Spawning Frequency of Matagorda Bay Female Spotted Seatrout

by
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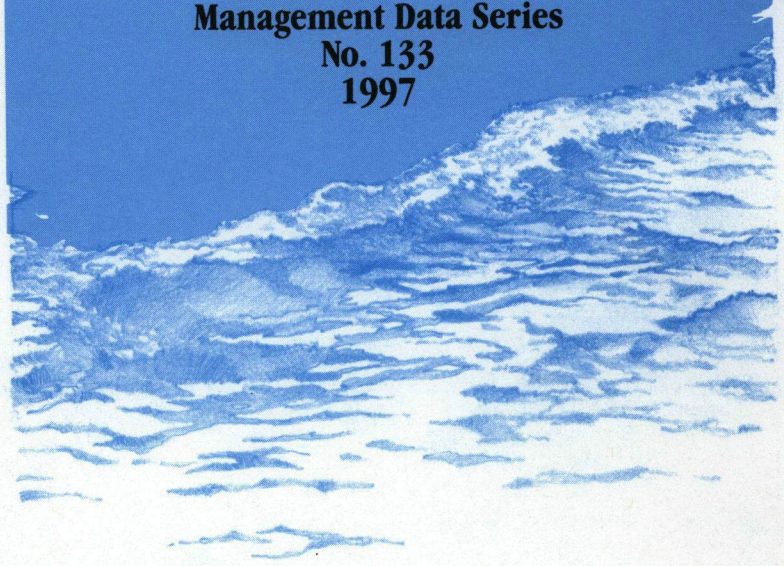

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FISHERY SURVEY OF CHOCOLATE BAY CALHOUN COUNTY, TEXAS

by

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ABSTRACT

Six stations in Chocolate Bay, a tertiary bay in the Matagorda Bay system, were sampled with a 3.1 m wide otter trawl semi-monthly from May 1972 through August 1973. A total of 43 species of vertebrates and 12 species of invertebrates were collected. Dominant fishes were bay anchovy (Anchoa mitchilli), Atlantic croaker (Micropogonias undulatus), spot (Leiostomus xanthurus), Gulf menhaden (Brevoortia patronus) and sand seatrout (Cynoscion arenarius). White shrimp (Penaeus setiferus) and brown shrimp (P. Aztecus) dominated the invertebrates.

INTRODUCTION

The Texas Parks and Wildlife Department(TPWD) has conducted studies on commercially important and dominant forage species of fish and shellfish in the Matagorda Bay system since 1959. However, prior to 1972, few studies specifically targeted Lavaca Bay. Munro (1961)mapped major oyster reefs in Lavaca Bay. Mackin (1971) studied effects of oil field brine effluent on biotic communities in Lavaca Bay. His trawl samples revealed bay anchovy (Anchoa mitchilli) and Atlantic croaker (Micropogonias undulatus) were dominant fish species. Blanton et al.(1971) reported 97 species of estuarine organisms from trawl samples in Lavaca Bay. Moseley and Copeland (1971) reported 16 species of invertebrates and 69 species of vertebrates from the Cox Bay area (which is a northeasrten portion of Lavaca Bay). Bay anchovy, Gulf menhaden (Brevoortia patronus), Atlantic croaker and spot (Leiostomus xanthurus) were dominant vertebrates with white shrimp (Penaeus setiferus) and brown shrimp (P. aztecus) dominant invertebrates.

Chocolate Bay is a small (674 ha) tertiary bay located on the western boundary of the Lavaca Bay system just south of Port Lavaca (Figures 1 and 2). The long axis runs east and west and is divided by a channel 3.9 m deep, 18.3 m wide and 1,830 m long. Spoil banks are present along the southeast side of the channel from the junction with Lavaca Bay to Kingfisher Marine Service Inc. The eastern boundary of the bay is marked by a long peninsula, comprised primarily of fine shell and sand. Two major floods and hurricane Carla washed the peninsula out three times between 1950 and 1972.

Depth of the bay, excluding the channel, is generally <1.1 m and averages about 0.6 m. Bay bottom is compacted clay with an overlay of fine silty mud, ranging in depth from a few centimeters to a meter. Big Chocolate Bayou, on the western edge, is the largest of several bayous draining into Chocolate Bay. The 20,235 ha watershed is row-crop farm land (Soil Conservation Service, personal communication) with major crops of milo, cotton and soybean. Upper portions of the watershed are improved pastureland, thus allowing extensive and rapid rainfall run-off. Little Chocolate Bayou, also on the western edge, has a drainage of about 3,642 ha consisting of row-crop farm land. On the southern perimeter, an area of 400 ha drains through Kingfisher Marine Service Inc's. property and the Harvey Johnson Ditch drains another 1,215 ha of row-crop farmland into Tiger Lake.

