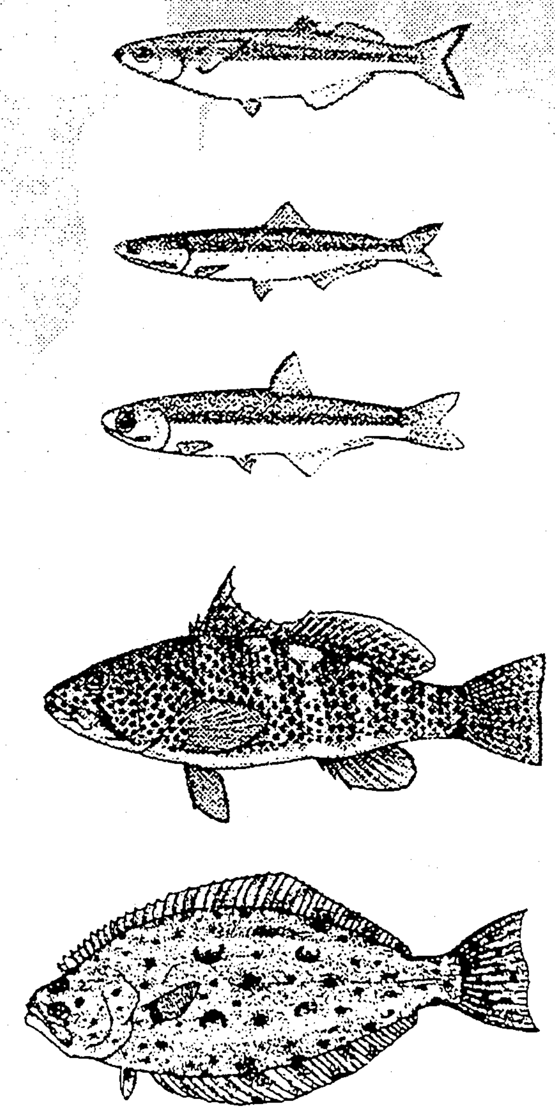
ATTACHMENT 21

FISHERIES INVENTORY AND UTILIZATION OF SAN DIEGO BAY, SAN DIEGO, CALIFORNIA

ANNUAL REPORT, FY 1994-95



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California State University Northridge
and the
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FISHERIES INVENTORY AND UTILIZATION OF SAN DIEGO BAY, SAN DIEGO, CALIFORNIA

ANNUAL REPORT, FY 1994-95

by

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EXECUTIVE SUMMARY

Quarterly samples were taken from July 1994 to April 1995 at four stations located in San Diego using a variety of sampling methods designed to assess all components of the ichthyofauna. The samples yielded a total of 43,807 fishes belonging to 63 species and weighing over 413 kg. Topsmelt (*Atherinops affinis*) was the most abundant fish comprising 49% of the total catch, followed by the slough anchovy (*Anchoa delicatissima*) at 18%, shiner surfperch (*Cymatogaster aggregata*) at 7.7%, and northern anchovy (*Engraulis mordax*) at about 4% of the total catch. Round stingrays (*Urolophus halleri*) constituted 33% of the total biomass taken followed by spotted sand bass (*Paralabrax maculatofasciatus*) at about 19%, California halibut (*Paralichthys californicus*), 9.5%, and topsmelt 8.4%.

Temperature varied from a high of 26.1 °C at Station 4 in July 1994 to a low of 14.9 °C at Station 2 in January 1995. Thermal stratification was evident during all sampling periods with temperatures becoming warmer (2-5 °C) north to south (Station 4 being the warmest) in the bay except in October 1994 when Station 1 had the highest mean temperature. Salinity was relatively stable over the study period varying only about 3 ppt (36.4 to 33.4 ppt) over the entire year despite heavy rainfall in January of 1995. Salinities were typically higher than 34 ppt, the average value for sea water. Mean pH readings were stable varying only from 7.5 in January 1995 to 8.2 in July 1994 while dissolved oxygen had a similar range of 7.6 to 8.8 mgO_2/l in July 1994 and April, 1995, respectively.

Stations 1 and 2 were located within the northern section of San Diego Bay. Station 1 was dominated numerically by topsmelt with round stingrays and California halibut constituting most of the biomass captured. Topsmelt and shiner surfperch were the two most abundant species taken at Station 2 while round stingrays, spotted sand bass, and barred sand bass (*Paralabrax nebulifer*) completely dominated in terms of biomass.

Station 3 and 4 were located in southern portion of San Diego Bay. Station 3 was dominated numerically by topsmelt and slough anchovy. Spotted sand bass, round

stingrays and barred sand bass dominated in terms of biomass. At Station 4, slough anchovies completely dominated the catch numerically while the round stingray and California halibut the bulk of the biomass.

The greatest total number of individuals was taken at Station 1 (16,245) with the next highest at Station 3 (9,744), then Station 4 (9,053), and Station 2 (8,765). The abundances of the two numerically dominant species, topsmelt and slough anchovy, appear to be negatively correlated with topsmelt dominating in north San Diego Bay and the slough anchovy being prominent in the south. The catch in terms of biomass was relatively even across the stations due to large catches of round stingray and spotted sand bass across all stations, although Station 4 posted the highest total (117,265.4 g).

Although the most common species generally occur throughout the bay, the northern and southern portions exhibit different assemblages in terms of relative abundances.

Marked changes in the number of individuals and total biomass occurred over the study. When all four stations are considered together, numerical abundance was highest in the spring (April 1995) and summer (July 1994) months. Heavy recruitment of juvenile surfperches and topsmelt in April 1995 was largely responsible for the abundance peak. Lowest abundances were encountered in the coldest months of the study (January 1995). This abundance pattern was consistent among stations 1, 2, and 3. However, the southern-most station, 4, exhibited peak abundance in October 1994 Biomass varied greatly from quarter to quarter and was highly dependent on the abundance of round stingrays and spotted sand bass in the catch. Weights of the catches peaked in the spring (April 1995) and the fall (October 1994).

The small seine (SS) and square enclosure (SE) yielded the highest numerical densities overall due to the sporadic capture of large numbers of small, juvenile fishes in the intertidal zones of the stations. Although both methods yielded higher mean densities in non-vegetated (N) than in vegetated (V) areas, the differences were not statistically significant (SS t-value = 0.064, df = 94, p = 0.948; SE t-value = -1.580, df = 94, p = 0.117) due to the high variance of non-vegetated samples. Purse seine (PS) samples yielded very similar densities between N and V sites, and these were not significantly different (PS t-value = -0.580, df = 94, p = 0.563). However, the relatively low mean densities calculated from the large seine (LS) and the beam trawl (BT) were significantly different between N and V areas. For the large seine the mean numerical density of 0.506 Ind./m^2 in V samples was significantly greater than the 0.113 Ind./m^2 in N samples (LS t-value = -3.273, df = 94, $p < 0.0014$**). For Beam trawls the mean numerical density of 0.275 Ind./m^2 in V samples was also significantly greater than the 0.076 Ind./m^2 in N samples (BT t-value = -3.696, df = 94, $p < 0.0004$**).

The small seine (SS) and square enclosure (SE) yielded the lowest biomass densities overall since they captured mainly small fishes. Although both methods yielded higher mean densities in non-vegetated (N) than in vegetated (V) areas, the differences were, again, not statistically significant (SS t-value = 0.014, df = 94, p = 0.988; SE t-value = -1.547, df = 94, p = 0.125) due to the high variance of non-vegetated samples. Purse seine (PS) samples yielded relatively high biomass densities at N (4.835 g/ m^2) and V (4.234 g/ m^2) sites, however, these values were not significantly different (PS t-value = 0.109, df = 94, p = 0.912). As was the case for numerical density, large seine (LS) and the beam trawl (BT) biomass densities were significantly different between N and V areas. For the large seine, the mean biomass density of 1.071 g/m^2 in V samples was significantly greater than the 0.366 g/m^2 in N samples (LS t-value = -2.512, df = 94, $p < 0.013$*). For beam trawls the mean numerical density of 3.521 g/m^2 in V samples was also significantly greater than the 2.410 g/m^2 in N samples (LS t-value = -2.303, df = 94, $p < 0.023$*). Otter trawl (OT) and Purse seine (PS) samples from the channel yielded similar very low mean numerical and biomass densities.

Preliminary correlation analysis on log-transformed station abundance and biomass versus temperature, salinity, pH, and dissolved oxygen yielded no significant relationships at this point in the ongoing study.

INTRODUCTION

The overall goal of this research project is to provide the first definitive assessment of the fish populations inhabiting San Diego Bay, the largest California embayment south of San Francisco Bay. San Diego Bay provides expansive and diverse habitats for fishes including deep channels, marinas, and extensive shallows largely covered with eelgrass. A characterization of the ichthyofauna of San Diego Bay can best be understood in the context of our current knowledge of bay and estuarine systems, especially those within southern California. Therefore, this report will first briefly summarize what is known about the fish assemblages which occupy these unique habitats.

Bays and estuaries are normally considered to be important nursery areas for coastal marine fishes (Haedrich and Hall, 1976; Cronin and Mansueti, 1971). The warm spring-summer water temperatures coupled with the high productivity enable these environments to support large numbers of juvenile fish. Southern California bays and estuaries are relatively small and scarce when compared to the large, river-dominated estuaries common in other parts of the world. They do, however, function as nursery areas in the classical sense for some species. At least one commercially important species (California halibut, *Paralichthys californicus*) has been shown, thus far, to rely heavily on southern California bays and estuaries as nursery areas (Allen, 1988). Juveniles of non-commercial fishes can be extremely abundant and usually dominate the fish assemblages of bays and estuaries in the Southern California Bight (Allen, 1982). Many of these abundant, non-commercial species (e.g. gobies, anchovies, and silversides) are important forage fishes for commercial fish species (Horn, 1980) and sea birds. Another characteristic of the fish assemblages from southern California bays and estuaries which is often overlooked is that these habitats support a unique set of species found nowhere else in the bight (Horn, 1980; Allen, 1985).

The principal, resident species found in the smaller bays and estuaries of the Bight include topsmelt (*Atherinops affinis*), California killifish (*Fundulus parvipinnis*), striped mullet (*Mugil cephalus*), longjaw mudsucker (*Gillichthys mirabilis*), arrow goby

(*Clevelandia ios*), shadow goby (*Quietula ycauda*), cheekspot goby (*Ilypnus gilberti*), yellowfin goby (*Acanthogobius flavimanus* - introduced), deepbody anchovy (*Anchoa compressa*), slough anchovy (*Anchoa delicatissima*), shiner surfperch (*Cymatogaster aggregata*), black surfperch (*Embiotoca jacksoni*), diamond turbot (*Hypsopsetta guttulata*), and juvenile California halibut (*Paralichthys californicus*), spotted sand bass (*Paralabrax maculatofasciatus*), round stingray (*Urolophus halleri*), and yellowfin croaker (*Umbrina roncador*).

California killifish and longjaw mudsuckers are most abundant in the shallow tidal channels of the marsh islands. Topsmelt, striped mullet, deepbody anchovy, and slough anchovy inhabit the water column of both the main channels and along the shoreline, although topsmelt and mullet feed on the bottom. The five species of gobies (family Gobiidae) as a group are the most abundant benthic fishes along the shoreline. The deeper channels are inhabited mainly by residents and seasonal migrants including shiner surfperch, black surfperch, diamond turbot, juvenile California halibut, spotted sand bass, barred sand bass, yellowfin croaker, and round stingray (Horn and Allen, 1981).

San Diego Bay is the largest naturally occurring marine embayment between San Francisco and Scammon's Lagoon in central Baja California containing approximately 12,000 acres (486 ha) of marine habitat (San Diego Unified Port, 1990). Only the lower portion, South San Diego Bay appears to most comparable to other Southern California bays and estuaries in terms of physical and biotic characterisitics.

Since 1968, the fish populations of San Diego Bay have been the subject of numerous monitoring studies with most being concentrated in the to the South San Diego Bay region (Ford 1968, 1985, & 1986, Ford *et al.* 1971, Lockheed 1979, San Diego Unified Port District 1980, San Diego Gas & Electric Co. 1980, Lockheed 1983). Most of these studies were limited in scope and duration. A comprehensive review of all work and the work in South San Diego Bay, in particular, is presented in San Diego Unified Port District (1990). *No comprehensive studies of the fish populations of the entire bay existed prior to the present study.*

San Diego Unified Port District (1990) also presented the most complete work on the South San Diego Bay fish populations yet completed. Sampling was conducted on a relationship to PC factors. The samples summarized in this report represent only the beginning of a long term study. **Any conclusions drawn here should only be viewed as preliminary.**

METHODS AND MATERIALS

Station Locations

In order to assess the status of all components of the ichthyofauna of San Diego Bay, we sampled intensively at four stations located in each of the four geographic sections (north, north-central, south-central, and south) of bay (Figure 1).

At each station, five subhabitat types were sampled. These subhabitats are designated as follows (from deep to shallow water): 1) channel, 2) nearshore, non-vegetated, 3) nearshore, vegetated, 4) intertidal, non-vegetated, and 5) intertidal vegetated.

Sampling Procedures

The actual sampling locations for each type of gear within each station subhabitat were randomly selected for each sampling period. Sampling was conducted on a quarterly basis beginning in July 1994. Subsequent sampling periods were October 1994, January 1995 and April 1995. We occupied each station on a separate day in order to sample each section thoroughly with a multiple gear approach. The use of multiple gears was necessary to adequately sample all of the habitat types available to the fishes of San Diego Bay. Collections were carried out using the R/V Yellowfin as our base of operations. Much of the work was conducted out of two, 5 m Boston Whalers which were towed behind the Yellowfin.

At each station, the following gear types were employed:

1) A 15.2 X 1.8 m **large seine** fitted with a 1.8 X 1.8 X 1.8 m bag (1.2 cm mesh in wings and 0.6 cm mesh in bag) was utilized to sample juvenile fishes in the nearshore portion of the station at a depth of 0-2 m. This net was set parallel to shore and hauled to shore by 15 m lines. This seine is an accurate sampler of nearshore schooling fishes and gives reliable density estimates. Two replicate hauls were made at each station, each of which covered about 220 m^2;

2) A 4.6 m X 1.2 m **small seine** (3 mm mesh) was employed to collect juvenile and adult fishes occupying the shallow, inshore areas (0- 0.5 m depth). The small seine

was hauled 10 m along shore and pivoted shoreward yielding a consistent areal coverage of about 62 m^2.

3) A **square enclosure** (1m x 1m x 1m) constructed of 2.5 cm PVC pipe and canvas was used to sample small, burrow inhabiting fish species such as gobies in the shallow waters of the bay. The enclosure was set randomly within each subhabitat in a depth range of 0.25 to 0.75 m and firmly settled into the substrate. One liter of 3:1 acetone-rotenone solution was then added to the enclosed water column and the substrate searched thoroughly for 10 min. with a 1 mm mesh, long-handled dipnet. This device samples an area of 1.0 m^2.

4) A 1.6 m **beam trawl** with 4 mm mesh in the wings and 2 mm knotless mesh in the codend. Standardized ten minute tows were be made behind the 5m Boston Whalers.

5) A 66 x 6 m **purse seine** (1.2 cm mesh in wings and 0.6 cm mesh in bag) was utilized to sample juvenile and adult fishes in the water column of nearshore portion of the station.

6) A 8 m semi-balloon **otter trawl** (2 cm mesh in wings and 0.8 cm mesh in codend) towed behind the R/V Yellowfin was used to sample demersal juvenile and adult fishes from the deepest channel portions of each sampling area.

Large seines, small seines, and square enclosures (all N=3 each) were used to sample both types of intertidal subhabitat. Both the nearshore subhabitats (non-vegetated and vegetated) were sampled using beam trawls (N=3 each) and purse seines (N=3 each). The channel was sampled using otter trawls (N=3) and purse seines (N=3).

All fishes or subsamples of large catches were identified, counted and weighed aboard ship or in the laboratory after freezing to the nearest 0.1g on a Mettler PE2000 digital scale.

Water temperature (°C), salinity (ppt), dissolved oxygen (mgO^2/l), and pH were measured at each station at the shoreline, nearshore surface and bottom, and channel surface and bottom using a Hydrolab Digital 4041 field analyzer. Maximum depth of each station was recorded using a Hummin'bird depth sounder mounted on each Boston Whaler. PC measurements were taken once at each of the four stations during each of the 4 sampling periods.

Data summarization and graphing were accomplished using *Microsoft Excell* and *Axum* software on an IBM compatible 486DX PC. Data analysis including t-tests comparing densities in vegetated and non-vegetated areas and correlations among PC factors and numbers and biomass were carried out using *Statistica*. As is the usual case with ecological data on fishes, raw catch data were generally non-normal with unequal variances. For this reason, all catch data for number of individuals of all species were log-transformed (ln(x+1)) before statistical comparisons were made. This transformation solved problems of unequal variances in this data set.

maculatofasciatus) at about 19%, California halibut (*Paralichthys californicus*), 9.5%, and topsmelt 8.4% (Table 3).

