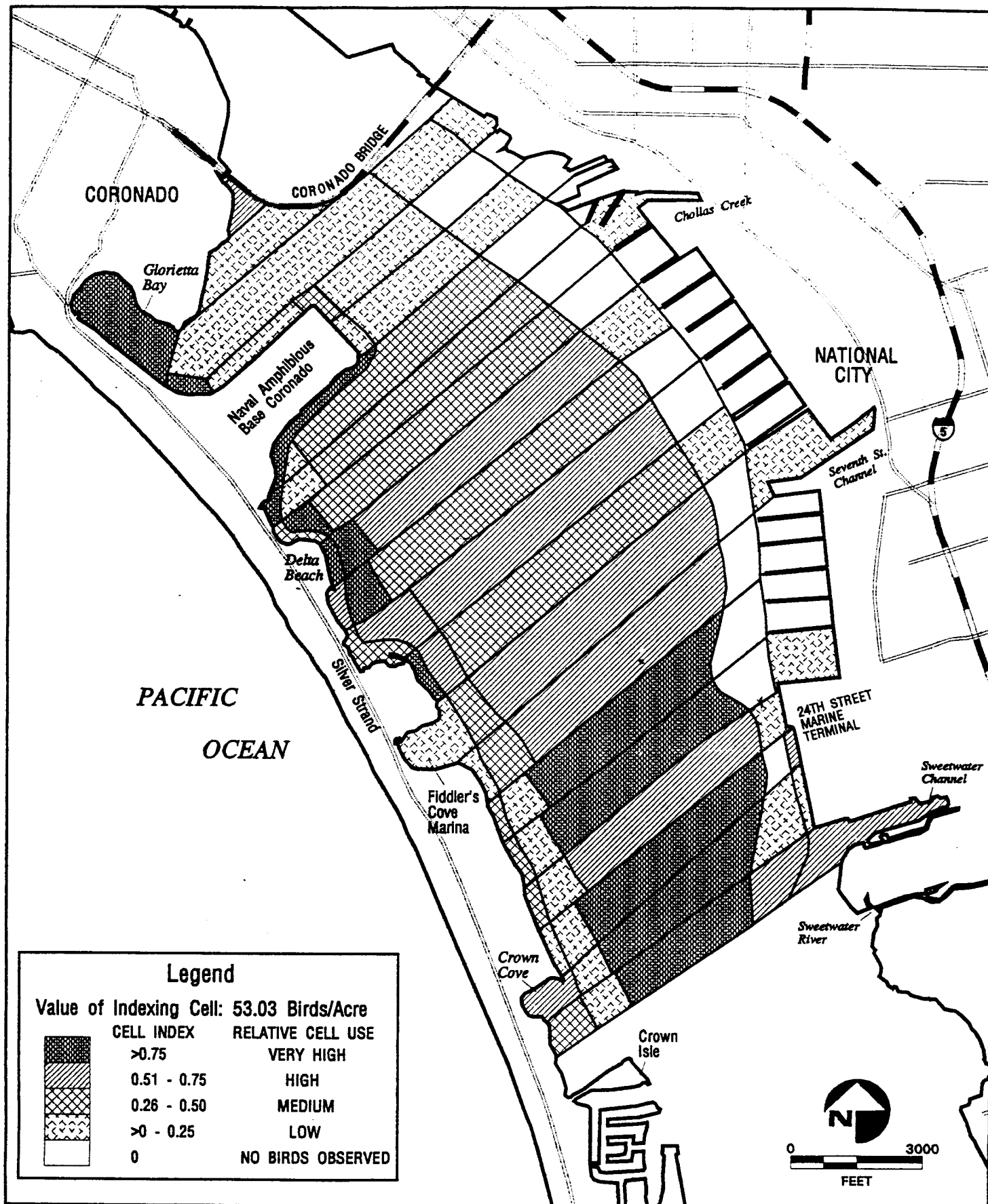
30



Relative Habitat Utilization by Foraging (a) and Resting (b) Bottom Feeding Foraging Guild in Central San Diego Bay During 1994

FIGURE

31



Spatial Use of Central San Diego Bay by the Bottom Feeding Foraging Guild During 1994

FIGURE

32

Crown Cove and the Sweetwater Marsh and Channel. The tenth highest total density cell (53.03 birds/acre) was used to create the bottom feeder cell index. There were no cells where foraging was a dominant activity so the indexing cell was chosen in the same manner as for all waterbirds (see Methods, Section 2.3). The highest total density cell with 324.25 birds/acre was considered an outlier and the second highest density cell (109.85 birds/acre) was 2.1 times larger than the indexing cell.

Water Column Divers

Water column divers showed a significant preference for foraging in the Silver Strand marina and shallow water habitats along both sides of the Bay (Figure 33a). There was a significant negative preference for mainland piers, and intermediate and deep water habitats. Resting water column divers showed a similar pattern of habitat use except they preferred rather than avoided the mainland piers habitat (Figure 33b).

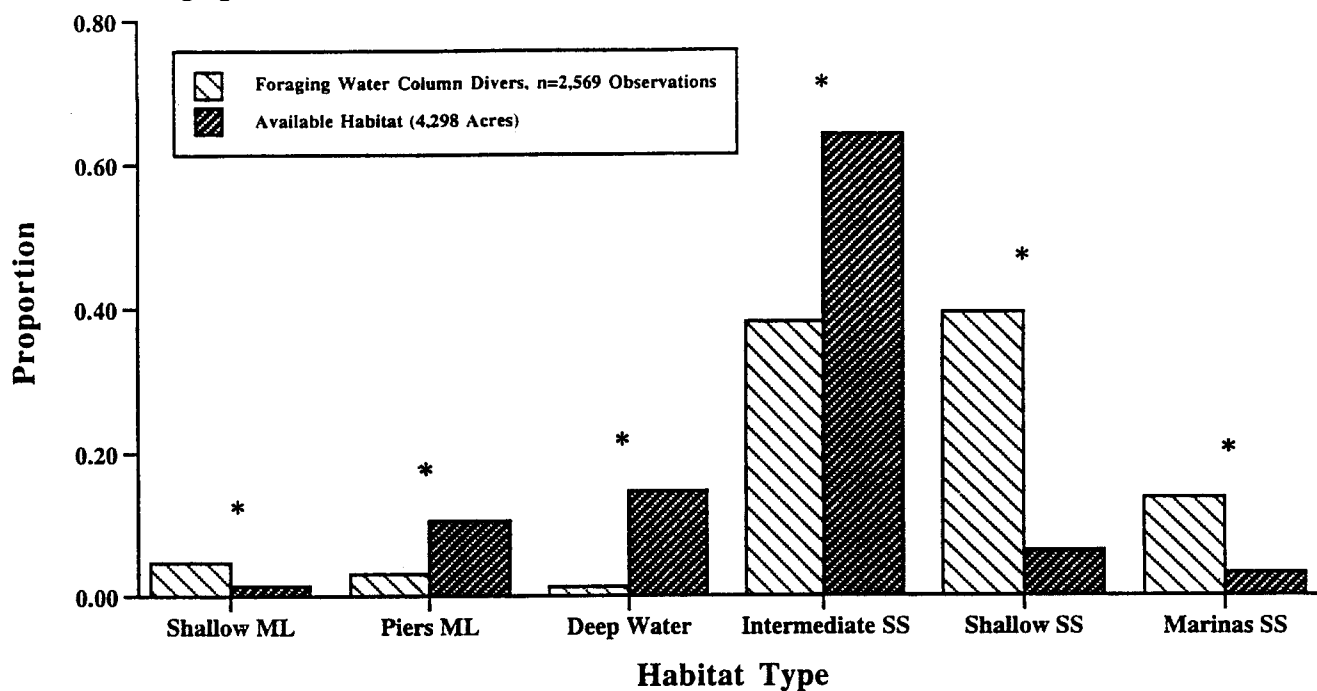
High use areas for water column divers in Central Bay were Glorietta Bay, the north and south edges of the Naval Amphibious Base, and several shoreline and nearshore cells along Delta Beach (Figure 34). Fiddler's Cove Marina and the shoreline south of it, the embayment north of the 24th Street Marine Terminal, and the Sweetwater Marsh/Channel were also highly used areas. The fourth highest total density cell (11.87 birds/acre) was used as the basis of the water column diver cell index, as it was the highest cell with foraging a dominant activity. The highest total density cell had 24.75 birds/acre which was 2.1 times greater than the indexing cell.

Plunge Divers

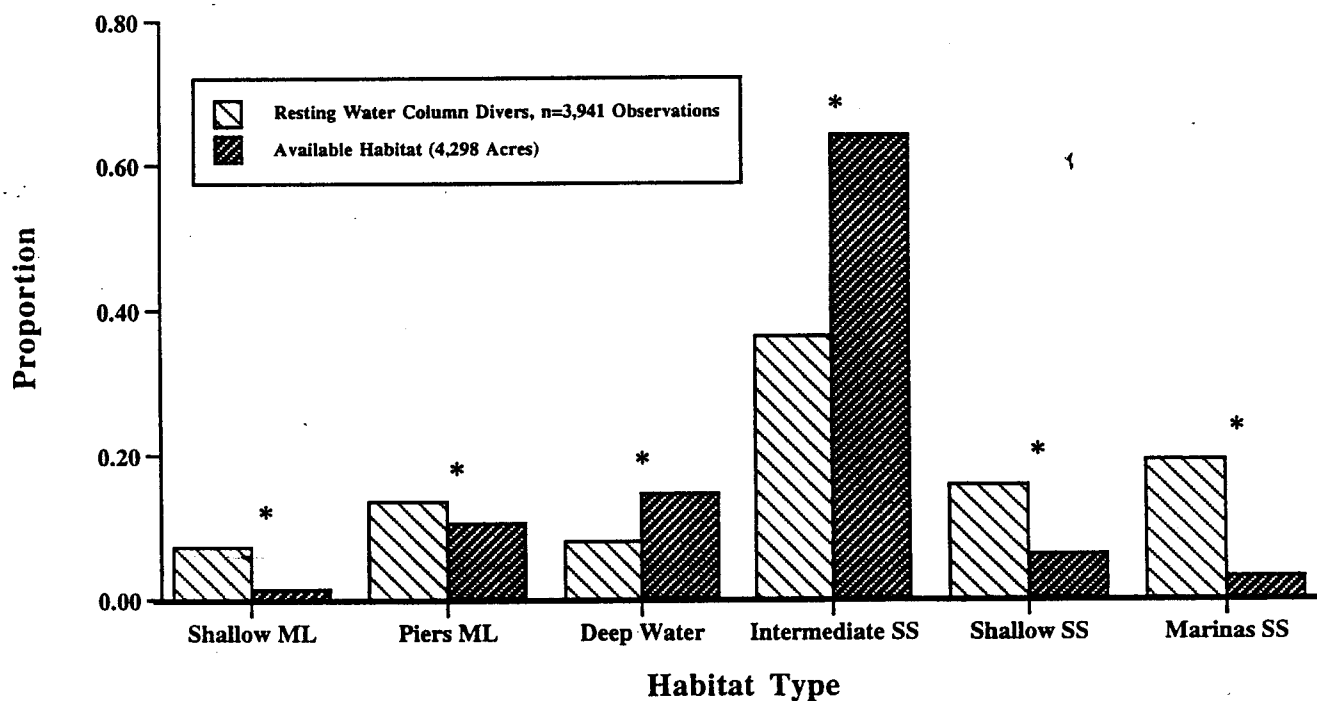
Plunge Divers in Central San Diego Bay preferred to forage in shallow water habitats on both sides of the bay and in Silver Strand marinas (Figure 35a). The Piers ML and Intermediate SS habitats were significantly underused. There was no significant preference for the deep water channel. Resting plunge divers showed a very strong preference for the Shallow SS and Marinas SS habitats (Figure 35b). Plunge divers avoided the Piers ML, Deep Water, and Intermediate SS habitats. There was no significant preference for shallow water habitats along the mainland side of Central Bay.

High use areas for plunge divers included the north and south edges of Naval Amphibious Base, most of the Silver Strand shoreline, Fiddler's Cove Marina, and Crown Cove (Figure 36). Other high use areas included a deep water cell west of the Seventh Street Channel, the embayment north of the 24th Street Marine Terminal, and the Sweetwater

a. Foraging Water Column Divers



b. Resting Water Column Divers



* $p \leq 0.05$

Habitat Type Definitions (see text for further description):

Shallow ML = Mainland shoreline and water generally within 100 feet of shore

Piers ML = Mainland shoreline with docks and piers

Deep Water = Dredged ship channel (water > 35 feet deep)

Intermediate SS = Shallow & medium depth water (5 to 35 feet) between the Shallow SS and Deep Water Sections

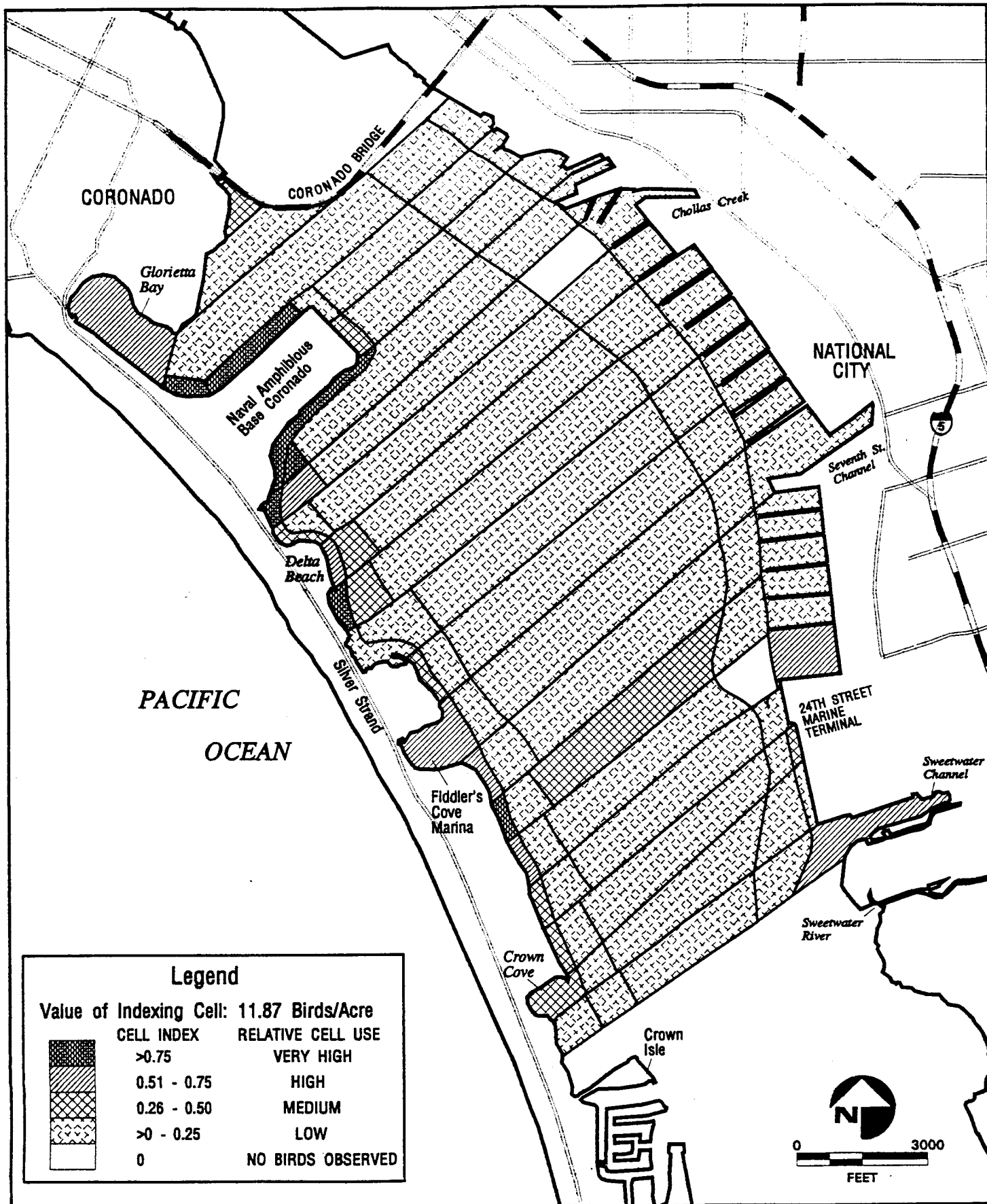
Shallow SS = Silver Strand and Coronado shorelines and water generally within 100 feet of shore

Marinas SS = Silver Strand and Coronado marinas and shoreline with docks and piers

Relative Habitat Utilization by Foraging (a) and Resting (b) Water Column Diving Guild in Central San Diego Bay During 1994

