INSHORE SOFT-BOTTOM FISHES OF TWO COASTAL LAGOONS ON THE NORTHERN PACIFIC COAST OF BAJA CALIFORNIA

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ABSTRACT

Two series of monthly trawls were made: from May 1992 to April 1993 at Estero de Punta Banda and during 1994 in Bahía de San Quintín, Baja California (Mexico). Seasonal samplings in both places were made during 1994 only. The stations in the two embayments were situated at 5 and 10 m; four replicate beam-trawl tows were made per station. A total of 160 tows was made, and 45 fish species were collected. The most important species in the ichthyofaunal community of Estero de Punta Banda differed from those in Bahía de San Quintín. In Estero de Punta Banda, three economically important species were dominant by the index of community importance (ICI) ranking (relative abundance and frequency of occurrence): *Paralichthys californicus*, *Paralabrax clathratus*, and *Paralabrax nebulifer*. In Bahía de San Quintín, the 5-m-depth catches were dominated by (ICI rank) *Syngnathus leptorhynchus*, *P. californicus*, and *Symphurus atricauda*; at 10 m *S. atricauda* was most important, followed by the other two species in the same order. Total annual catches were highest at 5 m and intermediate at 10 m in San Quintín, and lowest at 5 m in Punta Banda. The abundance by trawl and the standing crop were high during November and December in Punta Banda. In San Quintín, upwelling influence on fish abundance and biomass distribution is indicated by high abundance at 5 m when the temperature decreases, and low abundance when the temperature increases. At 10 m, abundance and biomass follow the same pattern of change as temperature. The low density (annual 558 fish/ha) in Estero de Punta Banda contrasted with the highest standing crop, both annual (17,355 g/ha) and monthly (November, 50,387 g/ha), compared to San Quintín at 5 m (annual 916 fish/ha; annual standing crop 10,002 g/ha; monthly standing crop 33,621 g/ha in November, too). In the seasons of 1994, no differences between areas and depths were found in catch parameters, except in the standing crop. Differences may be due to interannual variability. Owing to the nearly pristine condition of Estero de Punta Banda and Bahía de San Quintín, and their potential as nursery grounds and for dispersion of ecologically and economically important fishes to repopulate to the north, both areas should be protected.

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INTRODUCTION

The Pacific coast of Baja California is important to a number of fish communities. It is considered a transition zone between southern and northern ichthyofauna; it is a spawning zone for transboundary species; and it is frequented by commercial and recreational fisheries (Hubbs 1960; Escobar-Fernandez and Arenillas-Cuetara 1987; Moser and Watson 1990; Love 1991; Danemann and De la Cruz-Aguero 1993; Moser et al. 1993; Arenas et al. 1996; CDFG 1996). Many species found in California waters are also abundant in Baja California and, in fact, may have their centers of distribution there (Moser et al. 1993). Baja California may serve as a source of larvae, juveniles, and adults for California waters. The sparse development of the Baja California coastline and the relative paucity of fish studies contrasts markedly with the situation for southern California.

Coastal lagoons serve as nurseries for many fish species. High food production, a relatively higher temperature, and decreased predation risk are some of the benefits to fish in these areas (Kneib 1987; Kramer 1990). The lagoons are often dominated by species that move into estuaries for feeding, growth, or protection (Yañez-Arancibia 1985) during specific stages of their lives, and then move offshore (Monaco et al. 1990). Thus fishes represent an important link between estuaries and coastal zones (Deegan 1993).

Along the northern Pacific coast of Baja California, Estero de Punta Banda and Bahía de San Quintín are the two most extensive lagoons. The estero was a nearly pristine environment until 1984, when a dike built by an oil company isolated an area of 0.21 km^2 from the tidal regime; fortunately the main channel was not dredged and the main circulation was not disrupted before the activities were stopped. In 1987, a hotel was developed on the sand bar, and together with the dike modified 2.2 km^2 of the area's total 21 km^2. Nonetheless, the estero persists as an ecologically important place for invertebrates, fishes, and birds (Ibarra-Obando and Escofet 1987; Ibarra-Obando and Poumian-Tapia 1991, 1992).

In Bahía de San Quintín, an oyster culture has been developed for years, mainly situated in Bahía Falsa. The arm named Bahía de San Quintín includes a few houses and the Old Mill Hotel, but no drainages empty into the bay. Development pressure persists: a marina was proposed for the whole Estero de Punta Banda, and a tourist resort was proposed for the western sand bar of San Quintín. Fortunately, both projects were abandoned.

While the seagrass (Ballesteros-Grijalva and García-Lepe 1993; Poumian-Tapia 1995), invertebrate (Barnard 1970; Calderón-Aguilera 1992; Buenrostro-Lopez 1996), and bird communities (Sounders and Sounders 1981; Wilbur 1987; Ward et al. 1991; De la Cueva and Fernandez 1996; Fernandez-Aceves 1996) of these lagoons have been studied, very few studies on fishes have been published. Works on the fish fauna of Bahía de Todos Santos and Estero de Punta Banda were reviewed by Hammann and Rosales-Casián (1990). Except for the record of an endemic species, *Paraclinus walkeri* (Hubbs 1952; Rosenblatt and Parr 1969), and a recent species checklist (Rosales-Casián 1996), nothing has been published on the fishes of San Quintín.

The objective of this study was to describe the fish assemblages of the shallow, soft-bottom habitat of these two northern Baja California coastal lagoons.

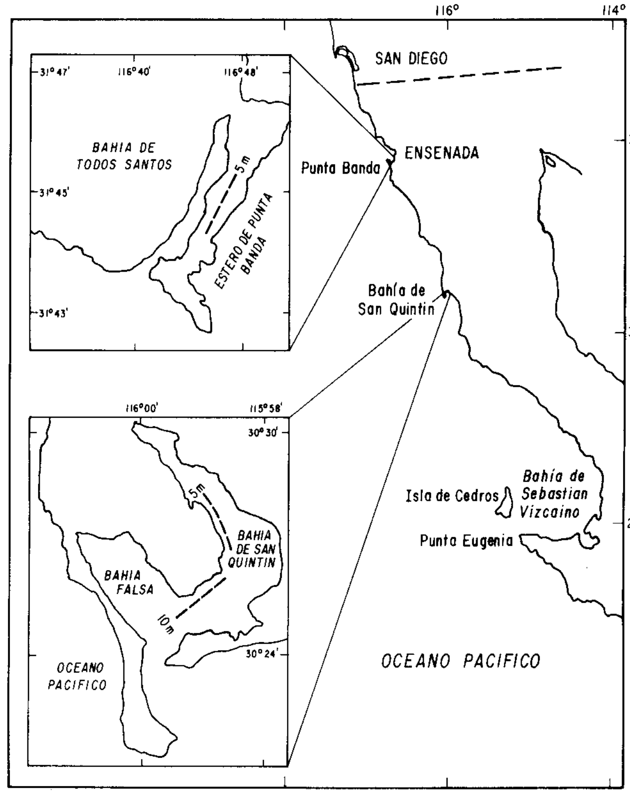

Figure 1. Beam-trawl sampling sites (Estero de Punta Banda and Bahía de San Quintín) in northern Pacific off Baja California, México.

STUDY AREAS

Estero de Punta Banda (31°40'–31°48'N, 116°04'–116°40'W), is an L-shaped coastal lagoon (figure 1) covering 21 km^2, with a narrow mouth (<200 m) and a natural channel (<8 m deep). It is situated in the southeast margin of Bahía de Todos Santos–Ensenada (123 km south of U.S. border), and is separated from the bay by a 7.5-km-long sand bar. It is a protected habitat containing *Zostera* and *Spartina* beds (3.3 km^2), mud and sand flats, and small channels (Ibarra-Obando and Poumian-Tapia 1991, 1992). The nearest coastal upwelling from Estero de Punta Banda is located about 15 km away (Cota 1971; Chavez de Ochoa 1975).