Marsh vegetation that occurs in the Chocolate Bay area is typical of a turbid, medium to low salinity, tertiary bay system. Smooth cordgrass (Spartina alterniflora)is located around the perimeter of the bay. Glasswort (Salicornia sp.), rush (Juncus sp.), saltwort (Batis maritima), salt grass (Districhlis spicata), saltmeadow cordgrass (Spartina patens), and three-cornered grass (Scirpus sp.) are found on the western edge of the bay and in all drainages. Submerged vegetation was absent from the bay. Limited information is available on the distribution of seagrasses in Chocolate Bay or even the Matagorda Bay system. However, an anecdotal note from a life-long resident of the bay area recounted that extensive communities of submerged seagrass were present in the southern portion of Chocolate Bay prior to 1960 (Bob Tanner, personal communication).

Oyster (Crassostrea virginica) reefs occur throughout the eastern two-thirds of the bay system (Figure 2). A small reef, developed by the culling of shell, is located immediately east of Tanner Aviation Services' boat ramp.

There are two reefs north of the entrance to the bay and a small reef at Clay Point due north of Kingfisher Marine Service Inc. Reefs are located on the spoil areas along Kingfisher Marine Service Inc.'s channel. Extensive scattered oyster clusters are found throughout Mud Lake and around the periphery of Tiger Lake. Shell is randomly scattered around the remainder of the Chocolate Bay shoreline. The bay is closed to oystering by the Texas Health Department due to high counts of coliform bacteria.

Chocolate Bay was altered in 1948 when Kingfisher Marine Service, Inc. dredged a harbor and channel for access to Lavaca Bay. All dredge spoil was placed on the southeast side of the channel causing that portion of the bay to become partially isolated on extremely low tides. In 1964 a "refuge harbor" on the Lavaca Bay shoreline, just north of the mouth of Chocolate Bay, was dredged and resulting spoil was deposited into Chocolate Bay. The northern portion of the bay also receives drainage by way of the Port Lavaca city dump. Presently, Tanner Aviation Services is located on the south-central shoreline just west of Kingfisher Marine Service, Inc. A small harbor was dredged at this facility.

The purpose of this study was to assess general hydrological parameters in the bay, describe habitat conditions, and to compile a check list of estuarine organisns present in Chocolate Bay. In the event that natural catastrophes or future municipal/industrial developments should occur, information presented here may serve as an ecological base-line for subsequent environmental comparisons of Chocolate Bay.

MATERIALS AND METHODS

Six biological and hydrological stations were sampled semi-monthly during May 1972-August 1973 (Figure 2). Station 1 was in the southeast corner of Chocolate Bay in about 0.6 m of water; bay bottom was silty mud. Station 2 was in Kingfisher Marine Service Inc.'s channel in about 2.4 m of water; bay bottom was soft mud. Station 3 was in the northern section of the bay in about 0.6 m of water; bay bottom was hard clay under a thin layer of silt. Station 4 was located in the western portion of the bay in about 0.5 m of water; bay bottom was silty mud. Stations 5 and 6 were in Big Chocolate Bayou, located 0.8 km and 7.7 km, respectively, from the mouth of the bayou. Both stations were in about 1.8 m of water with hard clay bottoms.

A 3.1 m wide otter trawl (35 mm stretched mesh with a 13 mm stretched mesh liner in the cod-end) was pulled at each biological station semi-monthly. Trawl boards measured 0.3 m by 0.6 m. The trawl was towed behind a skiff, powered by a 35 HP outboard motor, at a speed of about 2.0 knots for five minutes. It was towed in a S-shaped pattern at stations 1, 3 and 4 and in a straight line at stations 2, 5 and 6. All specimens were preserved in 10% formalin. Organisms were identified to species (Gallaway et al. 1972; American Fisheries Society 1980)and counted. Up to 50 individuals of each species in each sample were measured (nearest 1 mm). Fish were measured in standard length, shrimp were measured in total length (tip of rostrum to tip of telson) and crabs were measured in carapace width (tip of spine to tip of spine).

