

Coastal fish community structure at a proposed site for a new maritime port: Punta Colonet, Baja California, México (Eastern Pacific)

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ABSTRACT

Punta Colonet, Baja California, México, is 240 kilometres south of California (USA), an upwelling and fishing site considered for a seaport construction. Coastal fish structure was determined through monitoring and available information, resulting in 7,010 individuals (106 species). Black perch (*Embiotoca jacksoni*) was most abundant by diving, and with hook-and-line, the Starry rockfish (*Sebastes constellatus*). Otter trawls and gillnets caught abundant Dwarf perch (*Micrometrus minimus*) and *E. jacksoni*. Artisanal fishing caught the Ocean whitefish (*Caulolatilus princeps*) abundantly in winter, summer, fall, and Vermilion rockfish (*Sebastes miniatus*) in spring; the overall mean was 67.6 ± 17.3 SE fish/boat, highest in summer (81 ± 4.6 fish/boat), and lowest during winter (49.5 ± 4.2 fish/boat). Sportfishers caught Yellowtail (*Seriola lalandi*, 32.2%), *S. miniatus*, and Lingcod (*Ophiodon elongatus*). Ensenada Seafood Market sold California sheephead (*Bodianus pulcher*, formerly *Semicossyphus pulcher* 66.4%), *C. princeps*, and *Paralabrax nebulifer*. Colonet fish in the preserved collection recorded higher numbers of Northern anchovy (*Engraulis mordax*, $n = 286$) and White croaker (*Genyonemus lineatus*). The most abundant in all series was *B. pulcher* (16%) and ordered by Index of Community Importance: *E. jacksoni* (occurrence 41.1%), *C. princeps*, *S. miniatus*, *B. pulcher*, and *M. minimus*. With different methods, a greater number of fish and species were collected, and this shows the guidelines to follow after the port's construction. Colonet highlights fish habitat, also for commercial and sportfishing, and the information will help decision-makers before port construction.

Keywords: Baseline, Fish species, Abundance, Seasonality, Occurrence, Importance, Bahía Colonet



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Introduction

Many fish species from the temperate eastern Pacific have their spawning grounds off Baja California (Mexico). It is a source of eggs, larvae, and young-of-the-year (YOY) for the Southern California Bight, USA (Moser et al., 1993), by northward flow during the marine current relaxation (Shanks & Eckert, 2005). Fishes are distributed between the northern cold temperate province (Oregonian), from British Columbia (Canada) to near Point Conception in Southern California (USA), and the warm temperate San Diegan province extending south to Bahía Magdalena, Baja California Sur, Mexico (Horn et al., 2006).

In California, there is information about coastal fishes in habitats such as bays, estuaries, rocky intertidal, rocky reefs, kelp beds (*Macrocystis pyrifera*), surf to pelagic, and commercial and recreational fisheries (Allen et al., 2006). In Baja California, at 106 km south of the California border, there is information at Bahía Todos Santos and Estero Punta Banda (Hammann & Rosales-Casián, 1990; Rosales-Casián, 1997a). Also, 306 km south at Bahía and Coast of San Quintín (Rosales-Casián, 1996; 1997b; 2004a), and 366 km at Punta Baja (Rosales-Casián, 2011). Punta Banda and San Quintín, as coastal lagoons, are vital for California halibut, *Paralichthys californicus* (Kramer, 1990; Rosales-Casián, 2004b), and upwelling benefits the food web (Álvarez-Borrego, 2004; Rosales-Casián, 2004a).

An important site 132 km south of Bahía Todos Santos is Punta Colonet, with intense upwelling and a surface plume of 12°C flowing southward (Barton & Argote, 1980). Punta Colonet is 68 km north of San Quintín, a conservation priority (Morgan et al., 2005), with abundant fish in volcanic reefs and around Isla San Martín (Albino-Martínez & Rosales-Casián, 2024). Rocky reefs from Punta Colonet are key for reproduction and feeding of resources, as in the Southern California Bight (Pondella et al., 2005). Colonet fish information is null; a study in fishing fields along the temperate Baja California includes this site but does not describe their catches (Rosales-Casián & González-Camacho, 2003). However, considering the habitats of Colonet, it is expected to identify species associated with the *M. pyrifera* beds, demersal fish such as rockfishes and pelagic fish species during warm seasons.

Punta Colonet is pristine, and the first port proposal was suspended (DOF, 2008). In 2022-2023, it was reactivated as an option for the congested ports of Ensenada, Baja California, and California (SEMARNAT, 2022). Fish are an essential component of Punta Colonet, and integrating different methods for catching fish ensures a greater number of species, and

in turn shows the methods for monitoring after the possible port's construction. This study identifies fish species in different habitats, from 5 m to 150 m depth, determines their abundances, seasonality, and order of importance, and provides a baseline for evaluating changes due to the potential construction of the new port.

Materials and Methods

Study Area

Punta Colonet, Colonet or Cabo Colnett (Lat. 30°57' 22.5" N, Long. 116°19'21" W), is 240 km south of California, USA, 132 km south of Ensenada, Mexico (Figure 1), and 6 km from the highway. To the south is Punta San Telmo and northwest Punta Colonet, showing a cliff 4.5 km long and 250 m high protecting the bay that has 2,680 hectares (DOF, 2008; Madrigal-Sánchez, 2009; Castillo-Chávez, 2014).

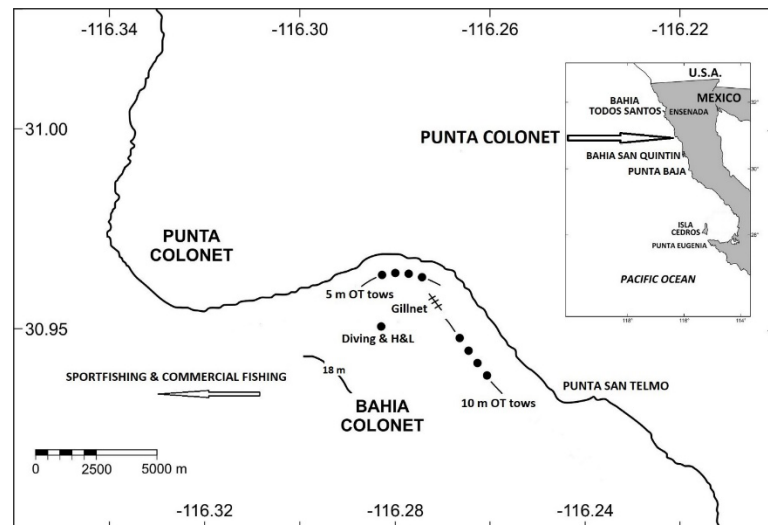


Figure 1. Punta Colonet on the Pacific coast of Baja California (Mexico) and the collection sites. The continuous black dots are repetitions of otter-trawl tows at 5 and 10 m depth. The striped line represents the gillnet collections site at 10 m depth; the separated black dot is the reef (13 m depth) for diving and hook-and-line. The 18 m isobath is shown on the map. The arrow indicates the area for commercial and sport fishing.

Punta Colonet Fish Species

Fish species identification: All fish species identified in monitoring were using the Pacific Northwest keys for the temperate Baja California, Mexico, and California, USA

(Miller & Lea, 1972; Love et al., 2002), and for tropical or subtropical fish species, the key of Humann & DeLoach (2004). In the case of the California sheephead, its scientific name was changed to *Bodianus pulcher* instead of *Semicossyphus pulcher*, according to Santini & Alfaro (2016) and Love & Passarelli (2020).

Diving observations and fishing: In October 1998, I boarded the M/V Horizon (San Diego, California, USA) and visited Colonet on October 29 and November 11. Fish identification and abundances were conducted by three scuba transects (Stephens et al., 2006), spear catch, and fishing with hook-and-line (H&L) at a shallow reef of the bay with 13m depth (latitude 30.91180° N, longitude -116.51791° W).