Bahía de San Quintín is 200 km south of Ensenada, 30°24'–30°30'N and 115°57'–116°01' W (figure 1). This bay has an area of 4,000 ha, and is divided into a western arm called Bahía Falsa, and an eastern arm, Bahía de San Quintín. The bay communicates with the sea through a mouth less than 1,000 m wide and 2–7 m deep (Contreras 1985; Ballesteros-Grijalva and García-Lepe 1993). Both arms are protected by sand bars. However, during high tides and high waves, the water can cross the narrow part of the Bahía Falsa sand bar. A third zone is the head of Bahía de San Quintín; divided by a breakwater, it creates shallow (<2 m), warm, and saline waters (Alvarez-Borrego et al. 1975). This backwater exhibits a lesser tide amplitude and height, and low current velocity (Del Valle-Lucero and Cabrera-Muro 1981a, b). A strong upwelling occurs throughout much of the year close to the mouth (Dawson 1951).

Because there is little rainfall, salinity and temperature values increase from the mouth toward the head of each lagoon (Chavez de Nishikawa and Alvarez-Borrego 1974; Celis-Ceseña and Alvarez-Borrego 1975; Ballesteros-Grijalva and García-Lepe 1993). Both lagoons are strongly influenced by tides (Alvarez-Borrego et al. 1977; Pritchard et al. 1978).

MATERIALS AND METHODS

Sampling Methods

In the Estero de Punta Banda, samplings were made monthly from May 1992 to April 1993; in Bahía de San Quintín they were made throughout 1994. Additional seasonal samplings in the estero were made during February (winter), May (spring), July (summer), and November (fall) of 1994. Collections were made with a beam trawl (Kramer and Hunter 1987; Kramer 1990; Allen and Herbinson 1990, 1991) on the soft bottom of Punta Banda and in the San Quintín channels (figure 1). The beam trawl (1.6 m by 0.4 m, 3-mm mesh netting) was towed at 1.5 knots for five minutes. Four replicate tows were made parallel to shore at 5 m in Punta Banda and at 5 and 10 m in San Quintín. A wheel with a revolution counter recorded the distance. When possible, distance was measured with a second wheel counter on the beach, by following the boat.

All fish were identified (Miller and Lea 1972; INP 1976), and family Clinidae was determined by the descriptions of Rosenblatt and Parr (1969). Fish biomass was recorded to ±0.1 g for fishes weighing up to 150 g, and to ±1.0 g for heavier fishes. At each trawl end, temperature (°C) was measured at the surface and near the bottom.

Data Analysis

The distance was based on the average attained by all "good" tows according to distances along the beach; low or high readings caused by fouling or damage to the meter were discarded. The sampled area was computed as the product of the distance towed and the beam-trawl width (1.6 m; Allen and Herbinson 1990; Kramer 1990; Allen and Herbinson 1991). The average area per tow in Punta Banda was 341 m^2; in San Quintín it was 429 m^2 (5 m), and 421 m^2 (10 m).

For each site, I computed the total fish caught and their biomass; total numbers caught per species; relative abundance; frequency of occurrence, abundance, and biomass per trawl; density (no./ha); and standing crop (g/ha).

To determine differences in catch patterns with time and between depths and areas, I transformed the data from each replicate monthly trawl to log $(x+1)$ prior to ANOVA analysis. I used the simple linear Pearson correlation between temperature (bottom and surface) and abundance to measure the degree of association (Zar 1984). To estimate the contribution of each species to its assemblage, I used the index of community importance (ICI; Stephens and Zerba 1981; Love et al. 1986). The ICI was obtained by the sum of the percent of abundance and frequency-of-occurrence rankings; afterwards, I reranked the species. I used Kendall's rank correlation to compare the top ten species (abundances and ICI ranking) from each assemblage (Siegel 1956).

RESULTS

Temperature

In Estero de Punta Banda (1992–93), temperatures at 5 m were highest in August (24.1°C, ±SD 0.3) and lowest in December (14.5°C ±0.6; figure 2A), with an overall mean of 18.9° (±2.7). Seasonal mean temperatures in 1994 were 16° (February), 17.2° (May), 22.8° (July), and 14.7° (November), with an overall mean of 17.7°, ±3.2.

In contrast, in Bahía de San Quintín there were two temperature maxima and minima; at 5 m, a first peak

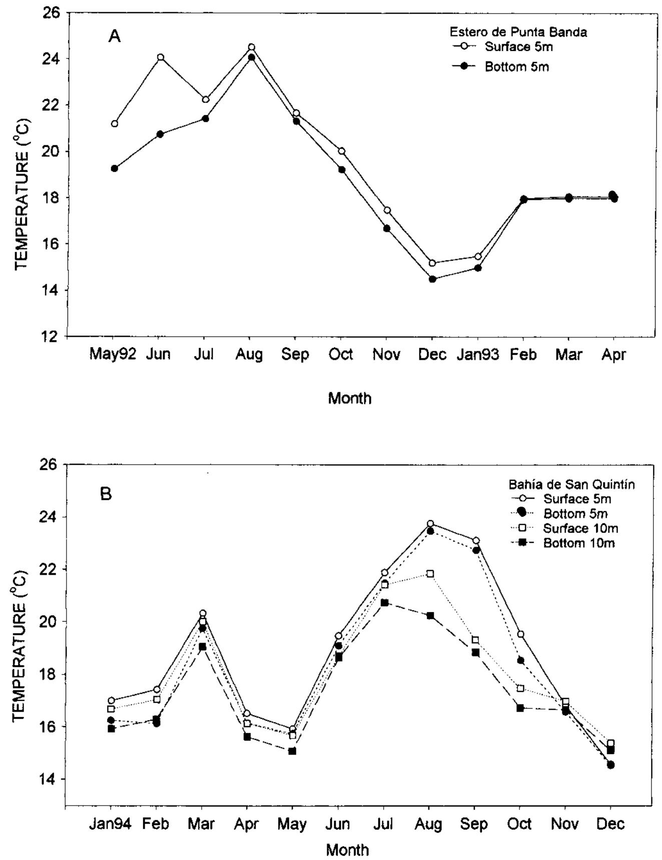

Figure 2. Mean monthly temperatures at sites surveyed. May 1992–April 1993 in Estero de Punta Banda (*A*), and 1994 in Bahía de San Quintín (*B*).

occurred in March (19.8°, ±0.2), and a second in August (23.5°, ±0.2). At 10 m, the first peak also occurred in March (19.1°, ±0.2), the second in July (20.8°, ±0.6). Lowest temperatures (figure 2B) were observed first during an upwelling event in May (15.1°, ±0.3), and during the cold month of December (15.1°, ±0.1).

Sampling Effort

Forty-eight trawls were taken during 1992–93 in Estero de Punta Banda (5 m only), and sixteen trawls as seasonal samplings during 1994. In Bahía de San Quintín, ninety-six trawl samplings (5 and 10 m) were taken in 1994.

Species Composition by Areas

In Punta Banda (1992–93), a total of 926 fish was caught belonging to 25 species (table 1). Most common species were kelp bass (*Paralabrax clathratus*), bay blenny (*Hypsoblennius gentilis*), bay pipefish (*Syngnathus leptorhynchus*), and California halibut (*Paralichthys californicus*). The halibut had the highest occurrence, 87.5%, and ranked highest by the ICI, followed by kelp bass and barred sandbass (*Paralabrax nebulifer*).