Stations 1 and 2 were located within the northern section of San Diego Bay. Station 1 was dominated numerically by topsmelt (Table 2). Round stingrays and California halibut constituted most of the biomass captured (Table 3) at Station 1. Topsmelt and shiner surfperch were the two most abundant species (Table 2) taken at Station 2 while round stingrays, spotted sand bass, and barred sand bass (*Paralabrax nebulifer*) completely dominated in terms of biomass (Table 3).

Station 3 and 4 were located in southern portion of San Diego Bay. Station 3 was dominated numerically by topsmelt and slough anchovy (Table 2). Spotted sand bass, round stingrays and barred sand bass dominated in terms of biomass (Table 3). At Station 4, slough anchovies completely dominated the catch numerically(Table 2) while the round stingray and California halibut the bulk of the biomass (Table 3). The species composition and relative abundances of fishes taken at Station 4 were remarkably similar to those reported by Ford in 1988-89 (San Diego Unified Port District, 1990).

The greatest number of individuals was taken at Station 1 (16,245) with the next highest at Station 3 (9,744), then Station 4 (9.053), and Station 2 (8,765) (Figure 3). The high count at Station 1 compared to the other station was due entirely to the large number of juvenile topsmelt. Whether this northern portion of the bay represents a preferred nursery area for topsmelt cannot be determined at this time. The abundances of the two numerically dominant species, topsmelt and slough anchovy, appear to be negatively correlated with topsmelt dominating in north San Diego Bay and the slough anchovy being prominent in the south (Figure 4). The catch in terms of biomass was relatively even across the stations (Figure 5) due to large catches of round stingray and spotted sand bass across all stations, although Station 4 posted the highest total (117,265.4 g).

Although the most common species generally occur throughout the bay, the northern and southern portions exhibit different assemblages in terms of relative abundances. These subtle differences in species composition are illustrated, qualitatively, in Figures 6 & 7.

A breakdown of the total abundance of fishes captured in each subhabitat is contained in Table 6. Summaries of station and quarterly catches broken down into vegetated, non-vegetated and channel samples are included in Appendix Tables 2 - 7.

Seasonal Abundance

Marked changes in the number individuals and total biomass occurred over the study. When all four stations are considered together, numerical abundance was highest in the spring (April 1995) and summer (July 1994) months. Heavy recruitment of juvenile surfperches and topsmelt in April 1995 was largely responsible for the abundance peak (Table 4; Figure 8). Lowest abundances were encountered in the coldest months of the study (January 1995). This abundance pattern was consistent among Stations 1, 2, and 3. However, the southern-most station, 4, exhibited peak abundance in October 1994 (Figure 9). Biomass varied greatly from quarter to quarter and was highly dependent on the abundance of round stingrays and spotted sand bass in the catch (Table 5). Weights of the catches peaked in the spring (April 1995) and the fall (October 1994) (Figure 10 & 11).

Comparison of Densities among Subhabitats

Vegetated versus Non-vegetated Samples

The only meaningful way to compare both numerical and biomass densities among subhabitats is to compare the catches only within gear types. This controls for the substantial differences in both areal coverage and gear efficiency among the different sampling devices.

The small seine (SS) and square enclosure (SE) yielded the highest numerical densities overall (Figure 12) due to the sporadic capture of large numbers of small, juvenile fishes in the intertidal zones of the stations. Although both methods yielded higher mean densities in non-vegetated (N) than in vegetated (V) areas, the differences were not statistically significant (SS t-value = 0.064, df = 94, p = 0.948; SE t-value = -1.580, df = 94, p = 0.117) due to the high variance of non-vegetated samples. Purse seine (PS) samples yielded very similar densities between N and V sites, and these were not significantly different (PS t-value = -0.580, df = 94, p = 0.563) (Figure 12). However, the relatively low mean densities calculated from the large seine (LS) and the beam trawl (BT) were significantly different between N and V areas (Figure 12 & 13). For the large seine the mean numerical density of 0.506 Ind./m^2 in V samples was significantly greater than the 0.113 Ind./m^2 in N samples (LS t-value = -3.273, df = 94, p < 0.0014**). For Beam trawls the mean numerical density of 0.275 Ind./m^2 in V samples was also significantly greater than the 0.076 Ind./m^2 in N samples (BT t-value = -3.696, df = 94, p < 0.0004**).

The small seine (SS) and square enclosure (SE) yielded the lowest biomass densities overall (Figure 14) since they captured mainly small fishes. Although both methods yielded higher mean densities in non-vegetated (N) than in vegetated (V) areas, the differences were, again, not statistically significant (SS t-value = 0.014, df = 94, p = 0.988; SE t-value = -1.547, df = 94, p = 0.125) due to the high variance of non-vegetated samples caused by sporadic catches of small schools of fish. Purse seine (PS) samples yielded relatively high biomass densities at both N (4.835 g/ m^2) and V (4.234 g/ m^2) sites. These values were not significantly different (PS t-value = 0.109, df = 94, p = 0.912) (Figure 13). As was the case for numerical density, large seine (LS) and the beam trawl (BT) biomass densities were significantly different between N and V areas (Figure 12 & 13). For the large seine, the mean biomass density of 1.071 g/m^2 in V samples was significantly greater than the 0.366 g/m^2 in N samples (LS t-value = -2.512, df = 94, p < 0.013*). For beam trawls the mean numerical density of 3.521 g/m^2 in V samples was also significantly greater than the 2.410 g/m^2 in N samples (LS t-value = -2.303, df = 94, p < 0.023*).

The significantly higher catches in beam trawls and large seines at the vegetated sites is consistent with the findings of Hoffman (1986) who concluded that catches were generally twice as large over eelgrass compared to non-vegetated sites. All of the results particularly those based on the small seine, square enclosure, and purse seine sampling must be viewed as preliminary and interpreted with caution for two main reasons. First, the sample sizes for the statistical comparisons is low at this first reporting. An increase in sample size is the only way to overcome the high natural variance which is always encountered when sampling mobile organisms with very patchy distributions. Secondly, non-vegetated sites actually had some eelgrass. The eelgrass beds in San Diego Bay are currently very healthy covering most of the available nearshore areas. In fact, in the original selection of station sites, it was difficult to locate non-vegetated sites. For this reason the non-vegetated sites actually contained eelgrass as less than about 20% bottom cover initially. Seasonal growth and die-off of eelgrass within the established stations over the year also added unwanted variance to the distinction between vegetated and non-vegetated areas.

Channel

Otter trawl (OT) and purse seine (PS) samples from the channel yielded similar very low mean numerical and biomass densities (Figure 13 & 15).

Summaries of density calculations are contained in Appendix Tables 8 & 9.

Relationship of PC factors to Fish Distribution and Abundance

Preliminary correlation analysis on log-transformed station abundance and biomass versus temperature, salinity, pH, and dissolved oxygen yielded no significant relationships (Table 7). Obviously, further sampling will be necessary to elucidate possible relationships among these biotic and abiotic factors.

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Table 1. Lambert Coordinates (LAT, LONG) for San Diego Bay Fisheries Inventory and Utilization Study, 1994-95.

AREA =STATION	SITE	LAT	LONG
1	VEGETATED	32° 41' 50"	117° 13' 40"
	NON-VEGETATED	32° 42' 45"	117° 12' 30"
2	VEGETATED	32° 41' 25"	117° 09' 50"
	NON-VEGETATED	32° 41' 12"	117° 09' 45"
3	VEGETATED	32° 39' 05"	117° 08' 30"
	NON-VEGETATED	32° 38' 48"	117° 08' 25"
4	VEGETATED	32° 37' 00"	117° 07' 45"
	NON-VEGETATED	32° 36' 50"	117° 06' 45"

Table 2. Total abundance of fish species taken from San Diego Bay, July 1994 to April 1995 by station.

SPECIES	SPCODE	COMMON NAME	STATION 1	2	3	4	Total	%
Atherinops affinis	ATHAFF	topsmelt	12723	3894	3938	908	21463	48.99
Anchoa delicatissima	ANCDEL	slough anchovy	0	12	2183	5674	7869	17.96
Cymatogaster aggregata	CYMAGG	shiner surfperch	711	1861	520	301	3393	7.75
Engraulis mordax	ENGMOR	northern anchovy	133	4	1567	3	1707	3.90
Heterostichus rostratus	HETROS	giant kelpfish	589	627	180	41	1437	3.28
Syngnathus auliscus	SYNAUL	barred pipefish	97	368	271	532	1268	2.89
Ilypnus gilberti	ILYGIL	cheekspot goby	498	555	37	12	1102	2.52
Syngnathus leptorhynchus	SYNLEP	bay pipefish	267	351	181	89	888	2.03
Urolophus halleri	UROHAL	round stingray	90	215	182	361	848	1.94
Paralabrax nebulifer	PARNEB	barred sand bass	82	383	133	111	709	1.62
Clevelandia ios	CLEIOS	arrow goby	10	48	0	547	605	1.38
Atherinopsis californiensis	ATHCAL	jacksmelt	190	83	251	12	536	1.22
Paralichthys californicus	PARCAL	California halibut	111	35	42	70	258	0.59
Paralabrax maculatofasciatus	PARMAC	spotted sand bass	19	70	106	35	230	0.53
Paralabrax clathratus	PARCLA	kelp bass	195	6	3	1	205	0.47
Fundulus parvipinnis	FUNPAR	California killifish	0	11	9	111	131	0.30
Micrometrus minimus	MICMIN	dwarf surfperch	118	1	2	0	121	0.28
Quietula ycauda	QUIYCA	shadow goby	5	14	17	67	103	0.24
Sardinops sagax	SARSAG	Pacific sardine	42	51	1	0	94	0.21
Xenistius californiensis	XENCAL	salema	66	13	8	0	87	0.20
Hypsoblennius gentilis	HYPGUT	bay blenny	21	23	13	23	80	0.18
Hyporhamphus rosae	HYPGEN	California halfbeak	15	46	2	1	64	0.15
Embiotoca jacksoni	EMBJAC	black surfperch	53	4	0	0	57	0.13
Hypsopsetta guttulata	HYPROS	diamond turbot	4	7	31	12	54	0.12
Gibbonsia montereyensis	GIBMON	crevice kelpfish	30	22	0	0	52	0.12
Post-larval anchovy	PLVENG	Post-larval anchovy	0	0	0	45	45	0.10
Anchoa compressa	ANCCOM	deepbody anchovy	0	2	4	35	41	0.09
Cheilotrema saturnum	CHESAT	black croaker	4	3	17	12	36	0.08
Pleuronichthys ritteri	PLERIT	spotted turbot	22	6	2	1	31	0.07
Scomber japonicus	SCOGUT	Pacific mackerel	24	5	1	0	30	0.07
Synodus lucioceps	SYNLUC	California lizardfish	23	0	0	4	27	0.06
Symphurus atricauda	SYMATR	California tonguefish	17	3	0	0	20	0.05
Leptocottus armatus	LEPARM	staghorn sculpin	5	8	3	3	19	0.04
Scorpaena guttata	SCOJAP	spotted scorpionfish	0	0	19	0	19	0.04
Umbrina roncador	UMBRON	yellowfin croaker	0	3	7	6	16	0.04
Xystreurys liolepis	XYSLIO	fantail sole	14	1	0	1	16	0.04
Halichoeres semicinctus	HALSEM	rock wrasse	15	0	0	0	15	0.03
Acanthogobius flavimanus	ACAFLA	yellowfin goby	0	1	1	12	14	0.03
Syngnathus exilis	SYNEXI	barcheek pipefish	2	7	5	0	14	0.03
Syngnathus californiensis	SYNCAL	kelp pipefish	10	2	1	0	13	0.03
Mugil cephalus	MUGCEP	striped mullet	8	0	1	2	11	0.03
Porichthys myriaster	PORMYR	specklefinfin midshipman	1	2	0	7	10	0.02
Gibbonsia elegans	GIBELE	spotted kelpfish	1	6	0	1	8	0.02
Anisotremus davidsoni	ANIDAV	sargo	6	0	1	0	7	0.02
Seriphus politus	SERPOL	queenfish	0	6	0	0	6	0.01
Bryx arctos	BRYARC	snubnose pipefish	5	0	0	0	5	0.01
Pleuronichthys coenosus	PLECOE	CO turbot	5	0	0	0	5	0.01
Mustelus californicus	MUSCAL	grey smoothhound	0	0	0	4	4	0.01
Myliobatis californica	MYLCAL	bat ray	1	0	0	3	4	0.01
Pleuronichthys verticalis	PLEVER	hornyhead turbot	0	4	0	0	4	0.01
Strongylura exilis	STREXI	California needlefish	0	1	2	1	4	0.01
Paraclinus integripinnis	PARINT	reef finspot	1	0	2	0	3	0.01
Sphyraena argentea	SPHARG	California barracuda	3	0	0	0	3	0.01
Atractoscion nobilis	ATRNOB	white sea bass	0	0	0	2	2	0.00
Girella nigricans	GIRNIG	opaleye	2	0	0	0	2	0.00
Oxyjulis californica	OXYCAL	senorita	2	0	0	0	2	0.00
Roncador stearnsii	RONSTE	spotfin croaker	0	0	0	2	2	0.00
Gillichthys mirabilis	GILMIR	longjaw mudsucker	0	0	0	1	1	0.00
Hippocampus ingens	HIPING	Pacific seahorse	0	1	0	0	1	0.00
Medialuna californica	MEDCAL	halfmoon	1	0	0	0	1	0.00
Parophrys vetulus	PARVET	English sole	1	0	0	0	1	0.00
Porichthys notatus	PORNOT	plainfin midshipman	1	0	0	0	1	0.00
Rimicola muscarum	RIMMUS	kelp clingfish	1	0	0	0	1	0.00
Tridentiger trigonocephalus	TRITRI	chameleon goby	0	0	1	0	1	0.00
Zapteryx exasperata	ZAPEXA	banded guitarfish	1	0	0	0	1	0.00
TOTAL			16245	8765	9744	9053	43807	

Table 4. Total abundance of fish species taken from San Diego Bay, July 1994 to April 1995 by quarterly sample.