Otter-trawl and gillnet fish samplings: Before the first Colonet port project (DOF, 2008), sampling was conducted in summer (August 20-21), fall (November 9-10) of 2007, and winter (February 8-9) of 2008. Fish were collected using four repetitions of otter-trawl (7.5m mouth width, 12m length, body 19mm mesh and 5mm at end), both at 5 and 10m depth, for five minutes, 2 knots, and parallel to the coast with a boat (Figure 1); sea surface temperature (SST °C) was recorded at each tow. Also, four gillnet operations (30m length x 2.5m height, and 2.5, 5, and 7.6cm mesh) at 10m depth (Figure 1) and by four hours of soak time were used (Rosales-Casián, 2004a; Rosales-Casián, 2011). Punta Colonet has no restrictions on fish collection since it is not a marine reserve area.

Commercial and sportfishing: Fish species were identified and fish counted in four commercial boats per season, in winter 2008 (February 22), spring (May 23), summer (August 28) and fall (November 28). Sportfishing catches were compiled from Colonet travel reports (2006-2023) on the web (<https://www>) by San Diego boats (241 km to south) and Long Beach, California (411 km to south), and from Ensenada, Ejido Erendira, Colonet and San Quintín, Baja California (bdoutdoors.com; bloodydecks.com; mexfish.com; pacificqueen.net; seaforthlanding.com; sergiosfishing.com; socialsalty.com; sport-fishing.com; wonews.com). The captains or reporters do not provide coordinates from sport or commercial fishing spots due to their secrecy; they only mention some depths and some distances from the coast within the bay or around Punta Colonet.

Colonet fish species sold at seafood market: The Ensenada Seafood Market was monthly monitored (2013-2023), to identify the fish species for sale, determine their abundance and order of importance. This market has 42 stalls, some selling seafood (shrimp, oysters, clams, shellfish, etc.), others selling smoked fish, and others selling whole fish. Up to 20 stalls selling whole fish were monitored per monthly visit,

whose catch came from the Pacific coast of Baja California and the Gulf of California. The catches from Punta Colonet were identified by surveys with the vendor of each stall, who reported the origin of the fish caught.

Preserved fish collection: The Colonet fish species recorded in the Vertebrate Collection of Scripps Institution of Oceanography (SIO), University of California, San Diego (La Jolla, California, USA) were included. Fish collected far from the coast or too deep were not considered, and among the multiple jars with the same species, only the one with the highest number of individuals was included, as in the case of the Northern anchovy, *Engraulis mordax* (<https://scripps.ucsd.edu/marine-vertebrate-collection>).

Fish species importance: To rank the species, the Index of Community Importance (ICI) was selected because it includes only percentages of abundance and frequency of occurrence (Stephens & Zerba, 1981) and covers all data series in the present study. In the first column, the species and relative abundance are in the second column, in the third column, an assigned score (R1); next, frequency of occurrence with scores in the fifth column (R2); the sum of both scores was the ICI, and the lowest values were the most important species. To calculate the frequency of occurrence, the species presence in collections was divided by the total events and expressed as a percentage (Albino-Martínez & Rosales-Casián, 2024). SIO collection species were included as one event in the overall ICI.

Statistical analysis: Fish abundances caught seasonally with nets and from commercial fishing were normally analysed with Levene's test (Zar, 1984). Normality was accepted in abundance with 5m depth otter-trawl tows ($F(2, 9) = 2.925, p = 0.104$); therefore, to determine differences in catch means with respect to time, a parametric ANOVA analysis was used (Zar, 1984). Normality was not accepted for 10 m otter-trawl ($F(2, 9) = 14.847, p = 0.001$) and gill net abundances ($F(2, 9) = 7.672, p = 0.011$), and a Kruskal-Wallis analysis was used to determine catch mean differences with respect to time. Normality of commercial fish catch was accepted (Levene, $F(3, 12) = 1.299, p = 0.319$), and an ANOVA was used to determine differences between the catch per boat means with respect to time. In all statistical analyses and graphics, the Statistica 7.1 program from StatSoft Inc. was used.

Results and Discussion

After Mexican independence, a Swedish colony was established in 1888 and ended the development project ten years later (Heath, 2001-2004). Now, the coast remains pristine with a town 7-8 km away and little development. Punta Colonet forms a semi-protected bay, and with the wind creates

upwelling (Barton & Argote, 1980), resulting in high productivity, abundant fisheries, and is why it is considered a marine priority for conservation (Morgan et al., 2005). Now, Colonet is under a new project as an option to the full ports of Ensenada, Baja California, Mexico and California, USA (DOF, 2008; SEMARNAT, 2022). There are opposing views between conservationists and developers. However, the main idea is to activate its economy, proposing a balance between infrastructure and sustainability with alternative governance for the new port, and maintaining a natural area for conservation (Santes-Álvarez & Riemann-González, 2013).

The SST mean at Punta Colonet was 15.8°C in October-November 1998. Summer 2007 was warmer (20.1°C \pm 0.13 SE) at 5m, and 19.7°C (\pm 0.11) at 10m; in fall, temperatures were 15.2°C and 14.9°C, respectively, with a colder winter 2008 (5m: 13.4°C; 10 m: 13.1°C). Similar SSTs to Punta Baja, a strong upwelling site 120 km south of Colonet, but in spring, it drops to 10°C (Rosales-Casián, 2011). Colonet SSTs are seasonal, with spring upwelling dropping to 12°C (Barton & Argote, 1980).

During the cruise on the M/V Horizon (1998), diving and fishing with H&L accounted for 627 fish (39 species), and diving contributed 69.5% of the total (Table 1). Most abundant species by diving were the Black perch, *Embiotoca jacksoni* (17.7%), the Opaleye, *Girella nigricans* (16.6%), and the Jacksmelt silverside, *Atherinopsis californiensis* (9.6%). The Black perch distribution ranges from Central California, USA, to Baja California, Mexico (Miller & Lea, 1972), where it inhabits kelp and rocks, searching for amphipods as food. Also, their numbers depend on predators such as the Kelp bass (*Paralabrax clathratus*), whose abundance changes with conditions and fishing (Johnson et al., 2019). Those species were registered north in Estero Punta Banda, and south at San Quintín (Rosales-Casián, 1996; 1997). With H&L, the most abundant species were the Starry rockfish (*Sebastes constellatus*, 5.1%), the Vermilion rockfish (*S. miniatus*, 4.1%), and the Greenblotched rockfish (*Sebastes rosemblatti*, 3.8%) (Table 1); rockfishes show 110 species in all oceans, of which 85 are in the temperate-cold zone of the Northeastern Pacific, and 53 species in Mexican waters (Love et al., 2002; Butler et al., 2012). By diving and H&L, 19 fish species accounted for 90.2% of the abundance, and by the ICI, the most important species were *E. jacksoni*, *O. californica*, *H. argenteum*, *G. nigricans*, and the Brown rockfish, *Sebastes auriculatus* (Table 1). Algae and rocky areas provide shelter and food for perches and rockfish species (Love et al., 2002; Miller et al., 2018).

In 2007-2008, 24 otter-trawl and 12 gillnet operations were made, resulting in 1,938 fish from 28 species. Summer 2007

showed the highest number of 832 fish but fewer species (19 species), and winter 2008 had the lowest individuals (383) but a higher number of 24 species, while fall 2007 had intermediate abundances and species (Table 2). The most abundant species were the Dwarf perch (*Micrometrus minimus*, 27.6%), *E. jacksoni* (25%), and the Walleye surfperch, *Hyperprosopon argenteum*, 16.8% (Table 2) several 12 fish species accounting for 91.5% of the abundance.