At 5 m in Bahía de San Quintín (1994), 1,929 fishes were caught from 30 species (table 2). Bay pipefish were abundant, appearing in 77% of the tows. Shiner perch (*Cymatogaster aggregata*) were second, followed by cheekspot goby (*Ilypnus gilberti*) and California tonguefish (*Symphurus atricauda*). California halibut were fifth in abundance, but they were taken in 68.8% of the tows. These species composed 76.6% of the total catch, and occurred in more than 40% of the tows. Bay pipefish, California halibut, California tonguefish, and cheekspot gobies dominated this isobath by ICI (table 2). We took one specimen of the endemic *Paraclinus walkeri*.

At 10 m in Bahía de San Quintín, a total of 1,125 fishes were collected, belonging to 28 species (table 3). The California tonguefish and bay pipefish were the most abundant species. The slough anchovy (*Anchoa delicatissima*) was taken infrequently but in relatively large numbers. These three species, comprising 57% of the total, were caught in one-third to more than one-half of the tows, and constituted the top ICI rankings; California tonguefish was first. Four specimens of the endemic *P. walkeri* were also collected at this depth (table 3).

Rank correlation tests between assemblages indicate a high similarity between depths in Estero de Punta Banda (5 m) and Bahía de San Quintín (5 and 10 m on the basis of the relative abundances of species (Kendall's tau = 1.0, p = 0.000), and the top ten ICI-ranking species (Kendall's tau > 0.977, p = 0.000).

Abundance and Biomass

In Punta Banda (1992–93), abundances increased in October and peaked in December (62 fish/trawl, ±SE 8). Otherwise they ranged from 1.5 to 15 fish/trawl (figure 3). The overall mean was 19 fish/trawl (±4). Abundance varied significantly with time (ANOVA, p = 0.000). No correlation between abundances and bottom temperature (r = −0.225, p = 0.124) was found. Overall biomass was 593 g/trawl ±364, and was highest in November (1,720 g/trawl ±635), lowest (29 g/trawl ±3) in April (figure 4) and varied significantly with time (p = 0.001). No significant correlation was found between biomass and temperature (r = −0.225, p = 0.124).

In San Quintín (1994), abundances were highest at 5 m in May (91 fish/trawl ±SE 37) and November (84 fish/trawl), and lowest (5 fish/trawl ±2) in January (figure 5). The bay pipefish (*S. leptorhynchus*) constituted 48.3% of total abundance in May and 63.4% in November. The overall mean was 39 fish/trawl (±6). Abundance varied with time (ANOVA, p = 0.000), and no significant correlation was found with bottom temperature (r = −0.114, p = 0.441). Biomass was highest (1,442 g/trawl ±512) in November, and lowest (3 g/trawl ±3) in January (figure 5). The overall mean was 429 g/trawl (±80). Biomass at 5 m varied significantly with time (p = 0.000), and was not significantly correlated with bottom temperature (r = −0.000, p = 0.998).

TABLE 1
Composition of Beam-Trawl Catches (5-m Depth) by the Index of Community Importance (ICI) in Estero de Punta Banda, B.C., México (May 1992 to April 1993)

Species	Number	% Relative	Rank	% FO	Rank	ICI
Paralichthys californicus	105	11.34	4.0	87.50	1.0	5.0
Paralabrax clathratus	353	38.12	1.0	33.33	5.0	6.0
Paralabrax nebulifer	58	6.26	5.0	45.83	2.0	7.0
Pleuronichthys ritteri	56	6.05	6.0	41.67	3.0	9.0
Hypsoblennius gentilis	119	12.85	2.0	29.17	7.0	9.0
Syngnathus leptorhynchus	107	11.56	3.0	14.58	8.0	11.0
Hypsopsetta guttulata	23	2.48	8.0	35.42	4.0	12.0
Paralabrax maculatofasciatus	32	3.46	7.0	31.25	6.0	13.0
Cymatogaster aggregata	22	2.38	9.0	12.50	9.0	18.0
Xenistius californiensis	13	1.40	10.0	8.33	11.0	21.0
Heterostichus rostratus	11	1.19	11.0	8.33	11.0	22.0
Anisotremus davidsonii	6	0.65	12.0	6.25	12.0	24.0
Symphurus atricauda	4	0.43	13.5	8.33	11.0	24.5
Seriphus politus	2	0.22	15.5	4.17	13.0	28.0
Oxyjulis californica	4	0.43	13.5	2.08	19.0	32.5
Anchoa compressa	2	0.22	15.5	2.08	19.0	34.5
Hypsoblennius jenkinsi	1	0.11	21.0	2.08	19.0	40.0
Girella nigricans	1	0.11	21.0	2.08	19.0	40.0
Hypsypops rubicundus	1	0.11	21.0	2.08	19.0	40.0
Menticirrhus undulatus	1	0.11	21.0	2.08	19.0	40.0
Plathyrinoidis triseriata	1	0.11	21.0	2.08	19.0	40.0
Scorpaena guttata	1	0.11	21.0	2.08	19.0	40.0
Atractoscion nobilis	1	0.11	21.0	2.08	19.0	40.0
Porichthys myriaster	1	0.11	21.0	2.08	19.0	40.0
Leptocottus armatus	1	0.11	21.0	2.08	19.0	40.0
Totals	926	100.0				

TABLE 2
Composition of Beam-Trawl Catches (5-m Depth) by the Index of Community Importance (ICI) in Bahía de San Quintín, B.C., México (January to December 1994)

Species	Number	% Relative	Rank	% FO	Rank	ICI
Syngnathus leptorhynchus	790	40.95	1.0	77.08	1.0	2.0
Paralichthys californicus	137	7.10	5.0	68.75	2.0	7.0
Symphurus atricauda	162	8.40	4.0	56.25	3.0	7.0
Ilypnus gilberti	183	9.49	3.0	47.92	5.5	8.5
Cymatogaster aggregata	205	10.63	2.0	39.58	8.0	10.0
Hypsoblennius gentilis	87	4.51	7.0	54.17	4.0	11.0
Embiotoca jacksoni	127	6.58	6.0	41.67	7.0	13.0
Hypsopsetta guttulata	55	2.85	8.0	47.92	5.5	13.5
Hypsoblennius jenkinsi	40	2.07	9.0	33.33	9.0	18.0
Porichthys myriaster	33	1.71	10.0	25.00	10.0	20.0
Heterostichus rostratus	28	1.45	11.0	22.92	11.0	22.0
Paraclinus integripinnis	19	0.98	12.0	18.75	12.5	24.5
Clevelandia ios	15	0.78	13.0	18.75	12.5	25.5
Pleuronichthys ritteri	7	0.36	15.0	12.50	14.0	29.0
Urolophus halleri	8	0.41	14.0	6.25	17.0	31.0
Squalus acanthias	5	0.26	16.5	8.33	15.5	32.0
Scorpaena guttata	4	0.21	18.0	8.33	15.5	33.5
Gillichthys mirabilis	5	0.26	16.5	4.17	18.5	35.0
Paralabrax nebulifer	2	0.10	21.0	4.17	18.5	39.5
Porichthys notatus	3	0.16	19.5	2.08	25.0	44.5
Paralabrax clathratus	3	0.16	19.5	2.08	25.0	44.5
Pleuronichthys verticalis	2	0.10	21.5	2.08	25.0	46.5
Syngnathus californiensis	2	0.10	21.5	2.08	25.0	46.5
Citharichthys sordidus	1	0.05	26.0	2.08	25.0	51.0
Synodus lucioceps	1	0.05	26.0	2.08	25.0	51.0
Engraulis mordax	1	0.05	26.0	2.08	25.0	51.0
Xystreuris liolepsis	1	0.05	26.0	2.08	25.0	51.0
Gobionellus longicaudus	1	0.05	26.0	2.08	25.0	51.0
Paraclinus walkeri	1	0.05	26.0	2.08	25.0	51.0
Leptocottus armatus	1	0.05	26.0	2.08	25.0	51.0
Totals	1,929	100.0				