			MONTH					
SPECIES	SPCODE	COMMON NAME	Jul-94	Oct-94	Jan-95	Apr-95	Total	%
Atherinops affinis	ATHAFF	topsmelt	5043	2369	1006	13045	21463	48.99
Anchoa delicatissima	ANCDEL	deepbody anchovy	1813	4245	159	1652	7869	17.96
Cymatogaster aggregata	CYMAGG	shiner surfperch	31	44	13	3305	3393	7.75
Engraulis mordax	ENGMOR	northern anchovy	1697	1	0	9	1707	3.90
Heterostichus rostratus	HETROS	giant kelpfish	322	395	23	697	1437	3.28
Syngnathus auliscus	SYNAUL	barred pipefish	550	112	100	506	1268	2.89
Ilypnus gilberti	ILYGIL	cheekspot goby	950	62	43	47	1102	2.52
Syngnathus leptorhynchus	SYNLEP	bay pipefish	225	255	189	219	888	2.03
Urolophus halleri	UROHAL	round stingray	89	155	123	481	848	1.94
Paralabrax nebulifer	PARNEB	barred sand bass	81	187	55	386	709	1.62
Clevelandia ios	CLEIOS	arrow goby	306	115	23	161	605	1.38
Atherinopsis californiensis	ATHCAL	jacksmelt	0	2	532	2	536	1.22
Paralichthys californicus	PARCAL	California halibut	159	25	29	45	258	0.59
Paralabrax maculatofasciatus	PARMAC	spotted sand bass	23	50	57	100	230	0.53
Paralabrax clathratus	PARCLA	kelp bass	1	192	4	8	205	0.47
Fundulus parvipinnis	FUNPAR	California killifish	5	11	94	21	131	0.30
Micrometrus minimus	MICMIN	dwarf surfperch	52	14	2	53	121	0.28
Quietula ycauda	QUIYCA	shadow goby	1	31	62	9	103	0.24
Sardinops sagax	SARSAG	Pacific sardine	1	84	9	0	94	0.21
Xenistius californiensis	XENCAL	salema	0	79	0	8	87	0.20
Hypsoblennius gentilis	HYPGUT	bay blenny	33	4	17	26	80	0.18
Hyporhamphus rosae	HYPGEN	California halfbeak	26	21	2	15	64	0.15
Embiotoca jacksoni	EMBJAC	black surfperch	4	19	0	34	57	0.13
Hypsopsetta guttulata	HYPROS	diamond turbot	13	39	1	1	54	0.12
Gibbonsia montereyensis	GIBMON	crevice kelpfish	52	0	0	0	52	0.12
Post-larval anchovy	PLVENG	Post-larval anchovy	45	0	0	0	45	0.10
Anchoa compressa	ANCCOM	deepbody anchovy	7	0	22	12	41	0.09
Cheilotrema saturnum	CHESAT	black croaker	3	9	3	21	36	0.08
Pleuronichthys ritteri	PLERIT	spotted turbot	13	6	3	9	31	0.07
Scomber japonicus	SCOGUT	Pacific mackerel	22	4	2	2	30	0.07
Synodus lucioceps	SYNLUC	California lizardfish	8	0	2	17	27	0.06
Symphurus atricauda	SYMATR	California tonguefish	12	3	0	5	20	0.05
Leptocottus armatus	LEPARM	staghorn sculpin	9	0	2	8	19	0.04
Scorpaena guttata	SCOJAP	spotted scorpionfish	0	0	0	19	19	0.04
Umbrina roncador	UMBRON	yellowfin croaker	9	4	1	2	16	0.04
Xystreurys liolepis	XYSLIO	fantail sole	9	1	1	5	16	0.04
Halichoeres semicinctus	HALSEM	rock wrasse	2	13	0	0	15	0.03
Acanthogobius flavimanus	ACAFLA	yellowfin goby	1	2	3	8	14	0.03
Syngnathus exilis	SYNEXI	barcheek pipefish	1	0	0	13	14	0.03
Syngnathus californiensis	SYNCAL	kelp pipefish	1	0	11	1	13	0.03
Mugil cephalus	MUGCEP	striped mullet	0	1	9	1	11	0.03
Porichthys myriaster	PORMYR	specklefinfin midshipman	9	0	0	1	10	0.02
Gibbonsia elegans	GIBELE	spotted kelpfish	0	0	0	8	8	0.02
Anisotremus davidsoni	ANIDAV	sargo	0	6	0	1	7	0.02
Seriphus politus	SERPOL	queenfish	0	0	0	6	6	0.01
Bryx arctos	BRYARC	snubnose pipefish	0	2	1	2	5	0.01
Pleuronichthys coenosus	PLECOE	CO turbot	5	0	0	0	5	0.01
Mustelus californicus	MUSCAL	grey smoothhound	3	1	0	0	4	0.01
Myliobatis californica	MYLCAL	bat ray	1	0	0	3	4	0.01
Pleuronichthys verticalis	PLEVER	hornyhead turbot	0	4	0	0	4	0.01
Strongylura exilis	STREXI	California needlefish	1	1	1	1	4	0.01
Paraclinus integripinnis	PARINT	reef finspot	0	3	0	0	3	0.01
Sphyraena argentea	SPHARG	California barracuda	2	1	0	0	3	0.01
Atractoscion nobilis	ATRNOB	white sea bass	0	0	0	2	2	0.00
Girella nigricans	GIRNIG	opaleye	0	2	0	0	2	0.00
Oxyjulis californica	OXYCAL	senorita	2	0	0	0	2	0.00
Roncador stearnsii	RONSTE	spotfin croaker	0	2	0	0	2	0.00
Gillichthys mirabilis	GILMIR	longjaw mudsucker	1	0	0	0	1	0.00
Hippocampus ingens	HIPING	Pacific seahorse	0	1	0	0	1	0.00
Medialuna californica	MEDCAL	halfmoon	1	0	0	0	1	0.00
Parophrys vetulus	PARVET	English sole	1	0	0	0	1	0.00
Porichthys notatus	PORNOT	plainfin midshipman	1	0	0	0	1	0.00
Rimicola muscarum	RIMMUS	kelp clingfish	1	0	0	0	1	0.00
Tridentiger trigonocephalus	TRITRI	chameleon goby	0	0	1	0	1	0.00
Zapteryx exasperata	ZAPEXA	banded guitarfish	0	0	0	1	1	0.00
TOTAL			11647	8577	2605	20978	43807	

Table 5. Total biomass (g) of fish species taken from San Diego Bay, July 1994 to April 1995 by quarterly sample.

Sum of TOTALWT		MONTH					
SCIENTIFIC NAME	COMMON NAME	Jul-94	Oct-94	Jan-95	Apr-95	Grand Total	%
Urolophus halleri	round stingray	12380.88	30696.31	31286.01	61684.3	136047.5	32.93
Paralabrax maculatofasciatus	spotted sand bass	7775.4	16746.88	20801.15	34147.6	79471.03	19.24
Paralichthys californicus	California halibut	23468.86	7462.75	4408.45	3832	39172.06	9.48
Atherinops affinis	topsmelt	7977.06	16520.4	5897	4293.1	34687.56	8.40
Paralabrax nebulifer	barred sand bass	2850.59	4650.16	534.8	15773.85	23809.4	5.76
Myliobatis californica	bat ray	4333.3	0	0	13000	17333.3	4.20
Cymatogaster aggregata	shiner surfperch	188.4	544.4	371.4	15862.7	16966.9	4.11
Heterostichus rostratus	giant kelpfish	2315.43	7168	207.5	1897.6	11588.53	2.81
Anchoa delicatissima	deepbody anchovy	1551.56	2530.7	138.5	6314.3	10535.06	2.55
Hypsopsetta guttulata	diamond turbot	3008.9	611.93	1622.2	2400	7643.03	1.85
Scorpaena guttata	spotted scorpionfish	3101.7	352.3	334.25	416.1	4204.35	1.02
Atherinopsis californiensis	jacksmelt	0	364.9	3500.3	1.1	3866.3	0.94
Cheilotrema saturnum	black croaker	132.86	1266.3	20	1947.6	3366.76	0.81
Scomber japonicus	Pacific mackerel	0	0	0	3147.4	3147.4	0.76
Xystreurys liolepis	fantail sole	1622.16	197.6	335.5	728.6	2883.86	0.70
Embiotoca jacksoni	black surfperch	79.2	1091.2	0	963.2	2133.6	0.52
Pleuronichthys ritteri	spotted turbot	732.68	407.67	35.9	546.1	1722.35	0.42
Umbrina roncador	yellowfin croaker	486.38	258.3	514.25	63.7	1322.63	0.32
Syngnathus leptorhynchus	bay pipefish	254.3	138.25	683.28	59.5	1135.33	0.27
Paralabrax clathratus	kelp bass	14.56	880.6	65.2	70.2	1030.56	0.25
Zapteryx exasperata	banded guitarfish	0	0	0	993.2	993.2	0.24
Engraulis mordax	northern anchovy	881.55	5.3	0	6.8	893.65	0.22
Pleuronichthys coenosus	CO turbot	746	0	0	0	746	0.18
Anchoa compressa	deepbody anchovy	89.2	0	348.9	210.1	648.2	0.16
Micrometrus minimus	dwarf surfperch	200.9	133.4	22.3	265	621.6	0.15
Syngnathus auliscus	barred pipefish	227	49.2	29.7	305.2	611.1	0.15
Hypsoblennius gentilis	bay blenny	303.6	214.7	3.3	87.3	608.9	0.15
Anisotremus davidsoni	sargo	0	18.2	0	579	597.2	0.14
Pleuronichthys verticalis	hornyhead turbot	0	596.79	0	0	596.79	0.14
Symphurus atricauda	California tonguefish	307.81	47.3	0	172	527.11	0.13
Mustelus californicus	grey smoothhound	272.3	226.8	0	0	499.1	0.12
Fundulus parvipinnis	California killifish	14.7	18.6	250.1	160.1	443.5	0.11
Sardinops sagax	Pacific sardine	1	361.6	74.7	0	437.3	0.11
Mugil cephalus	striped mullet	0	182.4	1.9	196.1	380.4	0.09
Atractoscion nobilis	white sea bass	0	0	0	317.9	317.9	0.08
Roncador stearnsii	spotfin croaker	0	316	0	0	316	0.08
Leptocottus armatus	staghorn sculpin	146.6	0	0.3	78.7	225.6	0.05
Hyporhamphus rosae	California halfbeak	135.3	73.6	0.9	1.8	211.6	0.05
Acanthogobius flavimanus	yellowfin goby	9.5	34.9	120.2	20.7	185.3	0.04
Seriphus politus	queenfish	0	0	0	136.6	136.6	0.03
Strongylura exilis	California needlefish	0.8	0.6	108.6	26.3	136.3	0.03
Gibbonsia montereyensis	crevice kelpfish	127.8	0	0	0	127.8	0.03
Quietula ycauda	shadow goby	0.2	95.66	29.6	0.6	126.06	0.03
Ilypnus gilberti	cheekspot goby	100.8	11.3	4.9	5.4	122.4	0.03
Xenistius californiensis	salema	0	51.5	0	55.8	107.3	0.03
Synodus lucioceps	California lizardfish	27.68	0	0.4	62.2	90.28	0.02
Porichthys myriaster	specklefin midshipman	78.3	0	0	8.7	87	0.02
Clevelandia ios	arrow goby	47	16.7	3.4	9.1	76.2	0.02
Gibbonsia elegans	spotted kelpfish	0	0	0	40.4	40.4	0.01
Hippocampus ingens	Pacific seahorse	0	26.7	0	0	26.7	0.01
Girella nigricans	opaleye	0	20.6	0	0	20.6	0.00
Syngnathus exilis	barcheek pipefish	1	0	0	15.5	16.5	0.00
Halichoeres semicinctus	rock wrasse	1.52	9.9	0	0	11.42	0.00
Syngnathus californiensis	kelp pipefish	0.1	0	10.1	0.7	10.9	0.00
Gillichthys mirabilis	longjaw mudsucker	10.6	0	0	0	10.6	0.00
Porichthys notatus	plainfin midshipman	8.7	0	0	0	8.7	0.00
Parophrys vetulus	English sole	5.3	0	0	0	5.3	0.00
Tridentiger trigonocephalus	chameleon goby	0	0	3.5	0	3.5	0.00
Paraclinus integripinnis	reef finspot	0	3.4	0	0	3.4	0.00
Sphyraena argentea	California barracuda	0.7	1.1	0	0	1.8	0.00
Oxyjulis californica	senorita	1.52	0	0	0	1.52	0.00
Post-larval anchovy	Post-larval anchovy	1.1	0	0	0	1.1	0.00
Bryx arctos	snubnose pipefish	0	0.4	0.1	0.4	0.9	0.00
Medialuna californica	halfmoon	0.3	0	0	0	0.3	0.00
Rimicola muscarum	kelp clingfish	0.1	0	0	0	0.1	0.00
Grand Total		76023.2	94405.3	71768.59	170904.6	413101.64	

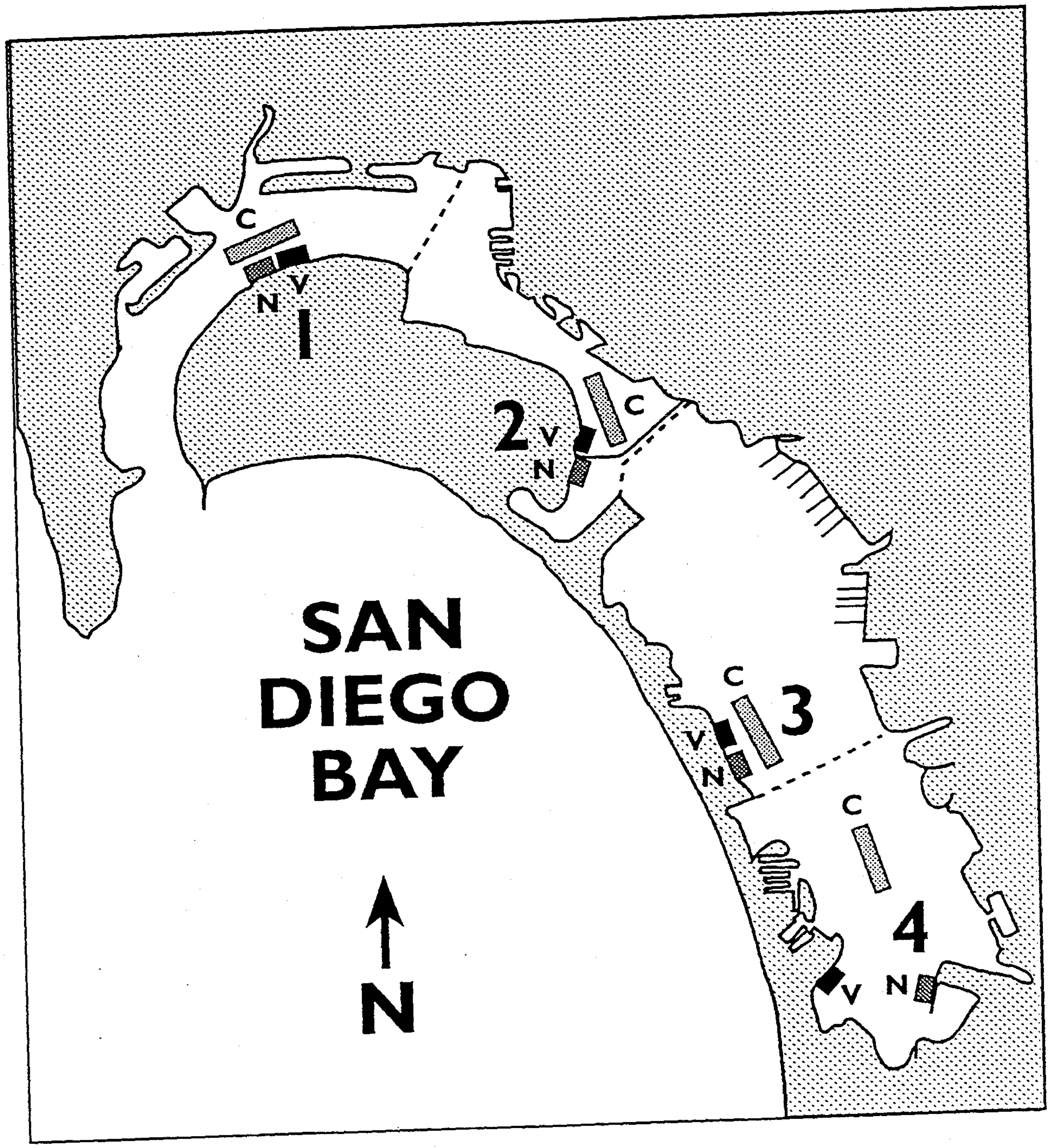
Table 6. Total abundance of fish species taken from San Diego Bay, July 1994 to April 1995 by subhabitat.(IN = intertidal non-vegetated; IV = intertidal vegetated; NN = nearshore non-vegetated; NV = nearshore vegetated; C = Channel)

Sum of TOTAL#						
	INTERTIDAL		NEARSHORE		CHANNEL	
SPCODE	IN	IV	NN	NV	C	Grand Total
ATHAFF	11189	7299	1475	1294	206	21463
ANCDEL	137	33	5106	2059	534	7869
CYMAGG	31	96	764	2502	0	3393
ENGMOR	0	0	4	1565	138	1707
HETROS	61	164	262	940	10	1437
SYNAUL	46	198	201	821	2	1268
ILYGIL	486	110	20	478	8	1102
SYNLEP	16	193	153	522	4	888
UROHAL	1	4	216	166	461	848
PARNEB	2	22	66	170	449	709
CLEIOS	57	233	17	298	0	605
ATHCAL	240	270	2	13	11	536
PARCAL	3	5	17	18	215	258
PARMAC	0	0	58	100	72	230
PARCLA	0	0	27	172	6	205
FUNPAR	3	128	0	0	0	131
MICMIN	5	57	5	54	0	121
QUIYCA	10	18	53	22	0	103
SARSAG	0	0	86	7	1	94
XENCAL	0	0	16	69	2	87
HYPGUT	7	8	1	1	63	80
HYPGEN	1	3	15	42	3	64
EMBJAC	4	11	17	25	0	57
HYPROS	31	14	1	7	1	54
GIBMON	0	0	5	47	0	52
PLVENG	45	0	0	0	0	45
ANCCOM	2	1	34	4	0	41
CHESAT	0	0	6	10	20	36
PLERIT	0	0	1	0	30	31
SCOGUT	0	0	0	5	25	30
SYNLUC	0	0	0	1	26	27
SYMATR	0	0	0	1	19	20
LEPARM	8	10	0	1	0	19
SCOJAP	0	0	0	0	19	19
UMBRON	0	3	3	0	10	16
XYSLIO	0	0	0	0	16	16
HALSEM	0	0	5	8	2	15
ACAFLA	1	10	1	2	0	14
SYNEXI	0	5	0	9	0	14
SYNCAL	3	2	3	5	0	13
MUGCEP	3	7	1	0	0	11
PORMYR	0	0	1	0	9	10
GIBELE	1	0	2	5	0	8
ANIDAV	0	0	5	2	0	7
SERPOL	0	0	1	5	0	6
PLECOE	0	0	0	0	5	5
SYNARC	0	2	0	3	0	5
MUSCAL	3	0	0	0	1	4
MYLCAL	0	0	3	0	1	4
PLEVER	0	0	0	0	4	4
STREXI	0	2	0	1	1	4
PARINT	0	0	0	3	0	3
SPHARG	0	2	1	0	0	3
ATRNOB	0	0	0	0	2	2
GIRNIG	2	0	0	0	0	2
OXYCAL	0	0	0	0	2	2
RONSTE	0	0	0	0	2	2
GILMIR	0	1	0	0	0	1
HIPING	0	0	0	1	0	1
MEDCAL	0	1	0	0	0	1
PARVET	0	0	0	1	0	1
PORNOT	0	0	0	0	1	1
RIMMUS	0	1	0	0	0	1
TRITRI	0	1	0	0	0	1
ZAPEXA	0	0	0	1	0	1
Grand Total	12398	8914	8654	11460	2381	43807

Table 7. Correlation coefficients for PC Factors versus abundance and biomass.