Bottom hydrological samples were collected at each trawl station. In 1973, if water depth was >0.9 m, surface samples were also taken. Water temperature was recorded to the nearest 0.1 C with a Taylor pocket thermometer. Dissolved oxygen (D.O.) was measured in milligrams per liter (mg/l) with a YSI, Model 54 Oxygen meter. An American Optical Goldberg refractometer was used to measure salinity (ppt). A Beckman pH meter was used to measure pH. Turbidity was measured in Jackson Turbidity Units (JTU). Nitrates and meta-phosphates were measured (mg/l) using the Hach Model DR-EL portable water engineer's laboratory chemical kit as described in the Hach Chemical Company Water Analysis Handbook (1969). When calculating means for each hydrological parameter, surface and bottom readings were pooled. Temperature, D.O., salinity and on occasion, pH were measured in the field, other parameters were measured in the laboratory. Rainfall data were taken from radio station KGUL in Port Lavaca.

RESULTS

Hydrologic Parameters

Temperatures ranged from 9.0 C (station 2) to 34.0 C (station 3) in February and August 1973, respectively (Tables 1 through 6); temperatures generally followed seasonal trends. Overall mean temperatures were similar (Table 7).

Rainfall averaged 10.5 cm/mo (Figure 3). Monthly rainfall ranged from 0.0 cm during May 1973 to 32.5 cm during June 1973. Salinities ranged from 0.0 ppt at all stations to 25.5 ppt at Station 3 in May 1972 (Tables 1 through 6). Overall mean salinities ranged from 2.5 ppt at station 6 to 11.6 ppt at station 3 (Table 7). The winter months had highest salinities. Generally, as rainfall increased in the area salinities decreased.

Dissolved oxygen patterns were typical of those found in shallow, turbid estuaries; measurements were lower in warmer months and higher in cooler months (Tables 1 through 6; Figure 4). D.O. levels ranged from 2.4 mg/l at station 2 in June 1972 to 12.5 mg/l at station 4 in October 1972. Generally, overall mean D. O. levels were lower at bayou stations (stations 5 and 6) than at bay stations (Table 7).

Highest turbidities occurred in western portions of the bay and in Big Chocolate Bayou during high freshwater inflow (Tables 1-6). Turbidities ranged from 14 JTU at station 2 (February 1973)to 220 JTU at station 5 (June 1973). Overall mean turbidities ranged from 51 JTU at station 1 to 78 JTU at station 5 (Table 7).

Highest pH (8.8) was recorded at station 5 in March 1973; lowest pH (6.3) occurred at station 2 in December 1972 (Tables 1-6). Overall mean pH was slightly higher at bay stations than at bayou stations (Table 7).

Nitrates ranged from 0.5 - 7.3 mg/l; meta-phosphates ranged from 0.04 - 1.40 mg/l (Tables 1-6). Overall mean nitrates ranged from 3.0 mg/l at station 4 to 3.5 mg/l at station 6. Overall mean meta-phosphates ranged from 0.28 mg/l at station 3 to 0.46 mg/l at station 6 (Table 7).

Even though some other species were present in Chocolate Bay, their abundance was not documented due to their low susceptibility to capture in a trawl.

ANNOTATED LIST OF SPECIES COLLECTED

There were 41,401 organisms collected in otter trawl samples consisting of 43 vertebrate and 10 invertebrate species (Table 8). In addition,two species of jellyfish were caught but not counted. Bay anchovy, Atlantic croaker, Gulf menhaden and sand seatrout (Cynoscion arenarius) were dominant vertebrates. White shrimp, brown shrimp and blue crab (Callinectes sapidus) were dominant invertebrates.

Phylum Cnidaria

Family Stomolophidae

Cabbagehead, Stomolophus meleagris: Cabbagehead were common at stations 1-3 during summer and early fall of 1972 when the average salinity was 11.3 ppt. Cabbagehead were scarce during summer and early fall in 1973 when mean salinity was 6.5 ppt.

Phylum Ctenophora

Family Beroidae

Large comb jelly, Beroe ovata: Common during June - October; none were caught during other months.

Phylum Mollusca

Family Loliginidae

Brief squid, Lolliguncula brevis: Of 24 squid caught, 10 were caught in May 1972 and 13 were caught in October 1972 at stations 1 and 2, respectively. During these months, salinities ranged from 11.0 - 16.0 ppt and temperatures ranged from 23.0 - 26.0 C.