FIGURE

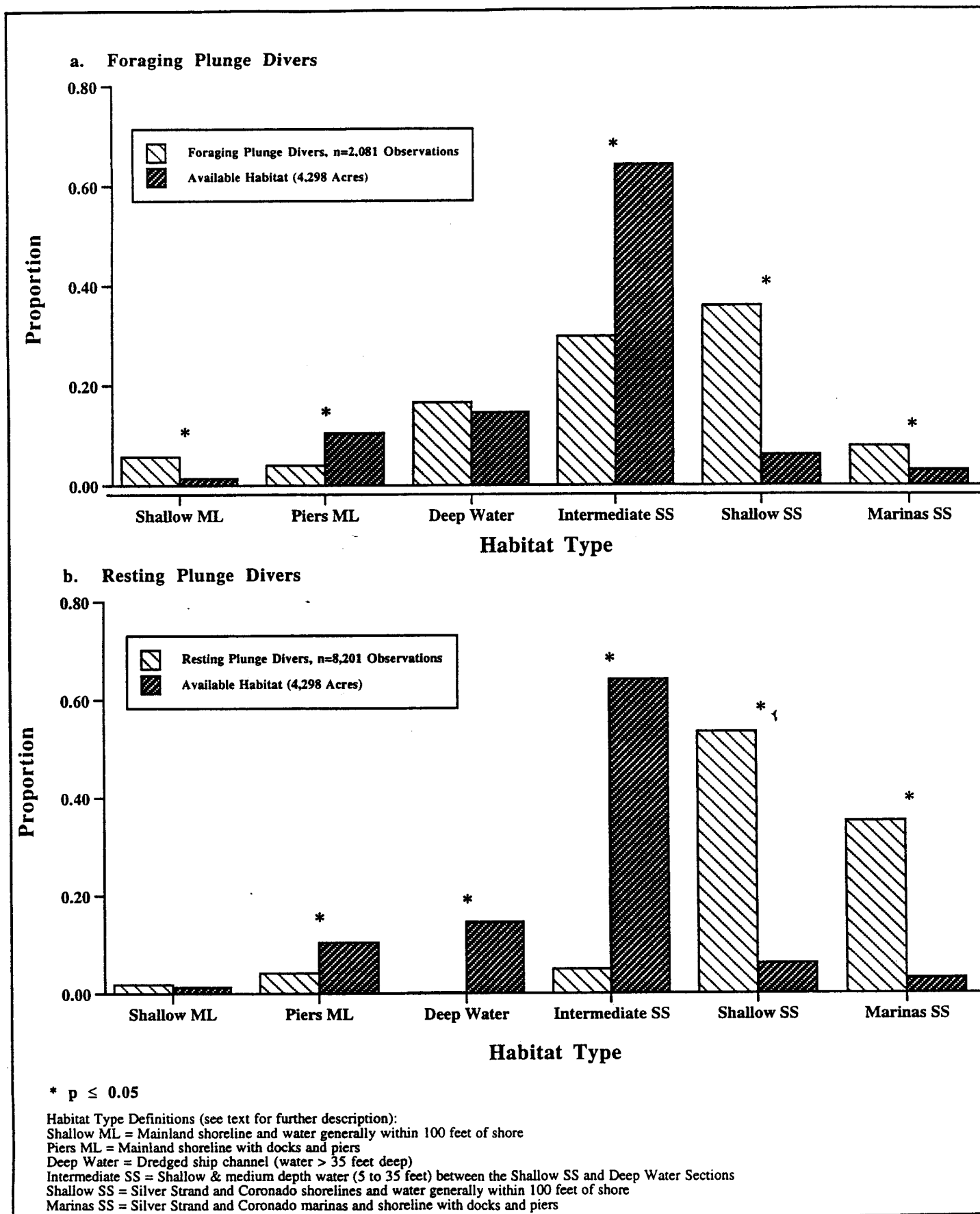
33



Spatial Use of Central San Diego Bay by the
Water Column Diving Foraging Guild During 1994

FIGURE

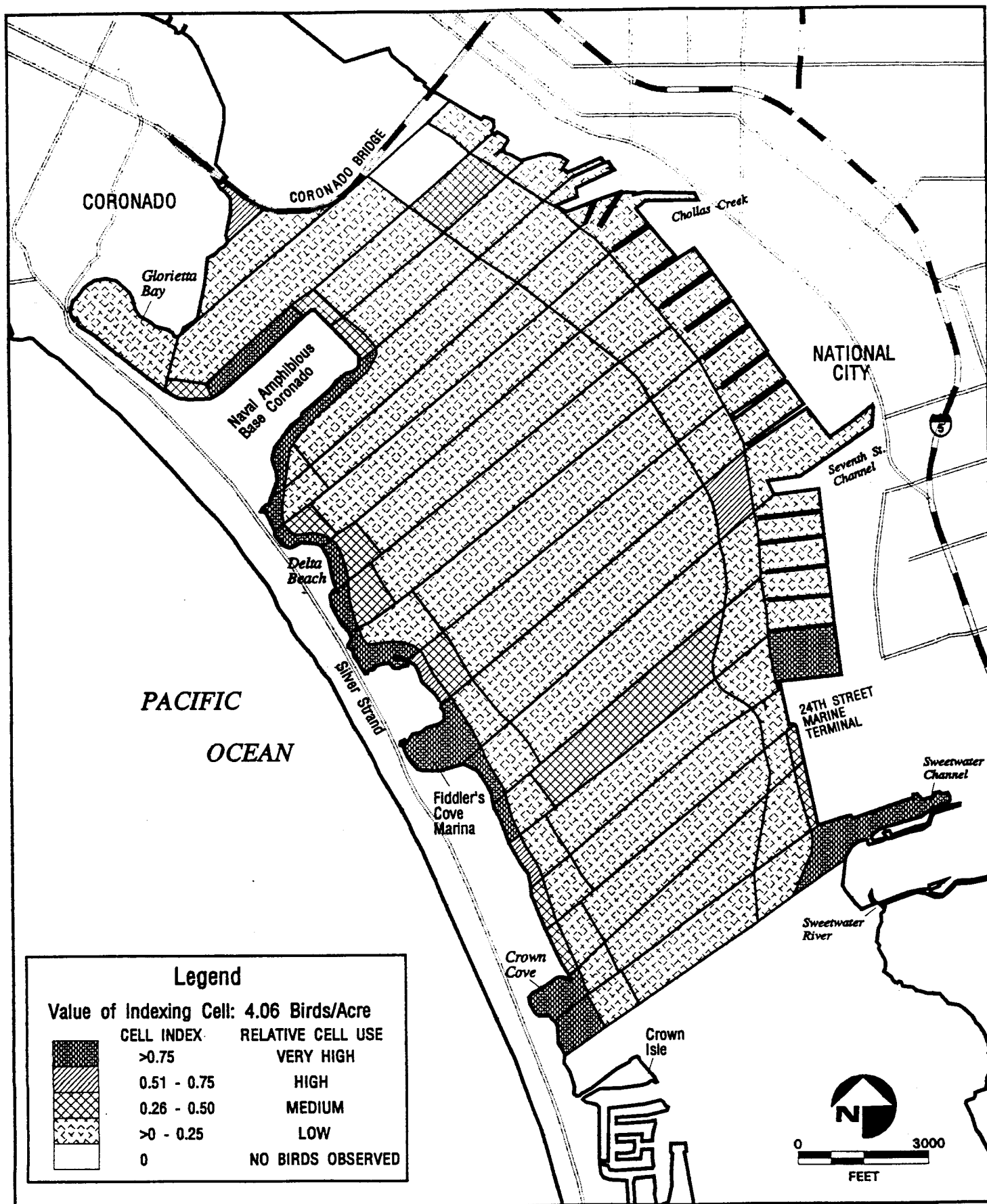
34



Relative Habitat Utilization by Foraging (a) and Resting (b) Plunge Diving Foraging Guild in Central San Diego Bay During 1994

FIGURE

35



Spatial Use of Central San Diego Bay by the
Plunge Diving Foraging Guild During 1994

FIGURE

36

Marsh and Channel. The 13th highest total density cell (4.06 birds/acre) was used as the basis for the plunge diver cell index, since it was the highest cell in which foraging was dominant. The highest total density cell had 278.16 birds/acre and was 68.5 times greater than the indexing cell.

Generalists

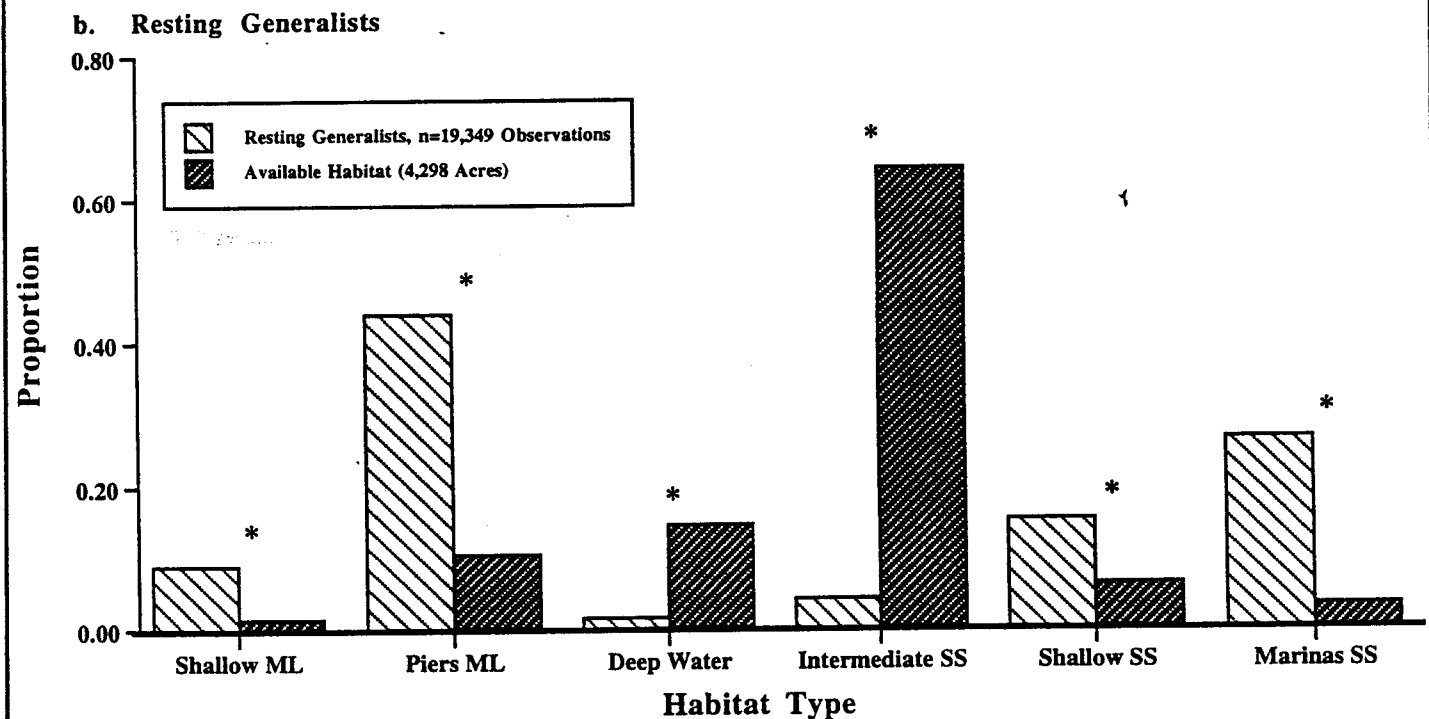
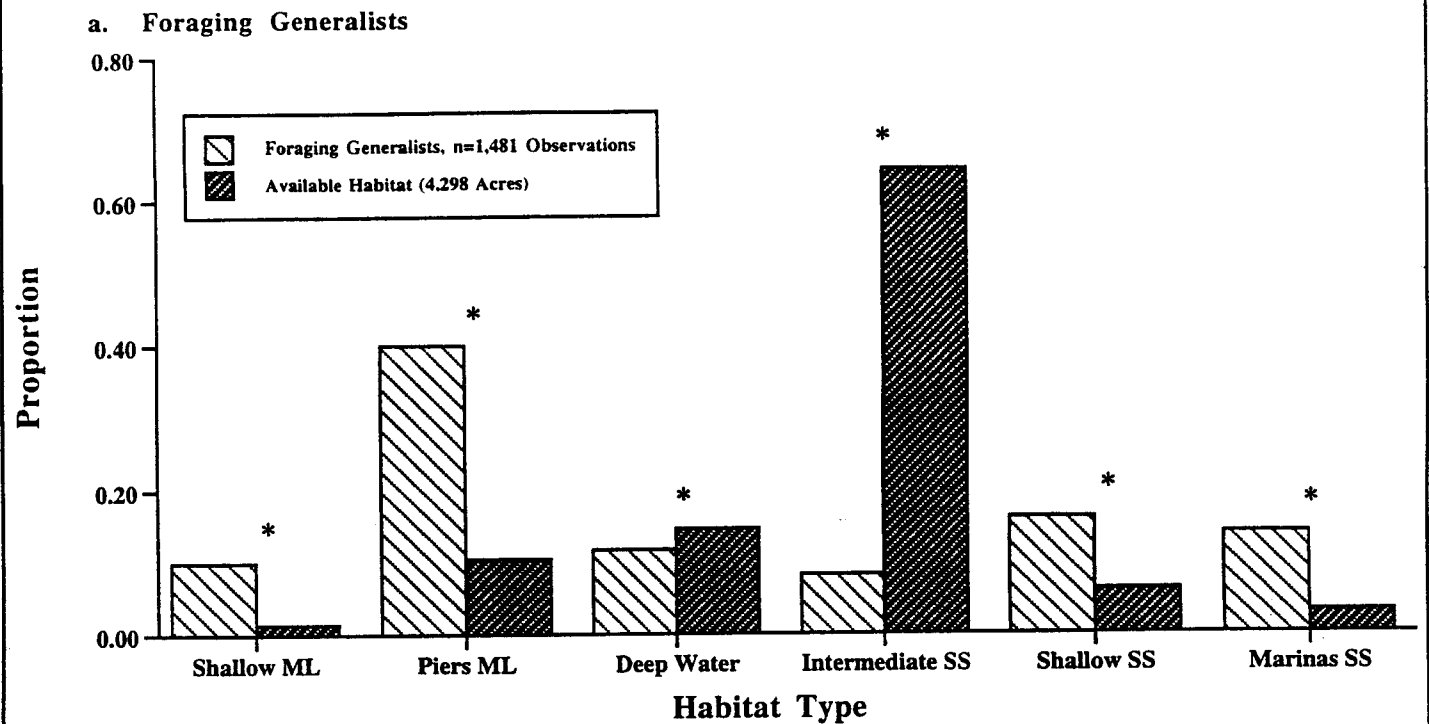
The generalist foraging guild showed significant positive preferences for foraging in the mainland pier, Silver Strand marina, and shallow water habitat on both sides of Central Bay (Figure 37a). Intermediate and deep water habitats were significantly underused for foraging. Resting generalists showed the same pattern of preferences (Figure 37b).

High use areas for resting generalists included the north and south edges of the Naval Amphibious Base, the embayment at Chollas Creek, Crown Cove, and the Sweetwater Marsh and Channel (Figure 38). Other high use areas included shoreline at Delta Beach, an embayment south of Chollas Creek and another embayment north of the 24th Street Marine Terminal. Foraging was not a dominant activity for most cells in the generalist guild. As a result, the method for indexing the "all waterbird" group was used (see Methods, Section 2.3) for the generalist guild. The second highest total density cell (49.14 birds/acre) was chosen as the basis for the index. The highest total density cell had 134.12 birds/acre and was 2.7 times larger than the indexing cell.

4

3.2.4 Eelgrass Abundance and Waterbird Spatial Use

The Navy comprehensively summarized eelgrass surveys of San Diego Bay and digitized this information into GIS (M. Perdue, pers. comm.). Ogden overlaid the waterbird study cells, defined by transects and habitat sections, onto the eelgrass distribution map. Each cell was ranked by the percent acreage of eelgrass it supported. The majority (75 percent) of the 20 highest ranked cells were in Central Bay. The highest ranked cells were at Crown Cove and along the south end of the study area, the shallow and intermediate depth water along the west and south edges of the Navy Amphibious Base, and the intermediate depth water cell to the north of the Base. Other high ranking cells include shoreline areas midway between Fiddler's Cove Marina and Crown Cove and cells at the west end of Coronado Bridge. In the North Bay, cells with a high percentage of eelgrass include a few along the North Island shoreline across from the West Basin of Harbor Island and along the bayside shore of Shelter Island.



* $p \leq 0.05$

Habitat Type Definitions (see text for further description):

Shallow ML = Mainland shoreline and water generally within 100 feet of shore

Piers ML = Mainland shoreline with docks and piers

Deep Water = Dredged ship channel (water > 35 feet deep)

Intermediate SS = Shallow & medium depth water (5 to 35 feet) between the Shallow SS and Deep Water Sections

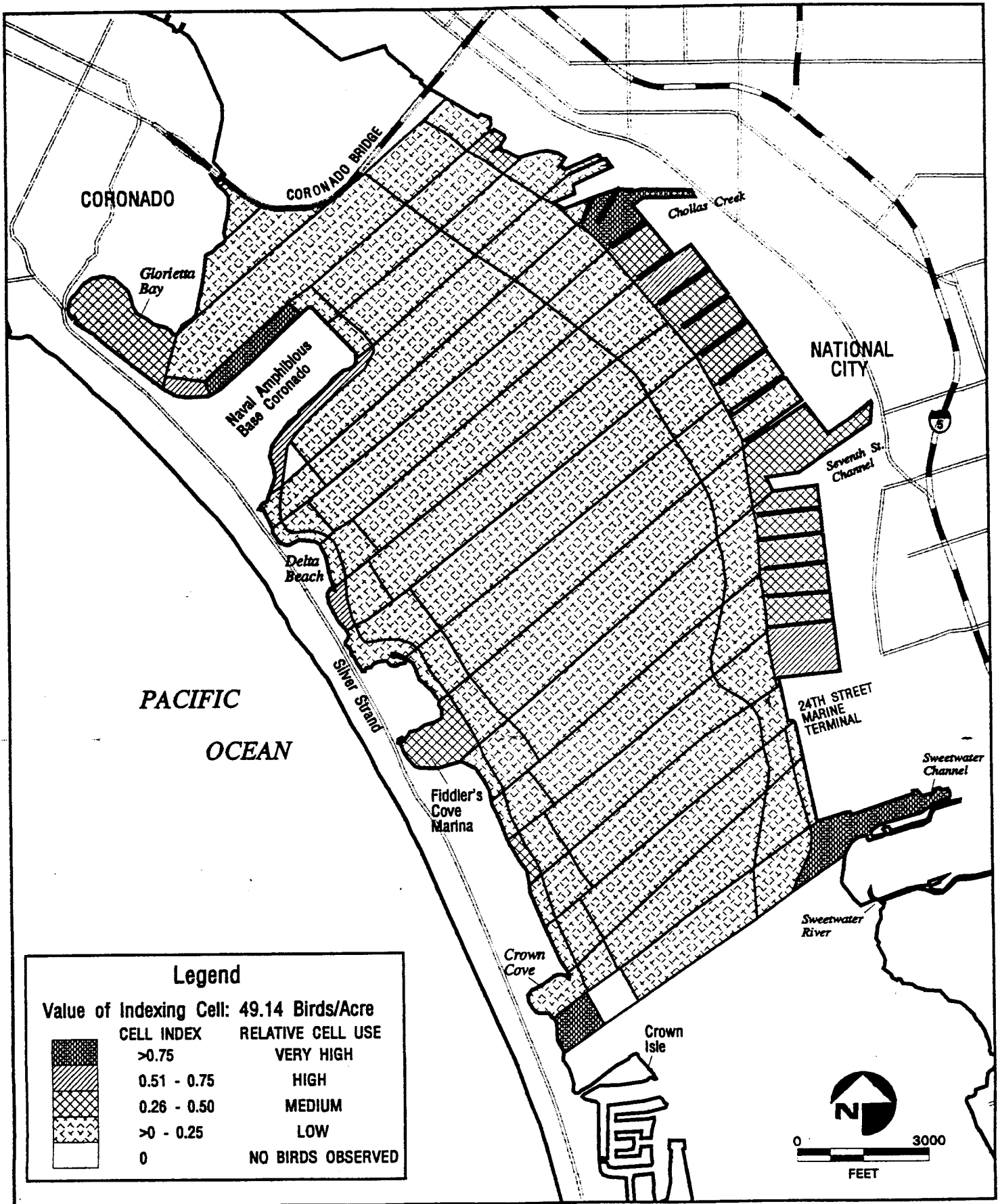
Shallow SS = Silver Strand and Coronado shorelines and water generally within 100 feet of shore

Marinas SS = Silver Strand and Coronado marinas and shoreline with docks and piers

Relative Habitat Utilization by Foraging (a) and Resting (b) Generalist Foraging Guild in Central San Diego Bay During 1994

FIGURE

37



Spatial Use of Central San Diego Bay by the Generalist Foraging Guild During 1994

FIGURE
38

Figure 39 presents the distribution of eelgrass in San Diego Bay overlaid with high value foraging areas for California least terns in Central and North San Diego Bay. There was no correlation between least tern high value foraging areas and cells with high percent cover of eelgrass. A similar comparison of the plunge diving guild foraging areas and eelgrass distribution also showed no trend for foraging in cells with high eelgrass cover.