PC FACTOR	LOG-TRANSFORMED NUMBER OF INDIVIDUALS	LOG-TRANSFORMED BIOMASS
TEMPERATURE	0.15	-0.07
SALINITY	-0.17	-0.09
pH	0.30	-0.11
DISSOLVED OXYGEN	0.41	-0.07

Figure 1. Map of San Diego Bay illustrating the locations of the 4 sampling stations. (N = Non-vegetated site; V = Vegetated site; C = Channel site)



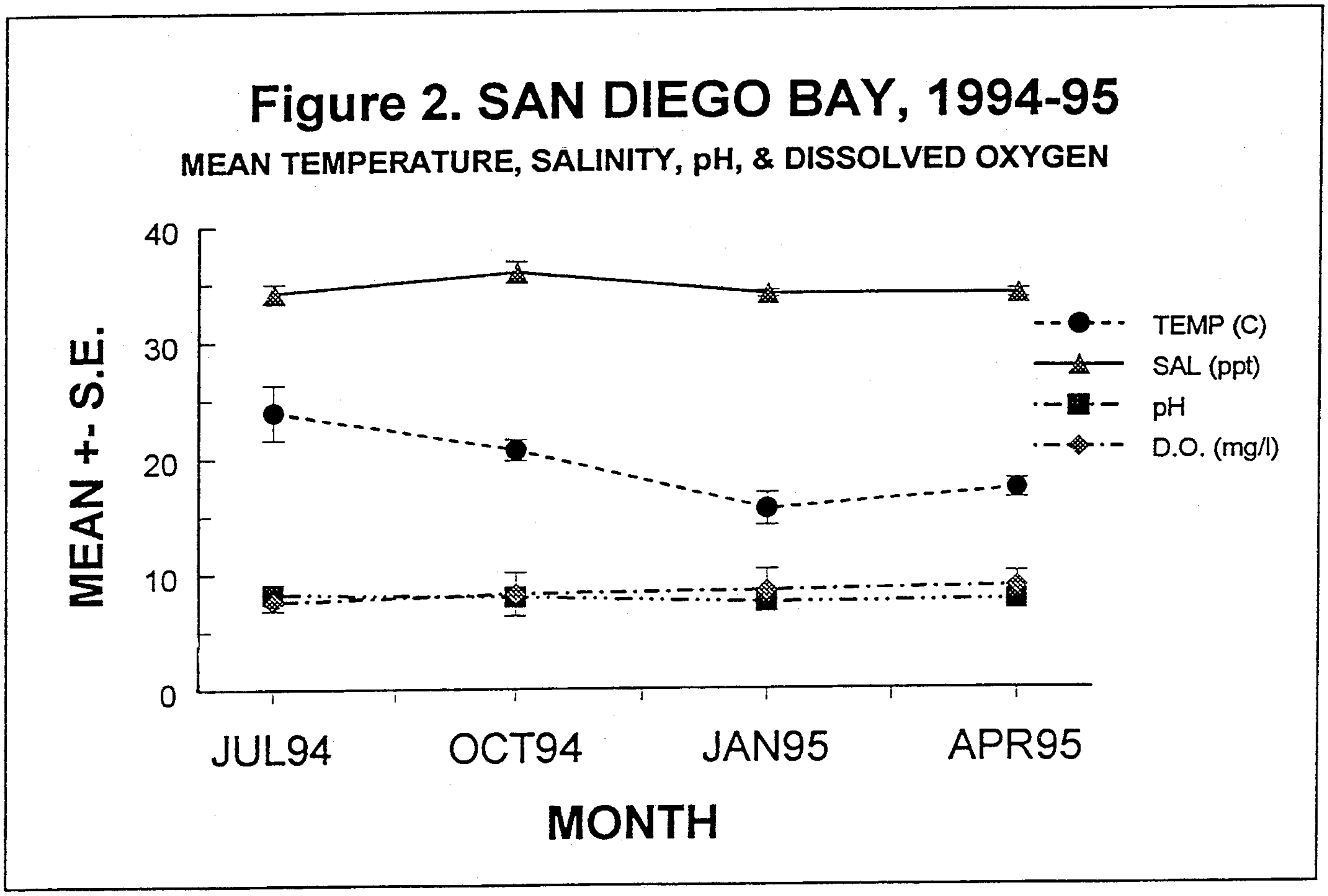


Figure 2. SAN DIEGO BAY, 1994-95
MEAN TEMPERATURE, SALINITY, pH, & DISSOLVED OXYGEN
MEAN +- S.E.
40
30
20
10
0
JUL94
OCT94
JAN95
APR95
MONTH
TEMP (C)
SAL (ppt)
pH
D.O. (mg/l)

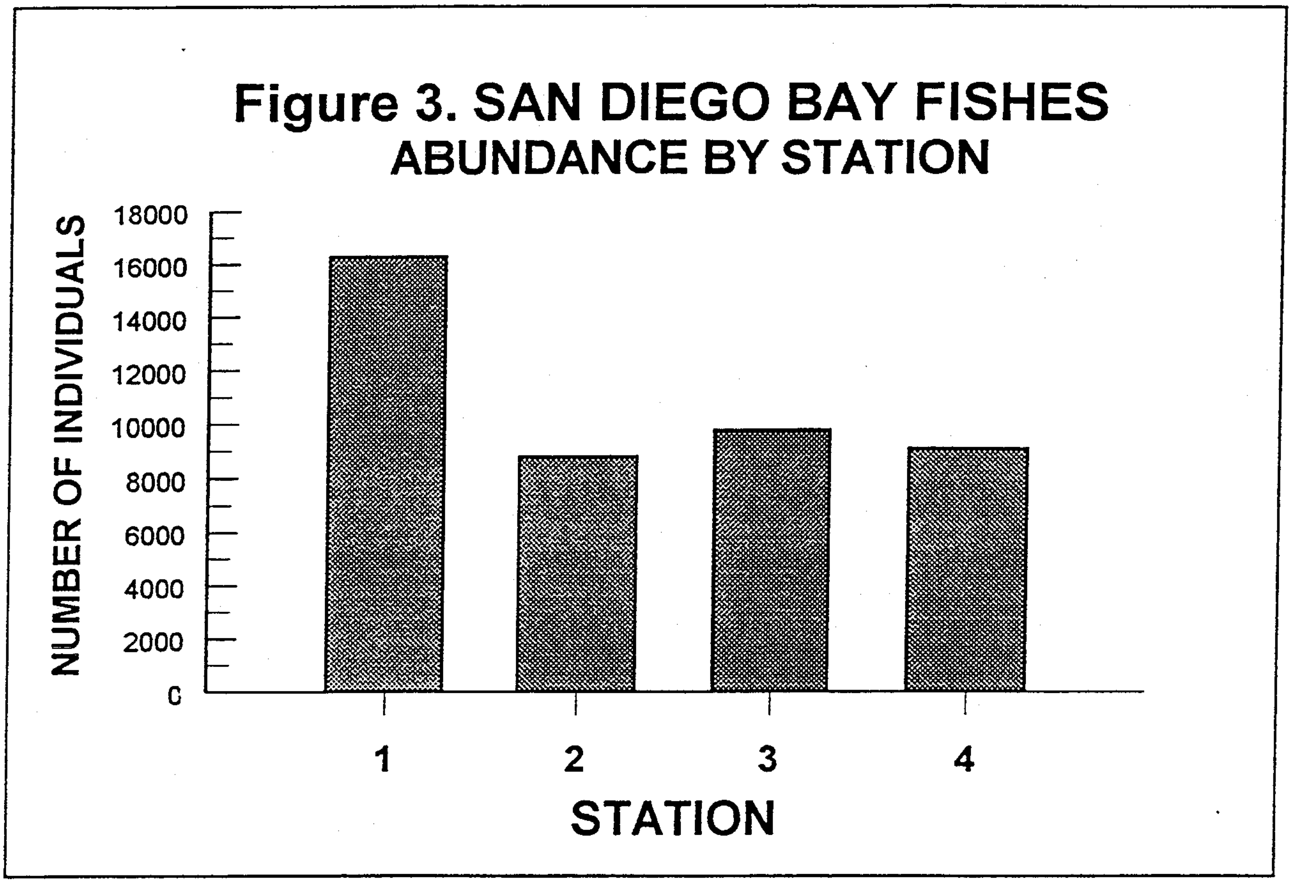


Figure 3. SAN DIEGO BAY FISHES
ABUNDANCE BY STATION
NUMBER OF INDIVIDUALS
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1
2
3
4
STATION

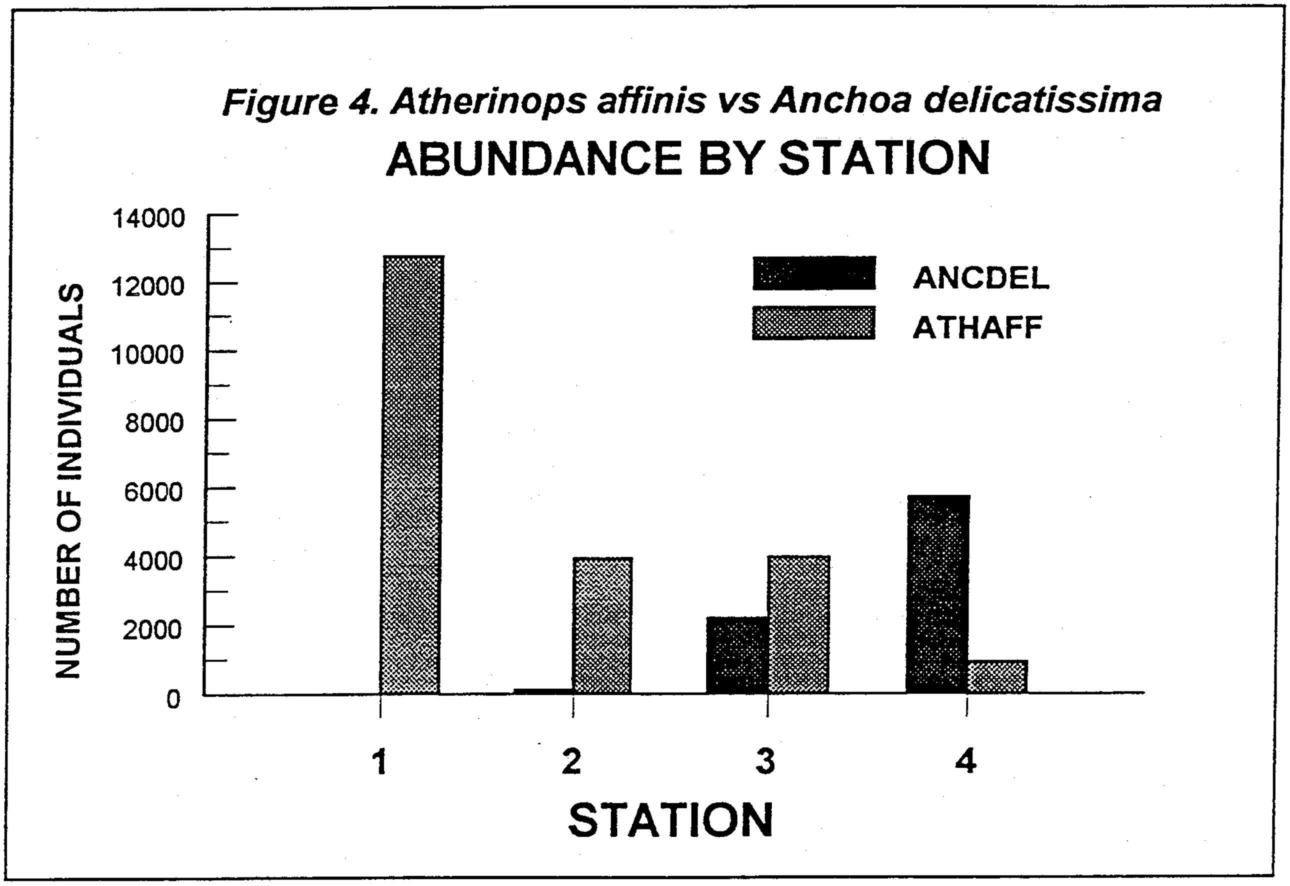
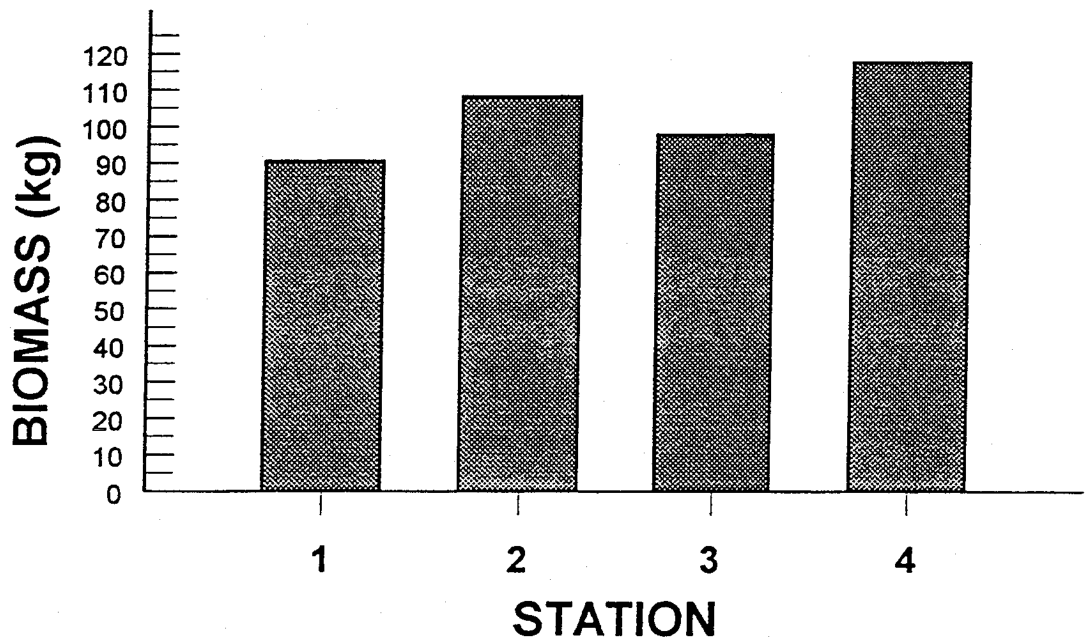


Figure 4. Atherinops affinis vs Anchoa delicatissima
ABUNDANCE BY STATION
14000
12000
10000
8000
6000
4000
2000
0
NUMBER OF INDIVIDUALS
ANCDEL
ATHAFF
1
2
3
4
STATION

Figure 5. SAN DIEGO BAY FISHES
BIOMASS TOTALS BY STATION



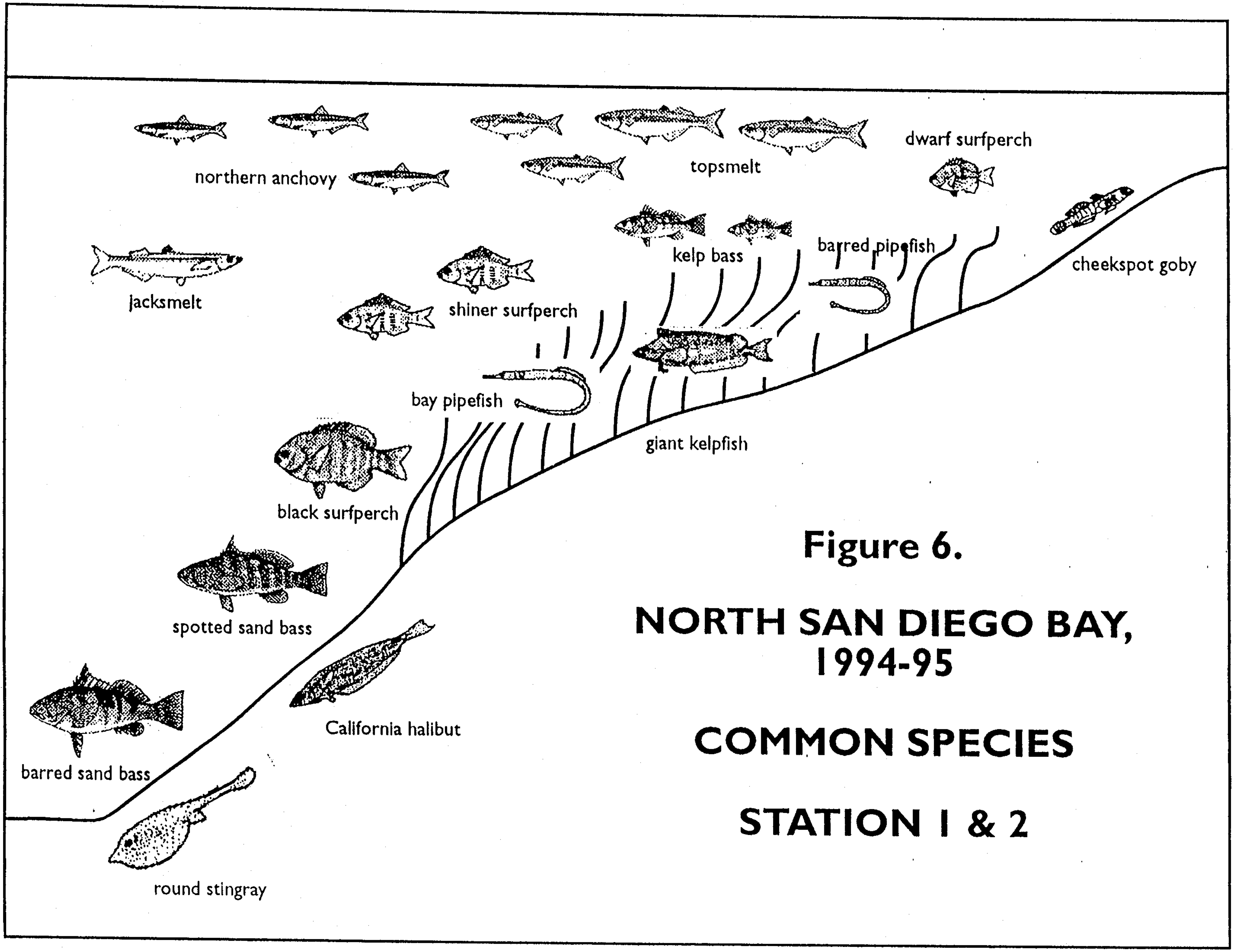


Figure 6.