Phylum Arthropoda

Family Penaeidae

White shrimp, Penaeus setiferus: White shrimp was the most abundant invertebrate and third most abundant organism with 5,261 specimens (Table 8). Greatest numbers were caught in August of both years (Table 9; Figure 5) in waters with average temperatures of 30.4 C and 30.8 C and average salinities of 8.0 ppt and 7.2 ppt, respectively (Table 10). In 1972, juveniles were found in May; however,in 1973, they were not found until June and then only in low numbers. Juveniles were caught from May - November 1972 revealing continual recruitment. No white shrimp were caught from Decemoer 1972- March 1973. Gunter (1950) and Lindner and Anderson (1956) found that during December-March white shrimp emigrate due to maturation and cooler temperatures.

Brown shrimp, Penaeus aztecus: Brown shrimp were the second most abundant invertebrate and fifth most abundant organism with 2,228 specimens(Table 8). For both years, highest catches were made in May (Table 11; Figure

5), when temperatures averaged 25.9 C and 23.1 C and salinities averaged 9.5 ppt and 4.2 ppt, respectively (Table 10). Moseley and Copeland (1971) found brown shrimp catches decreased as salinities increased. However, St. Amant et al.(1966) found a small year class may result from a large postlarval peak if they enter the bays when temperatures are low. Numbers of juveniles declined from July - November 1972; no brown shrimp were caught from December 1972 - February 1973.

Family Sergestidae

Sergestid shrimp, Acetes americanus: These small crustaceans were the fifth most abundant invertebrate with 271 specimens. Peak catches were made in 1972 during September, October and November when average salinity was 14.6 ppt. There was another small peak in May 1973; none were caught from December 1972 - April 1973.

Family Palaemonidae

Grass shrimp, Palaemonetes pugio: Grass shrimp were the fourth most abundant invertebrate and ninth most abundant organism with 283 specimens. They were caught in salinities ranging from 0.0 - 20.0 ppt and in temperatures ranging from 9.7 - 31.0 C. Largest catch was in May 1972 when salinities ranged from 1.9 - 14.4 ppt.

River shrimp, Macrobrachium ohione: Twenty river shrimp were caught during May - August of both years. Of these, 18 were caught at stations 5 and 6; average temperature was 28.3 C; average salinity was 2.6 ppt.

Family Alpheidae

Pistol shrimp, Alpheus heterochaelis: Three specimens were caught at station 1 during July 1972 and February 1973 in salinities of 11.3 and 19.0 ppt, respectively.

Family Astacidae

Crawfish, Procambarus clarki: Crawfish were caught at station 6 in salinities ranging from 0.0 - 3.6 ppt. Catches were infrequent throughout the year; however, none were caught in winter.

Family Portunidae

Blue crab, Callinectes sapidus: Blue crabs were the third most abundant invertebrate and eighth most abundant organism with 332 specimens (Table 8).They were caught in salinities ranging from 0.0 - 22.0 ppt. However, greatest numbers were caught at station 6 (Table 12) in salinities <5.0 ppt. More (1969) found blue crabs prefer brackish waters and are progressively less abundant as salinities increase. Largest catches occurred during April 1973 when salinities averaged 2.6 ppt and temperatures averaged 19.4 C (Table 10). Juveniles (≤25 mm) were found in every month with peak catches during April 1972. Legal size crabs (≥102 mm) were most abundant from April through August. Fewest crabs were caught from September through January which is consistent with findings

of Tan and Van Engel (1966) and More (1969). Tan and Van Engel (1966) report mature female crabs have difficulty osmoregulating in waters of low salinity. More (1969) found the majority of female crabs overwinter in lower and middle bay areas where salinities are higher;large male crabs (>102mm) normally stay buried in mud when water temperatures are below 15.0 C.

Family Xanthidae

Xanthid crab, Panopeus herbstii: Three mud crabs were caught at station 1.

Phylum Chordata

Family Lepisosteidae

Spotted gar, Lepisosteus oculatus: Only three spotted gar (not measured, but estimated weight was 2 to 4 lbs) were caught, even though the authors observed many spotted gar surfacing throughout Big Chocolate Bayou. These fish were caught at station 6 in March 1973 in a salinity of 1.5 ppt and temperature of 20.0 C.

Alligator gar, Lepisosteus spatula: Only one fish (1,600 mm SL) weighing about 25 kg was caught even though the authors observed several in gill nets in Big Chocolate Bayou. This fish was caught at station 6 in July 1972 in a salinity of 0.6 ppt and a temperature of 30.0 C.