3.3 BOAT TRAFFIC

Relative levels of boat traffic were calculated for North and Central Bay cells from data collected in 1993 and 1994 (Figure 40). Data were collected for thirty seconds on the number and type of boats in each cell. The entrances to marinas and harbors were also evaluated for boats passing in and out for 30 seconds. The indexing and ranking scheme were the same as that used for analyzing the relative value of cells for all waterbirds (see Methods, Section 2.3).

North Bay had much higher levels of boat traffic than Central Bay. In general, the North Bay deep water channel and intermediate depth water along the North Island side of the Bay had the highest levels of boat use. Shallow water areas adjacent to shorelines often had little or no use. Marinas showed relatively low levels of boat use. Levels of boat use may be undervalued in marinas since sampling occurred only at the entrance to the marinas and data were not collected on boat movements within the marina. Central Bay shows low levels of boat traffic except in the deep water channel where there are some cells with medium levels of use and one cell with a high level of use. Surprisingly the Navy pier areas show little or no boat traffic data. This may be because boat traffic is restricted to Navy vessels in these areas, and movement of the larger Navy vessels moored here is relatively infrequent and not spread out over time. Many of the pier areas in Central Bay are used by Navy boats moored for long periods of time while they are being repaired or renovated.

There are 58 very high and high ranked boat use cells in North and Central Bay. A comparison of these high density boat cells was made with the relative value of these cells to all waterbirds, regardless of behavior (Figures 40 and 12). All 58 very high and high density boat cells were of low relative value for waterbirds. Of the 41 medium ranked boat use cells, one (2.4 percent) was of very high value to waterbirds, two (4.9 percent) were of medium value, and 38 (92.7 percent) were of low relative value to all waterbirds. Of the 102 low boat use cells, four (3.9 percent) were of very high value to waterbirds, four

(3.9 percent) were of high value, six (5.9 percent) were of medium value, and 87 (85.3 percent) were of low relative value to waterbirds. Ninety-two cells had no recorded boat activity during the 1993 and 1994 waterbird studies. Of these cells, ten (10.9 percent) were of very high to waterbirds, six (6.5 percent) were of high value, eleven (12.0 percent) were of medium value, and 65 (70.7 percent) were of low relative value to waterbirds.

3.4 BIRD AVOIDANCE

A total of 637 recorded instances of waterbird avoidance behaviors caused by the 23-foot survey boat were analyzed. Species with less than 30 observations of avoidance behavior were excluded from this analysis. Table 2 presents the distances at which avoidance behavior was initiated. All species except surf scoter tended to exhibit avoidance behavior at distances between 11 to 100 feet. Surf scoter had a greater tendency to initiate boat avoidance at over 100 feet. Most species rarely allowed the boat to approach within 10 feet before moving away.

Table 2
PROPORTION OF WATERBIRDS SAMPLED AVOIDING
SURVEY BOAT BY DISTANCE CATEGORY

Species	Distance Interval (feet)			Sample Size
	0 to 10	11 to 100	> 100	
Bufflehead	1.0%	66.5 %	32.5%	197
Surf Scoter	1.3%	43.3%	55.3 %	150
Double-Crested Cormorant	0%	64.6 %	35.4%	79
California Brown Pelican	1.6%	67.2 %	31.1%	61
Eared Grebe	11.9%	74.6 %	13.6%	59
Great Blue Heron	0%	75.0 %	25.0%	52
Brant's Cormorant	0%	69.2 %	30.8%	39

Numbers in bold indicate the highest proportion of avoidance behaviors.

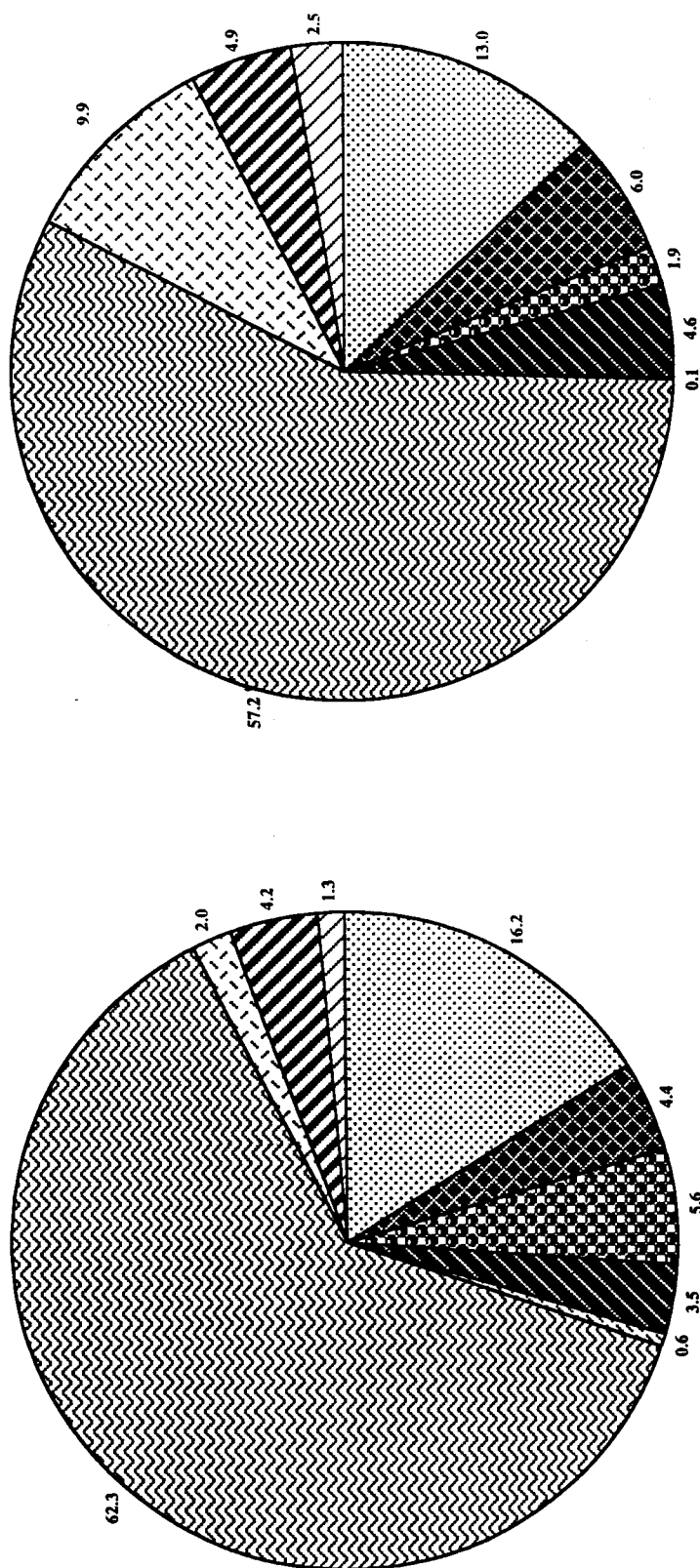


4.0 DISCUSSION

4.1 SPECIES RICHNESS AND SURVEY COUNTS

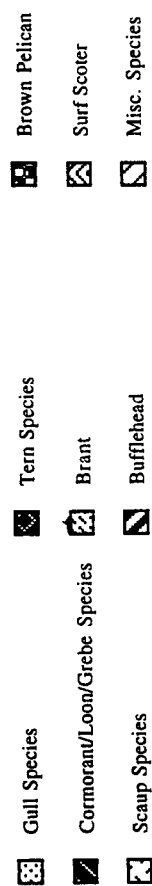
Comparison of USFWS and Ogden Waterbird Surveys of Central San Diego Bay

For a quantitative comparison with USFWS surveys of Central San Diego Bay, the southern most Ogden transect was excluded since this transect was within the boundary of the USFWS South Bay survey area. Some similarities and some significant differences were noted. Both studies found surf scoter to be the dominant species in Central San Diego Bay in approximately the same proportion (Figure 41). However, the cumulative counts and abundance ranking for other waterbird species varied (compare Table 1 with Table 4 in Manning 1995). Ogden had over two times as many cumulative observations (126,008) for all waterbirds compared to USFWS (52,853). The Ogden total



a. USFWS 1993-94: 46 Surveys, n = 52,853

b. Ogden 1994: 48 Surveys, n = 126,008 *



* For comparison with USFWS data set, shorebird and selected heron species are not included.

FIGURE

Percent Composition of Central San Diego Bay Waterbird Assemblage
Documented by (a) USFWS in 1993-94 and (b) Ogden in 1994

41

excludes the southern most transect, and shorebird and selected heron species since the abundance of these species were not quantified in the USFWS study. Differences between the two data sets could be explained by differences in survey and sampling effort, survey area coverage, and seasonal timing of the surveys.

Differences in survey and sampling effort could account for differences between the two data sets. Ogden had a higher survey effort with 47 complete surveys and one incomplete survey. USFWS conducted 46 surveys of which 42 were complete (Manning 1995). Ogden spent more time collecting data, 290 hours for Central Bay alone, versus 350 hours of USFWS effort for surveys of both Central and South San Diego Bay. Ogden did not limit the time for collecting data within the Central Bay study area (typical survey time: 6 survey hours), whereas USFWS limited field effort to approximately four hours per survey. USFWS counts at each point location (18-acre circle) were restricted to 5 minutes to minimize errors from bird movement. Ogden counted all individuals without any time restriction. Techniques were used to minimize double counting of individuals (see Section 2.2).

Coverage within the Central Bay survey area also differed between the two studies, possibly contributing to differences in results. Ogden surveyed both shore and open water areas, whereas USFWS focused primarily on open water. Ogden covered all water and shoreline areas between the Coronado Bridge and the Sweetwater Channel and surveyed areas such as Glorietta Bay and Seventh Street Channel, which were not surveyed by USFWS.

Following are some noticeable differences between USFWS (Manning 1995) and Ogden studies for target species abundance.

California Brown Pelican

The difference in the proportion of California brown pelicans observed in Central Bay by Ogden in 1994 and USFWS in 1993-1994 (Figure 41) is an example of variation attributable to differences in brown pelican abundance between years. Brown pelicans were more abundant in Central Bay in 1993 compared to 1994. Comparison of cumulative averages from 12 1993 Ogden surveys and 48 1994 Ogden surveys indicated brown pelicans were about 1.8 times more abundant in 1993 than in 1994. This is consistent with USFWS results which surveyed during the annual period of peak brown pelican abundance (August to December 1993).

California Least Tern

The relative abundance of least tern in Central Bay is similar between the Ogden and USFWS studies. USFWS ranked this species as 10th in abundance (Manning 1995) whereas Ogden ranked it as 9th most abundant (Table 1). However, Ogden had almost 6 times more cumulative sightings for this species than did USFWS. This may be attributed to differences in survey effort. USFWS had incomplete surveys for April and May whereas Ogden had one incomplete survey in June, which did include data collection at the Delta Beach colony. Ogden also counted birds on the shore and adjacent visible upland area of the colony whereas USFWS concentrated on the open water area.

Elegant Tern

Elegant tern were ranked the same, 7th most abundant species, in both Central Bay studies (Table 1 and Table 4 in Manning 1995). As with the other species, Ogden had over 3 times more cumulative observations of elegant tern than USFWS. This quantitative difference may be attributed to differences in survey effort and study area coverage. USFWS had incomplete surveys for 4 months when this species would be expected in the study area, whereas Ogden had only one incomplete survey during this time period. This species was frequently observed roosting on the shore at Crown Cove and south of Delta Beach, areas that may not have been as intensively surveyed by USFWS.

Scaup Species

Lesser and greater scaup provide an example of differences in USFWS and Ogden counts due primarily to differences in survey area and survey effort. Annual variation in abundance was likely a secondary factor. USFWS reported a total of 1,035 cumulative scaup species observations for Central San Diego Bay during 1993-1994. In 1994, Ogden had a cumulative count of 12,469 scaup species. The proportion of lesser and greater scaup observed by Ogden differed substantially compared with USFWS results (Figure 41). Scaup species combined were the second most abundant waterbird in Central Bay in the Ogden surveys, but were only fourth in abundance for in the USFWS study. In the 1993 North Bay (Ogden 1994) and 1994 Central Bay studies (Figure 23), scaup preferred marinas, shorelines, and pier areas. These areas were less intensively surveyed by USFWS. Ogden had approximately 9,000 scaup observations (65 percent of total count) in areas where USFWS did not report any sightings. These areas included Glorietta Bay, the shallow water area west of Coronado Bridge, Chollas Creek Canal, Seventh

Street Channel, Crown Cove, and the shoreline south of the Naval Amphibious Base (Figure 24).

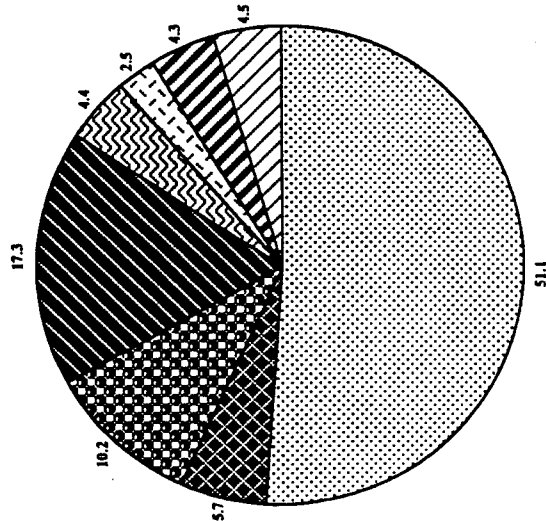
Surf Scoter

Surf scoters showed a large difference in abundance between the USFWS and Ogden 1994 data sets, although their relative abundance was similar (Figure 41). There were 32,929 cumulative surf scoter observations in Central Bay in the USFWS study versus 72,020 cumulative sightings by Ogden in 1994. These differences can be largely attributed to differences between years with differences in survey effort being a lesser influence.

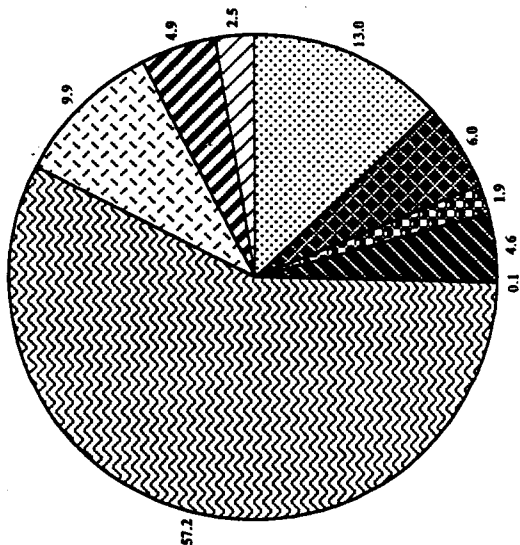
An evaluation of Ogden's 1993 and 1994 Central Bay survey data shows a difference in surf scoter abundance between the different winter periods. Ogden had cumulative averages of 2.1 times more birds in January through April 1993 compared with 1994, and 1.4 times more birds November to December 1994 compared with 1993. The USFWS collected their data during the 1993-1994 winter period when surf scoter abundance was lowest relative to the other two winter periods when surveys were conducted.

Comparison of Waterbird Assemblage in North, Central, and South San Diego Bay Study Areas

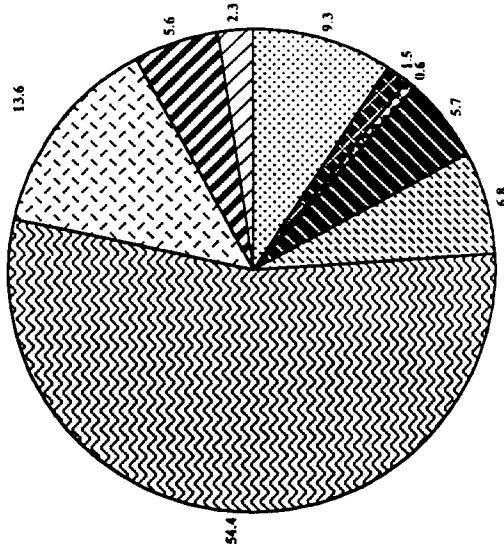
The Ogden and USFWS studies allow for a quantitative comparison of the three areas of San Diego Bay surveyed at similar levels of effort (see Appendix C). Figure 42 compares the relative composition of the waterbird assemblage for North, Central, and South San Diego Bay. Central and South Bay had similar species compositions, with some noticeable exceptions, whereas North Bay was substantially different. Gull species, California brown pelican, cormorants, loons, and grebes were proportionally more abundant in North Bay compared to Central and South Bay. Surf scoter was the predominant species in both Central (57.2%) and South Bay (54.4%), but was only a small fraction of the North Bay waterbird assemblage (4.4 percent). Central and South Bay also had higher proportions of scaup species. Tern species were equally abundant in North and Central Bay study areas with much fewer observations in South Bay, although South Bay supports substantial breeding areas (e.g., Saltworks). Brant were primarily restricted to the South Bay (6,929 cumulative observations; Manning 1995), with none seen in North Bay and only 280 observations in Central Bay.