TABLE 3
Composition of Beam-Trawl Catches (10-m Depth) by the Index of Community Importance (ICI) in Bahía de San Quintín, B.C., México (January to December 1994)

Species	Number	% Relative	Rank	% FO	Rank	ICI
Symphurus atricauda	349	31.02	1.0	52.08	1.0	2.0
Syngnathus leptorhynchus	168	14.93	2.0	35.42	3.5	5.5
Paralichthys californicus	64	5.69	5.0	43.75	2.0	7.0
Ilypnus gilberti	95	8.44	4.0	35.42	3.5	7.5
Hypsopsetta guttulata	55	4.89	6.0	31.25	5.0	11.0
Hypsoblennius gentilis	53	4.71	7.0	25.00	6.5	13.5
Porichthys myriaster	31	2.76	9.0	25.00	6.5	15.5
Citharichthys sordidus	25	2.22	11.0	22.92	8.0	19.0
Hypsoblennius jenkinsi	42	3.73	8.0	12.50	11.5	19.5
Cymatogaster aggregata	23	2.04	12.0	14.58	9.5	21.5
Pleuronichthys ritteri	14	1.24	14.0	14.58	9.5	23.5
Anchoa compressa	28	2.49	10.0	6.25	14.0	24.0
Clevelandia ios	21	1.87	13.0	12.50	11.5	24.5
Anchoa delicatissima	125	11.11	3.0	2.08	23.5	26.5
Heterostichus rostratus	7	0.62	15.0	6.25	14.0	29.0
Embiotoca jacksoni	5	0.44	16.0	6.25	14.0	30.0
Paraclinus walkeri	4	0.36	17.0	4.17	17.0	34.0
Scorpaena guttata	2	0.18	20.0	4.17	17.0	37.0
Pleuronichthys verticalis	2	0.18	20.0	4.17	17.0	37.0
Citharichthys stigmaeus	2	0.18	20.0	2.08	23.5	43.5
Atherinops affinis	2	0.18	20.0	2.08	23.5	43.5
Parophrys vetulus	2	0.18	20.0	2.08	23.5	43.5
Plathyrinoidis triseriata	1	0.09	25.5	2.08	23.5	49.0
Paralabrax clathratus	1	0.09	25.5	2.08	23.5	49.0
Urolophus halleri	1	0.09	25.5	2.08	23.5	49.0
Zapteryx exasperata	1	0.09	25.5	2.08	23.5	49.0
Xystreuris liolepis	1	0.09	25.5	2.08	23.5	49.0
Paraclinus integripinnis	1	0.09	25.5	2.08	23.5	49.0
Totals	1,125	100.0				

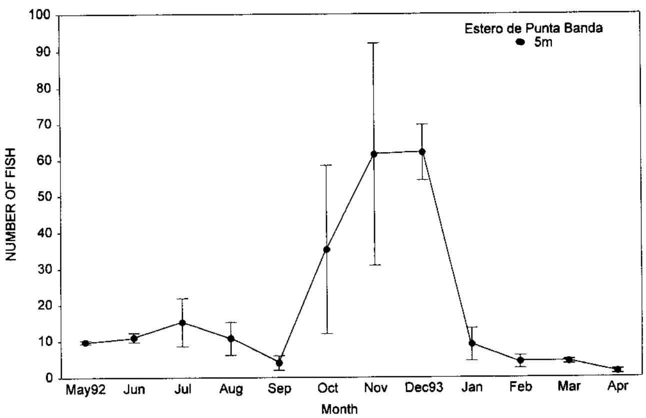

Figure 3. Mean abundance per beam-trawl tow at Estero de Punta Banda. *Bars* represent standard error (±SE).

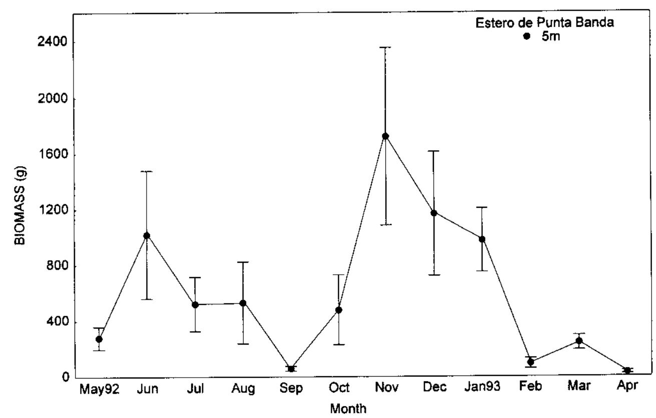

Figure 4. Mean biomass (g) per beam-trawl tow at Estero de Punta Banda. *Bars* represent standard error (±SE).

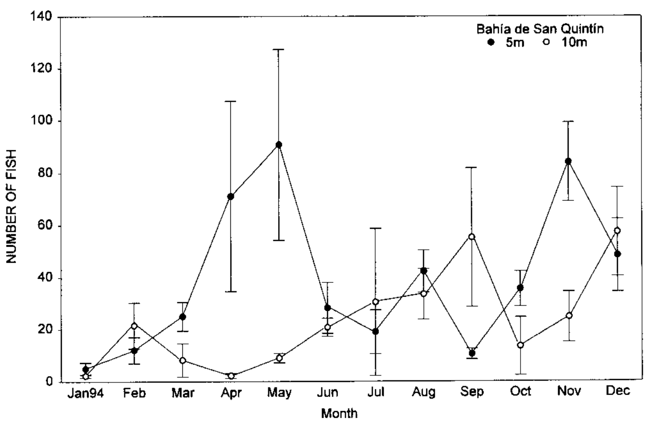

Figure 5. Mean abundance per beam-trawl tow (5- and 10-m depths) at Bahía de San Quintín. *Bars* represent standard error (±SE).

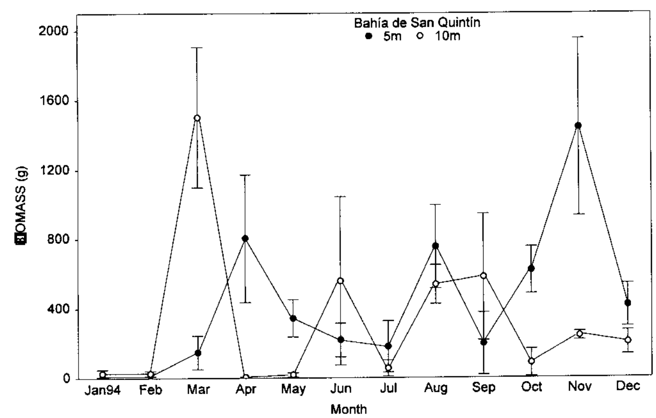

Figure 6. Mean biomass (g) per beam-trawl tow (5- and 10-m depths) at Bahía de San Quintín. *Bars* represent standard error (±SE).

Along the 10-m isobath, catches were highest in September (55 fish/trawl ±SE 27) and December (57 fish/trawl ±17), and lowest (2 fish/trawl ±0.6) in January (figure 6). The annual mean was 23 fish/trawl (±4). Catch per trawl varied significantly with time ($p = 0.000$), but was not significantly correlated with temperature ($r = 0.056$, $p = 0.705$). Biomass per trawl at 10 m was highest in March (1,501 g ±404; figure 6). The minimum biomass (6.4 g/trawl ±2) was collected in April. The overall mean was 320 g/trawl ±81. Biomass differed significantly with months ($p = 0.000$), and was significantly correlated with bottom temperature ($r = 0.361$, $p = 0.012$).