In summer 2007, abundant species were *M. minimus* (31.3%), *H. argenteum* (30.9%), *E. jacksoni* (13.8%) and the Calico surfperch, *Amphistichus koelzi* (10.2%), which contributed with 86.2% of the total. Most abundant in fall 2007 were *E. jacksoni* (33.1%), *M. minimus* (31.8%), the Shiner perch, *Cymatogaster aggregata* (8.4%), and the Californian needlefish, *Strongylura exilis* (4.6%), which accumulated 77.9% of the total (Table 2); in winter 2008, the most abundant species were *E. jacksoni* (34.2%), *H. argenteum* (13.1%), *M. minimus* (11.5%) and *C. aggregata* (5.0%), which accumulated 63.8% of the total. The most important fish species (ICI) were *E. jacksoni*, *M. minimus*, *H. argenteum*, the Pile perch (*Phanerodon vacca*), and the Giant kelpfish, *Heterostichus rostratus* (Table 2). Above species belong to Embiotocidae except *S. exilis*, a tropical species collected in Southern California Bight, USA, in the 1982-1983 El Niño event (Allen et al., 2006), and in Bahía Todos Santos, Estero Punta Banda, Bahía San Quintín, and Punta Baja, Baja California, Mexico (Hammann & Rosales-Casián, 1990; Rosales-Casián, 2004a; Rosales-Casián, 2011). *H. rostratus* lives in algae and rocky reefs, and shows red, brown and green colours, depending on the surrounding plants (Stepien, 1986).

Highest catches were in 5m otter-trawl tows (801 fish, 47.7% of total), versus 10m and gillnet catches (Table 3). The highest catch in a tow (n = 225 fish), the highest seasonal sum of fish (n = 382), and the highest mean catch (95.5 \pm 45.3 SE fish/tow) occurred with 5m otter-trawl tows in summer 2007; conversely, they were lower at 5 m trawls in winter 2008 (Table 3). Mean catches by 5m trawl tow did not differ (ANOVA, F = 1.571, df = 9, p = 0.259), but, mean catches at 10m trawls (K-W, H(2, 12) = 8.221, p = 0.016) as well as gillnet catches (K-W, H(2, 12) = 9.846, p = 0.007) were different. Compared to other sites, it is difficult due to the soft bottoms, and the Colonet site showed kelp and rocky bottom, which influenced the ichthyofauna and caused net damage between tows. However, in Colonet, the overall mean catch with a 5m otter-trawl was 66.8 fish per trawl (\pm 18.8 SE), while at the San Quintín coast, the mean catch at 5m was 11.2 (\pm 2) fish per trawl (Rosales-Casián, 1997), highlighting the algal habitat in the harbour with high fish numbers.

Artisanal commercial fishing in 2008 showed 1,082 fish individuals belonging to 22 species (Table 4). Annually, the most abundant species were *C. princeps* (42.2%) of the total, followed by *S. miniatus* (20.6%) and *P. nebulifer* (13.5%); the order of the species by the frequency of occurrence was *C. princeps* (93.8%), *S. miniatus* (97.5%) and *S. auriculatus*, 75% (Table 4). The most abundant fish species in winter were *C. princeps* (44.4%), *S. miniatus* (24.2%) and *S. paucispinis* (6.6%). In spring, the most abundant species were *S. miniatus* (28.9%), followed by *C. princeps* (26.5 %), and the Barred sand bass (*Paralabrax nebulifer*, 20.1%). In summer, *C. princeps* (46.6%), *P. nebulifer* (25.3%) and *S. miniatus* (10.8%), and during the fall season, *C. princeps* (53.1%), *S. miniatus* (20.6%) and *P. californicus*, 14.5% (Table 4). The order of the most important fish species (ICI) in the artisanal fishing was *C. princeps*, *S. miniatus*, *S. auriculatus*, *P. nebulifer* and three tied, *S. constellatus*, *B. pulcher*, and *P. californicus* (Table 4). Commercial catch showed an overall mean of 67.6 (± 17.3 SE) fish per boat, with the highest in summer (81

± 4.6) fish per boat and the lowest (49.5 ± 4.2 fish per boat) in winter (Figure 2). Mean commercial catches were different over time (ANOVA, $F = 3.996$, $df = 12$, $p = 0.034$). There is no information on Colonet commercial fishing, a study from eight fishing grounds in the temperate Pacific of Baja California, which included Colonet, but did not describe its catches (Rosales-Casián & González-Camacho, 2003). However, San Quintín showed an annual mean catch of $51.8 (\pm 5.2$ SE) fish per boat, and rockfish (*Sebastes* sp.) was the most important (ICI), followed by *P. clathratus* and *C. princeps*; as an inference because it was not part of the present study, differences in the species order and catch per boat maybe due to the environmental conditions, San Quintin (1994-1995) was under Neutral-El Niño conditions (Rosales-Casián & González-Camacho, 2003), and in Colonet (2008) was under La Niña-Neutral conditions (NOAA, 2025); this last condition benefits seasonal upwelling in the California Current (Wang et al., 2022).

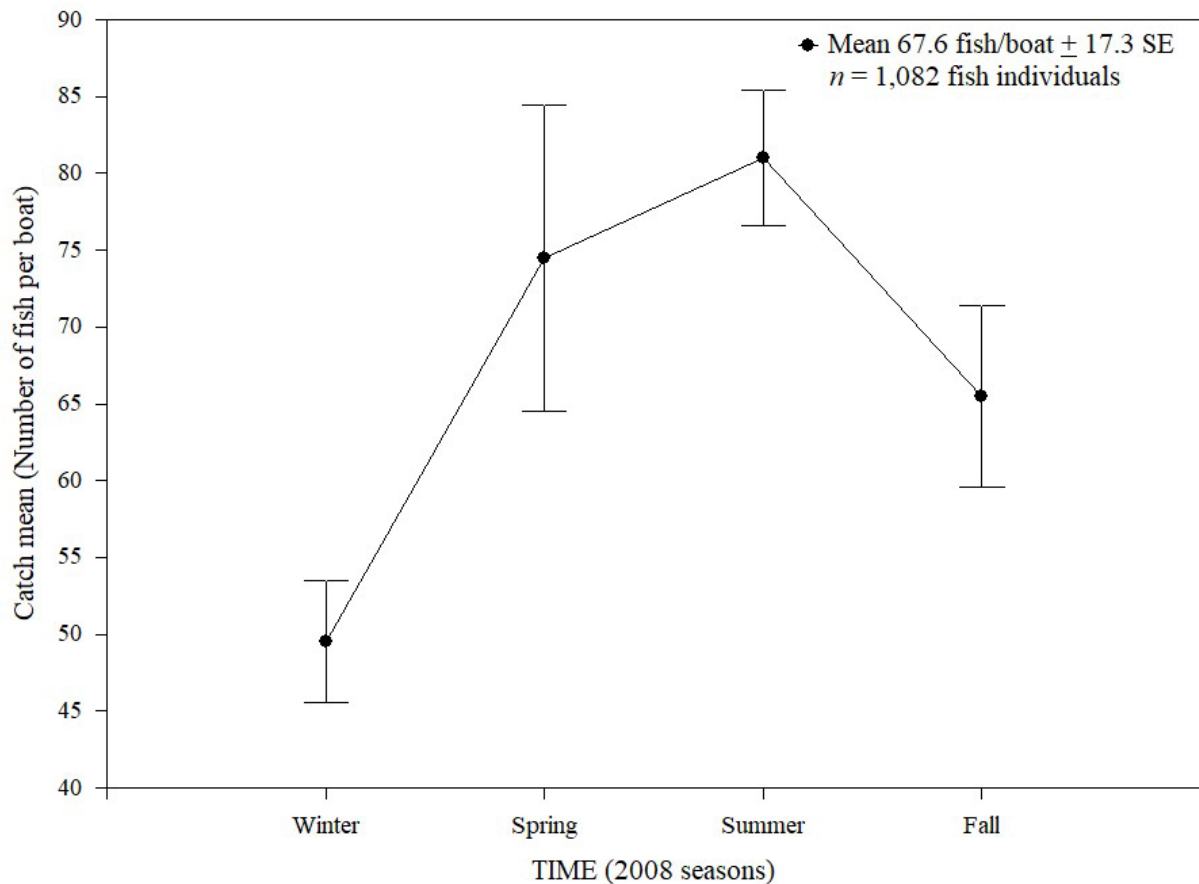


Figure 2. Mean commercial catch of coastal fish (fish per boat \pm SE, standard error) at Punta Colonet, Baja California, Mexico during the 2008 seasons