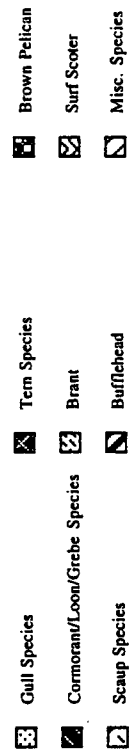
a. 1993 North Bay: 48 Surveys, n = 126,008



b. 1994 Central Bay: 48 Surveys, n = 118,335



c. 1993-94 South Bay: 46 Surveys, n = 95,969



Percent Composition of Waterbird Assemblage in
(a) North, (b) Central, and (c) South San Diego Bay During 1993 and 1994

Table 3 presents various indices of species evenness, richness, and diversity calculated from equations provided by Ludwig and Reynolds (1988). Depending on the equation chosen, either North or Central Bay had the most even distribution of species abundance. Species richness was relatively similar between all three study areas. Species diversity was very different between the study areas, with North Bay being relatively more diverse using the Simpson index (S'), while Central Bay was most diverse using the Shannon index (H'). This comparison is contrary to the analysis provided by Manning (1995). North Bay provides critical resources to a large number of waterbird species, particularly brown pelican, least tern, elegant tern, Heermann's gull, heron species, and cormorant species.

4.2 HABITAT USE, BEHAVIOR, AND SPATIAL USE OF NORTH AND CENTRAL SAN DIEGO BAY

The various foraging guilds showed strong preferences for certain habitat types within North Bay and Central Bay (Table 4). Most waterbird guilds preferred shoreline and marina areas and significantly underused deeper water habitats for foraging and resting. Bottom feeding divers (mostly surf scoters) preferred resting in intermediate depth water along the Silver Strand. Marina and pier areas along the Mainland side of the bay were preferred by more guilds in the North Bay compared to Central Bay. This habitat type is different between the two study areas, with North Bay having a large amount of marina habitat, whereas Central Bay is composed of military/industrial piers.

Waterbird behavior differed between North and Central Bay study areas (Table 5). For all waterbirds observed in North Bay, the dominant behavior was roosting on structure, followed by use of shoreline habitat. In Central Bay, the dominant behavior was resting on water, followed by foraging on water, and use of shoreline habitat. Foraging occurred in roughly the same proportions (13.2% vs. 16.5%). The high number of surf scoters resting on water in Central Bay accounts for the large proportion of observations in this behavior category. Only 10 percent of Central Bay observations were of birds roosting on structure. This is due to the lack of restricted access piers in Central Bay compared with North Bay. North Bay has many high use roosting areas, such as the degaussing piers and floating bait barges.

Table 3

**COMPARISON OF INDICES OF WATERBIRD
SPECIES EVENNESS, RICHNESS, AND DIVERSITY
FOR THREE AREAS OF SAN DIEGO BAY**

	1993 North Bay	1994 Central Bay	1993-1994 South Bay	Entire San Diego Bay Combined
Number of Surveys	48	48	46	142
Survey Area (acres)	3,937	4,044	2,962	10,943
Cumulative Abundance of All Species (n)	121,203	126,338	95,969	343,510
Number of Species (S)	51	48	49	60
Species Evenness Indices				
$E1 = H' / \ln(S)$	0.6018	0.8172	0.4587	0.8784
$E2 = e^{H'} / S$	0.2090	0.4927	0.1170	0.6077
$E3 = (e^{H'} - 1) / (S - 1)$	0.1932	0.4820	0.0986	0.6011
$E4 = (1/S') / e^{H'}$	0.5600	0.1211	0.5290	0.1427
$E5 = [(1/S') - 1] / (e^{H'} - 1)$	0.5144	0.0823	0.4374	0.1185
Species Richness Indices				
$R1 = (S-1) / \ln(n)$	4.2716	4.0011	4.1842	4.6286
$R2 = S / \sqrt{n}$	0.1465	0.1350	0.1582	0.1024
Species Diversity Indices				
$H' = -\sum p_i \ln(p_i)$	2.3663	3.1634	1.7462	3.5963
$1/S' = 1 / [\sum n_i (n_i - 1)] / n(n-1)$	5.9685	2.8642	3.0327	5.2019
$1-S' = 1 - [\sum n_i (n_i - 1)] / n(n-1)$	0.8325	0.6509	0.6703	0.8078

Highest index values between areas are bold.

n_i = abundance of species i .

p_i = proportional abundance of species i ($= n_i/n$).

See Ludwig and Reynolds (1988; pp. 85-103) for discussion of index formulas.

Table 4
Significant Habitat Preferences for
Waterbird Foraging Guilds in North and Central San Diego Bay

Habitat Type	Waterbird Foraging Guilds with Positive Preference for Habitat Type (Number of Species in Guild)			
	North San Diego Bay (1993)		Central San Diego Bay (1994)	
	Foraging	Resting	Foraging	Resting
Shoreline and Shallow Water on Mainland Side of Bay	Waders (7) Bottom Feeding Divers (7) Water Column Divers (14) Plunge Divers (10) Generalists (14)	Waders (7) Bottom Feeding Divers (7) Water Column Divers (14) Plunge Divers (10) Generalists (14)	Waders (7) Probers (18) Bottom Feeding Divers (7) Water Column Divers (14) Plunge Divers (10) Generalists (13)	Waders (7) Probers (18) Bottom Feeding Divers (7) Water Column Divers (14) Plunge Divers (10) Generalists (13)
Marinas and Pier Areas on Mainland Side of Bay	Waders (7) Probers (21) Bottom Feeding Divers (7) Water Column Divers (14) Plunge Divers (10) Generalists (14)	Waders (7) Probers (21) Bottom Feeding Divers (7) Water Column Divers (14) Plunge Divers (10) Generalists (14)	Generalists (13)	Water Column Divers (14) Generalists (13)
Marinas and Pier Areas on North Island/Silver Strand Side of Bay	Data merged with Mainland Marinas and Piers Areas for statistical analysis		Waders (7) Probers (18) Bottom Feeding Divers (7) Water Column Divers (14) Plunge Divers (10) Generalists (13)	Waders (7) Probers (18) Bottom Feeding Divers (7) Water Column Divers (14) Plunge Divers (10) Generalists (13)
Intermediate Depth Water on Mainland Side of Bay	Significantly Underused by All Guilds	Significantly Underused by All Guilds	Habitat Type not in Central Bay	
Deep Water Channel	Significantly Underused by All Guilds	Significantly Underused by All Guilds	Significantly Underused by All Guilds - Except Plunge Divers, Which Showed No Preference	Significantly Underused by All Guilds
Intermediate Depth Water on North Island/Silver Strand Side of Bay	Significantly Underused by All Guilds - Except Plunge Divers, Which Showed No Preference	Significantly Underused by All Guilds	Significantly Underused by All Guilds	Bottom Feeding Divers (7)
Shoreline and Shallow Water on North Island/Silver Strand Side of Bay	Waders (7) Probers (21) Bottom Feeding Divers (7) Water Column Divers (14) Plunge Divers (10) Generalists (14)	Waders (7) Probers (21) Bottom Feeding Divers (7) Plunge Divers (10) Generalists (14)	Waders (7) Probers (18) Bottom Feeding Divers (7) Water Column Divers (14) Plunge Divers (10) Generalists (13)	Waders (7) Probers (18) Bottom Feeding Divers (7) Water Column Divers (14) Plunge Divers (10) Generalists (13)

Table 5

**COMPARISON OF BEHAVIORS OF TARGET WATERBIRD SPECIES AND FORAGING GUILDS
IN NORTH SAN DIEGO BAY DURING 1993 AND CENTRAL SAN DIEGO BAY DURING 1994**

	North Bay							Central Bay						
	Percent of Observations							Percent of Observations						
	n	On Structure	On Shore	Foraging on Water	Resting on Water	Other * Behavior		n	On Structure	On Shore	Foraging on Water	Resting on Water	Other * Behavior	
All Waterbirds	132,445	45.4	23.9	13.2	14.8	2.7		181,488	10.0	14.9	16.5	57.4	1.2	
Target Species														
Brown Pelican	12,022	85.9	3.5	5.2	5.1	0.3		2,530	86.9	2.0	8.1	3.0	0.1	
Least Tern	920	25.0	0.9	71.3	0.3	2.5		2,150	0.1	60.9	22.2	0.8	16.1	
Elegant Tern	3,550	50.7	2.9	44.6	0.5	1.3		2,481	14.5	69.5	9.9	5.8	0.3	
Scaup Species	2,993	1.2	0.4	17.0	72.3	9.1		13,976	0.1	<0.1	9.0	90.8	0.3	
Surf Scoter	5,184	0.2	0.4	16.1	67.3	16.0		78,309	0.0	<0.1	2.7	97.1	0.2	
Foraging Guild														
Wader/Shallow Water	5,116	45.6	47.2	6.5	0.6	0.1		1,599	55.8	11.1	30.4	2.6	0.1	
Prober	11,156	3.1	80.9	15.7	0.3	0.0		42,521	0.9	44.3	43.2	8.9	2.7	
Bottom Feeding Diver	13,227	0.4	0.5	32.4	52.6	14.0		98,751	<0.1	<0.1	5.0	94.6	0.3	
Water Column Diver	20,952	60.0	1.4	18.9	16.7	3.1		6,634	23.5	1.3	38.7	34.6	1.9	
Plunge Diver	18,851	70.0	3.3	22.7	3.5	0.6		10,292	38.5	38.0	20.2	3.2	0.0	
Generalist	63,028	50.2	30.5	4.6	13.3	1.4		21,006	54.0	19.0	7.1	19.1	0.8	

* The "Other Behavior" category includes behaviors such as in transit, courtship, and unspecified behaviors.

California Brown Pelican

For both the Central and North Bay studies, brown pelicans were observed roosting on structures approximately 85 percent of the time. Pelicans had distinct concentrated areas for roosting (Figure 18 and Ogden 1994). These sites tended to be isolated from human activity (e.g., restricted access piers and floating structures) or in the case of the bait barges in North Bay also provided foraging opportunities.

California Least Tern

In North Bay, approximately 70 percent of least tern observations were of foraging birds, whereas in Central Bay only 22 percent of the observations were of foraging birds (Table 5). The lack of an association between foraging least terns and eelgrass dominated habitats is contrary to previous observations (e.g., ERCE 1989). Least tern preferred shallow water and marinas on the Silver Strand and the deep water channel in the Central Bay. This is similar to the North Bay study where shallow water along the Mainland shore and the deep water channel were the preferred foraging areas. Baird (1994, pers. comm.) documented that birds at the Delta Beach least tern colony foraged mostly in the ocean, but they also used shallow and deep bay waters extensively, including areas directly adjacent to the colony, north of the Coronado Bridge, and areas adjacent to the outer breakwater of Harbor Island. Least tern had two roosting areas which accounted for most of the roosting observations. These were the Delta Beach nesting area and the unused boats located in the open water anchorage at the entrance to the Commercial Basin (Ogden 1994).

Elegant Tern

Elegant terns were similar to least terns and had substantially higher foraging observations in North Bay compared to Central Bay (Table 5). Roosting elegant terns used structures in North Bay, whereas shorelines were used in Central Bay. Elegant tern followed the pattern exhibited by pelicans and least terns of using only a few key roosting areas, isolated from human access.

Scaup Species

The majority of observations of lesser and greater scaup in North and Central Bay were of birds resting on water (Table 5). Foraging was more common in North Bay than in Central. Spatial use in both the studies was localized. Scaup distribution was biased toward marinas and shallow water areas adjacent to shorelines. In Central Bay there were

also frequent observations of low levels of scaup use in intermediate depth water adjacent to the Silver Strand.

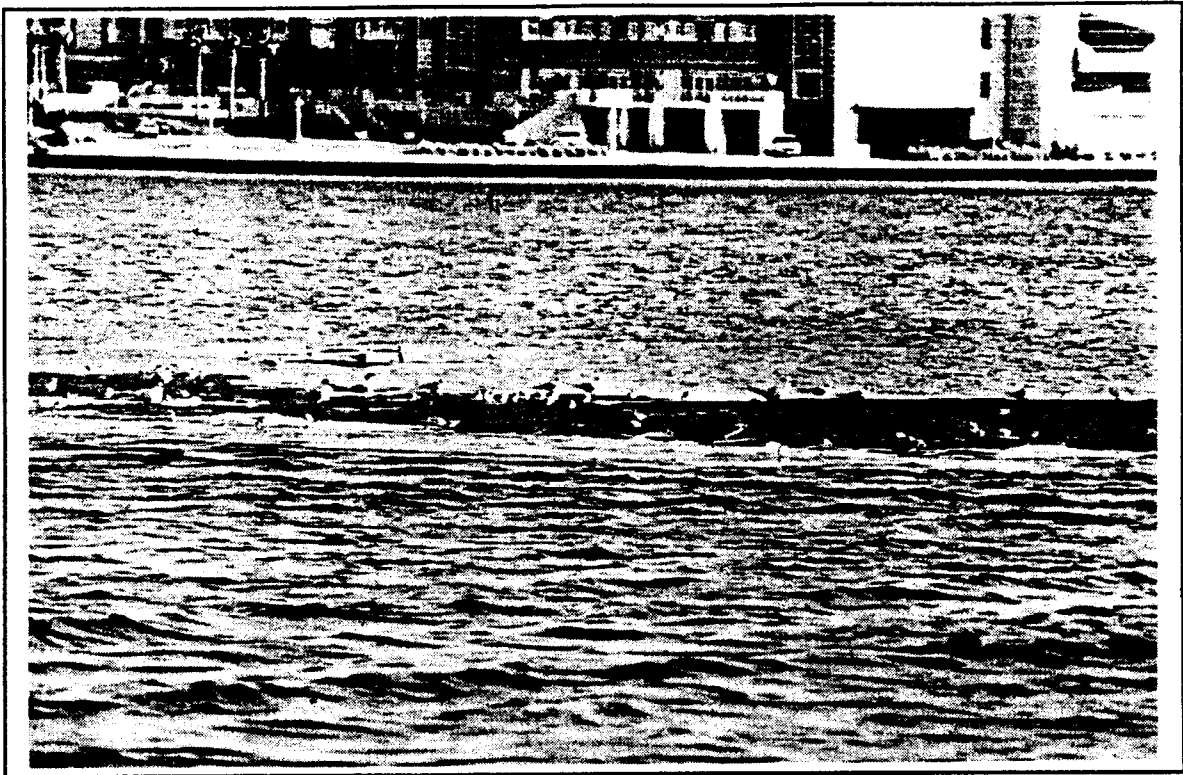
Surf Scoter

The predominant activity of surf scoters was resting on water in both study areas, especially in Central Bay (Table 5). The proportion of foraging observations was higher in North Bay than in Central Bay. Surf scoters were seldom seen out of the water on structures or onshore. Surf scoter distribution was more localized in North Bay (Ogden 1994) than in Central Bay. In North Bay there were large blocks of habitat where this species was not detected. In Central Bay surf scoter occurred in almost all areas except for the deep water channel and the Mainland Pier areas.

4.3 BOAT TRAFFIC AND BIRD AVOIDANCE

As would be expected, boat traffic tended to be greater in North Bay compared to Central Bay and was concentrated within the deep water channel and cells associated with military/industrial piers. Birds that tend to rest on open water (eared grebe, bufflehead and surf scoter) or roost on structures (cormorants, brown pelican, great blue heron) were those most susceptible to disturbance from boat traffic (Table 2). Since most boats cannot approach too closely to shore areas due to the shallow water depth, birds in these areas were less susceptible to disturbance from boat traffic.

Distribution of surf scoter within San Diego Bay may be partially determined by the levels of boat use within some areas of the bay. Surf scoter were the most sensitive species to boat activity, consistently avoiding the survey boat at a greater distance than 100 feet, a distance greater than that of other waterbird species. The Central Bay study area provides a large expanse of open water habitat that had relatively low levels of boat use. The majority of surf scoters occurred in these low boat-use areas. Other factors that could also influence surf scoter distribution include water depth and the proximity of resting areas to foraging areas. Relatively large areas of roosting habitat that can accommodate large rafts of scoters may be the preferred situation for this species.



4

5.0 REFERENCES

- Baird, P. 1994. Foraging ecology of the California least tern in San Diego Bay, California, 1993. Prepared for the U.S. Department of the Navy, Southwest Division, Natural Resources Management Branch, Naval Facilities Engineering Command. March.
- Briggs, K.T., W.B. Tyler, D.B. Lewis, and D.R. Carlson. 1987. Bird communities at sea off California: 1975 to 1983. *Studies in Avian Biology* No. 11.
- ERC Environmental and Energy Services Co. (ERCE) [Ogden]. 1989. Mission Bay least tern foraging ecology study. Prepared for Department of Parks and Recreation, City of San Diego. September. 17 pp.
- Hanley, J.C. and A.R. Solow. 1992. Testing for resource use and selection by marine birds. *Journal of Field Ornithology* 63:43-52.
- Humphrey, P.S. and K.C. Parkes. 1959. An approach to the study of molts and molting. *Auk* 76:1-31.
- Ludwig, J.A. and Reynolds. 1988. *Statistical Ecology*. J. Wiley & Sons, New York

- Macdonald, K.B., R.F. Ford, E.B. Copper, P. Unitt, and J.P. Haltner. 1990a. South San Diego Bay Enhancement Plan Volume I: Bay history, physical environment, and marine ecological characterization. Prepared for San Diego Unified Port District and the California State Coastal Conservancy. March.
- Macdonald, K.B., R.F. Ford, E.B. Copper, P. Unitt, and J.P. Haltner. 1990b. South San Diego Bay Enhancement Plan Volume II: Birds of San Diego Bay, historical data and 1988-89 surveys. Prepared for San Diego Unified Port District and the California State Coastal Conservancy. March.
- Manning, J.A. 1995. Waterbirds of Central and South San Diego Bay 1993-1994. Prepared by U.S. Fish and Wildlife Service, Coastal Ecosystem Program. Carlsbad, CA. January. 45 pp. plus Appendices.
- Neu, C.W., C.R. Byers, and J.M. Peek. 1974. A technique for analysis of utilization-availability data. *Journal of Wildlife Management* 38:541-545.
- Ogden Environmental and Energy Services Co. (Ogden). 1994. Waterbird Survey North and Central San Diego Bay, 1993. Prepared for U.S. Department of the Navy, Naval Air Station North Island. May. 72 pp. plus Appendices.
- Pavelka, M. 1990. Peregrine falcons nesting in San Diego, California. *Western Birds* 21:181-183.

6.0 REPORT PREPARERS

This technical report was prepared by the Biological Resources Branch, Ogden Environmental and Energy Services Co.

Authors

Kristine Preston, B.S. - Project Field Coordinator, Principal Investigator
Patrick J. Mock, Ph.D. - Project Technical Director

Project Field Personnel

Kristine Preston, B.S.
David King, B.A.
Eric Bailey, B.A.
Leslie Hickson, M.S.
Kim Swensrud, B.S.