Density and Standing Crop

In Punta Banda (1992–93), the annual mean density was 558 (±SE 430) fish/ha (table 4). High densities occurred from October to the peak (1,816 fish/ha ±227) in December. Low densities occurred during the rest of the year, with the lowest (44 fish/ha ±19) in April. The overall standing crop was 17,355 g/ha (±3,073), and peaked in June and in November (50,387 g/ha ±18,612). Again, the lowest density was in April (852 g/ha ±348; table 4). Fish density ($p = 0.001$) and standing crop ($p = 0.003$) changed significantly over the year at 5 m.

In Bahía de San Quintín, the annual mean density at 5 m was 916 fish/ha (±SE 137). Highest densities occurred in May (2,116 fish/ha ±854) and November, and the lowest in January (117 fish/ha ±55; table 5). Density varied with time (ANOVA, $p = 0.000$). The mean standing crop for the entire survey (5 m) was 10,002 g/ha (±1,871), with the highest peak (33,622 g/ha ±11,936) in November, and the minimum in January (74 g/ha ±SE 60). The standing crop differed significantly over the year (ANOVA, $p = 0.000$).

At 10 m, the annual density was 552 fish/ha ±SE 102. Two moderate peaks occurred in September (1,313 fish/ha) and December (1,361 fish/ha ±404), with the lowest density (54 fish/ha) in January and April (table 5). Density varied significantly with time (ANOVA, $p = 0.014$). The overall standing crop was 7,608 g/ha (±1,935), and the highest (March, 35,677 g/ha ±9,602), was three times those found in June, August, and

TABLE 4
Monthly Mean Density (no./ha) and Standing Crop (g/ha) of Beam-Trawl Tow (5-m Depth) at Estero de Punta Banda, B.C., México (May 1992 to April 1993)

Month	no./ha	±SE	g/ha	±SE
May	285.6	14.02	8,130.3	2,399.63
June	322.2	37.81	29,858.1	13,409.77
July	446.6	195.88	15,269.9	5,686.33
August	314.8	132.81	15,533.5	8,610.49
September	117.2	58.58	1,724.3	507.50
October	1,032.4	680.94	13,990.7	7,320.33
November	1,801.2	896.71	50,386.6	18,612.11
December	1,815.8	226.86	34,136.3	13,057.11
January	263.6	130.43	28,562.1	6,663.00
February	124.5	49.84	2,745.0	1,024.43
March	124.5	18.43	7,068.6	1,522.06
April	43.9	18.91	852.3	348.36
1992–93	557.7	429.66	17,354.8	3,073.18

September. The lowest mean (152 g/ha ±42) occurred in April (table 5). The standing crop varied significantly with time ($p = 0.000$).

Between-Area Comparisons

Total catch was highest (1,929 fish) at 5 m in Bahía de San Quintín, intermediate at 10 m (1,125 fish) in Bahía de San Quintín, and lowest (926 fish) in Estero de Punta Banda (tables 1–3). Bay pipefish, inhabiting the submerged seagrass beds, was most abundant (1,065 ind., 26.8%) primarily from the 5-m isobath of San Quintín. Tonguefish contributed 12.9% (515 ind.) of the total catch and was an important inhabitant of the mud bottom (10 m) of San Quintín. Kelp bass was abundant in Punta Banda and scarce in San Quintín, with a contribution of almost 9%. The cheekspot goby was fifth in overall abundance, contributing 7% of the catch. These five species accounted for 63.4% (2,521 fish) of the total catch from the two areas and depths. In spite of producing the lowest total catch (926), Estero de Punta Banda had the greatest total biomass (28,443 g) and the highest monthly mean biomass (November, 1,720 g ±SE 635.5), indicating that it contained some larger fishes. Abundance and biomass from Punta Banda and San Quintín varied significantly with depth (ANOVA, $p < 0.006$).

The lower annual density found at 5 m in Estero de Punta Banda (558 fish/ha ±SE 430), compared to 5 m (916 fish/ha ±137) in San Quintín, contrasted with the larger annual standing crop (17,355 g/ha ±3,073) and the greater monthly standing crop (November, 50,387 g/ha ±18,612; tables 4, 5). The difference was attributed to high numbers of small bay pipefish in San Quintín. There were significant differences in density ($p = 0.0033$) and standing crop ($p = 0.0026$) between depths in Punta Banda (5 m) and Bahía de San Quintín (5 and 10 m).

Seasonality

In Estero de Punta Banda (1992–93), 350 fish were caught from 15 species (table 6). *Paralabrax clathratus* was the most abundant (46.3%), and *P. californicus* the most frequent (68.8%) in tows; along with *Pleuronichthys ritteri*, these topped the ICI, with the halibut ranked first. In 1994, 593 fish from 17 species were collected; the most abundant were *I. gilberti* (57.2%), *S. atricauda* (15.5%), and *P. californicus* (6.8%). The most frequently caught species was *S. atricauda* (68.8%) with the highest ICI rank, followed by the cheekspot goby and California halibut (table 6).

In San Quintín and during the seasons of 1994, a total of 822 fishes belonging to 24 species were collected at 5 m; *S. leptorhynchus* was the most abundant (38.4%), the most frequent in collections (81.3%), and first in the ICI rank (table 7). *Symphurus atricauda* and *C. aggregata* showed a high frequency of occurrence and ranked second and third in ICI.

TABLE 5
Monthly Mean Density (no./ha) and Standing Crop (g/ha) of Beam-Trawl Tow (5- and 10-m Depth) at Bahía de San Quintín, B.C., México (January to December 1994)

	5 m				10 m			
Month	no./ha	±SE	g/ha	±SE	no./ha	±SE	g/ha	±SE
January	116.6	54.69	74.0	60.15	53.5	14.95	679.7	510.41
February	279.9	116.22	484.5	230.98	510.9	209.99	636.3	369.92
March	583.0	128.79	3,452.7	2,229.07	196.1	150.73	35,677.3	9,601.83
April	1,655.8	848.95	18,762.8	8,583.83	53.5	22.49	152.1	42.44
May	2,116.4	853.49	8,027.6	2,508.55	213.9	42.29	462.8	285.07
June	658.8	228.17	5,097.4	2,261.58	493.1	83.10	13,264.6	11,498.37
July	443.1	196.97	4,191.9	3,451.68	724.8	670.09	1,317.7	1,078.95
August	985.3	188.35	17,577.0	5,566.26	796.1	231.52	12,754.9	2,629.16
September	244.9	47.13	4,577.3	4,181.45	1,313.0	632.58	13,770.8	8,632.72
October	827.9	157.16	14,434.5	3,137.42	320.8	265.78	2,044.3	1,876.67
November	1,959.0	352.78	33,621.7	11,936.11	588.2	231.09	5,732.0	582.40
December	1,125.2	325.01	9,727.7	2,875.24	1,360.5	403.45	4,808.1	1,643.41
1994	916.3	137.25	10,002.4	1,870.95	552.0	102.43	7,607.6	1,934.97

TABLE 6
Composition of Beam-Trawl Catches (5-m Depth) by the Index of Community Importance (ICI) in Estero de Punta Banda, B.C., México, by Seasons, 1992–93 and 1994