NORTH SAN DIEGO BAY, 1994-95

COMMON SPECIES

STATION 1 & 2

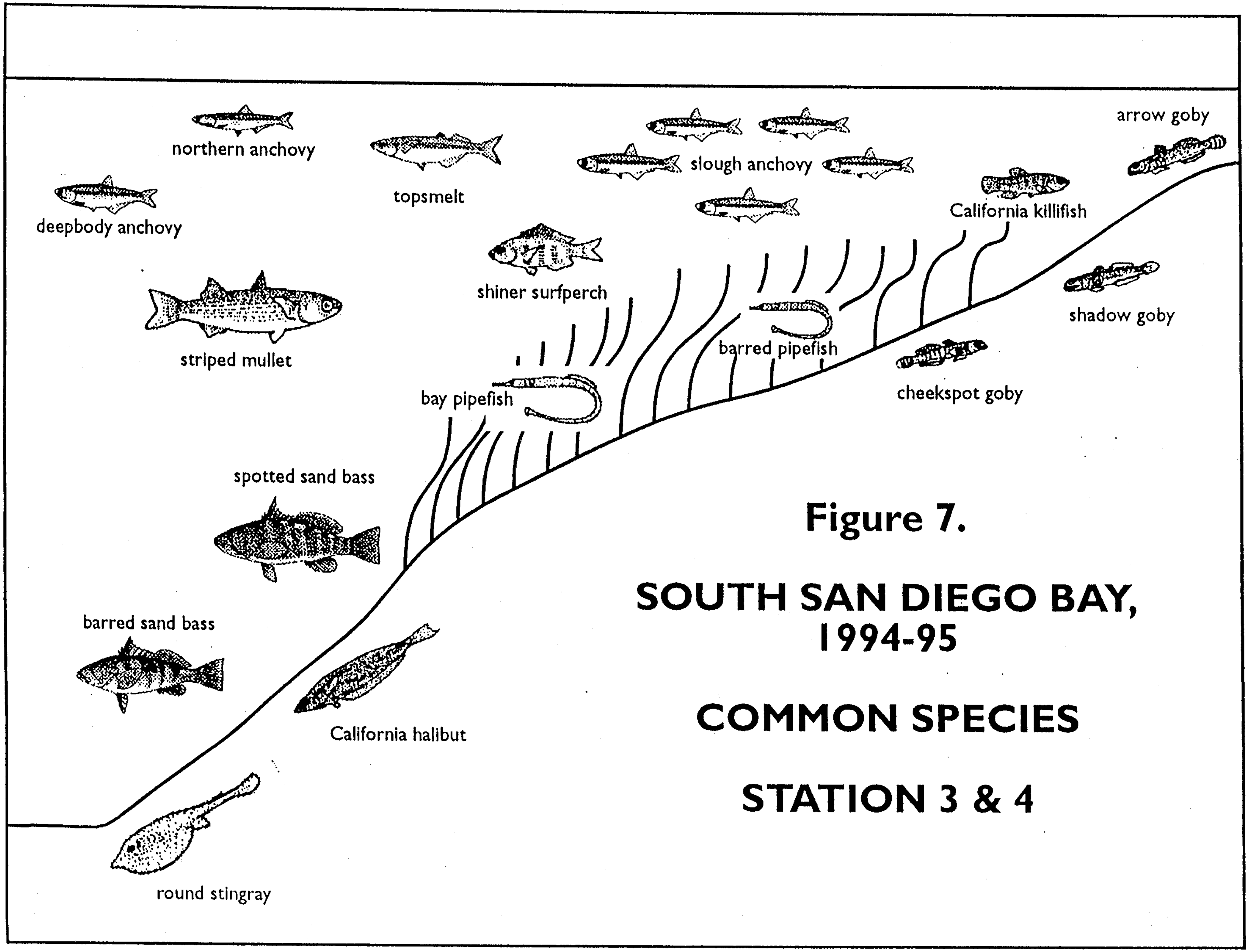


Figure 7.

SOUTH SAN DIEGO BAY, 1994-95

COMMON SPECIES

STATION 3 & 4

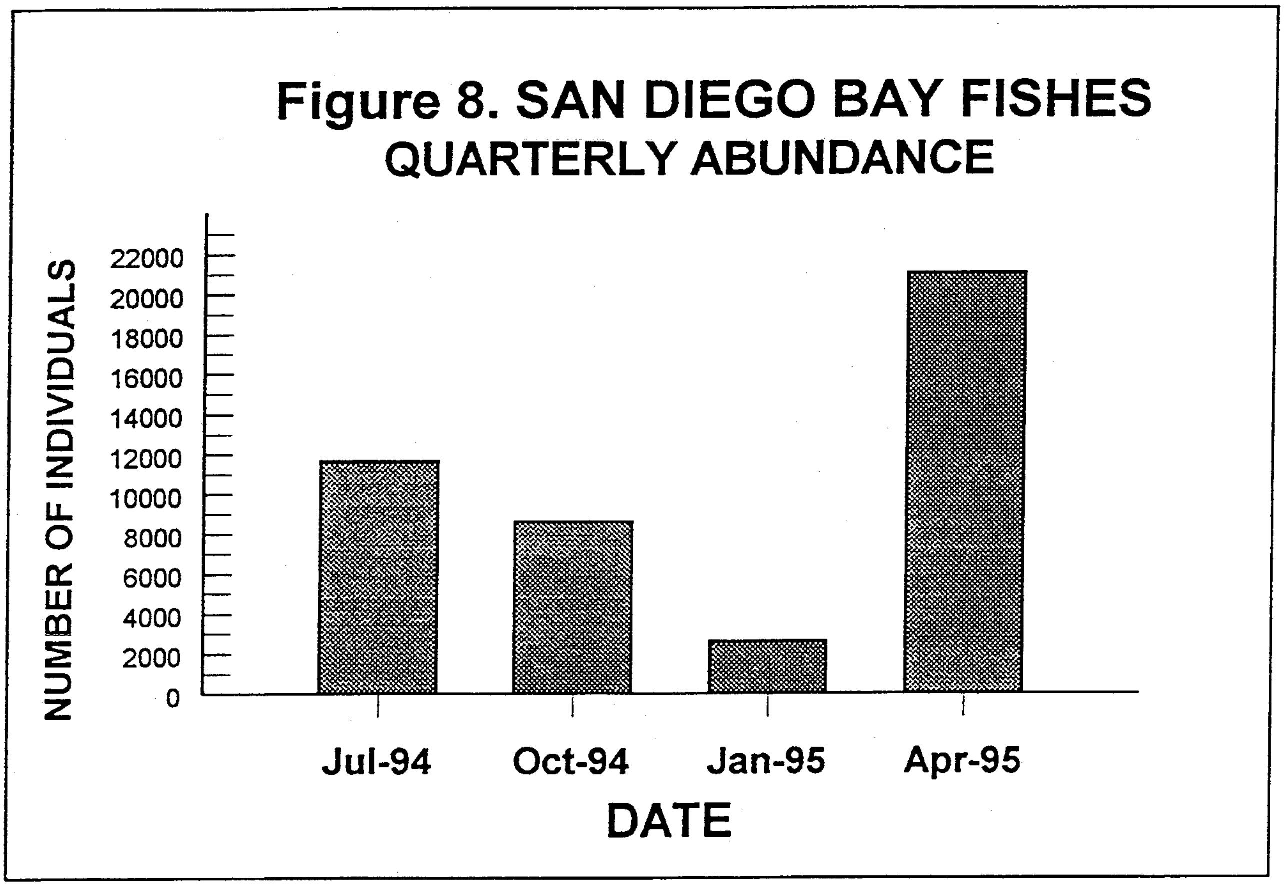


Figure 8. SAN DIEGO BAY FISHES
QUARTERLY ABUNDANCE
NUMBER OF INDIVIDUALS
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Jul-94
Oct-94
Jan-95
Apr-95
DATE

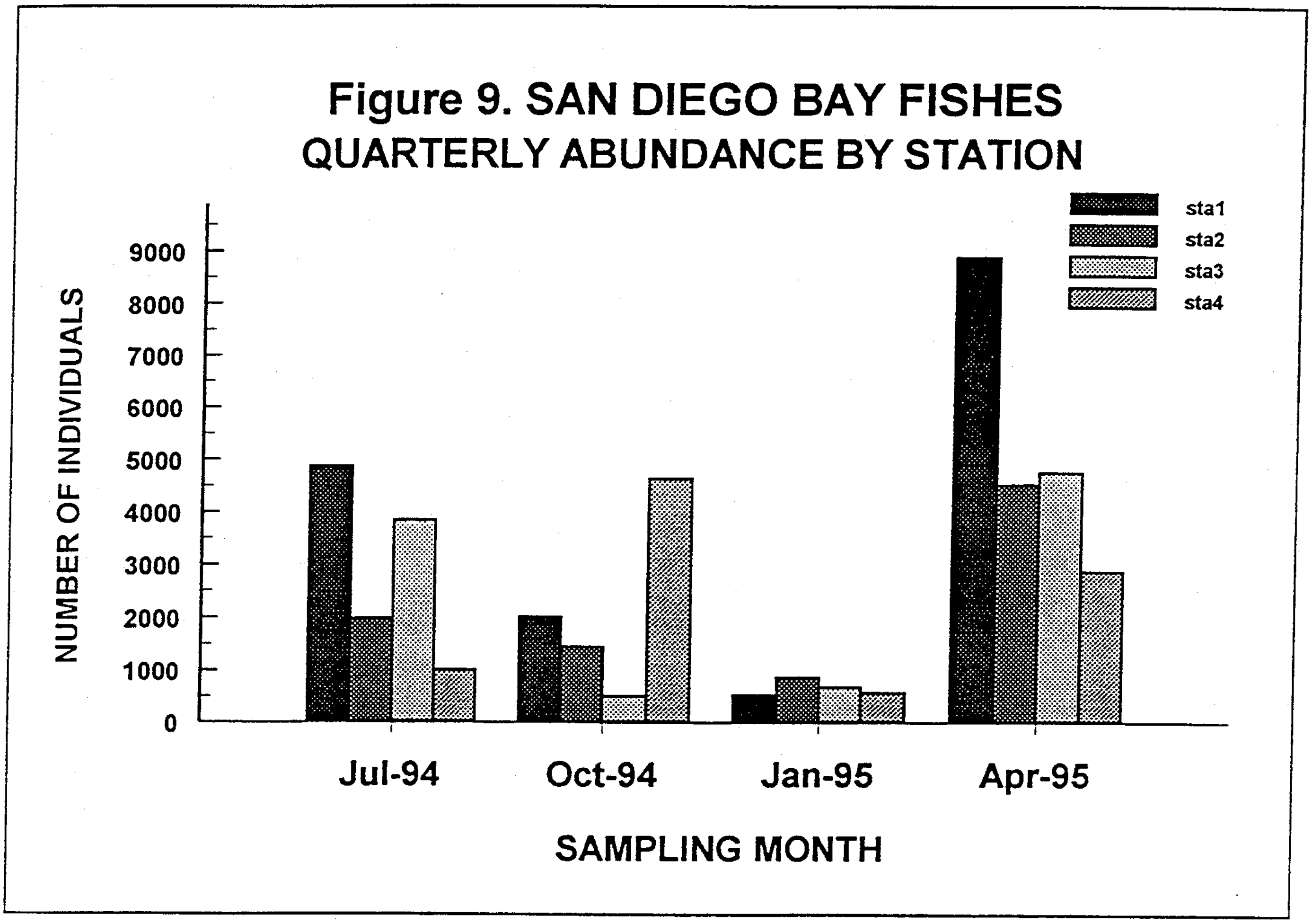
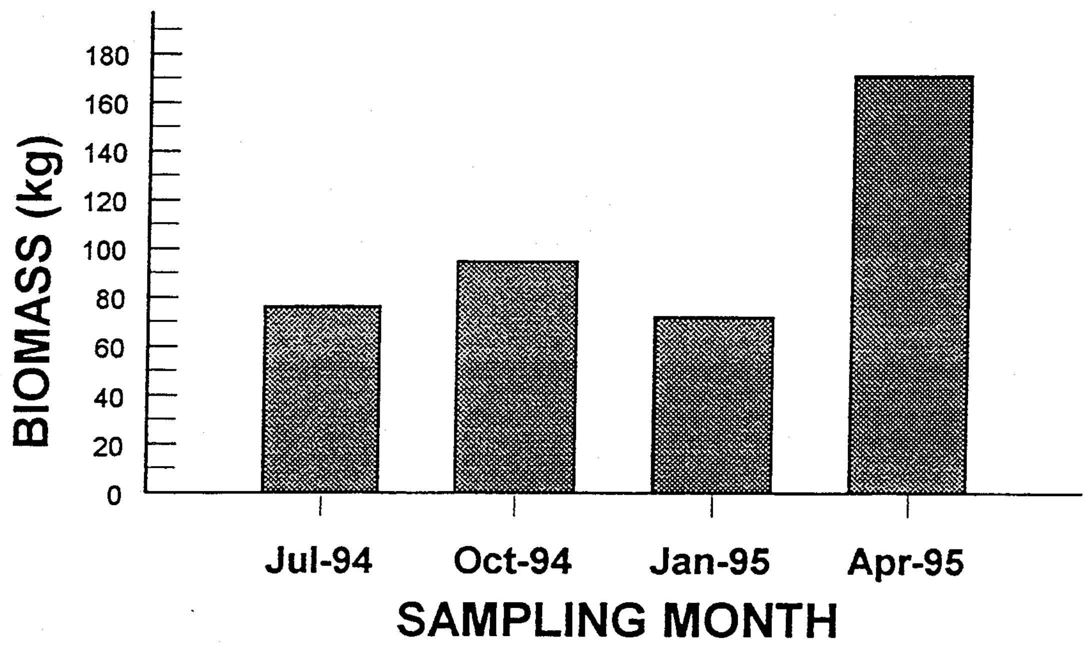


Figure 9. SAN DIEGO BAY FISHES
QUARTERLY ABUNDANCE BY STATION
sta1
sta2
sta3
sta4
NUMBER OF INDIVIDUALS
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Jul-94
Oct-94
Jan-95
Apr-95
SAMPLING MONTH