Table 1. Fish species and abundances by hook-and-line (H&L), spear, and diving in Punta Colonet, Baja California, Mexico (October and November 1998). Rel%: relative abundance %; Cum%: cumulative abundance %

Species	H&L	Spear	Dive1	Dive2	Sum	Rel%	Cum%	R1	FO %	R2	ICI
<i>Embiotoca jacksoni</i>		2	92	14	108	17.2	17.2	1	75	3	4
<i>Oxyjulis californica</i>		2	16	10	28	4.5	53.0	5	75	3	8
<i>Hyperprosopon argenteum</i>		3	3	17	23	3.7	68.3	8.5	75	3	11.5
<i>Girella nigricans</i>		1	103		104	16.6	33.8	2	50	10	12
<i>Sebastes auriculatus</i>		8	6	1	15	2.4	78.9	12.5	75	3	15.5
<i>Paralabrax nebulifer</i>		2	7	3	12	1.9	87.1	16.5	75	3	19.5
<i>Phanerodon furcatus</i>		6	13		19	3.0	71.3	10	50	10	20
<i>Phanerodon vacca</i>			15	3	18	2.9	74.2	11	50	10	21
<i>Paralabrax clathratus</i>			3	8	11	1.8	88.8	18	50	10	28
<i>Bodianus pulcher</i>		1	7		8	1.3	90.1	20	50	10	30
<i>Atherinopsis californiensis</i>			60		60	9.6	43.4	3	25	27	30
<i>Sebastes constellatus</i>	32				32	5.1	48.5	4	25	27	31
<i>Sebastes miniatus</i>	26				26	4.1	57.1	6	25	27	33
<i>Sebastes rosenblatti</i>	24				24	3.8	60.9	7	25	27	34
<i>Embiotoca lateralis</i>			4	1	5	0.8	96.2	25	50	10	35
<i>Micrometrus minimus</i>			4	1	5	0.8	97.0	25	50	10	35
<i>Sebastes paucispinis</i>	23				23	3.7	64.6	8.5	25	27	35.5
<i>Oxylebius pictus</i>		1	1		2	0.3	98.1	29.5	50	10	39.5
<i>Halichoeres semicinctus</i>			1	1	2	0.3	98.7	29.5	50	10	39.5
<i>Caulolatilus princeps</i>	15				15	2.4	76.6	12.5	25	27	39.5
<i>Sebastes chlorostictus</i>	14				14	2.2	81.2	14	25	27	41
<i>Sebastes rosaceus</i>	13				13	2.1	83.3	15	25	27	42
<i>Sebastes lentiginosus</i>	12				12	1.9	85.2	16.5	25	27	43.5
<i>Sebastes hopkinsi</i>	8				8	1.3	91.4	20	25	27	47
<i>Sphyræna argentea</i>	8				8	1.3	92.7	20	25	27	47
<i>Scomber japonicus</i>	6				6	1.0	93.6	22.5	25	27	49.5
<i>Rhacochilus toxotes</i>			6		6	1.0	94.6	22.5	25	27	49.5
<i>Sebastes umbrosus</i>	5				5	0.8	95.4	25	25	27	52
<i>Hypsypops rubicundus</i>			3		3	0.5	97.4	27	25	27	54
<i>Sebastes ovalis</i>	2			3	2	0.3	97.8	29.5	25	27	56.5
<i>Medialuna californiensis</i>			2		2	0.3	98.4	29.5	25	27	56.5
<i>Ophiodon elongatus</i>	1				1	0.2	98.9	35.5	25	27	62.5
<i>Sebastes levis</i>	1				1	0.2	99.0	35.5	25	27	62.5
<i>Sebastes elongatus</i>	1				1	0.2	99.2	35.5	25	27	62.5
<i>Sebastes atrovirens</i>			1		1	0.2	99.4	35.5	25	27	62.5
<i>Embiotoca caryi</i>				1	1	0.2	99.5	35.5	25	27	62.5
<i>Heterostichus rostratus</i>				1	1	0.2	99.7	35.5	25	27	62.5
<i>Haemulon californiensis</i>				1	1	0.2	99.8	35.5	25	27	62.5
<i>Sebastes rastrelliger</i>		1			1	0.2	100.0	35.5	25	27	62.5
Total	191	27	347	62	627	100.0					

Table 2. Seasonal fish species, abundance and importance by otter-trawl (OT) at 5 and 10m, and gillnet (GN) in Punta Colonet, Baja California, Mexico (2007-2008). Rel%: relative abundance %; FO%: frequency of occurrence %; R1: Rel% order; R2: FO% order; ICI: Index of Community Importance

Species	Summer 2007				Fall 2007				Winter 2008				Total	Rel%	R1	FO%	R2	ICI	
	C5	C10	GN	%	C5	C10	GN	%	C5	C10	GN	%							
<i>Embiotoca jacksoni</i>	36	45	34	13.8	113	92	34	33.1	17	84	30	34	485	25.0	2	94.4	1	3	
<i>Micrometrus minimus</i>	217	26	17	31.3	162	68		31.8	24	13	7	12	534	27.6	1	66.7	2	3	
<i>Hyperprosopon argenteum</i>	101	30	126	30.9		7	11	2.5	4	9	37	13	325	16.8	3	63.9	3	6	
<i>Phanerodon vacca</i>	8	9	9	3.1		7	3	1.4		2	4	1.6	42	2.2	7	41.7	5.5	12.5	
<i>Heterostichus rostratus</i>	5	3	2	1.2	10	4	2	2.2	6	3	2	2.9	37	1.9	9.5	55.6	4	13.5	
<i>Phanerodon furcatus</i>		9		1.1	4	25		4.0	8	5	3	4.2	54	2.8	6	33.3	7.5	13.5	
<i>Cymatogaster aggregata</i>		12		1.4		61		8.4	4	11	4	5.0	92	4.7	4	22.2	10	14	
<i>Oxijulis californica</i>	2	2	1	0.6		11	2	1.8		5	5	2.6	28	1.4	12	33.3	7.5	19.5	
<i>Paralichthys californicus</i>	1	2		0.4	1			0.1	7	5	6	4.7	22	1.1	14	41.7	5.5	19.5	
<i>Sebastes auriculatus</i>								16	2.2	1	2	6	2.3	25	1.3	13	25	9	22
<i>Amphistichus koelzi</i>		1	84	10.2						2	1	0.8	88	4.5	5	10.4	20	25	
<i>Genyonemus lineatus</i>								26	3.6			6	1.6	32	1.7	11	16.7	14	25
<i>Atherinopsis californiensis</i>			24	2.9							17	4.4	41	2.1	8	11.1	18	26	
<i>Embiotoca lateralis</i>		2	1	0.4	2	12		1.9		2	1	0.8	20	1.0	15	19.4	12	27	
<i>Strongylura exilis</i>	2			0.2	33			4.6	2			0.5	37	1.9	9.5	11.1	18	27.5	
<i>Syngnathus leptorhynchus</i>	4	1		0.6	2			0.3	11			2.9	18	0.9	16	19.4	12	28	
<i>Sebastes rastrelliger</i>	5		3	1.0						1	3	1	12	0.6	18	19.4	12	29.5	
<i>Paralabrax nebulifer</i>									2	2	2	1.6	6	0.3	20	13.9	16	35.5	
<i>Pleuronichtys guttulatus</i>						1		0.1	2	1	1	1	5	0.3	21	13.9	16	36	
<i>Amphistichus argenteus</i>							11	1.5					11	0.6	18	8.3	22	39.5	
<i>Citharichthys stigmaeus</i>		1		0.1	1	1	1	0.4					4	0.2	24	11.1	18	41.5	
<i>Paralabrax clathratus</i>										3	3	1.6	6	0.3	21	8.3	22	42.5	
<i>Symphurus atricauda</i>									3	1		1	4	0.2	24	8.3	22	45.5	
<i>Seriphus politus</i>			5	0.6									5	0.3	21	2.8	26	46.5	
<i>Scorpaena guttata</i>										2	0.5		2	0.1	27	2.8	26	52.5	
<i>Scorpaenichthys marmoratus</i>	1			0.1									1	0.1	27	2.8	26	52.5	
<i>Medialuna californiensis</i>			1	0.1									1	0.1	27	2.8	26	52.5	
<i>Trachurus symmetricus</i>											1	0.3	1	0.1	27	2.8	26	52.5	
Total	382	143	307		328	289	106		91	151	141		1938	100					
Total by season	Summer, n = 832				Fall, n = 723				Winter, n = 383										