Family Clupeidae

Gulf menhaden, Brevoortia patronus: Gulf menhaden was the fourth mostabundant finfish species (Table 8; Figure 6) with peak catches occurring in winter and spring; lowest catches occurred during August-November 1972 (Table 13; Fig. 7). Most Gulf menhaden (82%) were caught at salinities <9.9 ppt. Greater catches occurred from May-August in 1973 than during the same period in 1972. Moseley and Copeland (1971) caught fewer Gulf menhaden in Cox Bay during spring of 1971 than during the two previous springs and attributed this to lower salinities in 1971. According to Hoese et al. (1968), large juveniles and adult Gulf menhaden are generally found near the surface. Because this characteristic would reduce their susceptibility to capture by trawl, numbers caught in the present study probably do not reliably represent abundance of Gulf menhaden. Deeper stations (2 and 5) produced fewer Gulf menhaden than shallower stations (1, 3 and 4). Extensive schools of juvenile Gulf menhaden were observed by the authors throughout Big Chocolate Bayou, but few were caught.

Gizzard shad, Dorosoma cepedianum: Gizzard shad were caught at all stations during summer of 1972 in salinities ranging from 0.0 - 14.0 ppt. However, 88% (240 fish) were caught in Big Chocolate Bayou (station 6) in salinities ranging from 0.0 - 3.9 ppt. Lengths averaged 38-64 mm SL. Throughout 1973, they were caught only at station 6 where salinities were much lower than at stations in the bay. Gunter (1945) collected specimens in salinities ranging from 2.0 - 33.7 ppt with more than 50% being taken

in salinities between 10.0 ppt and 14.9 ppt. Renfro (1960) reported no juveniles caught above 1.1 ppt.

Threadfin shad, Dorosoma petenense: There were 13 threadfin shad caught at stations 4, 5 and 6 during 1972. Five (95 mm mean SL) were taken in summer in salinities ranging from 1.1 - 15.0 ppt; eight (46 mm mean SL) were caught at station 6 in August 1973 in a salinity of 1.1 ppt. Swingle (1971) found smaller fish in lower salinities (<1 ppt). Bryan (1971), reported numerous threadfin shad following the flood of 1967, in lower Laguna Madre.

Family Engraulidae

Bay anchovy, Anchoa mitchilli: Anchovies were the most abundant fish caught (Table 8; Figure 6) and were caught at all stations throughout the study. Maximum catches occurred from July - November 1972 (Table 14; Fig. 8) in salinities ranging from 0.2 - 25.0 ppt and temperatures ranging from 20.5 - 32.0 C (Table 10). From December 1972 - July 1973, catches were greatly reduced. From December 1972 - February 1973, average water temperature was 10.0 C; average salinity from April - August 1973 varied from 2.6 - 7.2 ppt.

Moseley and Copeland (1971) found greatest abundance in Cox Bay during late winter and spring with largest catches occurring in spring when salinities were highest. They postulated there may be a direct correlation between increasing salinity and abundance of bay anchovies. Gunter (1945) considered the bay anchovy to be euryhaline but larger specimens were more abundant in more saline waters. Hoese (1959) indicated that during June and July 1954, bay anchovies were most abundant in higher salinities in East Bay, Texas. Swingle (1971) reported greatest catches in salinities from 20.0 - 29.9 ppt. Fish ≤20 mm long were caught in every month except from May to August 1973. Fewer numbers were taken in February, March and April than in other months. Swingle (1971) caught fish ≤20 mm in every month except January, March and April. Hoese (1965) found bay anchovies <5 mm in East Bay during February.

Family Catostomidae

Smallmouth buffalo, Ictiobus bubalus: One (125 mm SL) individual was caught at station 6 in April 1973 (salinity = 0.0 ppt, temperature = 19.7 C).

Family Ictaluridae

Blue catfish, Ictalurus furcatus: Five blue catfish (68- 187 mm SL) were caught at station 6 in salinities ranging from 0.0 - 5.0 ppt during spring and summer 1973.

Family Ariidae

Hardhead catfish, Arius felis: There were 232 specimens caught in salinities ranging from 0.0 - 25.3 ppt. Of these, 53 (45-61 mm SL) were caught at station 2 during August 1972; salinity was 12.2 ppt. Only two

were caught in Big Chocolate Bayou and all hardhead catfish except three were caught during March - October. Breuer (1957) found hardhead catfish most abundant in deep channels in lower Laguna Madre, but Moseley and Copeland (1971) found no such distribution pattern in Cox Bay. However, Moseley and Copeland (1971) reported a relationship between temperature and abundance with a low catch rate during low temperatures.