Figure 10. SAN DIEGO BAY FISHES
QUARTERLY BIOMASS TOTALS



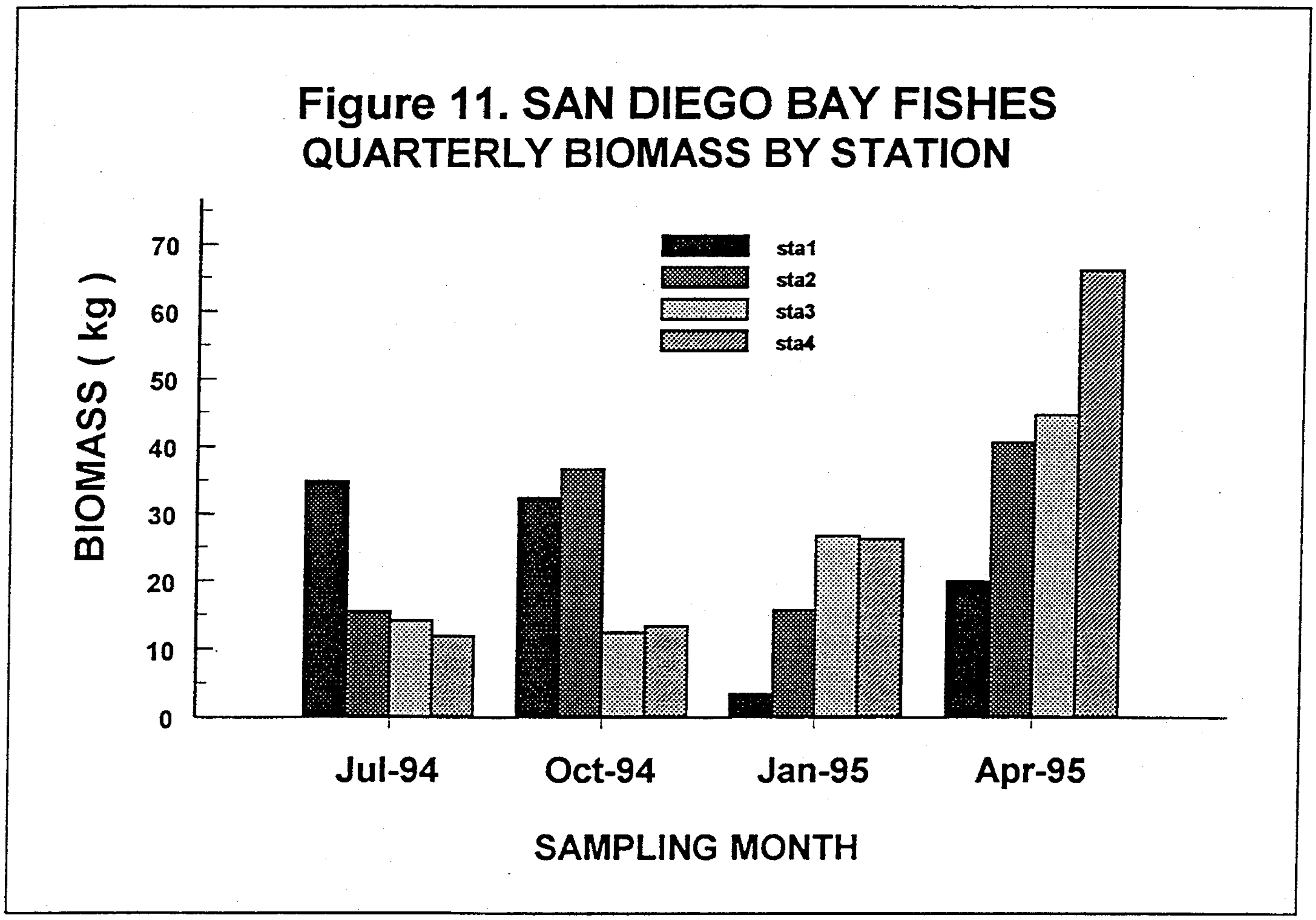
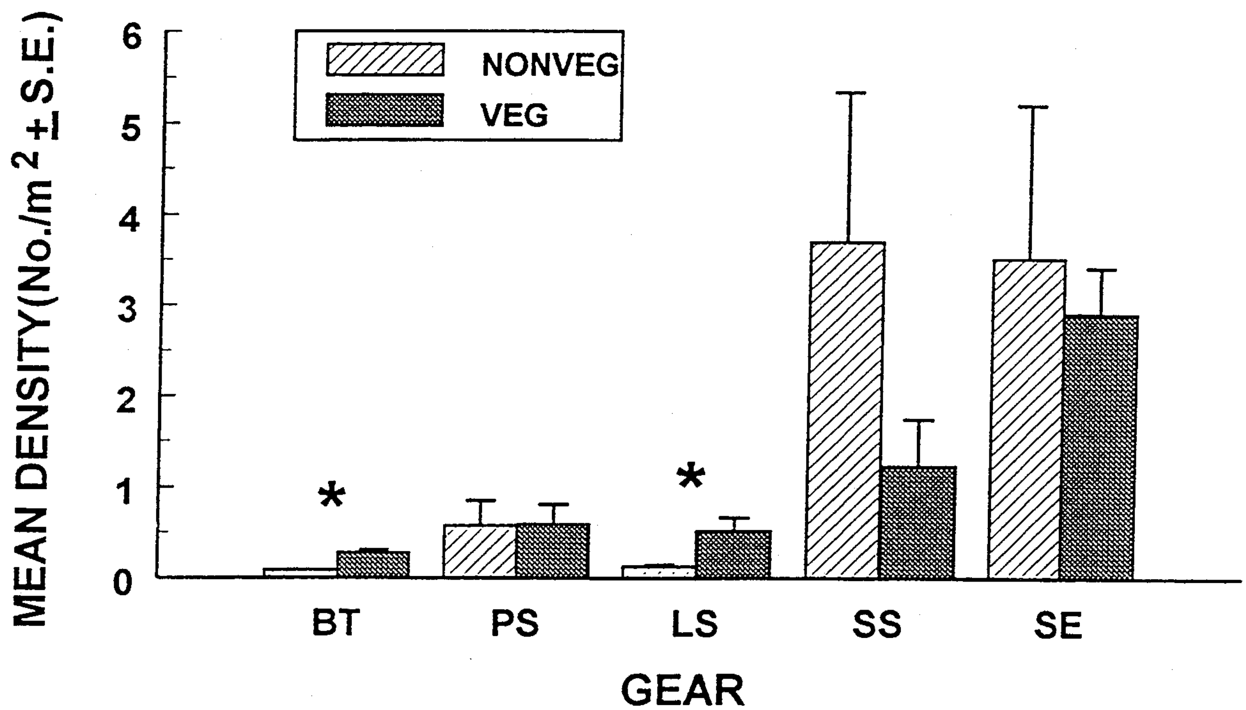


Figure 11. SAN DIEGO BAY FISHES
QUARTERLY BIOMASS BY STATION
BIOMASS (kg)
70
60
50
40
30
20
10
0
sta1
sta2
sta3
sta4
Jul-94
Oct-94
Jan-95
Apr-95
SAMPLING MONTH

Figure 12. COMPARISON OF FISH DENSITY
VEGETATED VS NON-VEGETATED SITES



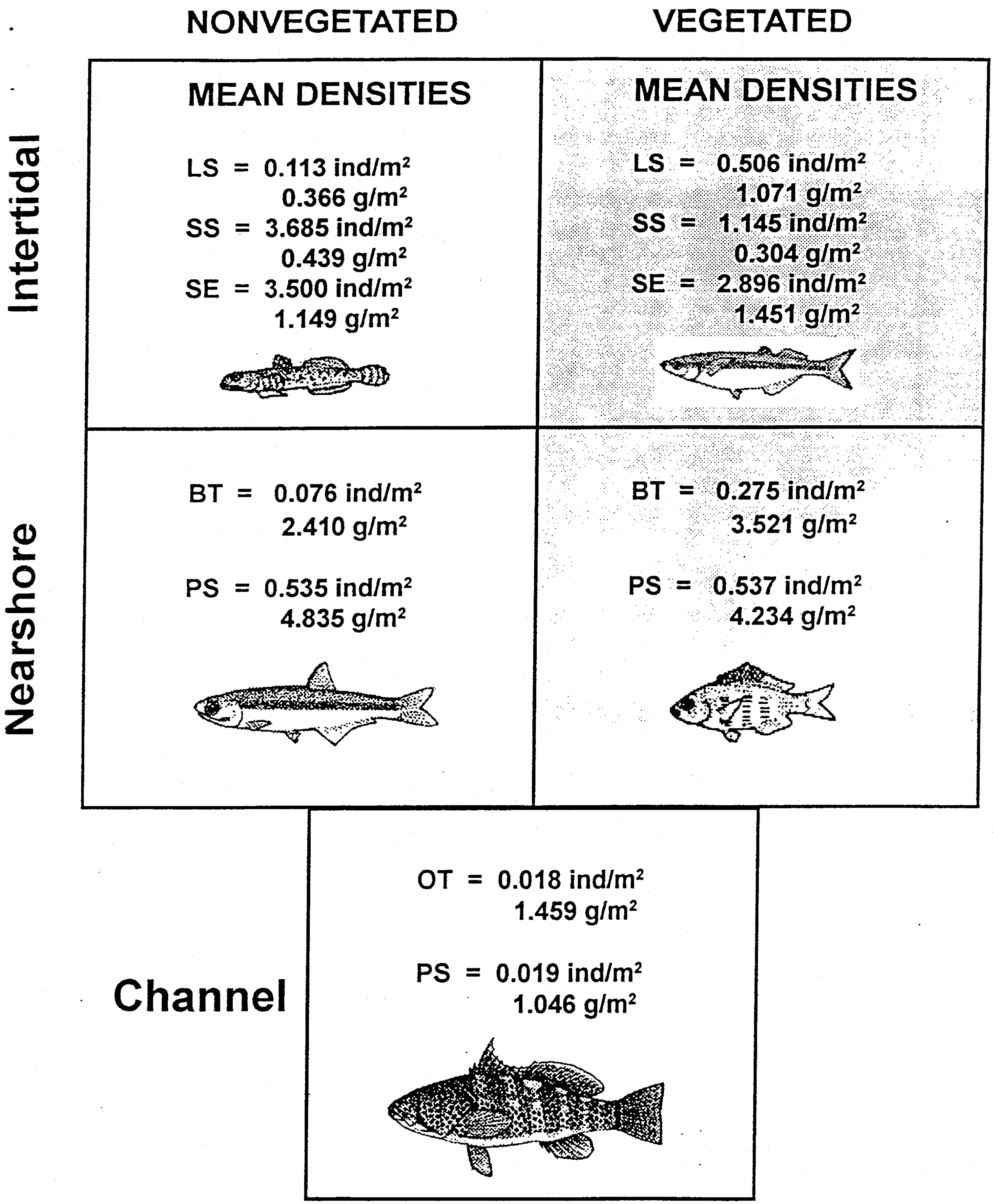


Figure 13. Comparison numerical and biomass densities by gear for each of the 5 subhabitats sampled in San Diego Bay, July 1994 - April 1995.

Figure 14. COMPARISON OF FISH BIOMASS DENSITY VEGETATED VS NON-VEGETATED SITES

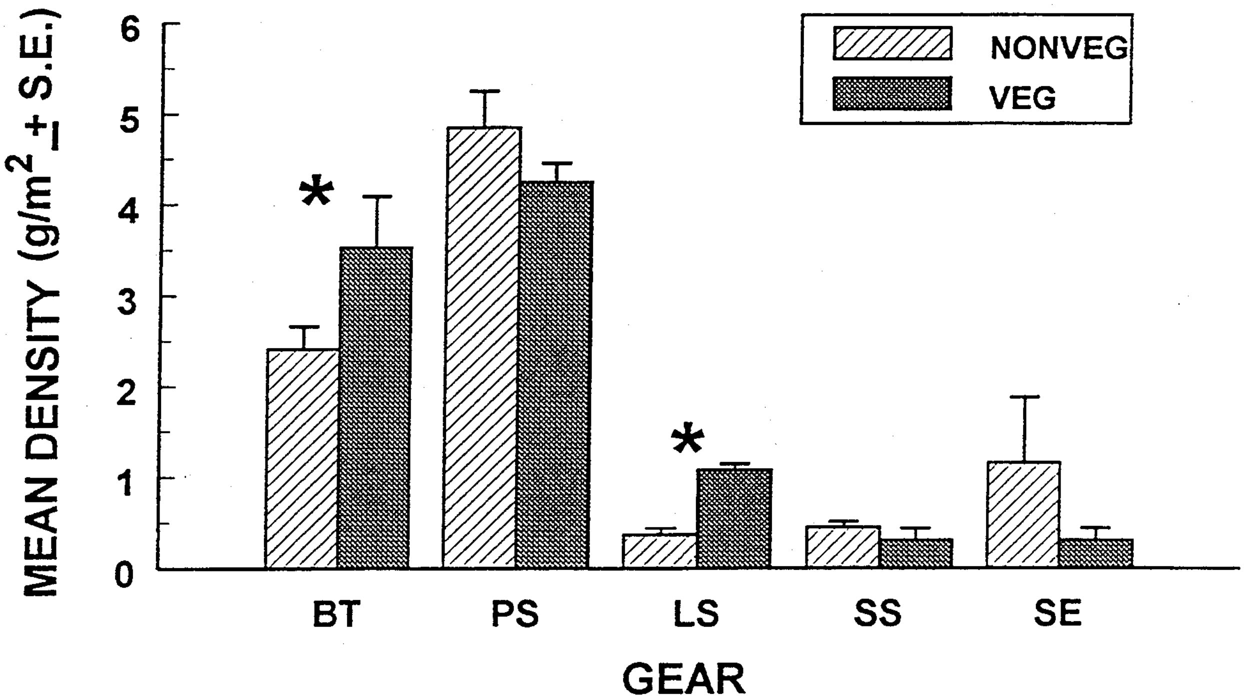
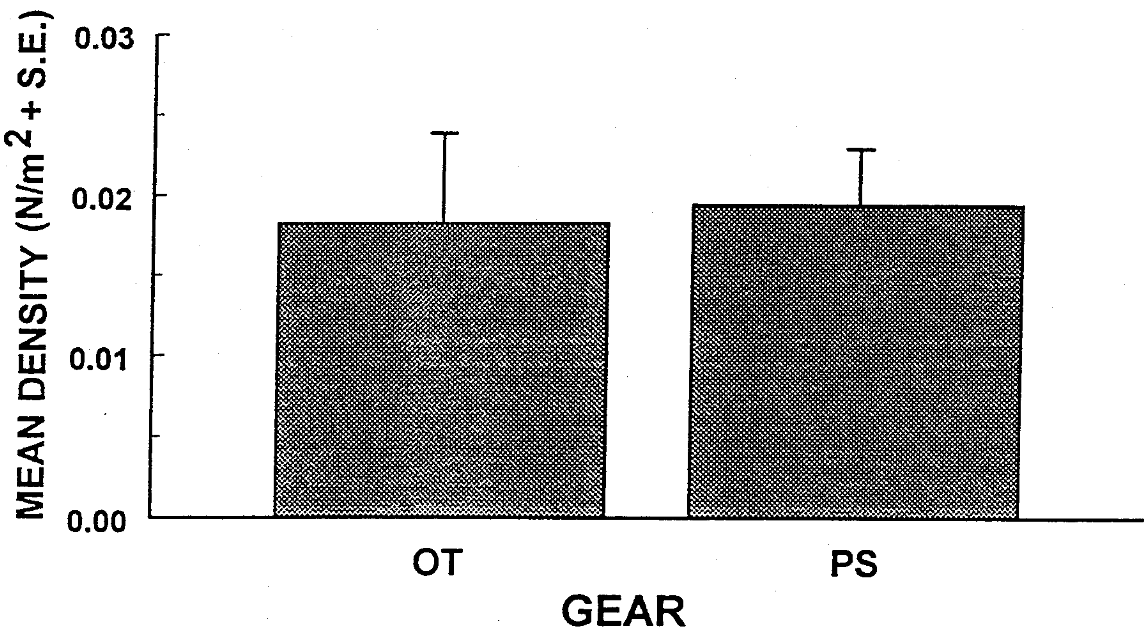
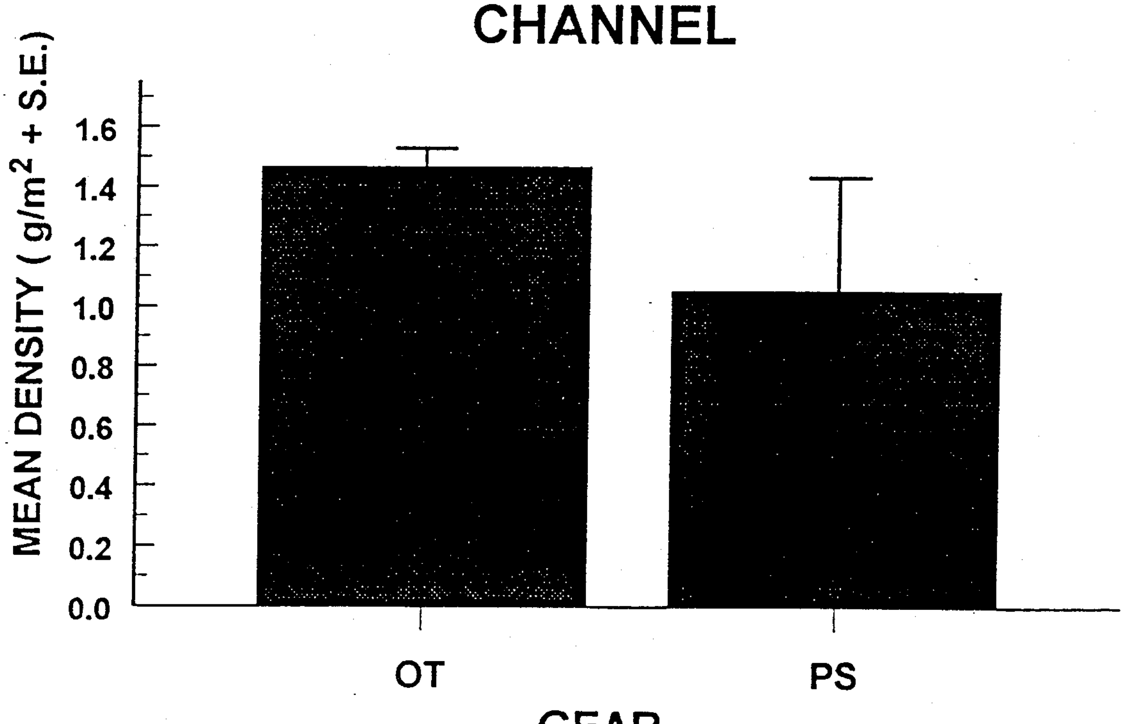