Marcia Dustin Mann, B.S.
Andy Pignolo, M.A.
Cheryl Hart, M.S.
Stacey Baczkowski, M.S.
Robert Taylor, M.S.

Project Managers

Jeanne Muñoz, Ph.D.
Julie McCall, B.A.

U.S. Navy, Southwestern Divison

Robert Hexom
Jerry Boggs, Ph.D.
Timothy Burr, M.S.

This Page Intentionally Left Blank

1

APPENDIX A

**WATERBIRD SPECIES OBSERVED AT
CENTRAL SAN DIEGO BAY IN 1994**

APPENDIX A

WATERBIRD SPECIES OBSERVED AT CENTRAL SAN DIEGO BAY IN 1994

Common Name	Scientific Name	Sensitivity Status †	Residency Status §
Wader/Shallow Water Foraging Guild			
Great Blue Heron	<i>Ardea herodias</i>	CSA (rookery)	BR
Great Egret	<i>Casmerodius albus</i>	CSA (rookery)	NR
Snowy Egret	<i>Egretta thula</i>	CSA (rookery)	BR
Little Blue Heron	<i>Egretta caerulea</i>		BR
Green Heron	<i>Butorides striatus</i>		BR
Black-Crowned Night Heron	<i>Nycticorax nycticorax</i>	CSA (rookery)	BR
Prober Foraging Guild			
Black-Bellied Plover	<i>Pluvialis squatarola</i>		W
Western Snowy Plover	<i>Charadrius alexandrinus nivosus</i>	FT, CSC	BR
Semipalmated Plover	<i>Charadrius semipalmatus</i>		W
Killdeer	<i>Charadrius vociferus</i>		BR
Greater Yellowlegs	<i>Tringa melanoleuca</i>		W
Willet	<i>Catoptrophorus semipalmatus</i>		W
Spotted Sandpiper	<i>Actitis macularia</i>		W
Whimbrel	<i>Numenius phaeopus</i>		W
Long-Billed Curlew	<i>Numenius americanus</i>	FC3, CSC	W
Marbled Godwit	<i>Limosa fedoa</i>		W
Ruddy Turnstone	<i>Arenaria interpres</i>		W
Black Turnstone	<i>Arenaria melanocephala</i>		W
Sanderling	<i>Calidris alba</i>		W
Western Sandpiper	<i>Calidris mauri</i>		W
Least Sandpiper	<i>Calidris minutilla</i>		W
Dunlin	<i>Calidris alpina</i>		W
Short-Billed Dowitcher	<i>Limnodromus griseus</i>		W
Red Phalarope	<i>Phalaropus fulicaria</i>		W
Bottom Feeding Diver Guild			
Brant	<i>Branta bernicla</i>		W
Redhead	<i>Aythya americana</i>		W
Greater Scaup	<i>Aythya marila</i>		W
Lesser Scaup	<i>Aythya affinis</i>		W
Oldsquaw	<i>Clangula hyemalis</i>		T
White-Winged Scoter	<i>Melanitta fusca</i>		T
Surf Scoter	<i>Melanitta perspicillata</i>		W
Bufflehead	<i>Bucephala albeola</i>		W

APPENDIX A (Continued)

WATERBIRD SPECIES OBSERVED AT CENTRAL SAN DIEGO BAY IN 1994

Common Name	Scientific Name	Sensitivity Status †	Residency Status §
Water Column Diving Guild			
Red-Throated Loon	<i>Gavia stellata</i>		W
Pacific Loon	<i>Gavia pacifica</i>		W
Common Loon	<i>Gavia immer</i>	CSC	W
Pied-Billed Grebe	<i>Podilymbus podiceps</i>		W
Horned Grebe	<i>Podiceps auritus</i>		W
Eared Grebe	<i>Podiceps nigricollis</i>		W
Western Grebe	<i>Aechmophorus occidentalis</i>	CSA	NB
Clark's Grebe	<i>Aechmophorus clarkii</i>	CSA	W
Double-Crested Cormorant	<i>Phalacrocorax auritus</i>	CSC	NR
Brandt's Cormorant	<i>Phalacrocorax penicillatus</i>		BR
Pelagic Cormorant	<i>Phalacrocorax pelagicus</i>		NR
Red-Breasted Merganser	<i>Mergus serrator</i>		W
Ruddy Duck	<i>Oxyura jamaicensis</i>		W
Plunge Diving Guild			
California Brown Pelican	<i>Pelecanus occidentalis californicus</i>	FE, SE	NR
Osprey	<i>Pandion haliaetus</i>	CSC (Nesting)	W
Gull-Billed Tern	<i>Sterna nilotica</i>	FC2, CSC (Nesting Colony)	S
Caspian Tern	<i>Sterna caspia</i>	CSA (Nesting Colony)	BR
Royal Tern	<i>Sterna maxima</i>		BR
Elegant Tern	<i>Sterna elegans</i>	FC2, CSC	S
Forster's Tern	<i>Sterna forsteri</i>	CSA (Nesting Colony)	BR
California Least Tern	<i>Sterna antillarum browni</i>	FE, SE	S
Black Skimmer	<i>Rynchops niger</i>	CSC	BR
Belted Kingfisher	<i>Ceryle alcyon</i>		W
Predator Guild			
Northern Harrier	<i>Circus cyaneus</i>	CSC	NR
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	FE, SE	BR
Generalist Guild			
Mallard	<i>Anas platyrhynchos</i>		BR
Northern Pintail	<i>Anas acuta</i>		W
Gadwall	<i>Anas strepera</i>		W
American Wigeon	<i>Anas americana</i>		W
American Coot	<i>Fulica americana</i>		W
Parasitic Jaeger	<i>Stercorarius parasiticus</i>		

APPENDIX A (Continued)

WATERBIRD SPECIES OBSERVED AT CENTRAL SAN DIEGO BAY IN 1994

Common Name	Scientific Name	Sensitivity Status †	Residency Status §
Bonaparte's Gull	<i>Larus philadelphia</i>		W
Heermann's Gull	<i>Larus heermanni</i>		NR
Mew Gull	<i>Larus canus</i>		W
Ring-billed Gull	<i>Larus delawarensis</i>		W
California Gull	<i>Larus californicus</i>	CSC (Nesting Colony)	W
Herring Gull	<i>Larus argentatus</i>		W
Western Gull	<i>Larus occidentalis</i>		BR

† species considered sensitive by state and federal resource agencies: CSA = California Department of Fish and Game Special Animal, CSC = California Department of Fish and Game Species of Special Concern, FC2 = Federal Candidate Category 2, FC3 = Federal Candidate Category 3, FE= Federally Endangered, FT= Federally Threatened, and SE= State Endangered.

§ Residency status codes are based on the predominant status of the species population in the Bay:

BR= Year Round Breeding Resident, NR= Year Round Non-Breeding Resident (Breeding Population leaves while some Non-Breeders Remain), S= Summer (Breeding) Visitor, W= Winter (Non-Breeding) Visitor, M = Migrant (species only occurs in bay during migration), T = Transient (stray individual, unusual occurrence for species to be in area)

APPENDIX B

**CENTRAL SAN DIEGO BAY WATERBIRD STUDY
SPECIES ACCOUNTS**

APPENDIX B
CENTRAL SAN DIEGO BAY WATERBIRD STUDY
SPECIES ACCOUNTS

Common Name: Red-Throated Loon

Scientific Name: *Gavia stellata*

Sensitivity Status: None

Regional Distribution: Common winter visitor and transient along the coast remaining rarely in summer. Casual to very rare away from the coast.

Residency Status in San Diego Bay: Uncommon to fairly common winter visitor; casual in summer. Ranked as 24th most abundant species in North Bay during 1993 and 37th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diver. Eats mostly small fish, but also aquatic invertebrates, and some aquatic plants. Prefers water < 30 feet deep.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Marinas, shallow water, and shorelines along the Silver Strand side of the Bay
- 2° Shallow water areas along the Mainland side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base
Shallow water along Delta Beach shoreline on the Silver Strand side of the Bay
Fiddler's Cove and shallow water areas to the south along the Silver Strand side of the Bay
Glorietta Bay
Sweetwater Channel and the north edge of the Sweetwater Marsh
Abandoned barges in the embayment north of the 24th Street Marine Terminal

Common Name: Pacific Loon

Scientific Name: *Gavia pacifica*

Sensitivity Status: None

Regional Distribution: Common to abundant transient and fairly common winter visitor along the coast, including offshore waters. Rare along the coast in summer; casual transient and winter visitor away from the coast.

Residency Status in San Diego Bay: Common to abundant migrant and winter visitor, very rare in summer. Ranked as 26th most abundant species in North Bay during 1993

and 31st most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diver. Eats small fish almost exclusively during winter. In other seasons, also includes crustaceans, mollusks, aquatic insects, frogs, and occasionally aquatic vegetation in diet.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Marinas, shallow water, and shorelines along the Silver Strand side of the Bay
- 2° Shallow water areas along the Mainland side of the Bay

High Use Areas for Guild in Central San Diego Bay:

- Shallow water and piers on north and south sides of the Naval Amphibious Base
- Shallow water along Delta Beach shoreline on the Silver Strand side of the Bay
- Fiddler's Cove and shallow water areas to the south along the Silver Strand side of the Bay
- Glorietta Bay
- Sweetwater Channel and the north edge of the Sweetwater Marsh
- Abandoned barges in the embayment north of the 24th Street Marine Terminal

Common Name: Common Loon

Scientific Name: *Gavia immer*

Sensitivity Status: CDFG Species of Special Concern.

Regional Distribution: Common transient and winter visitor along the length of the coast, remaining rarely through the summer. Uncommon spring and fall migrant inland on deep water lakes, remaining regularly in winter only along the Colorado River. A few summer records away from the coast.

Residency Status in San Diego Bay: Uncommon to fairly common migrant and winter visitor; rare to uncommon in summer. Ranked as 20th most abundant species in North Bay during 1993 and 21st most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diver. Often dives very deep water. Eats mostly fish, but also some aquatic invertebrates (especially crustaceans), frogs, salamanders, and aquatic insects.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Marinas, shallow water, and shorelines along the Silver Strand side of the Bay
- 2° Shallow water areas along the Mainland side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base
Shallow water along Delta Beach shoreline on the Silver Strand side of the Bay
Fiddler's Cove and shallow water areas to the south along the Silver Strand side of the Bay
Glorietta Bay
Sweetwater Channel and the north edge of the Sweetwater Marsh
Abandoned barges in the embayment north of the 24th Street Marine Terminal

Common Name: Pied-Billed Grebe

Scientific Name: *Podilymbus podiceps*

Sensitivity Status: None

Regional Distribution: Fairly common resident throughout most of the region; most common in winter due to influx of wintering individuals.

Residency Status in San Diego Bay: Fairly common winter visitor on salt water bays and estuaries. Ranked as 25th most abundant species in North Bay during 1993 and 26th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diver. Prefers foraging in water <20 feet deep. Eats primarily aquatic invertebrates and secondarily fish, but also will eat snails, and frogs.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Marinas, shallow water, and shorelines along the Silver Strand side of the Bay
- 2° Shallow water areas along the Mainland side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base
Shallow water along Delta Beach shoreline on the Silver Strand side of the Bay
Fiddler's Cove and shallow water areas to the south along the Silver Strand side of the Bay
Glorietta Bay
Sweetwater Channel and the north edge of the Sweetwater Marsh
Abandoned barges in the embayment north of the 24th Street Marine Terminal

Common Name: Horned Grebe

Scientific Name: *Podiceps auritus*

Sensitivity Status: None

Regional Distribution: Fairly common resident throughout most of the region; most common along coastal nearshore waters in winter.

Residency Status in San Diego Bay: Fairly common to very common winter visitor. San Diego Bay is primary wintering area in San Diego County. Ranked as 30th most abundant species in North Bay during 1993 and 25th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diver. Usually feeds in water <25 feet deep. Eats mostly fishes and crustaceans during winter.

Preferred Guild Habitat in Central San Diego Bay :

1° Marinas, shallow water, and shorelines along the Silver Strand side of the Bay

2° Shallow water areas along the Mainland side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Shallow water along Delta Beach shoreline on the Silver Strand side of the Bay

Fiddler's Cove and shallow water areas to the south along the Silver Strand side of the Bay

Glorietta Bay

Sweetwater Channel and the north edge of the Sweetwater Marsh

Abandoned barges in the embayment north of the 24th Street Marine Terminal

Common Name: Eared Grebe

Scientific Name: *Podiceps nigricollis*

Sensitivity Status: None

Regional Distribution: Common winter visitor throughout much of the region; primarily a transient away from the coast. Breeds throughout the region, except the Colorado River Valley.

Residency Status in San Diego Bay: Common to abundant migrant and winter visitor; rare in summer. Largest numbers are found in South San Diego Bay at the Saltworks. Ranked as 15th most abundant species in North Bay during 1993 and 4th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diver. Prefers water <20 feet deep. Eats mostly aquatic insects, but also eats small crustaceans, mollusks, amphibians, and fishes.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Marinas, shallow water, and shorelines along the Silver Strand side of the Bay
- 2° Shallow water areas along the Mainland side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base
Shallow water along Delta Beach shoreline on the Silver Strand side of the Bay
Fiddler's Cove and shallow water areas to the south along the Silver Strand side of the Bay
Glorietta Bay
Sweetwater Channel and the north edge of the Sweetwater Marsh
Abandoned barges in the embayment north of the 24th Street Marine Terminal

Common Name: Western Grebe

Scientific Name: *Aechmophorus occidentalis*

Sensitivity Status: CDFG Special Animal

Regional Distribution: Common along the coast in winter. Very local breeding resident in coastal reservoirs, Salton Sea, and Colorado River Valley. Transient and rare winter visitor elsewhere in the interior.

Residency Status in San Diego Bay: Common to abundant migrant and winter visitor. Ranked as 6th most abundant species in North Bay during 1993 and 14th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diver. Prefers waters <20 feet deep. Eats primarily fish, but also eats aquatic invertebrates and amphibians.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Marinas, shallow water, and shorelines along the Silver Strand side of the Bay
- 2° Shallow water areas along the Mainland side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base
Shallow water along Delta Beach shoreline on the Silver Strand side of the Bay
Fiddler's Cove and shallow water areas to the south along the Silver Strand side of the Bay
Glorietta Bay
Sweetwater Channel and the north edge of the Sweetwater Marsh

Abandoned barges in the embayment north of the 24th Street Marine Terminal

Common Name: Clark's Grebe

Scientific Name: *Aechmophorus clarkii*

Sensitivity Status: CDFG Special Animal

Regional Distribution: Common along the coast in winter. Local breeding resident in coastal reservoirs, Salton Sea, and Colorado River Valley. Transient and rare winter visitor elsewhere in the interior.

Residency Status in San Diego Bay: Common to abundant migrant and winter visitor. Ranked as 22nd most abundant species in North Bay during 1993 and 23rd most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diver. Prefers waters <20 feet deep. Eats primarily fish; also eats aquatic invertebrates and amphibians.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Marinas, shallow water, and shorelines along the Silver Strand side of the Bay
- 2° Shallow water areas along the Mainland side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Shallow water along Delta Beach shoreline on the Silver Strand side of the Bay

Fiddler's Cove and shallow water areas to the south along the Silver Strand side of the Bay

Glorietta Bay

Sweetwater Channel and the north edge of the Sweetwater Marsh

Abandoned barges in the embayment north of the 24th Street Marine Terminal

Common Name: California Brown Pelican

Scientific Name: *Pelecanus occidentalis californicus*

Sensitivity Status: Federally Endangered, State Endangered.

Regional Distribution: Common throughout the year along the coast, with the largest numbers present in summer. Breeding colonies are located on Channel Islands and the nearby Los Coronados Islands, and in the Gulf of California in Baja California. Regular post-breeding visitor to the Salton Sea. Rare elsewhere away from the coast.

Residency Status in San Diego Bay: Common to very common non-breeding visitor. Ranked as 3rd most abundant species in North Bay during 1993 and 6th most abundant

species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Plunge Diver. The brown pelican, eats only small schooling fish. Primary forage species in Southern California is northern anchovy.

Preferred Habitat for Species in Central San Diego Bay

- 1° Marinas on the Silver Strand side of the Bay (roosting and foraging)
- 2° Shallow water along both sides of the Bay (foraging) and selected pier areas on the Mainland side of the Bay (roosting)

High Use Areas by Species in Central San Diego Bay:

Piers on the north edge of the Naval Amphibious Base, Coronado
Shallow water and shoreline along Delta Beach on Silver Strand side of the Bay
Fiddler's Cove Marina
Abandoned barges in the embayment north of the 24th Street Marine Terminal
Sweetwater Channel and the north edge of the Sweetwater Marsh

Common Name: Double-crested Cormorant

Scientific Name: *Phalacrocorax auritus*

Sensitivity Status: CDFG Species of Special Concern at Rookery.

Regional Distribution: Fairly common to common throughout the year along the entire coast, on some of the Channel Islands, and along the Colorado River. Fairly common all year at the Salton Sea. A transient elsewhere in the interior. Breeds locally on the Channel Islands, Salton Sea, and Colorado River Valley.

Residency Status in San Diego Bay: Common to very common non-breeding visitor. A total of 53 nesting pairs documented at the Saltworks in 1993. Ranked as 9th most abundant species in North Bay during 1993 and 10th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diver. Eats primarily schooling fish; occasionally will eat mollusks, crustaceans, small vertebrates, and sea worms.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Marinas, shallow water, and shorelines along the Silver Strand side of the Bay
- 2° Shallow water areas along the Mainland side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base
Shallow water along Delta Beach shoreline on the Silver Strand side of the Bay
Fiddler's Cove and shallow water areas to the south along the Silver Strand side of

the Bay
Glorietta Bay
Sweetwater Channel and the north edge of the Sweetwater Marsh
Abandoned barges in the embayment north of the 24th Street Marine Terminal

Common Name: Brandt's Cormorant

Scientific Name: *Phalacrocorax penicillatus*

Sensitivity Status: None

Regional Distribution: Common resident along the coast and around the Channel Islands; primarily a winter visitor in San Diego County.