Table 3. Seasonal fish catch, minimum-maximum and mean (\pm SE: Standard error) by otter-trawl tow (OT) at 5 and 10m, and gillnet (GN) in Punta Colonet, Baja California, Mexico (2007-2008)

Season	Otter-trawl 5m catch		Otter-trawl 10m catch		Gillnet catch		Total catch
	Sum (min-max)	Mean (\pm SE)	Sum (min-max)	Mean (\pm SE)	Sum (min-max)	Mean (\pm SE)	
Summer 2007	382 (17-225)	95.5 (\pm 45.3)	143 (20-45)	35.8 (\pm 5.4)	307 (51-142)	76.8 (\pm 21.8)	832
Fall 2007	328 (38-164)	82.0 (\pm 28.6)	289 (44-94)	72.3 (\pm 28.8)	106 (24-30)	26.5 (\pm 1.3)	723
Winter 2008	91 (16-28)	22.8 (\pm 2.6)	151 (20-76)	37.8 (\pm 12.9)	141 (26-40)	35.3 (\pm 3.2)	383
Total catch	801	66.8 (\pm 18.8)	583	48.6 (\pm 7.6)	554	46.2 (\pm 9.4)	1938

Table 4. Seasonal fish species from the commercial catch, abundance and order of importance in Punta Colonet, Baja California, Mexico (2008). Rel%: relative abundance %; FO%: frequency of occurrence %; R1: Rel% order; R2: FO% order; ICI: Index of Community Importance

Fish species	Winter	%	Spring	%	Summer	%	Fall	%	Total	Rel%	R1	FO%	R2	ICI
<i>Caulolatilus princeps</i>	88	44.4	79	26.5	151	46.6	139	53.1	457	42.2	1.0	93.8	1.0	2.0
<i>Sebastes miniatus</i>	48	24.2	86	28.9	35	10.8	54	20.6	223	20.6	2.0	87.5	2.0	4.0
<i>Sebastes auriculatus</i>	8	4.0	19	6.4	16	4.9	1	0.4	44	4.1	4.5	75.0	3.0	7.5
<i>Paralabrax nebulifer</i>	4	2.0	60	20.1	82	25.3			146	13.5	3.0	37.5	6.5	9.5
<i>Sebastes constellatus</i>	7	3.5	14	4.7	2	0.6	3	1.1	26	2.4	7.0	50.0	4.0	11.0
<i>Bodianus pulcher</i>	4	2.0	3	1.0	9	2.8	17	6.5	33	3.0	6.0	43.8	5.0	11.0
<i>Paralichthys californicus</i>	3	1.5			3	0.9	38	14.5	44	4.1	4.5	37.5	6.5	11.0
<i>Sebastes paucispinis</i>	13	6.6					7	2.7	20	1.8	9.0	31.3	8.0	17.0
<i>Seriola lalandi</i>			11	3.7	10	3.1			21	1.9	8.0	18.8	13.5	21.5
<i>Sebastes chlorostictus</i>	3	1.5	2	0.7	3	0.9			8	0.7	13.5	25.0	10.0	23.5
<i>Ophiodon elongatus</i>	2	1.9	3	1.0	2	0.6			7	0.6	15.0	25.0	10.0	25.0
<i>Sebastes umbrosus</i>	4	2.0	5	1.7					9	0.8	11.5	18.8	13.5	25.0
<i>Sebastes babcocki</i>	2	1.0	1	0.3	1	0.3	1	0.4	5	0.5	16.0	25.0	10.0	26.0
<i>Sphyaena argentea</i>			8	2.7					8	0.7	13.5	18.8	13.5	27.0
<i>Atractoscion nobilis</i>	8	4.0	4	1.3					12	1.1	10.0	12.5	17.5	27.5
<i>Scorpaena guttata</i>	2	1.0			7	2.2			9	0.8	11.5	12.5	17.5	29.0
<i>Sebastes atrovirens</i>	2	1.0	2	0.7					4	0.4	17.0	18.8	13.5	30.5
<i>Girella nigricans</i>			1	0.3	1	0.3			2	0.2	18.0	12.5	17.5	35.5
<i>Sebastes caurinus</i>							1	0.4	1	0.1	21	12.5	17.5	38.0
<i>Sebastes flavidus</i>					1	0.3			1	0.1	21	6.3	21.0	41.5
<i>Coryphaena hippurus</i>					1	0.3			1	0.1	21	6.3	21.0	41.5
<i>Stereolepis gigas</i>							1	0.4	1	0.1	21	6.3	21.0	41.5
Total	198		298		324		262		1082	100				

Sportfishing data came from 20 boats that made trips to Punta Colonet and reported their catches online (2006-2023); 14 vessels travelled south from San Diego, CA (USA), and one boat from Long Beach, CA. Furthermore, three trips from Ensenada, Baja California (120 km south), and individual

trips from Erendira (37 km south), San Quintín (60 km north), and one local boat from Colonet. The boats carried between two and 26 anglers and visited rocky spots within and around the bay and occasionally up to 6 km offshore in search of tuna species, and depths of 38–150 m, with a preference for 90–

116 m for Yellowtail and demersal fish. The total caught was 1,193 fish belonging to 33 species, and 18 of those from the *Sebastes* sp. (Table 5). Anglers caught the Yellowtail (*Seriola lalandi*, 32%) by 14 boats, followed by *S. miniatus* (19.1%) in 16 trips, and the Lingcod (*Ophiodon elongatus*, 10.1%) in 12 boats. Most important fish species (ICI), both *S. lalandi* and *S. miniatus* ranked in first place; *S. lalandi* by their highest abundance and *S. miniatus* by the highest frequency of occurrence (80%), followed by *O. elongatus*, with low abundance but high frequency of occurrence of 60% (Table 5). About demersal fish, *S. miniatus* was most abundant by the San Quintín sportfishing in 2005 and also during 2009, changing the first place from *C. princeps* (winter-fall) seasonally, to *S. miniatus* in spring-summer and with the Yellowtail in seventh place (Rodríguez-Santiago & Rosales-Casián, 2008; Rosales-Casián & Delgadillo-Hernández, 2010). San Quintín sportfishing for pelagic fishes during Neutral conditions 2008-2009, El Niño 2009-2010, and La Niña 2010-2011 captured 787 individuals belonging to 12 species, with abundant Yellowtail during Neutral and El Niño years, and a drastic reduction during La Niña (Ibarra-Gonzalez, 2013). In California, the main catch is groundfish; recreational anglers in 2004 landed 212 metric tons of *S. miniatus*, which ranked seventh in abundance; in 2005, in south-central California, anglers caught 2,751 Blue rockfish (*Sebastes mystinus*), with 1,218 individuals of *S. miniatus* ranked second (CDFG, 2005; Stephens et al., 2006; Wang et al., 2022).