	1992–93							1994					
Species	Total	% Relative	Rank	% FO	Rank	ICI	Species	Total	% Relative	Rank	% FO	Rank	ICI
Paralichthys californicus	46	13.14	2.0	68.8	1.0	3.0	*Symphurus atricauda*	92	15.51	2.0	68.8	1.0	3.0
Pleuronichthys ritteri	38	10.86	3.0	31.3	2.5	5.5	*Ilypnus gilberti*	339	57.17	1.0	56.3	4.0	5.0
Paralabrax clathratus	162	46.29	1.0	18.8	4.5	5.5	*Paralichthys californicus*	40	6.75	3.0	62.5	2.5	5.5
Paralabrax nebulifer	19	5.43	4.0	18.8	4.5	8.5	*Hypsopsetta guttulata*	12	2.02	8.0	62.5	2.5	10.5
Hypsopsetta guttulata	11	3.14	8.0	31.3	2.5	10.5	*Pleuronichthys ritteri*	19	3.20	6.0	50.0	5.0	11.0
Hypsoblennius gentilis	18	5.14	5.0	12.5	8.0	13.0	*Paralabrax maculatofasciatus*	22	3.71	5.0	37.5	6.0	11.0
Paralabrax maculatofasciatus	14	4.00	6.0	12.5	8.0	14.0	*Xenistius californiensis*	32	5.40	4.0	12.5	10.0	14.0
Cymatogaster aggregata	13	3.71	7.0	12.5	8.0	15.0	*Paralabrax clathratus*	15	2.53	7.0	12.5	10.0	17.0
Heterostichus rostratus	6	1.71	10.5	12.5	8.0	18.5	*Syngnathus leptorhynchus*	4	0.67	10.5	18.8	7.0	17.5
Anisotremus davidsonii	5	1.43	12.0	12.5	8.0	20.0	*Paralabrax nebulifer*	5	0.84	9.0	12.5	10.0	19.0
Syngnathus leptorhynchus	8	2.29	9.0	6.3	13.0	22.0	*Anisotremus davidsonii*	4	0.67	10.5	12.5	10.0	20.5
Xenistius californiensis	6	1.71	10.5	6.3	13.0	23.5	*Hypsoblennius gentilis*	3	0.51	12.0	12.5	10.0	22.0
Symphurus atricauda	2	0.57	13.0	6.3	13.0	26.0	*Heterostichus rostratus*	2	0.34	13.0	6.3	15.0	28.0
Scorpaena guttata	1	0.29	14.5	6.3	13.0	27.5	*Hypsoblennius jenkinsi*	1	0.17	15.5	6.3	15.0	30.5
Atractoscion nobilis	1	0.29	14.5	6.3	13.0	27.5	*Urolophus halleri*	1	0.17	15.5	6.3	15.0	30.5
							Synodus lucioceps	1	0.17	15.5	6.3	15.0	30.5
							Porichthys myriaster	1	0.17	15.5	6.3	15.0	30.5
Totals	350	100.0						593	100.0				

The seasonality in Punta Banda (1992–93) showed an overall mean of 26 fish/trawl (±SD 36). Abundances increased from lowest in winter (4 fish/trawl) to highest in fall (61 fish/trawl; figure 7A). Abundances did not vary with seasons (ANOVA, $p = 0.078$). In 1994, the estero had the lowest mean (6 fish/trawl) in winter and the highest (96 fish/trawl) in spring, with an overall mean of 46 fish/trawl (±55). A similar pattern was found for 5 m in San Quintín (1994), with the lowest mean (12 fish/trawl) in winter and the highest (91 fish/trawl) in spring (figure 7A); the highest overall mean (51 fish/trawl ±52) occurred at this site and depth. The abundance at 5 m varied with seasons in 1994 in the estero (ANOVA, $p = 0.023$) and in San Quintín ($p = 0.008$). At 10 m in San Quintín, the highest abundance (33.3 fish/trawl) was in summer, and the lowest in spring. An inverse trend was found: a spring increase at 5 m and decrease at 10 m, and vice versa in summer (figure 7A). Seasonal abundances (5 m) in Punta Banda (1992–93, 1994) and San Quintín (1994) did not differ significantly (ANOVA, $p = 0.237$), nor did San Quintín abundances at 10 m ($p = 0.130$).

In Punta Banda, the lowest seasonal biomass (1992–93) was in spring (356 g/trawl) and the highest (813 g/trawl) in fall (figure 7B), with an overall of 701 g/trawl (±SE 407). In 1994, the overall mean was 555 g/trawl, ±296, with the lowest (356 g/trawl) in spring and highest (813 g/trawl) in fall. In Bahía de San Quintín (1994), the lowest biomass (5 m) occurred in winter (21 g/trawl), and highest in fall (1,442 g/trawl). At 10 m, biomass was low during all seasons (lowest, 6 g/trawl, in fall; highest, 56 g/trawl, in summer). The overall biomass for 5 m was

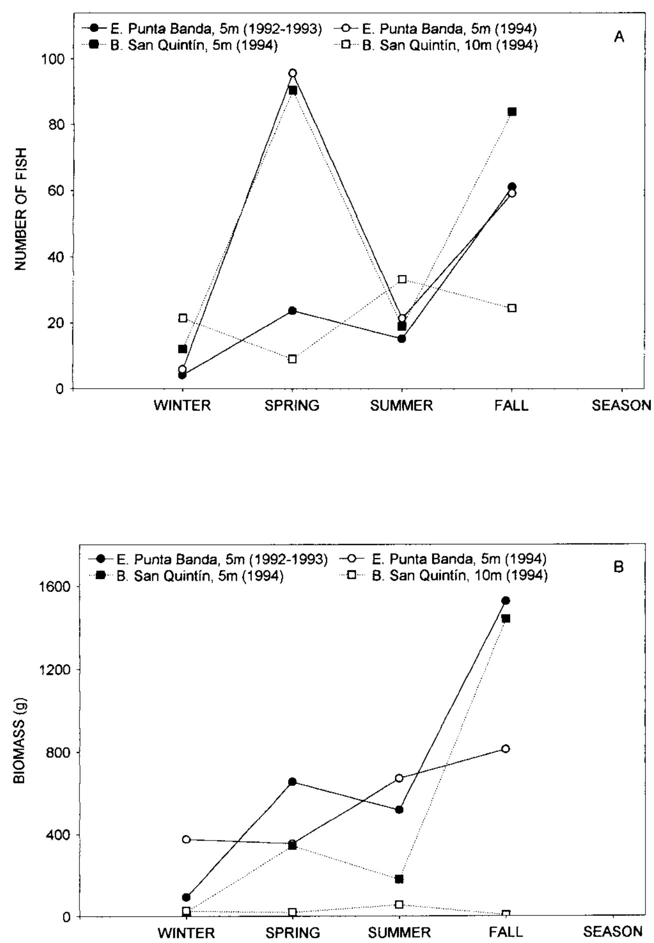

Figure 7. Seasonal mean abundance (*A*) and biomass (*B*) in Estero de Punta Banda (5 m) during 1992–93 and 1994, and in Bahía de San Quintín (5 and 10 m) in 1994.