Residency Status in San Diego Bay: Very common to abundant throughout the year as a non-breeding resident. This species nests sporadically at La Jolla and one pair nested on a Point Loma pier in 1993. Ranked as 2nd most abundant species in North Bay during 1993 and 13th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diver. Eats primarily fishes; also eats crabs and shrimp.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Marinas, shallow water, and shorelines along the Silver Strand side of the Bay
- 2° Shallow water areas along the Mainland side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base
Shallow water along Delta Beach shoreline on the Silver Strand side of the Bay
Fiddler's Cove and shallow water areas to the south along the Silver Strand side of the Bay
the Bay
Glorietta Bay
Sweetwater Channel and the north edge of the Sweetwater Marsh
Abandoned barges in the embayment north of the 24th Street Marine Terminal

Common Name: Pelagic Cormorant

Scientific Name: *Phalacrocorax pelagicus*

Sensitivity Status: None

Regional Distribution: Fairly common resident along the coast and around the Channel Islands. Primarily a winter visitor along the coast of San Diego.

Residency Status in San Diego Bay: Fairly common to common winter visitor; casual in summer. Ranked as 28th most abundant species in North Bay during 1993 with only 1

observation in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diver. Deep water diver to nearly 200 feet. Eats primarily fish; occasionally marine invertebrates.

Foraging Guild: Bottom Feeding Diver.

Preferred Habitat and Use Areas for Species in Central San Diego Bay :

Not Determined: This species was only observed once in Central San Diego Bay

Common Name: Great Blue Heron

Scientific Name: *Ardea herodias*

Sensitivity Status: Species considered sensitive at rookery sites by CDFG.

Regional Distribution: Fairly common resident throughout most of the region, becoming more numerous in warmer areas in winter. Breeds locally.

Residency Status in San Diego Bay: Common throughout the year as a non-breeding visitor. Great blue herons breed in colonies at Point Loma, the northeast corner of the Naval Air Station, and on abandoned boats, barges, and dry docks in Central San Diego Bay. Ranked as 11th most abundant species in North Bay during 1993 and 12th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Wader/Shallow Water Forager. Eats mostly small fish, but will eat aquatic invertebrates, small mammals, nestling birds, and amphibians.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and natural shoreline on both sides of the Bay
- 2° Marinas on the Silver Strand side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Shallow water and shoreline along Delta Beach on Silver Strand side of the Bay

Abandoned boats, barges, and dry docks in intermediate depth water northwest of the 24th Street Marine Terminal (roosting and great blue heron nesting)

North edge of the Sweetwater Marsh and associated Sweetwater Channel

Common Name: Great Egret

Scientific Name: *Casmerodias albus*

Sensitivity Status: Species considered sensitive at rookery sites by CDFG.

Regional Distribution: Fairly common winter visitor along the coast; common resident and breeder at Salton sea and Colorado River Valley; uncommon transient through the rest of the interior.

Residency Status in San Diego Bay: Fairly common winter visitor; rare to uncommon in summer. Ranked as 16th most abundant species in North Bay during 1993 and 24th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Wader/Shallow Water Forager. Eats fish, small vertebrates, and aquatic invertebrates.

Preferred Guild Habitat in Central San Diego Bay :

1° Shallow water and natural shoreline on both sides of the Bay

2° Marinas on the Silver Strand side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Shallow water and shoreline along Delta Beach on Silver Strand side of the Bay

Abandoned boats, barges, and dry docks in intermediate depth water northwest of the 24th Street Marine Terminal (roosting and great blue heron nesting)

North edge of the Sweetwater Marsh and associated Sweetwater Channel

Common Name: Snowy Egret

Scientific Name: *Egretta thula*

Sensitivity Status: Species considered sensitive at rookery sites by CDFG.

Regional Distribution: Common winter visitor and uncommon during summer along the coast. Common resident at Salton Sea and Colorado River Valley. Generally an uncommon transient away from the coast. Breeding documented at Buena Vista Lagoon and Tijuana River Valley.

Residency Status in San Diego Bay: Common to very common winter visitor, generally uncommon to fairly common in summer. Ranked as 13th most abundant species in North Bay during 1993 and 16th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Wader/Shallow Water Forager. Eats aquatic invertebrates, fish, frogs, lizards, and snakes.

Preferred Guild Habitat in Central San Diego Bay :

1° Shallow water and natural shoreline on both sides of the Bay

2° Marinas on the Silver Strand side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Shallow water and shoreline along Delta Beach on Silver Strand side of the Bay

Abandoned boats, barges, and dry docks in intermediate depth water northwest of the 24th Street Marine Terminal (roosting and great blue heron nesting)

North edge of the Sweetwater Marsh and associated Sweetwater Channel

Common Name: Little Blue Heron

Scientific Name: *Egretta caerulea*

Sensitivity Status: None

Regional Distribution: Casual visitor along the coast, primarily in fall and winter, and at Salton Sea in summer. This species was observed four times in the 1993 North Bay study and two times in the 1994 Central Bay study.

Residency Status in San Diego Bay: Rare non-breeding resident.

Foraging Guild: Wader/Shallow Water Forager. Eats primarily fish, but also amphibians, and aquatic invertebrates.

Preferred Habitat and Use Areas for Species in Central San Diego Bay :

Not Determined: This species was only observed twice in Central San Diego Bay

Common Name: Green Heron

Scientific Name: *Butorides striatus*

Sensitivity Status: None

Regional Distribution: Uncommon to fairly common resident in the region, but seasonal status varies with locality.

Residency Status in San Diego Bay: Uncommon to fairly common resident. Ranked as 33rd most abundant species in North Bay during 1993 with only three observations in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Wader/Shallow Water Forager.

Preferred Guild Habitat in Central San Diego Bay :

1° Shallow water and natural shoreline on both sides of the Bay

2° Marinas on the Silver Strand side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base
Shallow water and shoreline along Delta Beach on Silver Strand side of the Bay
Abandoned boats, barges, and dry docks in intermediate depth water northwest of
the 24th Street Marine Terminal (roosting and great blue heron nesting)
North edge of the Sweetwater Marsh and associated Sweetwater Channel

Common Name: Black-crowned Night Heron

Scientific Name: *Nycticorax nycticorax*

Sensitivity Status: Species considered sensitive at rookery sites by CDFG.

Regional Distribution: Fairly common but local resident in the coastal area, Salton Sea, and Colorado River Valley; nests locally. Uncommon transient and rare winter visitor in the dry inland areas and desert.

Residency Status in San Diego Bay: Common to very common fall and winter visitor, uncommon to fairly common in spring and summer, but with substantial numbers nesting at a few localities. Colony sites in San Diego Bay: Point Loma; North Island Naval Air Station; and Coronado. Ranked as 19th most abundant species in North Bay during 1993 and 35th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Wader/Shallow Water Forager. An opportunistic forager, this species eats, fish, aquatic invertebrates, eggs, nestling birds, small mammals, amphibians, snakes, and plant material.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and natural shoreline on both sides of the Bay
- 2° Marinas on the Silver Strand side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base
Shallow water and shoreline along Delta Beach on Silver Strand side of the Bay
Abandoned boats, barges, and dry docks in intermediate depth water northwest of
the 24th Street Marine Terminal (roosting and great blue heron nesting)
North edge of the Sweetwater Marsh and associated Sweetwater Channel

Common Name: Brant

Scientific Name: *Branta bernicla*

Sensitivity Status: None

Regional Distribution: Very locally common winter visitor along the coast; common to abundant transient. Erratic spring transient at Salton Sea and locally rare elsewhere in the interior. A few individuals occasionally remain through summer along the coast.

Residency Status in San Diego Bay: Very common but extremely localized winter visitor, and migrant; rare in summer. This species was not observed in North Bay during 1993 and was ranked 19th in abundance in Central Bay in 1994 (this ranking excludes most shorebird and gull species which were grouped for analyses).

Foraging Guild: Bottom Feeding Diver. Prefers shallow water with dense growth of eelgrass. In winter eats primarily eelgrass and sea lettuce, but occasionally marine invertebrates.

Habitat Where Species was Observed in Central San Diego Bay :

- 1° Shallow water and natural shoreline on both sides of the Bay
- 2° Deeper waters adjacent to natural shoreline on the Mainland side of the Bay

High Use Areas for Species in Central San Diego Bay:

- North edge of the Sweetwater Marsh and the Sweetwater Channel
- Crown Cove
- Shallow waters along Delta Beach on the Silver Strand side of the Bay

Common Name: Mallard

Scientific Name: *Anas platyrhynchos*

Sensitivity Status: None

Regional Distribution: Fairly common winter visitor throughout; Uncommon to locally common in summer. Nests along coast and on montane lakes. Rare winter visitor to the Channel Islands.

Residency Status in San Diego Bay: Common to very common migrant and winter visitor, generally uncommon to fairly common in summer, with some local breeding. Ranked as 10th most abundant species in North Bay during 1993 and 11th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Generalist.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Piers along the Mainland side of the Bay and Marinas on the Silver Strand side

2° Shallow water and shorelines on both sides of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Piers and embayment at Chollas Creek and selected piers to the south

Delta Beach shoreline and shallow water

Abandoned barges in embayment north of 24th Street Marine Terminal

Crown Cove shoreline and shallow water

North edge of the Sweetwater Marsh and Sweetwater Channel

Common Name: Northern Pintail

Scientific Name: *Anas acuta*

Sensitivity Status: None

Regional Distribution: Common to abundant and widespread winter visitor throughout; an early fall arrival, common by late July. Uncommon and local nester.

Residency Status in San Diego Bay: Abundant migrant and winter visitor, uncommon in summer, nests sporadically. This species was not detected in North Bay during 1993 and was the 32nd most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Generalist.

Preferred Guild Habitat in Central San Diego Bay :

1° Piers along the Mainland side of the Bay and Marinas on the Silver Strand side

2° Shallow water and shorelines on both sides of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Piers and embayment at Chollas Creek and selected piers to the south

Delta Beach shoreline and shallow water

Abandoned barges in embayment north of 24th Street Marine Terminal

Crown Cove shoreline and shallow water

North edge of the Sweetwater Marsh and Sweetwater Channel

Common Name: Gadwall

Scientific Name: *Anas strepera*

Sensitivity Status: None

Regional Distribution: Fairly common, often local winter visitor to freshwater lakes, marshes, ponds, and coastal estuaries throughout. Uncommon to locally fairly common summer resident with nesting records throughout, except for Salton Sea.

Residency Status in San Diego Bay: Uncommon to fairly common winter visitor, uncommon and localized breeding resident. This species was not detected in North Bay in 1993 and was only observed once in Central Bay in 1994.

Foraging Guild: Generalist.

Preferred Habitat and Use Areas for Species in Central San Diego Bay :

Not Determined: This species was only observed once in Central San Diego Bay

Common Name: American Wigeon

Scientific Name: *Anas americana*

Sensitivity Status: None

Regional Distribution: Common to abundant winter visitor except in desert. In summer quite rare but regularly observed at Salton Sea. Not known to nest in region.

Residency Status in San Diego Bay: Very common to abundant winter visitor, casual in summer. This species was not observed in North Bay during 1993 and was the 20th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Generalist.

Preferred Guild Habitat in Central San Diego Bay :

1° Piers along the Mainland side of the Bay and Marinas on the Silver Strand side

2° Shallow water and shorelines on both sides of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Piers and embayment at Chollas Creek and selected piers to the south

Delta Beach shoreline and shallow water

Abandoned barges in embayment north of 24th Street Marine Terminal

Crown Cove shoreline and shallow water

North edge of the Sweetwater Marsh and Sweetwater Channel

Common Name: Greater Scaup

Scientific Name: *Aythya marila*

Sensitivity Status: None

Regional Distribution: Rare but regular winter visitor at bays, lagoons, and estuaries on the coast, and at lakes and below spillways in the Colorado River Valley.

Residency Status in San Diego Bay: Rare winter visitor. Greater and lesser scaup combined ranked 8th in abundance in North Bay during 1993 and 2nd in abundance in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Bottom Feeding Diver. Prefers foraging in water < 20 feet. Eats mollusks, crustaceans, aquatic insects, and aquatic vegetation.

Preferred Habitat for Scaup Species in Central San Diego Bay :

1° Shallow water and marinas along the Silver Strand side of the Bay

2° Shallow water and pier areas on the Mainland side of the Bay

High Use Areas for Scaup Species in Central San Diego Bay:

Glorietta Bay and adjacent shallow water along the shoreline to the southwest

Shallow water along the south side of the Naval Amphibious Base

Shallow water along the shoreline just north of Fiddler's Cover Marina

Crown Cover

Shallow water bordering the 24th Street Marine Terminal

North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Lesser Scaup

Scientific Name: *Aythya affinis*

Sensitivity Status: None

Regional Distribution: Common winter visitor throughout region. Rare to uncommon in summer, when most numerous at the Salton Sea.

Residency Status in San Diego Bay: Abundant winter visitor, very rare in summer. In San Diego County, Lesser Scaups are most abundant on San Diego Bay. Greater and lesser scaup combined ranked 8th in abundance in North Bay during 1993 and 2nd in abundance in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Bottom Feeding Diver. Prefers foraging in water < 20 feet. Eats mollusks, crustaceans, aquatic insects, and aquatic vegetation.

Preferred Habitat for Scaup Species in Central San Diego Bay :

- 1° Shallow water and marinas along the Silver Strand side of the Bay
- 2° Shallow water and pier areas on the Mainland side of the Bay

High Use Areas for Scaup Species in Central San Diego Bay:

Glorietta Bay and adjacent shallow water along the shoreline to the southwest
Shallow water along the south side of the Naval Amphibious Base
Shallow water along the shoreline just north of Fiddler's Cover Marina
Crown Cover
Shallow water bordering the 24th Street Marine Terminal
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Oldsquaw

Scientific Name: *Clangula hyemalis*

Sensitivity Status: None

Regional Distribution: Rare but regular winter visitor along the coast, primarily from November to March. Remains casually into summer. Casual at the Salton Sea; six records elsewhere in the interior.

Residency Status in San Diego Bay: Rare winter visitor, casual in summer, occurring primarily on San Diego and Mission Bays. This species was observed two times in the 1993 North Bay study and six times in the 1994 Central Bay study.

Foraging Guild: Bottom Feeding Diver.

Preferred Habitat and Use Areas for Species in Central San Diego Bay :

Not Determined: This species was only observed infrequently in Central Bay

Common Name: White-Winged Scoter

Scientific Name: *Melanitta fusca*

Sensitivity Status: None

Regional Distribution: Irregular winter visitor along the coast, fairly common some years and quite rare others. Rare but somewhat regular in summer. Casual at the Salton Sea.

Residency Status in San Diego Bay: Irregularly rare to fairly common winter visitor. This species was not observed in the 1993 North Bay study and was observed once in the 1994 Central Bay study.

Foraging Guild: Bottom Feeding Diver.

Preferred Habitat and Use Areas for Species in Central San Diego Bay :

Not Determined: This species was observed only once in Central Bay

Common Name: Surf Scoter

Scientific Name: *Melanitta perspicillata*

Sensitivity Status: None

Regional Distribution: Abundant winter visitor and spring transient along coast; uncommon in summer. Uncommon spring transient, rare fall transient and winter visitor at the Salton Sea; rare in summer. Flocks of spring transients are also noted irregularly on lakes in and near the southern part of the mountain areas. Rare transient elsewhere in the interior.

Residency Status in San Diego Bay: Abundant winter visitor. Reported as fairly common to common in summer, but was rare during summer of 1993 in North Bay and was absent from Central Bay in summer of 1994. In the County, surf scoters occur in greatest abundance on San Diego Bay. Ranked as 4th most abundant species in North Bay during 1993 and 2nd most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Bottom Feeding Diver. Dives to depths of 6-30 feet. Feeds more heavily on mollusks throughout the year than any other animal foods; also eats some crustaceans, marine worms, fishes, eelgrass, sea urchins and sand dollars.

Preferred Habitat for Species in Central San Diego Bay :

- 1° Intermediate depth water between the west side of the Deep Water Channel and shallow water along the Silver Strand shoreline

High Use Areas for Species in Central San Diego Bay:

Intermediate depth water, between the Deep Water Channel and the Silver Strand shoreline, encompassing the southern two-thirds of the study area

Common Name: Bufflehead

Scientific Name: *Bucephala albeola*

Sensitivity Status: None

Regional Distribution: Fairly common winter visitor in all areas; locally common along the coast (e.g. around San Diego). Casual in summer, with most records from the Salton Sea.

Residency Status in San Diego Bay: Very common winter visitor, very rare in summer. Ranked as 5th most abundant species in North Bay during 1993 and 3rd most abundant

species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Bottom Feeding Diver. Feeds on crustaceans, snails, and other mollusks and some aquatic vegetation when in salt water habitats.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Intermediate depth water between the Deep Water Channel and the Silver Strand shoreline (resting)
- 2° Shallow water and shorelines on both sides of the Bay and marinas on the Silver Strand side of the Bay (foraging)

High Use Areas for Guild in Central San Diego Bay:

Glorietta Bay and shallow water along the shoreline to the southwest
Shallow water at the southwest corner of the Coronado Bridge
Shallow water on the south side of the Naval Amphibious Base
Shallow and intermediate depth waters along the Silver Strand shoreline from Delta Beach south to the north edge of Fiddler's Cove Marina
Intermediate depth water from Fiddler's Cove Marina south to the end of the study area
Crown Cove
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Redhead

Scientific Name: *Aythya americana*

Sensitivity Status: None

Regional Distribution: Complex status. Generally uncommon to locally fairly common winter visitor throughout most of the region. Uncommon and local in summer. At Salton Sea fairly common breeding bird and less abundant in winter.

Residency Status in San Diego Bay: Uncommon to fairly common winter visitor, uncommon and localized breeding resident in San Diego County. Less common on San Diego Bay. This species was not detected in North Bay during 1993 and there were nine observations in Central Bay in 1994.

Foraging Guild: Water Column Diving Guild.

Preferred Habitat and Use Areas for Species in Central San Diego Bay :

Not Determined: This species was observed infrequently in Central Bay

Common Name: Red-breasted Merganser

Scientific Name: *Mergus serrator*

Sensitivity Status: None

Regional Distribution: Common winter visitor along the coast, uncommon through the summer. In interior, status complex, but primarily an uncommon spring transient and rare fall transient.

Residency Status in San Diego Bay: Common winter visitor, uncommon in summer. In the county, Red-breasted Mergansers are most numerous on San Diego Bay. Ranked as 17th most abundant species in North Bay during 1993 and 18th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Water Column Diving Guild. Eats mostly small fishes; also eats crustaceans and aquatic insects.