Figure 15. COMPARISON OF FISH DENSITY CHANNEL



COMPARISON OF BIOMASS DENSITY CHANNEL



APPENDIX TABLE 1. San Diego Bay,
Physical-Chemical Database, 1994-95

STATION	DEPTH(m	VEG/NON	TEMP(S)	TEMP(B)	SAL(S)	SAL(B)	pH(S)	pH(B)	D.O.(S)	D.O.(B)	MONTH	DATE
1	10.6	C	20.88	17.07	33.2	33.4	8.09	8.26	9.64	8.43	Jul-94	12-Jul-94
1	1	V	21.84		33.5		8.35		9.03		Jul-94	12-Jul-94
1	1	NV	21.84		33.5		8.35		9.03		Jul-94	12-Jul-94
2	10.1	C	23.55	21.89	33.6	33.4	8.25	8.24	7.29	7.05	Jul-94	13-Jul-94
2	4.8	NV	23.4	23.03	33.7	33.6	8.26	8.23	7.92	7.35	Jul-94	13-Jul-94
2	1	V	22.94	23.49	33.6	33.7	8.27	8.28	8.41	8.21	Jul-94	13-Jul-94
3	3.9	C	25.05	24.9	34	34.1	8.22	8.2	6.92	6.81	Jul-94	14-Jul-94
3	3	V	25.33	25.05	34.3	34.3	8.24	8.24	7.75	7.54	Jul-94	14-Jul-94
3	1.2	NV	25.2	25.04	34.3	34.3	8.21	8.21	7.12	7.05	Jul-94	14-Jul-94
4	1.5	C	25.33	25.33	34.7	34.7	8.18	8.2	6.91	7.03	Jul-94	15-Jul-94
4	1	V	25.69	25.69	35.5	35.3	8.22	8.22	7.4	7.29	Jul-94	15-Jul-94
4	1.1	NV	27.32	27.31	35.7	35.8	8.2	8.22	6.75	6.44	Jul-94	15-Jul-94
1	SHORE	NV	22.28		35.8		7.92		7.57		Oct-94	28-Oct-94
1	2	NV	21.9	21.94	36.8	36.9	7.89	7.91	7.4	7.13	Oct-94	28-Oct-94
1	SHORE	V	21.38		36.5		7.96		8.19		Oct-94	28-Oct-94
1	1.8	V	21.05	20.55	36.7	36.6	7.93	7.98	7.61	7.7	Oct-94	28-Oct-94
1	6	C	20.65	20.53	36.1	36.5	7.87	7.91	7.28	7.11	Oct-94	28-Oct-94
2	SHORE	NV	20.8		35.9		7.81		7.35		Oct-94	27-Oct-94
2	2	NV	20.65	20.56	36	36	7.9	7.9	7.28	7.34	Oct-94	27-Oct-94
2	2	V	20.7	20.5	35.9	36	7.94	7.93	7.84	7.76	Oct-94	27-Oct-94
2	SHORE	V	20.98		35.9		7.98		8.31		Oct-94	27-Oct-94
2	5	C	20.66	20.62	36	35.9	7.89	7.89	7.05	7.15	Oct-94	27-Oct-94
3	SHORE	V	21.68		35.7		7.94		7.34		Oct-94	26-Oct-94
3	2.3	V	21.28	21.16	35.8	35.7	7.93	7.94	7.51	7.32	Oct-94	26-Oct-94
3	SHORE	NV	21.69		35.8		7.98		8		Oct-94	26-Oct-94
3	3.9	NV	21.15	20.68	36	36	7.91	7.88	7.15	6.69	Oct-94	26-Oct-94
3	6.4	C	21.11	20.56	35.8	36	7.88	7.88	7.01	6.68	Oct-94	26-Oct-94
4	SHORE	V	21.55		35.2		8.03		10.03		Oct-94	25-Oct-94
4	1.4	V	20.3	19.59	35.3	35.6			11.11	14.27	Oct-94	25-Oct-94
4	11.3	C	19.52	17.3	35.4	35	7.91	7.88	8.52	8.66	Oct-94	25-Oct-94
4	SHORE	NV	21.05		35.5		8.06		12.96		Oct-94	25-Oct-94
4	1.2	NV	20.09	19.79	35.5	35.4			11.22	9.84	Jan-95	25-Oct-94
1	13.5	C	14.86	14.73	33.8	34.1	7.61	7.61	7.92	7.68	Jan-95	13-Jan-95
1	10.7	NV	14.95	14.81	33.8	34.5	7.58	7.6	7.96	7.87	Jan-95	13-Jan-95
1	SHORE	NV	15.52		33.9		7.63		8.82		Jan-95	13-Jan-95
1	8.1	V	14.94	14.77	34.2	34.3	7.6	7.61	7.96	7.77	Jan-95	13-Jan-95
1	SHORE	V	16.3		34.1		7.85		11.72		Jan-95	13-Jan-95
2	13.2	C	14.89	14.83	32.8	34.2			11.24	10.07	Jan-95	12-Jan-95
2	4.5	NV	14.95	14.75	33.5	33.6			10.83	11.22	Jan-95	12-Jan-95
2	SHORE	NV	15.01		33				12.21		Jan-95	12-Jan-95
2	3.8	V	14.82	14.72	33.8	34.1	7.23		9	11.57	Jan-95	12-Jan-95
2	SHORE	V	14.82		33.8		7.25		11.26		Jan-95	12-Jan-95
3	2.7	C	15.2	15.16	34.1	34.1	7.58	7.59	7.32	7.31	Jan-95	11-Jan-95
3	4	NV	15.29	14.95	34.1	34.2	7.34	7.39	8.16	7.16	Jan-95	11-Jan-95
3	SHORE	NV	15.57		33.9		8.35	7.41			Jan-95	11-Jan-95
3	2	V	15.23	14.99	34.2	34.2	7.35	7.38	7.56	7.2	Jan-95	11-Jan-95
3	SHORE	V	15.68		33.9		6.91		8.72		Jan-95	11-Jan-95
4	6	C	15.42	15.03	33.9	34.1	7.31	7.27	7.41	7.3	Jan-95	10-Jan-95
4	1	NV	19.66	19.69	34.1	34.2	7.9	7.61	7.16	7.01	Jan-95	10-Jan-95
4	SHORE	NV	19.34		34.2		7.47		6.67		Jan-95	10-Jan-95
4	1	V	16.09	16.08	34.2	34	7.39	7.55	6.11	5.9	Jan-95	10-Jan-95
4	SHORE	V	16.3		33.9		6.98		7.05		Jan-95	10-Jan-95
1	SHORE	V	17.98		34.4		8.03		15.05		Apr-95	21-Apr-95
1	SHORE	NV	18.22		34.4				12.81		Apr-95	21-Apr-95
1	4.9	V	16.17	16.3	34.4	34.4	7.6	7.6	8.86	8.54	Apr-95	21-Apr-95
1	5.1	NV	16.44	16.13	34.5	34.5			8.9	8.9	Apr-95	21-Apr-95
1	11.5	C	15.22	16.39	34.6	34.3	7.32	7.47	8.31	8.47	Apr-95	21-Apr-95
2	SHORE	V	18.73		33.9		7.66		9.9		Apr-95	20-Apr-95
2	SHORE	NV	17.93		34		7.59		9.59		Apr-95	20-Apr-95
2	3.4	V	16.81	16.78	34.1	34.3	7.55	7.57	7.76	8.45	Apr-95	20-Apr-95
2	2.9	NV	17.4	16.58	34	34.2	7.6	7.6	8.59	9.63	Apr-95	20-Apr-95
2	14.1	C	16.4	15.7	34.3	34.4					Apr-95	20-Apr-95
3	SHORE	V	18.08		33.4		7.66		9.14		Apr-95	19-Apr-95
3	SHORE	NV	17.88		33.6		7.62		8.5		Apr-95	19-Apr-95
3	4.5	V	17.63	17.07	33.8	33.8	7.64	7.62	8.4	8.21	Apr-95	19-Apr-95
3	6.3	NV	17.69	17.12	33.7	33.7	7.62	7.62	8.18	8.15	Apr-95	19-Apr-95
3	4.6	C	17.65	17.29	33.8	33.6	7.63	7.61	8.16	8.25	Apr-95	19-Apr-95
4	SHORE	V	17.9		33.2		7.7		9.34		Apr-95	18-Apr-95
4	SHORE	NV	18.85		33.5		7.64		8.04		Apr-95	18-Apr-95
4	1.6	V	17.5	17.5	33.9	33.9	8.27	8.02	9.26	9.27	Apr-95	18-Apr-95
4	1.3	NV	19.32	18.28	33.4	33.7	7.62	7.65	7.4	7.7	Apr-95	18-Apr-95
4	7.5	C	17.78	17.29	33.7	34	7.64	7.67	8.3	7.5	Apr-95	18-Apr-95

APPENDIX TABLE 2. 7/94 - 4/95 Vegetated Station Totals

Sum of TOTAL#	STATION					
SPCODE	1	2	3	4	Grand Total	% Total
ATHAFF	3252	1659	3263	419	8593	0.42176
CYMAGG	83	1789	426	300	2598	0.12752
ANCDEL	0	5	2050	37	2092	0.10268
ENGMOR	0	1	1564	0	1565	0.07681
HETROS	499	431	133	41	1104	0.05419
SYNAUL	82	239	195	503	1019	0.05001
SYNLEP	229	283	124	79	715	0.03509
ILYGIL	481	79	23	5	588	0.02886
CLEIOS	10	8	0	513	531	0.02606
ATHCAL	38	46	190	9	283	0.01389
PARNEB	49	109	34	0	192	0.00942
PARCLA	165	4	3	0	172	0.00844
UROHAL	51	44	48	27	170	0.00834
FUNPAR	0	9	8	111	128	0.00628
MICMIN	108	1	2	0	111	0.00545
PARMAC	5	27	47	21	100	0.00491
XENCAL	60	1	8	0	69	0.00339
GIBMON	30	17	0	0	47	0.00231
HYPGEN	8	35	2	0	45	0.00221
QUIYCA	5	7	17	11	40	0.00196
EMBJAC	32	4	0	0	36	0.00177
PARCAL	10	5	7	1	23	0.00113
HYPROS	2	0	13	6	21	0.00103
SYNEXI	2	7	5	0	14	0.00069
ACAFLA	0	0	1	11	12	0.00059
LEPARM	4	1	3	3	11	0.00054
CHESAT	2	2	6	0	10	0.00049
HYPGUT	2	1	0	6	9	0.00044
HALSEM	8	0	0	0	8	0.00039
MUGCEP	6	0	1	0	7	0.00034
SARSAG	5	1	1	0	7	0.00034
SYNCAL	5	1	1	0	7	0.00034
ANCCOM	0	1	4	0	5	0.00025
GIBELE	0	4	0	1	5	0.00025
SCOGUT	4	1	0	0	5	0.00025
SERPOL	0	5	0	0	5	0.00025
SYNARC	5	0	0	0	5	0.00025
PARINT	1	0	2	0	3	0.00015
STREXI	0	1	1	1	3	0.00015
UMBRON	0	3	0	0	3	0.00015
ANIDAV	1	0	1	0	2	9.8E-05
SPHARG	2	0	0	0	2	9.8E-05
GILMIR	0	0	0	1	1	4.9E-05
HIPING	0	1	0	0	1	4.9E-05
MEDCAL	1	0	0	0	1	4.9E-05
PARVET	1	0	0	0	1	4.9E-05
RIMMUS	1	0	0	0	1	4.9E-05
SYMATR	1	0	0	0	1	4.9E-05
SYNLUC	0	0	0	1	1	4.9E-05
TRITRI	0	0	1	0	1	4.9E-05
ZAPEXA	1	0	0	0	1	4.9E-05
Grand Total	5251	4832	8184	2107	20374	

APPENDIX TABLE 3. 7/94 - 4/95 Vegetated Season Totals

Sum of TOTAL#	Month					
SPCODE	July	October	January	April	Grand Total	% Total
ATHAFF	3707	1016	510	3360	8593	0.4218
CYMAGG	11	36	12	2539	2598	0.1275
ANCDEL	1752	8	0	332	2092	0.1027
ENGMOR	1561	0	0	4	1565	0.0768
HETROS	278	309	12	505	1104	0.0542
SYNAUL	481	87	58	393	1019	0.05
SYNLEP	186	217	126	186	715	0.0351
ILYGIL	491	43	30	24	588	0.0289
CLEIOS	298	108	13	112	531	0.0261
ATHCAL	0	1	282	0	283	0.0139
PARNEB	34	80	11	67	192	0.0094
PARCLA	0	164	0	8	172	0.0084
UROHAL	14	71	29	56	170	0.0083
FUNPAR	5	11	91	21	128	0.0063
MICMIN	52	10	2	47	111	0.0054
PARMAC	6	22	17	55	100	0.0049
XENCAL	0	61	0	8	69	0.0034
GIBMON	47	0	0	0	47	0.0023
HYPGEN	22	9	1	13	45	0.0022
QUIYCA	0	20	15	5	40	0.002
EMBJAC	4	19	0	13	36	0.0018
PARCAL	13	2	6	2	23	0.0011
HYPROS	9	11	0	1	21	0.001
SYNEXI	1	0	0	13	14	0.0007
ACAFLA	0	2	3	7	12	0.0006
LEPARM	4	0	2	5	11	0.0005
CHESAT	2	4	0	4	10	0.0005
HYPGUT	3	0	4	2	9	0.0004
HALSEM	0	8	0	0	8	0.0004
MUGCEP	0	0	7	0	7	0.0003
SARSAG	1	5	1	0	7	0.0003
SYNCAL	1	0	5	1	7	0.0003
ANCCOM	5	0	0	0	5	0.0002
GIBELE	0	0	0	5	5	0.0002
SCOGUT	2	2	0	1	5	0.0002
SERPOL	0	0	0	5	5	0.0002
SYNARC	0	2	1	2	5	0.0002
PARINT	0	3	0	0	3	0.0001
STREXI	1	1	1	0	3	0.0001
UMBRON	3	0	0	0	3	0.0001
ANIDAV	0	1	0	1	2	1E-04
SPHARG	2	0	0	0	2	1E-04
GILMIR	1	0	0	0	1	5E-05
HIPING	0	1	0	0	1	5E-05
MEDCAL	1	0	0	0	1	5E-05
PARVET	1	0	0	0	1	5E-05
RIMMUS	1	0	0	0	1	5E-05
SYMATR	1	0	0	0	1	5E-05
SYNLUC	0	0	1	0	1	5E-05
TRITRI	0	0	1	0	1	5E-05
ZAPEXA	0	0	0	1	1	5E-05
Grand Total	9001	2334	1241	7798	20374	