TABLE 7
Composition of Beam-Trawl Catches (5-m and 10-m Depth) by the Index of Community Importance (ICI) in Bahía de San Quintín, B.C., México, by Seasons (February, May, July, and November), 1994

	5-m depth							10-m depth					
Species	Total	% Relative	Rank	% FO	Rank	ICI	Species	Total	% Relative	Rank	% FO	Rank	ICI
Syngnathus leptorhynchus	316	38.4	1.0	81.3	1.0	2.0	*Symphurus atricauda*	113	53.3	1.0	68.8	1.0	2.0
Symphurus atricauda	55	6.7	5.0	75.0	2.0	7.0	*Citharichthys sordidus*	25	11.8	2.0	43.8	2.0	4.0
Cymatogaster aggregata	106	12.9	3.0	50.0	5.5	8.5	*Paralichthys californicus*	11	5.2	4.5	31.3	3.0	7.5
Embiotoca jacksoni	56	6.8	4.0	50.0	5.5	9.5	*Porichthys myriaster*	15	7.1	3.0	18.8	7.5	10.5
Ilypnus gilberti	138	16.8	2.0	43.8	8.0	10.0	*Syngnathus leptorhynchus*	7	3.3	7.0	25.0	4.5	11.5
Hypsopsetta guttulata	22	2.7	8.0	56.3	3.0	11.0	*Hypsopsetta guttulata*	4	1.9	9.0	25.0	4.5	13.5
Paralichthys californicus	40	4.9	6.0	50.0	5.5	11.5	*Pleuronichthys ritteri*	10	4.7	6.0	18.8	7.5	13.5
Hypsoblennius gentilis	28	3.4	7.0	50.0	5.5	12.5	*Parophrys vetulus*	11	5.2	4.5	12.5	10.0	14.5
Hypsoblennius jenkinsi	15	1.8	9.0	25.0	9.0	18.0	*Hypsoblennius gentilis*	4	1.9	9.0	18.8	7.5	16.5
Paraclinus integripinis	10	1.2	10.0	18.8	10.5	20.5	*Ilypnus gilberti*	3	1.4	11.0	18.8	7.5	18.5
Gillichthys mirabilis	5	0.6	12.5	18.8	10.5	23.0	*Synodus lucioceps*	4	1.9	9.0	6.3	13.0	22.0
Urolophus halleri	6	0.7	11.0	12.5	13.5	24.5	*Cymatogaster aggregata*	2	0.9	12.0	6.3	13.0	25.0
Clevelandia ios	4	0.5	14.0	12.5	13.5	27.5	*Pleuronichthys verticalis*	1	0.5	14.0	6.3	13.0	27.0
Pleuronichthys verticalis	2	0.2	17.5	12.5	13.5	31.0	*Pleuronichthys decurrens*	1	0.5	14.0	6.3	13.0	27.0
Pleuronichthys ritteri	2	0.2	17.5	12.5	13.5	31.0	*Scorpaena guttata*	1	0.5	14.0	6.3	13.0	27.0
Heterostichus rostratus	5	0.6	12.5	6.3	20.0	32.5							
Porichthys myriaster	3	0.4	15.5	6.3	20.0	35.5							
Paralabrax clathratus	3	0.4	15.5	6.3	20.0	35.5							
Gobionellus longicaudus	1	0.1	21.5	6.3	20.0	41.5							
Synodus lucioceps	1	0.1	21.5	6.3	20.0	41.5							
Paralabrax nebulifer	1	0.1	21.5	6.3	20.0	41.5							
Scorpaena guttata	1	0.1	21.5	6.3	20.0	41.5							
Citharichthys sordidus	1	0.1	21.5	6.3	20.0	41.5							
Paraclinus walkeri	1	0.1	21.5	6.3	20.0	41.5							
Totals	822	100.0					Totals	212	100.0				

TABLE 8
Seasonal Mean of Density (fish/ha) and Standing Crop (g/ha) in Estero de Punta Banda (1992–93 and 1994), and Bahía de San Quintín, B.C., México (1994)

	Density (fish/ha)				Standing crop (g/ha)			
	Punta Banda		San Quintín		Punta Banda		San Quintín	
Season	1992–93 (5 m)	1994 (5 m)	1994 (5 m)	1994 (10 m)	1992–93 (5 m)	1994 (5 m)	1994 (5 m)	1994 (10 m)
Winter	124.6	176.0	279.7	21.5	93.7	376.1	20.8	26.8
Spring	696.4	2,808.0	2,109.6	9.0	657.4	355.9	344.2	19.5
Summer	447.2	630.5	442.9	33.3	521.4	673.6	179.8	55.5
Fall	1,796.2	1,737.5	1,958.0	24.5	1,529.4	813.1	1,441.7	5.8
Overall	766.1	1,338.0	1,197.6	22.1	700.5	554.6	496.6	26.9
±SE	266.2	402.1	303.1	7.9	203.5	147.8	124.2	12.1

497 g/trawl (±377), and for 10 m, 27 g/trawl (±24). The mean biomass varied with the seasons at 5 m in San Quintín only (ANOVA, $p = 0.001$).

The highest overall density (1,338 fish/ha ±SE 402) and seasonal density (2,808 fish/ha, spring) were observed in Punta Banda in 1994 (table 8). In San Quintín, low densities were found at 10 m during all seasons of 1994, including the lowest for all periods, depths, and places (9 fish/ha, spring). At 5 m, low densities coincided with winter and summer, and the highs with spring and fall (table 8).

In Estero de Punta Banda, there was no difference in density between seasons in 1992–93 (ANOVA, $p = 0.081$), but density differed significantly with seasons during 1994 ($p = 0.023$). In San Quintín (1994), density also differed with season at 5 m ($p = 0.009$), but not at 10 m ($p = 0.445$).

As density, the overall mean standing crop was highest at Punta Banda in 1992–93 (701 g/ha ±SE 204), and lowest in 10 m of San Quintín during 1994 (27 g/ha ±12; table 8). The highest seasonal standing crop (1,529 g/ha) was found at 5 m in Punta Banda during fall of 1992–93, and the lowest (6 g/ha) at 10 m during fall in San Quintín (table 8). The only place where differences in mean standing crop were found between seasons (ANOVA, $p = 0.000$) was at 5 m of Bahía de San Quintín (1994).

Seasonal density did not vary significantly between sites, depths, and years (ANOVA, $p = 0.095$), but the standing crop varied significantly ($p = 0.000$).

DISCUSSION

Small-meshed beam trawls have been used in some studies of demersal assemblages in California nearshore coast and bays (Allen 1985; Kramer and Hunter 1987; Allen and Herbinson 1990, 1991; Kramer 1990). Until this study, such studies had not been made off Baja California. Between 1992 and 1994, we sampled fishes living on or over mud or mud-sandy substrata in Estero de Punta Banda and Bahía de San Quintín. This survey indicates that these fish assemblages are quite dynamic from year to year, with different species dominant in each area and depth, and with differences in total catches, abundances by trawl, density (fish/ha), and standing crop. However, seasonal catches in 1994 in both areas and depths differed only in the standing crop.

The study shows that both lagoons serve as nursery grounds for a number of species. Three species (California halibut, kelp bass, and barred sand bass) are of major commercial and recreational importance in both Mexico and the United States. In Estero de Punta Banda, small California halibut were the dominant species in the trawls. A previous study (Rosales-Casián and Hammann 1993) showed that while few large halibut are found inside Estero de Punta Banda, substantial numbers of larger individuals are found just outside, in Bahía de Todos Santos. It appears that metamorphosing halibut larvae settle in Estero de Punta Banda, then migrate to Bahía de Todos Santos as they grow (Castro-Longoria and Grijalva-Chon 1988; Hammann and Rosales-Casián 1990; Rosales-Casián and Hammann 1993).

In Estero de Punta Banda, newly settled kelp bass were abundant in seagrass beds from August to December. Their presence was probably due to good annual reproductive success in Bahía de Todos Santos, because they had not been previously reported from the Estero (Estrada-Ramírez 1985; Navarro-Mendoza 1985; Beltrán-Félix et al. 1986; Castro-Longoria and Grijalva-Chon 1988). This bay–lagoon–bay movement of larvae and juvenile kelp bass was described by Rosales-Casián (1995). Juvenile barred sand bass were also common in this lagoon, again in association with the abundant seagrass beds. In the same habitat, we caught fair numbers of another economically important serranid, the spotted sand bass (*Paralabrax maculatofasciatus*); the catch for this species (in contrast to that for the other two species) included adults as well as immature fish. The high density of seagrass in Estero de Punta Banda indicates the relatively pristine environment (Ibarra-Obando and Poumian-Tapia 1991) and appears to be a major factor in the abundance of juveniles of a number of species.