Preferred Guild Habitat in Central San Diego Bay :

1° Marinas, shallow water, and shorelines along the Silver Strand side of the Bay

2° Shallow water areas along the Mainland side of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Shallow water along Delta Beach shoreline on the Silver Strand side of the Bay

Fiddler's Cove and shallow water areas to the south along the Silver Strand side of the Bay

Glorietta Bay

Sweetwater Channel and the north edge of the Sweetwater Marsh

Abandoned barges in the embayment north of the 24th Street Marine Terminal

Common Name: Ruddy Duck

Scientific Name: *Oxyura jamaicensis*

Sensitivity Status: None

Regional Distribution: Common winter visitor throughout the region, may be very abundant locally such as at the Salton Sea. Remains fairly common through summer, breeding locally.

Residency Status in San Diego Bay: In the County this species is a very common to abundant winter migrant and visitor and is locally common in summer. During 1993 and 1994 this species was rarely observed in the northern two-thirds of San Diego Bay.

Foraging Guild: Water Column Diving Guild.

Preferred Habitat and Use Areas for Species in Central San Diego Bay :

Not Determined: This species was observed infrequently in Central Bay

Common Name: Osprey

Scientific Name: *Pandion haliaetus*

Sensitivity Status: CDFG Species of Special Concern at nesting sites.

Regional Distribution: Rare to uncommon year-round visitor; most widely noted in fall and winter on the coast and in migration in the interior. Has nested sporadically in recent years. Formerly more numerous.

Residency Status in San Diego Bay: Uncommon fall and winter visitor, rare in spring and summer, two old nesting records. Ranked as 32nd most abundant species in North Bay during 1993 and 30th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Plunge Diver. Usually hunts from 30-100 feet in air. Eats fish almost exclusively, although also eats small vertebrates, including small birds.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shorelines on both sides of the Bay, particularly the Silver Strand side (foraging and resting)
- 2° Marinas along the Silver Strand side of the Bay (resting)

High Use Areas for Guild in Central San Diego Bay:

Most of the Silver Strand shoreline from the north edge of the Naval Amphibious Base south to Crown Cove
The Deep Water Channel west of the Seventh Street Channel
Abandoned barges in the embayment north of the 24th Street Marine Terminal
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Northern Harrier

Scientific Name: *Circus cyaneus*

Sensitivity Status: CDFG Species of Special Concern

Regional Distribution: Fairly common winter visitor to open marshes and fields throughout the region. Now is very scarce and local as a breeder.

Residency Status in San Diego Bay: Uncommon to fairly common migrant and winter visitor, rare and local breeder. This species was not observed in North Bay in 1993 and was only seen once in Central Bay in 1994.

Foraging Guild: Predator.

Preferred Habitat and Use Areas for Species in Central San Diego Bay :

Not Determined: This species was only observed once in Central Bay.

Common Name: Peregrine Falcon

Scientific Name: *Falco peregrinus anatum*

Sensitivity Status: Federally Endangered. State Endangered

Regional Distribution: Primarily a rare fall transient and winter visitor along the immediate coast, with a few pairs remaining to nest in the northwestern portion of the region and in San Diego Bay. Even rarer in the interior, where its status is complex. Has undergone a sharp decline in the last several decades.

Residency Status in San Diego Bay: Rare fall and winter visitor; casual in late spring and early summer. Formerly a rare breeding resident, then extirpated. Documented nests on Coronado Bay Bridge (1989 to present) and in 1993 and 1994 in Central Bay on large crane at the 24th Street Marine Terminal. This species was observed four times in North Bay in 1993 and was ranked 15th in abundance in Central Bay in 1994 (this ranking excludes most shorebird and gull species which were grouped for analysis).

Foraging Guild: Predator. Eats a wide variety of small to medium size birds, especially doves and pigeons, but also shorebirds, waterfowl, and passerines. Also known to occasionally eat mammals, beetles, dragonflies, and butterflies.

Preferred Habitat and Use Areas for Species in Central San Diego Bay₁:

Of the 36 peregrine falcon sightings in Central San Diego Bay in 1994, 91.7 percent were of birds perched on the large crane at the 24th Street Marine Terminal. The remainder of the sightings were in close vicinity of this crane.

Common Name: American Coot

Scientific Name: *Fulica americana*

Sensitivity Status: None

Regional Distribution: Common breeding summer resident and abundant winter visitor on bodies of water throughout the region.

Residency Status in San Diego Bay: Abundant migrant and winter visitor, breeding status on San Diego Bay undetermined. Ranked as 23rd most abundant species in North Bay during 1993 and 15th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Generalist. Dabbles or may dive 10-25 feet. Eats mostly aquatic vegetation, but also terrestrial vegetation, mollusks (especially snails), worms, berries, and fruit.

Preferred Guild Habitat in Central San Diego Bay :

1° Piers along the Mainland side of the Bay and Marinas on the Silver Strand side

2° Shallow water and shorelines on both sides of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Piers and embayment at Chollas Creek and selected piers to the south

Delta Beach shoreline and shallow water

Abandoned barges in embayment north of 24th Street Marine Terminal

Crown Cove shoreline and shallow water

North edge of the Sweetwater Marsh and Sweetwater Channel

Common Name: Black-bellied Plover

Scientific Name: *Pluvialis squatarola*

Sensitivity Status: None

Regional Distribution: Common winter visitor along the coast, with smaller numbers of non-breeding birds remaining through summer. Fairly common transient and slightly less numerous as winter visitor at Salton Sea. Generally, a rare transient elsewhere in the interior.

Residency Status in San Diego Bay: Very common to abundant migrant and winter visitor, also locally common as a non-breeding summer visitor.

Foraging Guild: Prober. Eats marine worms and insects, small mollusks, crabs and other marine invertebrates.

Preferred Guild Habitat in Central San Diego Bay :

1° Shallow water and shoreline on the Silver Strand side of the Bay

2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base

Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina

Crown Cove

North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Western Snowy Plover

Scientific Name: *Charadrius alexandrinus nivosus*

Sensitivity Status: Federally Threatened. CDFG Species of Special Concern.

Regional Distribution: Fairly common, but somewhat local and declining resident on sandy coastal beaches (including some of the Channel Islands); numbers on the coast are augmented in winter. Primarily a summer resident in the interior, nesting at the Salton Sea and at various alkali lakes.

Residency Status in San Diego Bay: Uncommon migrant and winter visitor, uncommon but localized breeding resident. Has been known to breed in San Diego Bay at North Island, Silver Strand State Beach, Delta Beach, and the Sweetwater River mouth. A total of 7 breeding pairs documented at the Salt Works in 1993.

Foraging Guild: Prober. Western snowy plovers forage primarily on the wet sand at the beach-surf interface, where they feed on small crustaceans, marine worms, insects and amphipods.

Preferred Habitat and Use Areas for Species in Central San Diego Bay :

Not Determined: This species was detected three times in Central Bay. Two individuals were seen on shoreline between Glorietta Bay and Coronado Bridge, and seventeen plovers were seen along the Silver Strand shoreline from Delta Beach south to the little cove north of Fiddler's Cove Marina.

Common Name: Semipalmated Plover

Scientific Name: *Charadrius semipalmatus*

Sensitivity Status: None

Regional Distribution: Common transient and uncommon (to locally common) winter visitor along the coast. Transient through the interior, generally rare except at the Salton Sea where common in spring and fairly common in fall. A few remain locally through the summer.

Residency Status in San Diego Bay: Common spring and fall migrant, fairly common winter visitor.

Foraging Guild: Prober. Eats marine worms, small mollusks, small crustaceans, eggs of marine animals and insects.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base
Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's
Cove Marina
Crown Cove
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Killdeer

Scientific Name: *Charadrius vociferus*

Sensitivity Status: None

Regional Distribution: Common breeding resident near water, irrigated fields, and lawns throughout region; largely withdraws from the colder areas in winter, but numbers are greatly augmented elsewhere at this season. Breeds locally on the Channel Islands.

Residency Status in San Diego Bay: Very common resident, occupying a wide variety of habitats.

Foraging Guild: Prober. Primarily eats insects; also eats a variety of invertebrates.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base
Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's
Cove Marina
Crown Cove
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Greater Yellowlegs

Scientific Name: *Tringa melanoleuca*

Sensitivity Status: None

Regional Distribution: Fairly common transient and uncommon to fairly common winter visitor along the coast and in the Salton Sea area. Primarily a transient elsewhere in the region.

Residency Status in San Diego Bay: Fairly common to common fall migrant, fairly common winter visitor and spring migrant, casual in summer.

Foraging Guild: Prober. Eats fishes, aquatic and other insects and their larvae, snails, crabs, worms, tadpoles.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base
Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina
Crown Cove
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Willet

Scientific Name: *Catoptrophorus semipalmatus*

Sensitivity Status: None

Regional Distribution: Common to abundant transient and winter visitor along the coast and at the Salton Sea, remaining fairly commonly through the summer as a non-breeder. Uncommon transient through the rest of the region. May nest occasionally in the Owens Valley.

Residency Status in San Diego Bay: Very common to abundant migrant and winter visitor, locally common to very common as a non-breeding visitor in summer.

Foraging Guild: Prober. Eats aquatic insects, marine worms, small crustaceans, small mollusks, small fishes.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base
Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina
Crown Cove
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Spotted Sandpiper

Scientific Name: *Actitis macularia*

Sensitivity Status: None

Regional Distribution: Fairly common winter visitor in the coastal lowlands, Salton Sea area, and the Colorado River Valley. Primarily a transient through the coastal lowlands and an uncommon transient and summer resident in the mountain areas. Also nests very locally in the coastal lowlands.

Residency Status in San Diego Bay: Uncommon to fairly common migrant and winter visitor.

Foraging Guild: Prober. In bay primarily eats fish, crustaceans, and mollusks.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base
Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina
Crown Cove
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Whimbrel

Scientific Name: *Numenius phaeopus*

Sensitivity Status: None

Regional Distribution: Common transient and fairly common winter visitor along the coast, with non-breeding birds remaining uncommonly through the summer. Abundant spring transient and common fall transient at the Salton sea, with few remaining through the summer. Generally a rare to casual transient (mostly spring) in the rest of the interior, although large flocks may be noted in spring in the Antelope Valley. Common transient and winter visitor on the Channel Islands from late July to mid-May.

Residency Status in San Diego Bay: Common to very common fall migrant, uncommon to fairly common winter visitor, fairly common spring migrant, rare to uncommon in summer.

Foraging Guild: Prober. Eats insects, worms, spiders, small mollusks, amphipods, and crustaceans.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base
Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina
Crown Cove
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Long-billed Curlew

Scientific Name: *Numenius americanus*

Sensitivity Status: Federal Category 3 Candidate. CDFG Species of Special Concern.

Regional Distribution: Uncommon to locally fairly common, or even common, transient and winter visitor along the coast. Common winter visitor in the Salton Sea area, and fairly common at this season in the Antelope Valley. Otherwise, generally a rare transient through the interior. Has nested once in the Owens Valley.

Residency Status in San Diego Bay: Fairly common to common fall migrant, uncommon to fairly common winter visitor and spring migrant, uncommon and local in summer.

Foraging Guild: Prober. Eats insects, worms, crustaceans, mollusks, and toads.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base
Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina
Crown Cove
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Marbled Godwit

Scientific Name: *Limosa fedoa*

Sensitivity Status: None

Regional Distribution: Common winter visitor along the coast, remaining uncommonly through the summer as a non-breeder. Fairly common transient and winter visitor at the Salton Sea, with small numbers remaining through the summer. Generally a rare transient elsewhere in the interior.

Residency Status in San Diego Bay: Very common to abundant migrant and winter visitor, locally common to very common in summer.

Foraging Guild: Prober.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

- South edge of the Naval Amphibious Base
- Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina
- Crown Cove
- North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Ruddy Turnstone

Scientific Name: *Arenaria interpres*

Sensitivity Status: None

Regional Distribution: Fairly common to common transient and uncommon to locally common winter visitor along the coast, with a few remaining through the summer. Uncommon spring transient and rare fall transient at the Salton Sea; casual transient elsewhere in the interior.

Residency Status in San Diego Bay: Common to very common migrant and winter visitor; fairly common as a non-breeding summer visitor on San Diego Bay.

Foraging Guild: Prober. Eats amphipods, worms, crustaceans, mollusks, insects and their larvae.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base

Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina

Crown Cove

North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Black Turnstone

Scientific Name: *Arenaria melanocephala*

Sensitivity Status: None

Regional Distribution: Common winter visitor along rocky coastlines, including those of the Channel Islands. Casual spring transient in the interior, with seven records from the Salton Sea and one from the Colorado River.

Residency Status in San Diego Bay: Common migrant and winter visitor, rare through mid-summer.

Foraging Guild: Prober. Eats barnacles, slugs, small mollusks, crustaceans, and other small marine animals.

Preferred Guild Habitat in Central San Diego Bay :

1° Shallow water and shoreline on the Silver Strand side of the Bay

2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base

Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina

Crown Cove

North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Sanderling

Scientific Name: *Calidris alba*

Sensitivity Status: None

Regional Distribution: Common to abundant transient and winter visitor along the immediate coast and on the Channel Islands, remaining uncommonly through the summer. Fairly common transient and rare to uncommon winter visitor at the Salton Sea. Very rare transient elsewhere in the region.

Residency Status in San Diego Bay: Common to very common winter visitor, abundant spring and fall migrant, fairly common through summer.

Foraging Guild: Prober. In the Bay eats primarily marine invertebrates.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base

Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina

Crown Cove

North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Western Sandpiper

Scientific Name: *Calidris mauri*

Sensitivity Status: None

Regional Distribution: Common to abundant transient throughout, except on the Channel Islands (where uncommon); uncommon to locally common winter visitor along the coast. Fairly common in winter at the Salton Sea, but casual elsewhere in the interior at this season.

Residency Status in San Diego Bay: Abundant migrant and winter visitor, rare during the brief period in summer between spring and fall migration.

Foraging Guild: Prober. Eats small mollusks, insects, worms, and crustaceans and other marine invertebrates.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base
Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's
Cove Marina
Crown Cove
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Least Sandpiper

Scientific Name: *Calidris minutilla*

Sensitivity Status: None

Regional Distribution: Very common and widespread transient and winter visitor; most numerous in the coastal lowlands and the Salton Sea area. Non-breeding birds remain casually through the summer.

Residency Status in San Diego Bay: Very common to abundant migrant and winter visitor, very rare in summer.

Foraging Guild: Prober. Eats small mollusks, small crustaceans (especially amphipods), worms, insects and their larvae.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base
Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's
Cove Marina
Crown Cove
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Dunlin

Scientific Name: *Calidris alpina*

Sensitivity Status: None

Regional Distribution: Common winter visitor along the coast. Fairly common spring and fall transient at the Salton Sea, remaining uncommonly through the winter. Elsewhere in the interior and uncommon transient, being largely absent in winter.

Residency Status in San Diego Bay: Very common to abundant migrant and winter visitor, accidental in summer.

Foraging Guild: Prober. Eats amphipods and other crustaceans, marine worms, mollusks, and insects.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base
Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina
Crown Cove
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Short-Billed Dowitcher

Scientific Name: *Limnodromus griseus*

Sensitivity Status: None

Regional Distribution: Common transient along the coast and at the Salton Sea. Rare to locally uncommon transient, mainly in fall, through the rest of the region. Winters only along the coast, where generally scarce, but locally common.

Residency Status in San Diego Bay: Locally abundant migrant and winter visitor. Fairly common locally in summer as non-breeder.

Foraging Guild: Prober. Eats amphipods and other crustaceans, marine worms, mollusks, and insects.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shoreline on the Silver Strand side of the Bay
- 2° Marinas on the Silver Strand side of the Bay, and shallow water and shoreline on the Mainland side

High Use Areas for Guild in Central San Diego Bay:

South edge of the Naval Amphibious Base

Silver Strand shoreline between Delta Beach and the small cove north of Fiddler's Cove Marina

Crown Cove

North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Red Phalarope

Scientific Name: *Phalaropus fulicaria*

Sensitivity Status: None

Regional Distribution: Complex status. Irregularly common to abundant as late fall and early winter visitor offshore and to a lesser degree along the coast. More irregular as spring transient along coast, occasionally abundant. Usually occurs spring, summer, and fall at Salton Sea.

Residency Status in San Diego Bay: Irregular migrant and winter visitor, at times abundant. Usually found in open ocean, although bad weather may drive flocks into bay.

Foraging Guild: Prober.

Preferred Habitat and Use Areas for Species in Central San Diego Bay :

Not Determined: This species was only observed once in Central San Diego Bay

Common Name: Parasitic Jaeger

Scientific Name: *Stercorarius parasiticus*

Sensitivity Status: None

Regional Distribution: Fairly common transient and uncommon winter visitor off the coast, mainly within 4-5 km of shore. Rather rare inshore and around the Channel Islands. Casual in summer. Rare fall transient at the Salton Sea; casual at that season along the Colorado River.

Residency Status in San Diego Bay: Fairly common migrant and winter visitor, casual in summer within 4-5 km of shore, but rarely does this species enter San Diego Bay.

There were two observations of this species in North Bay in 1993 and one observation in Central Bay in 1994..

Foraging Guild: Generalist, kleptoparasitic.

Preferred Habitat and Use Areas for Species in Central San Diego Bay :

Not Determined: This species was observed several times in Central Bay

Common Name: Bonaparte's Gull

Scientific Name: *Larus philadelphia*

Sensitivity Status: None

Regional Distribution: Common to abundant winter visitor along the coast and adjacent inshore waters. Primarily a transient through the interior, being common during spring at the Salton Sea and locally on lakes in the southern portion of the mountain areas.

Residency Status in San Diego Bay: Abundant migrant and winter visitor; irregularly uncommon as a non-breeding summer visitor. Eighteenth most abundant species in North Bay during 1993 and 22nd in abundance in Central Bay during 1994 (these rankings exclude most gull and shorebird species which were grouped for analysis).

Foraging Guild: Generalist. In winter eats primarily fishes; also eats crustaceans and marine worms.

Preferred Guild Habitat in Central San Diego Bay :

1° Piers along the Mainland side of the Bay and Marinas on the Silver Strand side

2° Shallow water and shorelines on both sides of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Piers and embayment at Chollas Creek and selected piers to the south

Delta Beach shoreline and shallow water

Abandoned barges in embayment north of 24th Street Marine Terminal

Crown Cove shoreline and shallow water

North edge of the Sweetwater Marsh and Sweetwater Channel

Common Name: Heermann's Gull

Scientific Name: *Larus heermanni*

Sensitivity Status: None

Regional Distribution: Common non-breeding visitor along the immediate coast; only uncommon to fairly common in spring, when breeding takes place in Mexico. Rare and irregular post-breeding visitor to the Salton Sea; casual elsewhere in the interior (seven records).