At the Ensenada Seafood Market, only 19 stalls monitored over different months and years offered fish caught in Colonet, according to vendor responses, with 1,626 fish belonging to four fish species. *B. pulcher* was first in abundance with 1,080 individuals (66.4%), followed by *C. princeps* (18.7%), *P. nebulifer* (14.7%) and three individuals of the Giant black seabass (*Stereolepis gigas*, 0.2%). These species showed the same importance (ICI) order, *B. pulcher* also with the highest (73.7%) frequency of occurrence (Table 6). A 2013-2014 study at the Seafood Market counted 6,830 individuals from 75 species, with 20 species of the Scorpaenidae family, Sciaenidae (nine species), Embiotocidae (seven species), and Serranidae (six species); the most abundant were *P. nebulifer* (25.7%), *C. princeps* (8.5%), *S. auriculatus* (6.2%), *S. miniatus* (4.8%), and the Gulf corvina (*Cynoscion othonopterus*) with 4.7% (Adame-Fraire, 2015). The last species is endemic to the Gulf of California and is caught during the spawning migration to the Upper Gulf and the Colorado River (Enciso-Enciso et al., 2025).

The SIO Vertebrate Collection (UCSD) showed 544 fish belonging to 47 species from Colonet; the Northern anchovy (*Engraulis mordax*) showed the highest number of individuals (n = 286), followed by the White croaker (*Genyonemus*

lineatus), the Spotted kelpfish (*Gibbonsia elegans*), the Longfin sanddab (*Citharichthys xanthostigma*), the Pacific sanddab (*Citharichthys sordidus*), and the Blacksmith, *Chromis punctipinnis* (Table 7). Those species have been collected in Bahía Todos Santos, Bahía and the coast of San Quintín (Hammann & Rosales-Casián, 1990; Rosales-Casián, 1997; Albino-Martínez & Rosales-Casián, 2024), as well as on the California coast (Allen et al., 2006).

All data series of fish showed a total of 7,010 individuals belonging to 106 species; the most abundant species was the California sheephead (*B. pulcher*) with the highest percentage (16%), 1,122 individuals (Table 7) derived from Colonet commercial fishing and sold at the Ensenada Seafood Market. Second was the *C. princeps* (11.7%, 820 individuals) caught with H&L, commercial and sportfishing and sold at the seafood market. In third place, the Black perch (*E. jacksoni*, 8.5%) was collected with otter-trawl tows, gillnet and observed by diving, in fourth place and with the same methods, the Dwarf surfperch (*M. minimus*, 7.7%), and in fifth place *S. miniatus* (6.7%) caught with H&L, by the commercial and sportfishing (Table 7). Based on the fish species identified in the 96 monitoring events at Punta Colonet and the final order of the ICI, the most important species was the Black perch, *Embiotoca jacksoni*, by their highest frequency of occurrence (41.1%), and 8.5% of the abundance (Table 70). This species is associated with kelp beds and shallow rocky reefs, essential habitats for Embiotocidae family members (Froeschke et al., 2007), followed by the Ocean whitefish (*C. princeps*), Vermilion rockfish (*S. miniatus*), California sheephead (*B. pulcher*) and the Dwarf perch, *M. minimus* (Table 8). This study shows the importance of using different methods to represent the fish community, with rocky bottoms and kelp forests for shelter, feeding, reproduction, and migration of species. The 106 species from Punta Colonet are greater than 69 species from the San Quintín and coast system (Rosales-Casián, 1996), although it does not include commercial, sportfishing, or SIO Collection species. However, it is similar to the Bahía Todos Santos-Estero Punta Banda system (120 fish species), using net samplings, ichthyoplankton surveys and diving (Hammann & Rosales-Casián, 1990). Colonet is an essential fish habitat that can be perturbed, such as dredging and filling in California (USA), which reduced fish habitat up to 90% (Kramer, 1990). Based on the abundance of species of the Embiotocidae family in the present study, it is possible to consider them as indicators during the development of the possible port, after its construction in shallow depths (<10m), and using gillnets to avoid active collection methods. In turn, it is possible to select the species of the Scorpaenidae family at greater depths (<20m) using hook-and-line.

Table 5. Fish species from the sportfishing catch, abundance and order of importance in Punta Colonet, Baja California, Mexico (2006-2023). Rel%: relative abundance %; FO%: frequency of occurrence %; R1: Rel% order; R2: FO% order; ICI: Index of Community Importance. Port of boat: COL: Colonet; ENS: Ensenada; ERE: Erendira; LB: Long Beach; SD: San Diego; SQ: San Quintin. NP: Not provided.

YEAR	2006	2007	2008			2009			2010	2014	2016	2017	2019			2020	2021	2022			2023			Total	Rel %	R1	FO %	R2	ICI
MONTH	Jun	Aug	Feb	Oct	Nov	Jan	Feb	Sep	Jul	Jan	Aug	Jan	Jul	Jan	Feb	Mar	Jan	Mar	Apr	Jul									
DEPTH (meters)	38-42	NP	21-38	NP	NP	15-45	NP	70-110	NP	NP	60	60-120	60	150	55-150	NP	150	NP	NP	NP									
PORT	ERE	SQ	SD	ENS	ENS	SD	SD	SD	SD	SD	LB	SD	SD	SD	SD	SD	SD	COL	SD	ENS									
Fish species/No. boats	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20									
<i>Seriola lalandi</i>	3	6	1	20		6		43	6	118		90	10		8	36	14	23	384	32.2	1.0	70	2.0	3.0					
<i>Sebastes miniatus</i>	12		11		15	26	10		7	18	10	37	6	5	50	6	12		228	19.1	2.0	80	1.0	3.0					
<i>Ophiodon elongatus</i>			10		12	25			8	26	5	2	8		11		4		120	10.1	3.0	60	3.0	6.0					
<i>Sebastes paucispinis</i>			10				2		2	10		22	8		8		5	12	87	7.3	4.0	50	4.0	8.0					
<i>Sebastes constellatus</i>						2	2		3	8		11	5		10		6		47	3.9	5.0	40	6.0	11.0					
<i>Sarda chiliensis</i>	2			1	6	6						10		2		4	2	1	34	2.8	7.0	45	5.0	12.0					
<i>Sebastes caurinus</i>						10			1	1		6	1						19	1.6	11.5	25	7.0	18.5					
<i>Thunnus albacares</i>				8				25											33	2.8	8.0	20	10.5	18.5					
<i>Sebastes chlorostictus</i>									4	4		8					7		23	1.9	10.0	20	10.5	20.5					
<i>Caulolatilus princeps</i>			10			30											4		44	3.7	6.0	15	15.5	21.5					
<i>Sebastes umbrosus</i>						1					2					10		6	19	1.6	11.5	20	10.5	22.0					
<i>Paralabrax clathratus</i>	4	4								5									13	1.1	14.0	20	10.5	24.5					
<i>Sebastes rastrelliger</i>											2		7	3					12	1.0	14.0	20	10.5	24.5					
<i>Sebastes melanostomus</i>					9		1												10	0.8	17.0	20	10.5	27.5					
<i>Sebastes ovalis</i>						1						6	1				4		12	1.0	14.0	15	15.5	29.5					
<i>Sebastes auriculatus</i>									2	9		13					4		28	2.3	9.0	10	22.0	31.0					
<i>Sebastes babcocki</i>										2		1				5	2		10	0.8	19.0	15	15.5	34.5					
<i>Sebastes serripes</i>										2		5	1						8	0.7	20.5	15	15.5	36.0					
<i>Sebastes atrovirens</i>										2		3	1						6	0.5	23.0	15	15.5	38.5					
<i>Sebastes rosaceus</i>																10			10	0.8	17.0	10	22.0	39.0					
<i>Thunnus orientalis</i>														1		1	1		3	0.3	25.5	15	15.5	41.0					
<i>Sebastes serranoides</i>												3			5				8	0.7	20.5	10	22.0	42.5					
<i>Scorpaena guttata</i>			3			4													7	0.6	22.0	10	22.0	44.0					
<i>Sphyrna argentea</i>	3																	1	4	0.3	24.0	10	22.0	46.0					
<i>Paralichthys californicus</i>	1							2	4		5								12	1.0	17.0	5	29.0	46.0					
<i>Sebastes goodei</i>															3				3	0.3	25.5	5	29.0	54.5					
<i>Scomber japonicus</i>					2														2	0.2	27.5	5	29.0	56.5					
<i>Katsuwonus pelamis</i>				2															2	0.2	27.5	5	29.0	56.5					
<i>Semicossyphus pulcher</i>													1						1	0.1	31.0	5	29.0	60.0					
<i>Atractoscion nobilis</i>		1																	1	0.1	31.0	5	29.0	60.0					
<i>Sebastes levis</i>					1														1	0.1	31.0	5	29.0	60.0					
<i>Scorpaenichthys marmoratus</i>		1																	1	0.1	31.0	5	29.0	60.0					
<i>Sebastes helvomaculatus</i>							1												1	0.1	31.0	5	29.0	60.0					
Total																					1193								

Table 6. Fish species offered for sale at the Ensenada Seafood Market stalls from the commercial catch in Punta Colonet, Baja California, Mexico (2013-2023). Rel%: relative abundance %; FO%: frequency of occurrence %; R1: Rel% order; R2: FO% order; ICI: Index of Community Importance.