Few beam-trawl studies of California lagoons have been made. However, Allen and Herbinson (1991), working in bay habitats of southern California, found that topsmelt (*Atherinops affinis*), cheekspot goby, bay pipefish, staghorn sculpin (*Leptocottus armatus*), and arrow goby (*Clevelandia ios*) were all important. Kramer (1991) studied flatfishes in shallow waters of San Diego, California, and found more California halibut and diamond turbot in bays than in coastal habitats. The most abundant species from that study was the speckled sanddab (*Citharichthys stigmaeus*; 78.6% of total), caught mostly on the open coast off San Diego. California halibut ranked second in abundance. The tonguefish was reported as poorly estimated because it is nocturnally active (Kramer 1991), and its diel pattern of activity affects availability to trawling (DeMartini and Allen 1984). However, in our 10-m-depth samples from Bahía de San Quintín, tonguefish was the dominant species in abundance, frequency of occurrence, and ICI ranking. The turbid water of the tidal current probably accounts for this change.

Some bias can be expected when sampling with a beam trawl, mainly because it has a small open mouth, but the estuarine environments of Punta Banda and San Quintín offer similar conditions (turbidity, seagrasses, tidal current), and the absence of some fish species in the samples can be due to interannual variation, rather than to the beam trawl. This gear does capture small halibut (*P. californicus*) fairly efficiently (Kramer 1990), and also primarily small fishes.

In Bahía de San Quintín, seagrasses at 5 m led to high abundances of bay pipefish. These plants contain large quantities of the small invertebrates eaten by pipefish and many other species. An analysis of the diets of juvenile kelp bass, barred sand bass, and spotted sand bass in Estero de Punta Banda showed a notable amount (up to 12.9% by weight), and frequency of occurrence (up to 47%) of *Zostera marina* fragments (Mendoza-Carranza 1995). This probably results from the fishes' biting leaves as they eat their prey.

The major fish species in Estero de Punta Banda and Bahía de San Quintín differ. California halibut, kelp bass, barred sand bass, hornyhead turbot, and bay blenny dominated the 5-m depth trawls of Punta Banda. At the same depth in San Quintín, pipefish, California halibut, tonguefish, cheekspot goby, and shiner perch dominated, as they did at 10 m, except that diamond turbot replaced shiner perch.

Temperature and tidal current can significantly influence the abundance and distribution of fishes. During this study, there was considerable upwelling in April–June off San Quintín. As first reported by Dawson (1951), this cold water is positioned very near the lagoon's mouth. When temperatures fell during May, fish abundances at 5 m increased. When temperatures increased from June to September, abundances decreased. At 10-m depth, the abundance patterns were reversed. Our data (5 m) showed a more than 8°C difference between May and August. Our unpublished data from outside the bay reveal within-month differences of more than 12°C. These low temperatures can produce an unfavorable environment for some species, and fishes probably respond by moving from deeper and colder water into the warmer shallows. The barred sandbass (*Paralabrax maculatofasciatus*) inhabits a broad range of temperature regimes and was abundant in Estero de Punta Banda. Its absence from Bahía de San Quintín may be due to its inability to survive the seasonally low temperatures in this lagoon.

Other differences in the fish species from Punta Banda and San Quintín can be explained by El Niño. In 1992–93, a strong event influenced our samplings in the estero; 1994, however, is considered a cold year, and some species (e.g., cheekspot gobies, *Ilypnus gilberti*) that were absent in 1992–93 became most abundant. This species is a major prey for juvenile California halibut in coastal and bay habitats of San Diego (Drawbridge 1990) and in Estero de Punta Banda (Sandoval-Muy 1995).

Estero de Punta Banda, despite being a smaller and less productive lagoon (Alvarez-Borrego et al. 1977; Millán-Nuñez and Alvarez-Borrego 1978) had a greater annual total biomass and a higher standing crop than did Bahía de San Quintín. This implies that Estero de Punta Banda is not only a nursery ground, but also a feeding place for larger fishes. This may be because Estero de Punta Banda is connected with Bahía de Todos Santos, another fish-rich environment (Hammann and Rosales-Casián 1990), while San Quintín connects to the relatively depauperate open coast. This trend has also been noted on the coast of southern California for flatfishes and for nearshore assemblages in general (Kramer 1990; Allen and Herbinson 1990, 1991).

The density at 5-m depth in San Quintín was nearly twice that found at 10 m in the same place, and in Estero de Punta Banda. In contrast, the standing crop of fish in Estero de Punta Banda was greater than that collected at either depth in Bahía de San Quintín. This difference was due to the presence of some larger fishes (California halibut, spotted sand bass, barred sand bass) in the estero, and great numbers of bay pipefish in the bay.

The clinid *Paraclinus walkeri* is an interesting species, apparently endemic to Bahía de San Quintín (Hubbs 1952; Rosenblatt and Parr 1969; Rosales-Casián 1996). We caught a few individuals of this species but did not sample around the pier pilings of the Old Mill Hotel, where previous collections had shown them to be quite abundant (Richard Rosenblatt, SIO, pers. comm.).

Some change in the fish species assemblage at Punta Banda seems to have occurred over time. In a 1982–83 study, Beltrán-Félix et al. (1986) found spotfin croaker (*Roncador stearnsii*) and diamond turbot to be very abundant. In our study, diamond turbot were less important, and spotfin croakers were absent. It is unclear what has led to these changes, though decade-long oceanographic changes, noted in several studies, may be responsible (Roemmich and McGowan 1995; MacCall 1996).

Protected areas have been identified as nursery grounds along the southern California coast (Allen and Herbinson 1990, 1991; Kramer 1991). These habitats, however, are not only relatively rare along the California coast, but are also severely impacted by human activities, and have been reduced by up to 90% of their original size (Kramer 1990). On the other hand, because the bays and coastal lagoons along Pacific Baja California are relatively pristine, they have a great potential for reproduction, feeding, and refuge for fish species of ecological and economic importance. They may be major nursery sites and an important source of fishes for southern California. Little information exists about the coastal ichthyofauna of Baja California, but many species are distributed from Baja California to the Southern California Bight. It seems apparent that the ecological role of both Estero de Punta Banda and Bahía de San Quintín should be maintained through careful preservation.

CONCLUSIONS

This study in Estero de Punta Banda and Bahía de San Quintín showed that these soft-bottom habitats differ between years in dominant species, total and per-trawl catch, density, and standing crop. By areas, the seasonality of 1994 showed differences in standing crop only.

In Punta Banda three economically important species were dominant by ICI: *P. californicus*, *P. clathratus*, and *P. nebulifer*. In San Quintín the dominant species were *S. leptorhynchus*, *P. californicus*, and *S. atricauda* at 5 m; at 10 m this order changed to *S. atricauda*, *S. leptorhynchus*, and *P. californicus*.

Total catch of fishes was highest in Bahía de San Quintín (5 m), intermediate there at 10 m, and lowest in Estero de Punta Banda.

Bahía de San Quintín presented the highest mean abundance during May at 5 m, and the lowest mean at 10 m. The May low temperatures, caused by an upwelling close to the bay mouth, probably influenced this pattern. The only notable increase in Punta Banda was during October and November, mainly because of the presence of juvenile *P. clathratus*.

Overall, the density was lowest in Punta Banda and at 10-m depth in San Quintín; it was highest at 5 m in San Quintín. In contrast, the highest standing crop was found in Punta Banda, both annual mean and monthly mean (during November).

Estero de Punta Banda and Bahía de San Quintín both need protection and regulation.

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