Residency Status in San Diego Bay: Abundant non-breeding visitor in summer, fall, and winter; uncommon to locally common in spring. This was the most abundant species in North Bay during 1993 and was 7th most abundant in Central Bay in 1994 (these rankings exclude most other gull and shorebird species which were grouped for analysis).

Foraging Guild: Generalist. Primarily eats fishes, crustaceans, and mollusks; also scavenges along shore.

Preferred Guild Habitat in Central San Diego Bay :

1° Piers along the Mainland side of the Bay and Marinas on the Silver Strand side

2° Shallow water and shorelines on both sides of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Piers and embayment at Chollas Creek and selected piers to the south

Delta Beach shoreline and shallow water

Abandoned barges in embayment north of 24th Street Marine Terminal

Crown Cove shoreline and shallow water

North edge of the Sweetwater Marsh and Sweetwater Channel

Common Name: Mew Gull

Scientific Name: *Larus canus*

Sensitivity Status: None

Regional Distribution: Fairly common to locally common winter visitor along the coast, remains casually into summer.

Residency Status in San Diego Bay: Fairly common to common but rather localized winter visitor, accidental in summer. Detected infrequently in 1993 North Bay and 1994 Central Bay studies.

Foraging Guild: Generalist.

Preferred Guild Habitat in Central San Diego Bay :

1° Piers along the Mainland side of the Bay and Marinas on the Silver Strand side

2° Shallow water and shorelines on both sides of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Piers and embayment at Chollas Creek and selected piers to the south

Delta Beach shoreline and shallow water

Abandoned barges in embayment north of 24th Street Marine Terminal

Crown Cove shoreline and shallow water

North edge of the Sweetwater Marsh and Sweetwater Channel

Common Name: Ring-Billed Gull

Scientific Name: *Larus delawarensis*

Sensitivity Status: None

Regional Distribution: Common to abundant winter visitor throughout the coast. Abundant winter visitor at Salton Sea and fairly common to common winter visitor at the Colorado River. Primarily a transient throughout the rest of the region. Fairly common in summer along the coast and at the Salton Sea.

Residency Status in San Diego Bay: Abundant migrant and winter visitor. Fairly common non-breeder in the summer.

Foraging Guild: Generalist.

Preferred Guild Habitat in Central San Diego Bay :

1° Piers along the Mainland side of the Bay and Marinas on the Silver Strand side

2° Shallow water and shorelines on both sides of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Piers and embayment at Chollas Creek and selected piers to the south

Delta Beach shoreline and shallow water

Abandoned barges in embayment north of 24th Street Marine Terminal

Crown Cove shoreline and shallow water

North edge of the Sweetwater Marsh and Sweetwater Channel

Common Name: California Gull

Scientific Name: *Larus californicus*

Sensitivity Status: CDFG Species of Special Concern (Nesting Colony)

Regional Distribution: Abundant winter visitor along the coast, ranging from inland valleys to well offshore. Small numbers remain at the coast in the summer. Common transient at Salton Sea, remains as uncommon winter visitor and is fairly common as a non-breeder in summer. This species is a transient throughout the rest of the region.

Residency Status in San Diego Bay: Abundant migrant and winter visitor. Remains as a rare or uncommon summer non-breeding visitor.

Foraging Guild: Generalist.

Preferred Guild Habitat in Central San Diego Bay :

1° Piers along the Mainland side of the Bay and Marinas on the Silver Strand side

2° Shallow water and shorelines on both sides of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base
Piers and embayment at Chollas Creek and selected piers to the south
Delta Beach shoreline and shallow water
Abandoned barges in embayment north of 24th Street Marine Terminal
Crown Cove shoreline and shallow water
North edge of the Sweetwater Marsh and Sweetwater Channel

Common Name: Herring Gull

Scientific Name: *Larus argentatus*

Sensitivity Status: None

Regional Distribution: Uncommon to fairly common winter visitor along the coast. Rather common winter visitor at Salton Sea. Casual elsewhere in the region.

Residency Status in San Diego Bay: Very common to abundant winter visitor. Occurs accidentally in summer.

Foraging Guild: Generalist.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Piers along the Mainland side of the Bay and Marinas on the Silver Strand side
- 2° Shallow water and shorelines on both sides of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base
Piers and embayment at Chollas Creek and selected piers to the south
Delta Beach shoreline and shallow water
Abandoned barges in embayment north of 24th Street Marine Terminal
Crown Cove shoreline and shallow water
North edge of the Sweetwater Marsh and Sweetwater Channel

Common Name: Western Gull

Scientific Name: *Larus occidentalis*

Sensitivity Status: None

Regional Distribution: Common resident along the immediate coast, breeding locally. Abundant resident on and around the Channel Islands. Wanders only a short distance inland on the coastal slope. One record for the Colorado River Valley.

Residency Status in San Diego Bay: Reported as abundant to very abundant throughout the year as a non-breeder; with a few pairs nesting locally. In 1993, 40 gull nests were counted in North Bay and in 1994 a few nests were found in Central Bay.

Foraging Guild: Generalist. Eats fishes; scavenges along beaches for dead fishes, clams, shrimps, worms; catches small mammals; may force pelicans and cormorants to give up their catches of fish; also eats mollusks that it may drop from the air to open and expose soft internal parts.

Preferred Guild Habitat in Central San Diego Bay :

1° Piers along the Mainland side of the Bay and Marinas on the Silver Strand side

2° Shallow water and shorelines on both sides of the Bay

High Use Areas for Guild in Central San Diego Bay:

Shallow water and piers on north and south sides of the Naval Amphibious Base

Piers and embayment at Chollas Creek and selected piers to the south

Delta Beach shoreline and shallow water

Abandoned barges in embayment north of 24th Street Marine Terminal

Crown Cove shoreline and shallow water

North edge of the Sweetwater Marsh and Sweetwater Channel

Common Name: Gull-billed Tern

Scientific Name: *Sterna nilotica*

Sensitivity Status: Federal Category 2 Candidate. California Department of Fish and Game Species of Special Concern at nesting colonies.

Regional Distribution: Fairly common summer resident at the Salton Sea, with six late fall and early winter records. Unrecorded in California away from the Salton Sea until 1980's.

Residency Status in San Diego Bay: This species was unrecorded in coastal California until the 1980's. This species has now been seen every summer in south San Diego Bay and has been found nesting in the Saltworks. The 10 breeding pairs were documented in 1993. Gull-billed Terns have also been seen somewhat regularly roosting at the mouth of

the Sweetwater River. This species was observed twice in North Bay in 1993 and once in Central Bay in 1994.

Foraging Guild: This species was included in plunge diver category based on taxonomy as there were no insectivorous foraging guilds in this study. Gull-billed Terns are insectivores and feed primarily over salt marsh and adjacent mud flats with the basins of the Chula vista Wildlife Reserve and the area south of Emory cove being some of the most frequently used foraging areas (Copper, pers. obs.).

Preferred Habitat and Use Areas for Species in North San Diego Bay :

Not Determined: This species was only observed once in Central Bay

Common Name: Caspian Tern

Scientific Name: *Sterna caspia*

Sensitivity Status: Considered a Sensitive Species at nesting colonies by California Department of Fish and Game.

Regional Distribution: Fairly common to common transient and summer visitor along the coast, breeding at San Diego Bay. Fairly common but local in winter. Very common to abundant transient and common summer visitor at the Salton Sea; formerly bred there. Rare to uncommon transient through the remainder of the region.

Residency Status in San Diego Bay: Common to locally abundant resident, with one breeding colony at the south end of San Diego Bay. A minimum estimate of 280 pairs of caspian terns nested at the Salt Works in 1993. Ranked as 21st most abundant species in North Bay during 1993 and 28th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Plunge Diver. Eats primarily small fishes; also eats aquatic invertebrates.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shorelines on both sides of the Bay, particularly the Silver Strand side (foraging and resting)
- 2° Marinas along the Silver Strand side of the Bay (resting)

High Use Areas for Guild in Central San Diego Bay:

Most of the Silver Strand shoreline from the north edge of the Naval Amphibious Base south to Crown Cove
The Deep Water Channel west of the Seventh Street Channel
Abandoned barges in the embayment north of the 24th Street Marine Terminal
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Royal Tern

Scientific Name: *Sterna maxima*

Sensitivity Status: None

Regional Distribution: Fairly common but somewhat local winter visitor along the coast and over offshore waters. More numerous around the Channel Islands and the San Diego area, where numbers of non-breeding birds remain through summer. Has nested in small numbers in San Diego.

Residency Status in San Diego Bay: Fairly common visitor in fall, winter, and spring, uncommon in summer. A minimum of 10 pairs of breeding Royal Terns were at the Saltworks in South San Diego Bay in 1993. Ranked as 27th most abundant species in North Bay during 1993 and 17th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Plunge Diver. Eats primarily small fishes; also eats aquatic invertebrates.

Preferred Guild Habitat in Central San Diego Bay :

1° Shallow water and shorelines on both sides of the Bay, particularly the Silver Strand side (foraging and resting)

2° Marinas along the Silver Strand side of the Bay (resting)

High Use Areas for Guild in Central San Diego Bay:

Most of the Silver Strand shoreline from the north edge of the Naval Amphibious Base south to Crown Cove

The Deep Water Channel west of the Seventh Street Channel

Abandoned barges in the embayment north of the 24th Street Marine Terminal

North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Elegant Tern

Scientific Name: *Sterna elegans*

Sensitivity Status: Federal Category 2 Candidate. California Department of Fish and Game Species of Special Concern at nesting colonies.

Regional Distribution: Common post-breeding visitor along the coast, primarily from July through October; lingers very exceptionally to late December and January. One nesting colony at San Diego Bay where birds arrive in March.

Residency Status in San Diego Bay: Abundant summer resident in the single nesting colony at the south end of San Diego Bay; otherwise, a fairly common to common visitor in spring and early summer, becoming abundant in late summer and early fall, then uncommon to rare by late fall. An estimated 312-427 breeding pairs of elegant terns

were at the Salt Works in South San Diego Bay in 1993. Ranked as 7th most abundant species in North Bay during 1993 and in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Plunge Diver. Eats almost exclusively small fishes.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shorelines on both sides of the Bay, particularly the Silver Strand side (foraging and resting)
- 2° Marinas along the Silver Strand side of the Bay (resting)

High Use Areas for Guild in Central San Diego Bay:

Most of the Silver Strand shoreline from the north edge of the Naval Amphibious Base south to Crown Cove
The Deep Water Channel west of the Seventh Street Channel
Abandoned barges in the embayment north of the 24th Street Marine Terminal
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Forster's Tern

Scientific Name: *Sterna forsteri*

Sensitivity Status: Considered a Sensitive Species at nesting colonies by California Department of Fish and Game.

Regional Distribution: Common year-round visitor along the coast, with a breeding colony south of San Diego. Rather common summer resident at the Salton Sea (mostly non-breeding), remaining uncommonly through winter. Transient through the remainder of the region, commonest along the Colorado River.

Residency Status in San Diego Bay: Common to abundant resident, with one breeding colony at the south end of San Diego Bay. A total of 510 pairs were documented at the Salt Works in 1993. Ranked as 12th most abundant species in North Bay during 1993 and 5th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Plunge Diver. Eats small fishes, insects (taken in flight or on surface of water), dead fishes, live and dead frogs.

Preferred Guild Habitat in Central San Diego Bay :

- 1° Shallow water and shorelines on both sides of the Bay, particularly the Silver Strand side (foraging and resting)
- 2° Marinas along the Silver Strand side of the Bay (resting)

High Use Areas for Guild in Central San Diego Bay:

Most of the Silver Strand shoreline from the north edge of the Naval Amphibious

Base south to Crown Cove
The Deep Water Channel west of the Seventh Street Channel
Abandoned barges in the embayment north of the 24th Street Marine Terminal
North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: California Least Tern

Scientific Name: *Sterna antillarum browni*

Sensitivity Status: USFWS: Endangered. CDFG: Endangered at nesting colonies.

Regional Distribution: Fairly common but local summer resident along the coast, primarily from late April through August. Casual spring and summer visitor to the Salton Sea; four records for the Colorado River Valley.

Residency Status in San Diego Bay: Locally common summer resident and migrant. Ranked as 14th most abundant species in North Bay during 1993 and 9th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Plunge Diver. Thought to feed almost exclusively on small fishes.

Preferred Habitat for Species in Central San Diego Bay

- 1° Shallow water and shoreline along the Silver Strand side of the Bay (foraging, resting, and nesting)
- 2° Deep Water Channel (Foraging)
- 3° Marinas on the Silver Strand side of the Bay (foraging)

High Use Areas by Species in Central San Diego Bay:

Shallow water and shoreline at Delta Beach (nesting colony) and adjacent shoreline to the north and south (resting, foraging)

Deep Water Channel south of the Coronado Bridge (foraging)

Deep Water Channel west of the Seventh Street Channel (foraging)

Common Name: Black Skimmer

Scientific Name: *Rynchops niger*

Sensitivity Status: CDFG Species of Special Concern at nesting colonies.

Regional Distribution: Fairly common summer resident at the Salton Sea; small (but increasing) numbers have recently become resident at the south end of San Diego Bay. Sporadic visitor elsewhere along the coast, with one record for the Colorado River Valley and one (possibly two) for the interior of the coastal lowlands.

Residency Status in San Diego Bay: Common resident on San Diego Bay, breeding in the Saltworks; rare elsewhere on the coast of San Diego County. A minimum of 326

breeding pairs were documented at the Salt Works in 1993. Ranked as 31st most abundant species in North Bay during 1993 and 34th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Plunge Diver.

Preferred Guild Habitat in Central San Diego Bay :

1° Shallow water and shorelines on both sides of the Bay, particularly the Silver Strand side (foraging and resting)

2° Marinas along the Silver Strand side of the Bay (resting)

High Use Areas for Guild in Central San Diego Bay:

Most of the Silver Strand shoreline from the north edge of the Naval Amphibious Base south to Crown Cove

The Deep Water Channel west of the Seventh Street Channel

Abandoned barges in the embayment north of the 24th Street Marine Terminal

North edge of the Sweetwater Marsh and the Sweetwater Channel

Common Name: Belted Kingfisher

Scientific Name: *Ceryle alcyon*

Sensitivity Status: None

Regional Distribution: Uncommon to fairly common winter visitor to aquatic habitats, with the greatest numbers occurring along the coast and in the Colorado River Valley. Primarily a transient in the mountainous areas and over much of the arid sections and deserts. Rare breeder, mainly on the coastal slope.

Residency Status in San Diego Bay: Fairly common during migration and winter and rare in summer. Ranked as 29th most abundant species in North Bay during 1993 and 27th most abundant species in Central Bay in 1994 (this ranking excludes most gull and shorebird species which were grouped for analysis).

Foraging Guild: Plunge Diver.

Preferred Guild Habitat in Central San Diego Bay :

1° Shallow water and shorelines on both sides of the Bay, particularly the Silver Strand side (foraging and resting)

2° Marinas along the Silver Strand side of the Bay (resting)

High Use Areas for Guild in Central San Diego Bay:

Most of the Silver Strand shoreline from the north edge of the Naval Amphibious Base south to Crown Cove

The Deep Water Channel west of the Seventh Street Channel

Abandoned barges in the embayment north of the 24th Street Marine Terminal
North edge of the Sweetwater Marsh and the Sweetwater Channel

This Page Intentionally Left Blank

1

APPENDIX C

CUMULATIVE TOTALS BY SPECIES FOR THREE WATERBIRD SURVEY AREAS IN SAN DIEGO BAY

4

APPENDIX C

CUMULATIVE TOTALS BY SPECIES FOR THREE WATERBIRD SURVEY AREAS IN SAN DIEGO BAY

Species	1993 North Bay Total (1)	1994 Central Bay Total (2)	1993-1994 South Bay Total (3)	Entire San Diego Bay Total
American coot	134	395	16	545
American wigeon	0	0	1436	1436
Belted kingfisher	50	64	0	114
Black skimmer	32	30	30	92
Black-bellied whistling duck	1	0	0	1
Blck-crowned night heron	328	16	16	360
Bonaparte's gull	353	145	648	1146
Brandt's cormorant	12672	618	9	13299
Brant	0	72	6611	6683
Bufflehead	5104	6222	5447	16773
California brown pelican	12020	2435	618	15073
California gull	895	280	142	1317
California least tern	920	2138	148	3206
Caspian tern	175	57	172	404
Cattle egret	0	0	1	1
Cinnamon teal	5	0	6	11
Clark's grebe	378	39	292	709
Common loon	312	187	20	519
Double-crested cormorant	2461	1461	832	4754
Eared grebe	795	2918	1642	5355
Elegant tern	3550	2332	419	6301
Forster's tern	1994	2672	675	5341
Fulvous whistling duck	2	0	0	2
Great blue heron	2214	951	83	3248
Great egret	740	77	100	917
Greater scaup	2694	11222	11821	25737
Green heron	11	3	0	14
Green-winged teal	0	0	2	2
Gull-billed tern	2	0	1	3
Heermann's gull	15402	2207	27	17636
Herring gull	447	140	83	670
Horned grebe	44	79	64	187
Lesser scaup	299	1247	1313	2859
Little blue heron	4	2	2	8

APPENDIX C (Continued)

CUMULATIVE TOTALS BY SPECIES FOR THREE WATERBIRD SURVEY AREAS IN SAN DIEGO BAY

Species	1993 North Bay Total (1)	1994 Central Bay Total (2)	1993-1994 South Bay Total (3)	Entire San Diego Bay Total
Mallard	2440	1378	23	3841
Mew gull	2	2	2	6
Northern harrier	1	1	0	2
Northern pintail	0	10	149	159
Northern shoveler	0	0	15	15
Oldsquaw	2	6	0	8
Osprey	18	45	53	116
Pacific loon	99	36	12	147
Parasitic jaeger	2	1	0	3
Pelagic cormorant	69	0	0	69
Peregrine falcon	4	36	2	42
Pied-billed grebe	126	64	7	197
Red-breasted merganser	395	265	456	1116
Red-throated loon	127	13	16	156
Redhead	0	1	35	36
Rhinoceraus auklet	2	0	0	2
Ring-billed gull	895	280	143	1318
Royal tern	85	212	53	350
Ruddy duck	1	2	3	6
Snowy egret	1811	298	298	2407
Storm petrel sp.	0	1	0	1
Surf scoter	5185	72020	52546	129751
Western grebe	3403	348	2627	6378
Western gull	42496	13310	6840	62646
White-winged scoter	0	0	13	13
Wood duck	2	0	0	2
Totals	121203	126338	95969	343510

(1) Ogden 1994

(2) This Study

(3) Manning 1994