APPENDIX TABLE 4. 7/94 - 4/95 Nonvegetated StationTotals

Sum of TOTAL#	STATION					
SPCODE	1	2	3	4	Grand Total	% Total
ATHAFF	9376	2235	564	489	12664	0.6016
ANCDEL	0	7	126	5110	5243	0.249
CYMAGG	628	72	94	1	795	0.0378
ILYGIL	13	476	12	5	506	0.024
HETROS	86	193	44	0	323	0.0153
SYNAUL	15	129	76	27	247	0.0117
ATHCAL	152	29	60	1	242	0.0115
UROHAL	9	16	28	164	217	0.0103
SYNLEP	38	67	55	9	169	0.008
SARSAG	36	50	0	0	86	0.0041
CLEIOS	0	40	0	34	74	0.0035
PARNEB	15	36	8	9	68	0.0032
QUIYCA	0	7	0	56	63	0.003
PARMAC	1	31	23	3	58	0.0028
PLVENG	0	0	0	45	45	0.0021
ANCCOM	0	1	0	35	36	0.0017
HYPROS	2	7	17	6	32	0.0015
PARCLA	27	0	0	0	27	0.0013
EMBJAC	21	0	0	0	21	0.001
PARCAL	7	2	9	2	20	0.001
HYPGEN	7	8	0	1	16	0.0008
XENCAL	4	12	0	0	16	0.0008
MICMIN	10	0	0	0	10	0.0005
HYPGUT	0	8	0	0	8	0.0004
LEPARM	1	7	0	0	8	0.0004
CHESAT	0	0	6	0	6	0.0003
SYNCAL	5	1	0	0	6	0.0003
ANIDAV	5	0	0	0	5	0.0002
GIBMON	0	5	0	0	5	0.0002
HALSEM	5	0	0	0	5	0.0002
ENGMOR	1	0	3	0	4	0.0002
MUGCEP	2	0	0	2	4	0.0002
FUNPAR	0	2	1	0	3	0.0001
GIBELE	1	2	0	0	3	0.0001
MUSCAL	0	0	0	3	3	0.0001
MYLCAL	0	0	0	3	3	0.0001
UMBRON	0	0	1	2	3	0.0001
ACAFLA	0	1	0	1	2	1E-04
GIRNIG	2	0	0	0	2	1E-04
PLERIT	1	0	0	0	1	5E-05
PORMYR	0	0	0	1	1	5E-05
SERPOL	0	1	0	0	1	5E-05
SPHARG	1	0	0	0	1	5E-05
Grand Total	10471	3445	1127	6009	21052	

APPENDIX TABLE 5. 7/94 - 4/95 Nonvegetated SeasonTotals

Sum of TOTAL#	Month					
SPCODE	July	October	January	April	Grand Total	
ATHAFF	1294	1269	417	9684	12664	0.6016
ANCDEL	60	3707	159	1317	5243	0.249
CYMAGG	20	8	1	766	795	0.0378
ILYGIL	453	19	11	23	506	0.024
HETROS	41	84	9	189	323	0.0153
SYNAUL	69	24	41	113	247	0.0117
ATHCAL	0	1	240	1	242	0.0115
UROHAL	15	30	56	116	217	0.0103
SYNLEP	39	38	59	33	169	0.008
SARSAG	0	78	8	0	86	0.0041
CLEIOS	8	7	10	49	74	0.0035
PARNEB	5	44	4	15	68	0.0032
QUIYCA	1	11	47	4	63	0.003
PARMAC	2	17	18	21	58	0.0028
PLVENG	45	0	0	0	45	0.0021
ANCCOM	2	0	22	12	36	0.0017
HYPROS	4	28	0	0	32	0.0015
PARCLA	0	27	0	0	27	0.0013
EMBJAC	0	0	0	21	21	0.001
PARCAL	4	1	3	12	20	0.001
HYPGEN	4	9	1	2	16	0.0008
XENCAL	0	16	0	0	16	0.0008
MICMIN	0	4	0	6	10	0.0005
HYPGUT	3	1	0	4	8	0.0004
LEPARM	5	0	0	3	8	0.0004
CHESAT	0	0	0	6	6	0.0003
SYNCAL	0	0	6	0	6	0.0003
ANIDAV	0	5	0	0	5	0.0002
GIBMON	5	0	0	0	5	0.0002
HALSEM	0	5	0	0	5	0.0002
ENGMOR	1	1	0	2	4	0.0002
MUGCEP	0	1	2	1	4	0.0002
FUNPAR	0	0	3	0	3	0.0001
GIBELE	0	0	0	3	3	0.0001
MUSCAL	3	0	0	0	3	0.0001
MYLCAL	0	0	0	3	3	0.0001
UMBRON	0	0	1	2	3	0.0001
ACAFLA	1	0	0	1	2	1E-04
GIRNIG	0	2	0	0	2	1E-04
PLERIT	0	0	0	1	1	5E-05
PORMYR	0	0	0	1	1	5E-05
SERPOL	0	0	0	1	1	5E-05
SPHARG	0	1	0	0	1	5E-05
Grand Total	2084	5438	1118	12412	21052	

APPENDIX TABLE 6.

7/94 - 4/95 Channel Station Totals

Sum of TOTAL#	STATION					
SPCODE	1	2	3	4	Grand Total	% Total
ANCDEL	0	0	7	527	534	0.224276
UROHAL	30	155	106	170	461	0.193616
PARNEB	18	238	91	102	449	0.188576
PARCAL	94	28	26	67	215	0.090298
ATHAFF	95	0	111	0	206	0.086518
ENGMOR	132	3	0	3	138	0.057959
PARMAC	13	12	36	11	72	0.030239
HYPGUT	19	14	13	17	63	0.026459
PLERIT	21	6	2	1	30	0.0126
SYNLUC	23	0	0	3	26	0.01092
SCOGUT	20	4	1	0	25	0.0105
CHESAT	2	1	5	12	20	0.0084
SCOJAP	0	0	19	0	19	0.00798
SYMATR	16	3	0	0	19	0.00798
XYSLIO	14	1	0	1	16	0.00672
ATHCAL	0	8	1	2	11	0.00462
HETROS	4	3	3	0	10	0.0042
UMBRON	0	0	6	4	10	0.0042
PORMYR	1	2	0	6	9	0.00378
ILYGIL	4	0	2	2	8	0.00336
PARCLA	3	2	0	1	6	0.00252
PLECOE	5	0	0	0	5	0.0021
PLEVER	0	4	0	0	4	0.00168
SYNLEP	0	1	2	1	4	0.00168
HYPGEN	0	3	0	0	3	0.00126
ATRNOB	0	0	0	2	2	0.00084
HALSEM	2	0	0	0	2	0.00084
OXYCAL	2	0	0	0	2	0.00084
RONSTE	0	0	0	2	2	0.00084
SYNAUL	0	0	0	2	2	0.00084
XENCAL	2	0	0	0	2	0.00084
HYPROS	0	0	1	0	1	0.00042
MUSCAL	0	0	0	1	1	0.00042
MYLCAL	1	0	0	0	1	0.00042
PORNOT	1	0	0	0	1	0.00042
SARSAG	1	0	0	0	1	0.00042
STREXI	0	0	1	0	1	0.00042
Grand Total	523	488	433	937	2381	

APPENDIX TABLE 7.

7/94 - 4/95 Channel Season Totals

Sum of TOTAL#	Month					
SPCODE	July	October	January	April	Grand Total	% Total
ANCDEL	1	530	0	3	534	0.224276
UROHAL	60	54	38	309	461	0.193616
PARNEB	42	63	40	304	449	0.188576
PARCAL	142	22	20	31	215	0.090298
ATHAFF	42	84	79	1	206	0.086518
ENGMOR	135	0	0	3	138	0.057959
PARMAC	15	11	22	24	72	0.030239
HYPGUT	27	3	13	20	63	0.026459
PLERIT	13	6	3	8	30	0.0126
SYNLUC	8	0	1	17	26	0.01092
SCOGUT	20	2	2	1	25	0.0105
CHESAT	1	5	3	11	20	0.0084
SCOJAP	0	0	0	19	19	0.00798
SYMATR	11	3	0	5	19	0.00798
XYSLIO	9	1	1	5	16	0.00672
ATHCAL	0	0	10	1	11	0.00462
HETROS	3	2	2	3	10	0.0042
UMBRON	6	4	0	0	10	0.0042
PORMYR	9	0	0	0	9	0.00378
ILYGIL	6	0	2	0	8	0.00336
PARCLA	1	1	4	0	6	0.00252
PLECOE	5	0	0	0	5	0.0021
PLEVER	0	4	0	0	4	0.00168
SYNLEP	0	0	4	0	4	0.00168
HYPGEN	0	3	0	0	3	0.00126
ATRNOB	0	0	0	2	2	0.00084
HALSEM	2	0	0	0	2	0.00084
OXYCAL	2	0	0	0	2	0.00084
RONSTE	0	2	0	0	2	0.00084
SYNAUL	0	1	1	0	2	0.00084
XENCAL	0	2	0	0	2	0.00084
HYPROS	0	0	1	0	1	0.00042
MUSCAL	0	1	0	0	1	0.00042
MYLCAL	1	0	0	0	1	0.00042
PORNOT	1	0	0	0	1	0.00042
SARSAG	0	1	0	0	1	0.00042
STREXI	0	0	0	1	1	0.00042
Grand Total	805	562	246	768	2381	

Appendix Table 8. Summary of numerical density calculations, 1994-1995.

ALL MONTHS										
Sum of TOTAL#			STATION						MEAN	
STRATA	DEP	REP	1	2	3	4	Grand Total	AREA	DENSITY	DENSITY	SE
C	C	OT1	153	42	101	127	423	38672	0.010938		
		OT2	65	250	89	147	551	38672	0.014248		
		OT3	203	178	91	660	1132	38672	0.029272	0.018153	0.005641
		PS1	75	11	34	1	121	4736	0.025549		
		PS2	27	2	34	0	63	4736	0.013302		
		PS3	0	5	84	2	91	4736	0.019215	0.019355	0.003536
	C Total		523	488	433	937	2381	130224	0.018284	0.018754	0.000601
C Total			523	488	433	937	2381				
N	IN	LS1	156	171	47	75	449	3520	0.127557		
		LS2	33	139	193	106	471	3520	0.133807		
		LS3	38	64	70	99	271	3520	0.076989	0.112784	0.017988
		SE1	79	6	7	15	107	16	6.6875		
		SE2	4	33	1	4	42	16	2.625		
		SE3	7	9	1	2	19	16	1.1875	3.5	1.646888
		SS1	4660	1459	90	76	6285	998.4	6.295072		
		SS2	566	307	29	5	907	998.4	0.908454		
		SS3	3320	261	58	208	3847	998.4	3.853165	3.685564	1.557239
	IN Total		8863	2449	496	590	12398	13603.2	0.911403	2.432783	1.161235
	NN	BT1	60	107	90	72	329	4640	0.070905		
		BT2	76	104	73	102	355	4640	0.076509		
		BT3	94	181	37	60	372	4640	0.080172	0.075862	0.002695
		PS1	359	69	319	112	859	4736	0.181377		
		PS2	174	399	52	4500	5125	4736	1.082137		
		PS3	845	136	60	573	1614	4736	0.340794	0.534769	0.277526
	NN Total		1608	996	631	5419	8654	28128	0.307665	0.305316	0.137416
N Total			10471	3445	1127	6009	21052	**41731.2**	**0.504467**	**0.504467**	**1.063733**
V	IV	LS1	1328	176	209	76	1789	3520	0.508239		
		LS2	852	455	764	75	2146	3520	0.609659		
		LS3	546	515	252	95	1408	3520	0.4	0.505966	0.060534
		SE1	7	8	5	25	45	16	2.8125		
		SE2	4	6	10	28	48	16	3		
		SE3	5	10	16	15	46	16	2.875	2.895833	0.05512
		SS1	214	69	706	42	1031	998.4	1.032652		
		SS2	174	19	174	149	516	998.4	0.516827		
		SS3	98	138	1431	217	1884	998.4	1.887019	1.145499	0.399545
	IV Total		3229	1396	3567	722	8914	13603.2	0.655287	1.515766	0.72912
	NV	BT1	352	260	158	334	1104	4640	0.237931		
		BT2	563	317	106	333	1319	4640	0.284267		
		BT3	638	320	192	253	1403	4640	0.302371	0.274856	0.019188
		PS1	81	771	3102	95	4049	4736	0.854941		
		PS2	78	563	745	205	1591	4736	0.335938		
		PS3	310	1205	314	165	1994	4736	0.42103	0.537303	0.160707
	NV Total		2022	3436	4617	1385	11460	28128	0.407423	0.40608	0.189982
V Total			5251	4832	8184	2107	20374	**41731.2**	**0.48822**	**0.960923**	**0.554843**
Grand Total			16245	8765	9744	9053	43807	213686.4	0.205006	0.205006	

Appendix Table 9. Summary of biomass density calculations, 1994-1995.

ALL MONTHS											
Sum of TOTALWT			STATION							MEAN	
STRATA	DEP	REP	1	2	3	4	Grand Total	AREA	DENSITY	DENSITY	SE
C	C	OT1	21684.7	4373.31	14575.89	15332.25	55966.15	38672	1.44720082		
		OT2	7482.29	13428.43	11341.68	20015.88	52268.28	38672	1.35157944		
		OT3	12326.03	24191.29	9809.52	14710.32	61037.16	38672	1.57832954	1.459037	0.065724
		PS1	415.3	1520.2	970.15	0.1	2905.75	4736	0.61354519		
		PS2	1707.3	571	6299	0	8577.3	4736	1.8110853		
		PS3	0	855	2303.05	228.7	3386.75	4736	0.71510769	1.046579	0.383376
	C Total		43615.62	44939.23	45299.29	50287.25	184141.39	130224	1.41403574	1.252808	0.206229
C Total			43615.62	44939.23	45299.29	50287.25	184141.39				
N	IN	LS1	722	572.7	99.7	404.7	1799.1	3520	0.51110795		
		LS2	86.3	322.3	265.1	260.5	934.2	3520	0.26539773		
		LS3	238.3	366	219.4	310.9	1134.6	3520	0.32232955	0.366278	0.074256
		SE1	5.2	0.9	0.4	0.8	7.3	16	0.45625		
		SE2	0.4	40.7	0.1	0.2	41.4	16	2.5875		
		SE3	0.6	5.5	0.1	0.1	6.3	16	0.39375	1.145833	0.721059
		SS1	354.9	109.2	32.6	19.2	515.9	998.4	0.51672676		
		SS2	78.2	128.5	93.2	1.3	301.2	998.4	0.30168269		
		SS3	401.1	25.9	16.5	54	497.5	998.4	0.49829728	0.438902	0.068816
	IN Total		1887	1571.7	727.1	1051.7	5237.5	13603	0.3850197	0.650338	0.248633
	NN	BT1	1811.3	886.7	3524.1	7068.51	13290.61	4640	2.8643556		
		BT2	526.8	1472.85	772.5	6496.8	9268.95	4640	1.99761853		
		BT3	492	4139.2	1149.4	5208.1	10988.7	4640	2.36825431	2.410076	0.251078
		PS1	3813.1	4444.65	6546	11349.35	26153.1	4736	5.52219172		
		PS2	3050.9	4563.9	5275.15	10154.1	23044.05	4736	4.86572002		
		PS3	5613	4321.85	2394.25	7172.35	19501.45	4736	4.11770481	4.835206	0.405727
	NN Total		15307.1	19829.15	19661.4	47449.21	102246.86	28128	3.63505617	3.622641	0.077325
N Total			**17194.1**	**21400.85**	**20388.5**	**48500.91**	**107484.36**	**41731**	**2.5756355**	**2.575635**	**1.486151**
V	IV	LS1	2423.84	457.8	482.3	224.4	3588.34	3520	1.01941477		
		LS2	1302.7	1454.7	1258.2	250.7	4266.3	3520	1.21201705		
		LS3	1472.5	993.1	873.97	123	3462.57	3520	0.98368466	1.071705	0.07091
		SE1	40.66	9	0.7	2.7	53.06	16	3.31625		
		SE2	1.9	0.8	1.3	3.1	7.1	16	0.44375		
		SE3	0.8	1.9	5.6	1.2	9.5	16	0.59375	1.45125	0.933505
		SS1	30.5	30.2	149.5	4.3	214.5	998.4	0.21484375		
		SS2	20	2.5	49.1	63	134.6	998.4	0.13481571		
		SS3	263.1	60.6	179.4	59.9	563	998.4	0.56390224	0.304521	0.131732
	IV Total		5556.1	3010.6	3000.07	732.3	12299.07	13603	0.90413065	0.942492	0.38712
	NV	BT1	7301.72	2931.56	3734.08	528.5	14495.86	4640	3.12410776		
		BT2	4340.4	2864.53	3837	1998.45	13040.38	4640	2.81042672		
		BT3	8112.8	7047.6	5439.25	877.9	21477.55	4640	4.62878233	3.521106	0.561192
		PS1	1097.8	7601.3	7400.58	1995.55	18095.23	4736	3.82078336		
		PS2	879	7862.6	6047	5883.75	20672.35	4736	4.36493877		
		PS3	2117.8	10343.9	2473	6460.75	21395.45	4736	4.51762035	4.234447	0.211476
	NV Total		23849.52	38651.49	28930.91	17744.9	109176.82	28128	3.88142847	3.877777	1.603059
V Total			**29405.62**	**41662.09**	**31930.98**	**18477.2**	**121475.89**	**41731**	**2.91091294**	**2.410134**	**1.467642**
Grand Total			90215.34	108002.2	97618.77	117265.4	413101.64	213686	1.93321447	1.933214	