Fish species	Fish stalls	Total	Rel%	R1	FO%	R2	ICI
<i>Bodianus pulcher</i>	14	1080	66.4	1	73.7	1	2
<i>Caulolatilus princeps</i>	11	304	18.7	2	57.9	2	4
<i>Paralabrax nebulifer</i>	8	239	14.7	3	42.2	3	6
<i>Stereolepis gigas</i>	1	3	0.2	4	10.5	4	8
Total		1626	100				

Table 7. Fish species and numbers of individuals from Punta Colonet, Baja California, Mexico, preserved in the Vertebrate Collection at Scripps Institution of Oceanography (SIO), University of California, San Diego (UCSD). Rel%: relative abundance %; UR: unregistered depth

Fish species	Total	Rel%	Depth m	Fish species	Total	Rel%	Depth m
<i>Engraulis mordax</i>	286	52.5	0-16	<i>Sebastes ensifer</i>	2	0.4	101
<i>Genyonemus lineatus</i>	73	13.4	0-12.8	<i>Sebastes rubrivinctus</i>	2	0.4	27
<i>Gibbonsia elegans</i>	20	3.7	0.25	<i>Icelinus quadriseriatus</i>	2	0.4	38-40
<i>Citharichthys xanthostigma</i>	20	3.7	38-40	<i>Syngnathus californiensis</i>	2	0.4	0-16.5
<i>Citharichthys sordidus</i>	18	3.3	38-40	<i>Hypsoblennius jenkinsi</i>	2	0.4	0-16.5
<i>Chromis punctipinis</i>	13	2.4	16.5	<i>Citharichthys fragilis</i>	2	0.4	38-40
<i>Citharichthys stigmaeus</i>	9	1.7	38-40	<i>Pleuronichthys verticalis</i>	2	0.4	38-40
<i>Anaploma fimbria</i>	8	1.5	0-220	<i>Sebastes paucispinis</i>	1	0.2	UR
<i>Sebastes auriculatus</i>	7	1.3	42-90	<i>Sebastes umbrosus</i>	1	0.2	27
<i>Sebastes macdonaldi</i>	7	1.3	16-220	<i>Heterodontus francisci</i>	1	0.2	20-22
<i>Oligocottus snyderi</i>	7	1.3	Surface	<i>Raja binoculata</i>	1	0.2	14.6-22
<i>Sebastes miniatus</i>	6	1.1	220	<i>Paralepis brevis</i>	1	0.2	UR
<i>Sebastes chlorostictus</i>	6	1.1	91	<i>Zalemnius rosaceus</i>	1	0.2	38-40
<i>Clinocottus analis</i>	5	0.9	0.25	<i>Scorpaena mystes</i>	1	0.2	38-40
<i>Sebastes vexillaris</i>	4	0.7	27	<i>Sebastes chrysomelas</i>	1	0.2	27
<i>Chitonotus pugetensis</i>	4	0.7	38-40	<i>Zaniolepis latipinnis</i>	1	0.2	38-40
<i>Hypsoblennius gilberti</i>	4	0.7	0-18	<i>Syngnathus exilis</i>	1	0.2	UR
<i>Symphurus atricaudus</i>	4	0.7	38-40	<i>Rimicola eigenmanni</i>	1	0.2	0.25
<i>Synodus lucioceps</i>	3	0.6	Surface	<i>Chilara taylori</i>	1	0.2	141
<i>Porichthys notatus</i>	3	0.6	38-40	<i>Ophidion scrippsae</i>	1	0.2	141
<i>Gibbonsia metzi</i>	3	0.6	0.25	<i>Apodichthys fucorum</i>	1	0.2	0.25
<i>Sebastes constellatus</i>	2	0.4	27	<i>Hippoglossus stenolepis</i>	1	0.2	UR
<i>Sebastes rosenblatti</i>	2	0.4	192-220	<i>Parophrys vetulus</i>	1	0.2	38-39.5
				Total	544	100.0	

Table 8. Fish species by importance order from the data series of Punta Colonet, Baja California, Mexico. Cruise (Horizon) 1998; Nets: Otter-trawl and gillnet catch 2007–2008; CF: Seasonal commercial catch 2008; SF: Sportfishing catch 2006–2023; SFM: Ensenada Seafood Market 2003–2023; SIO Coll: Preserved fish species at the Vertebrate Collection of the Scripps Institution of Oceanography, University of California at San Diego, California, USA. Rel%: relative abundance %; FO%: frequency of occurrence %; R1: Rel% order; R2: FO% order; ICI: Index of Community Importance

Species	Cruise	Nets	CF	SF	SFM	SIO	Total	Rel%	R1	FO%	R2	ICI
	1998	2007-08	2008	2006-23	2003-23	Coll						
	Sum	Sum	Sum	Sum	Sum	Sum						
<i>Embiotoca jacksoni</i>	108	485					593	8.46	3.0	41.1	1	4
<i>Caulolatilus princeps</i>	15		457	44	304		820	11.70	2.0	33.3	3.5	5.5
<i>Sebastes miniatus</i>	26		223	228		6	483	6.89	4.0	35.6	2	6
<i>Bodianus pulcher</i>	8		33	1	1080		1122	16.01	1.0	26.7	8	9
<i>Micrometrus minimus</i>	5	534					539	7.69	7.0	28.9	5.5	12.5
<i>Hyperprosopon argenteum</i>	23	325					348	4.96	8.0	28.9	5.5	13.5
<i>Paralabrax nebulifer</i>	12	6	146		239		403	5.75	6.0	24.4	9	15
<i>Sebastes auriculatus</i>	15	26	44	28		7	120	1.71	12.0	33.3	3.5	15.5
<i>Seriola lalandi</i>			21	384			405	5.78	5.0	18.9	13.5	18.5
<i>Sebastes paucispinis</i>	23		20	87		1	131	1.87	10.0	18.9	13.5	23.5
<i>Sebastes constellatus</i>	32		26	47		2	107	1.53	13.0	20.0	11	24
<i>Ophiodon elongatus</i>	1		7	120			128	1.83	11.0	18.9	13.5	24.5
<i>Paralichthys californicus</i>		23	44	12			79	1.13	19.0	27.8	7	26
<i>Heterostichus rostratus</i>	1	37					38	0.54	24.0	23.3	10	34
<i>Phanerodon vacca</i>	18	42					60	0.86	21.0	18.9	13.5	34.5
<i>Phanerodon furcatus</i>	19	54					73	1.04	20.0	15.6	17	37
<i>Oxyjulis californica</i>	28	28					56	0.80	22.0	16.7	16	38
<i>Cymatogaster aggregata</i>		92					92	1.31	17.0	8.9	24	41
<i>Sebastes chlorostictus</i>	14		8	23		6	51	0.73	23.0	11.1	18.5	41.5
<i>Genyonemus lineatus</i>		31				73	104	1.48	15.0	7.8	27.5	42.5
<i>Amphistichus koelzi</i>		88					88	1.26	18.0	7.8	27.5	45.5
<i>Sebastes umbrosus</i>	5		9	19		1	34	0.49	26.5	10.0	21	47.5
<i>Sarda chiliensis</i>				34			34	0.49	26.5	10.0	21	47.5
<i>Atherinopsis californiensis</i>	60	41					101	1.44	16.0	5.6	33.5	49.5
<i>Sebastes rastrelliger</i>	1	12		12			25	0.36	31.5	11.1	18.5	50
<i>Girella nigricans</i>	104		2				106	1.51	14.0	4.4	37	51
<i>Embiotoca lateralis</i>	5	20					25	0.36	31.5	10.0	21	52.5
<i>Paralabrax clathratus</i>	11	6		13			30	0.43	29.0	8.9	24	53
<i>Strongylura exilis</i>		37					37	0.53	25.0	4.4	37	62
<i>Sebastes babcocki</i>			5	10			15	0.21	41.0	8.9	24	65
<i>Sebastes caurinus</i>			1	19			20	0.29	35.5	6.7	30.5	66
<i>Sphyaena argentea</i>	8		8	4			20	0.29	35.5	6.7	31	66
<i>Syngnathus leptorhynchus</i>		18					18	0.26	39.0	7.8	27.5	66.5
<i>Sebastes atrovirens</i>	1		4	6			11	0.16	47.5	7.8	27.5	75
<i>Sebastes ovalis</i>	2			12			14	0.20	42.0	5.6	33.5	75.5
<i>Thunnus albacares</i>				33			33	0.47	28.0	2.2	48	76
<i>Sebastes rosenblatti</i>	24					2	26	0.37	30.0	2.2	48	78

Table 8. Cont.

<i>Citharichthys stigmaeus</i>	3			9	12	0.17	45.0	5.6	33.5	78.5
<i>Scorpaena guttata</i>	2	9	7		18	0.26	39.0	3.3	40.5	79.5
<i>Sebastes rosaceus</i>	13		10		23	0.33	33.0	2.2	48	81
<i>Amphistichus argenteus</i>	11				11	0.16	47.5	3.3	40.5	88
<i>Engraulis mordax</i>				286	286	4.08	9.0	1.1	80	89
<i>Symphurus atricaudus</i>	4			4	8	0.11	52.5	4.4	37	89.5
<i>Sebastes serriceps</i>			8		8	0.11	52.5	3.3	40.5	93
<i>Atractoscion nobilis</i>		12			12	0.17	45.0	2.2	48	93
<i>Pleuronichthys guttulatus</i>	5				5	0.07	60.0	5.6	33.5	93.5
<i>Sebastes melanostomus</i>			10		10	0.14	49.0	2.2	48	97
<i>Sebastes serranoides</i>			8		8	0.11	52.5	2.2	48	100
<i>Scomber japonicus</i>	6		2		8	0.11	52.5	2.2	48	101
<i>Thunnus orientalis</i>			3		3	0.04	69.0	3.3	40.5	110
<i>Stereolepis gigas</i>		1		3	4	0.06	63.5	2.2	48	111
<i>Gibbonsia elegans</i>					20	0.29	35.5	1.1	80	115
<i>Citharichthys xanthostigma</i>					20	0.29	35.5	1.1	80	115
<i>Citharichthys sordidus</i>					18	0.26	39.0	1.1	80	119
<i>Chromis punctipinis</i>					13	0.19	43.0	1.1	80	123
<i>Sebastes lentiginosus</i>	12				12	0.17	45.0	1.1	80	125
<i>Oxylebius pictus</i>	2				2	0.03	78.5	2.2	48	126
<i>Halichoeres semicinctus</i>	2				2	0.03	78.5	2.2	48	126
<i>Sebastes levis</i>	1		1		2	0.03	78.5	2.2	48	126
<i>Sebastes hopkinsi</i>	8				8	0.11	52.5	1.1	80	132
<i>Anaploma fimbria</i>					8	0.11	52.5	1.1	80	132
<i>Sebastes macdonaldi</i>					7	0.10	56.5	1.1	80	136
<i>Oligocottus snyderi</i>					7	0.10	56.5	1.1	80	136
<i>Rhacochilus toxotes</i>	6				6	0.09	58.0	1.1	80	138
<i>Seriphus politus</i>		5			5	0.07	60.0	1.1	80	140
<i>Clinocotus analis</i>					5	0.07	60.0	1.1	80	140
<i>Sebastes vexillaris</i>					4	0.06	63.5	1.1	80	144
<i>Chitonotus pugetensis</i>					4	0.06	63.5	1.1	80	143
<i>Hypsoblennius gilberti</i>					4	0.06	63.5	1.1	80	143
<i>Hypsypops rubicundus</i>	3				3	0.04	69.0	1.1	80	149
<i>Medialuna californiensis</i>	2	1			3	0.04	69.0	1.1	80	149
<i>Sebastes goodei</i>			3		3	0.04	69.0	1.1	80	149
<i>Synodus lucioceps</i>					3	0.04	69.0	1.1	80	149
<i>Porichthys notatus</i>					3	0.04	69.0	1.1	80	149
<i>Gibbonsia metzi</i>					3	0.04	69.0	1.1	80	149
<i>Scorpaenichthys marmoratus</i>	1		1		2	0.03	78.5	1.1	80	158
<i>Katsuwonus pelamis</i>			2		2	0.03	78.5	1.1	80	158
<i>Sebastes ensifer</i>					2	0.03	78.5	1.1	80	158

Table 8. Cont.

<i>Sebastes rubrivinctus</i>						2	2	0.03	78.5	1.1	80	158.5
<i>Icelinus quadriseriatus</i>						2	2	0.03	78.5	1.1	80	158.5
<i>Syngnathus californiensis</i>						2	2	0.03	78.5	1.1	80	158.5
<i>Hypsoblennius jenkinsi</i>						2	2	0.03	78.5	1.1	80	158.5
<i>Citharichthys fragilis</i>						2	2	0.03	78.5	1.1	80	158.5
<i>Pleuronichthys verticalis</i>						2	2	0.03	78.5	1.1	80	158.5
<i>Haemulon californiensis</i>	1						1	0.01	95.5	1.1	80	175.5
<i>Sebastes elongatus</i>	1						1	0.01	95.5	1.1	80	175.5
<i>Embiotoca caryi</i>	1						1	0.01	95.5	1.1	80	175.5
<i>Trachurus symmetricus</i>		1					1	0.01	95.5	1.1	80	175.5
<i>Sebastes flavidus</i>			1				1	0.01	95.5	1.1	80	175.5
<i>Coryphaena hippurus</i>			1				1	0.01	95.5	1.1	80	175.5
<i>Atractoscion nobilis</i>				1			1	0.01	95.5	1.1	80	175.5
<i>Sebastes helvomaculatus</i>				1			1	0.01	95.5	1.1	80	175.5
<i>Heterodontus francisci</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Raja binoculata</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Paralepis brevis</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Zalembeus rosaceus</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Scorpaena mystes</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Sebastes chrysomelas</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Zaniolepis latipinnis</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Syngnathus exilis</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Rimicola eigenmanni</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Chilara taylori</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Ophidion scrippsae</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Apodichthys fucorum</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Hippoglossus stenolepis</i>						1	1	0.01	95.5	1.1	80	175.5
<i>Parophrys vetulus</i>						1	1	0.01	95.5	1.1	80	175.5
Total		627	1938	1082	1193	1626	544	7010	100			

Conclusion

This study highlights Punta Colonet, Baja California, Mexico, for fish species diversity, with commercial and recreational fishing. This study identified 106 coastal fish species using various methods, including their abundances, frequencies of occurrence, and species importance. These findings, along with other studies, will support decision-makers prior

to port construction. Future studies on fish and invertebrates and their relationship to changing conditions during El Niño and La Niña will be necessary for understanding the dynamics of the bay of Punta Colonet.

Compliance with Ethical Standards

Conflict of interest: The author(s) declare no actual, potential, or perceived conflict of interest for this article.

Ethics committee approval: This study was conducted in accordance with ethics committee procedures with no animal experiments.

Data availability: The data will be made available upon request from the author.

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