Gafftopsail catfish, Bagre marinus: There were 104 fish (76-200 mm SL) caught in salinities ranging from 0.6 - 16.7 ppt; all were caught during summer. Only 15 were caught in salinities < 6.0 ppt. This corresponds with Gunter (1945) and Moseley and Copeland (1971) who found greatest numbers of gafftopsail catfish during August and September. No gafftopsail catfish were caught after September 1972 when water temperatures were < 25.0 C.

Family Batrachoididae

Atlantic midshipmen, Porichthys plectrodon: Nine midshipmen (29-128 mm SL) were caught at stations 1, 2 and 4 in spring and summer of 1972 and 1973 in salinities ranging from 3.9 - 20.0 ppt and in temperatures ranging from 26.0 - 31.0 C. However, sampling may not yield a reliable estimate of abundance because this species burrows during daytime, which enables it to avoid trawls (Lane, 1967).

Family Cyprinodontidae

Gulf killifish, Fundulus grandis: Two Gulf killifish (13 and 30 mm SL) were caught in salinities of 0.5 ppt and 5.0 ppt and temperatures of 21.5 C and 22.3 C. This fish generally inhabits shallow shoreline areas and, therefore, are not susceptible to trawls in deep water.

Family Antherinidae

Inland silverside, Menidia beryllina: One (60 mm SL)individual was caught at station 3 in November 1972 (salinity = 17.0 ppt, temperature = 10.0 C).

Family Centropomidae

Common snook, Centropomus undecimalis: One (77 mm SL)individual was caught at station 6 in November 1972 in a salinity of 0.5 ppt and a temperature of 12.0 C. Moseley and Copeland (1971) caught one in Cox Bay in September 1969.

Family Centrarchidae

Green sunfish, Lepomis cyanellus: One (90 mm SL)individual was caught in August 1973 at station 6 in a salinity of 1.2 ppt.

Bluegill, Lepomis macrochirus: Ten bluegill (40-90 mm SL) were caught at station 6 in salinities ranging from 0.0 - 5.0 ppt.

Black crappie, Pomoxis nigromaculatus: One fish (119 mm SL) was caught at station 6 in July 1973 in water with salinity of 2.8 ppt.

Family Carangidae

Crevalle jack, Caranx hippos: Five crevalle jack (35-84 mm SL) were caught at stations 1, 2, 3 and 5 in May, July and October in salinities from 2.2 - 23.3 ppt and in temperatures ranging from 24.5 - 30.0 C. Moseley and Copeland (1971) caught a few specimens in late summer and fall in Cox Bay.

Atlantic bumper, Chloroscombrus chrysurus: Seven fish (29- 100 mm SL) were caught at stations 1, 2 and 3 in salinities ranging from 10.5 - 17.2 ppt and in temperatures ranging from 22.0 - 30.0 C. Smallest specimens were caught in July 1972 (36 mm) and October 1972 (29 mm). Hoese (1965) and Swingle (1971) reported immigration of smallest fish during July and September.

Bluntnose jack, Hemicaranx amblyrhynchus: One (36 mm SL)individual was caught at station 1 in June 1973 in a salinity of 7.5 ppt. Moseley and Copeland (1971) found them to be common in summer 1970 and attributed abundance to association with cabbagehead jellyfish.

Family Gerreida

Spotfin mojarra, Eucinostomus argenteus: Three fish (27-50 mm SL) were caught in July, August and September 1972 at stations 1 and 5 in salinities ranging from 2.2 - 16.7 ppt and in temperatures ranging from 30.0 - 34.0 C. This size range corresponds to that found by Moseley and Copeland (1971) in Cox Bay.

Family Sparidae

Sheepshead, Archosargus probatocephalus: Five specimens were caught (110-170 mm SL). They were caught in late winter and early spring in salinities ranging from 0.0 - 10.8 ppt and in temperatures ranging from 10.0 - 18.5 C.

Family Sciaenidae

Silver perch, Bairdiella chrysura: There were 183 silver perch caught in salinities ranging from 2.2 - 20.0 ppt and in temperatures ranging from 9.0 - 30.0 C. They were caught at all stations except station 6 and in every month except September and December 1972 and January and April 1973. Highest catches were in June and August 1972 in a temperature of 30.0 C and in salinities ranging from 5.5 - 12.2 ppt. Average size was 58.9 mm TL during June-August 1973. Gunter (1945) reported spawning occurs in the bays during spring and summer.

Sand seatrout, Cynoscion arenarius: There were 1,226 specimens caught, making it the fifth most abundant finfish (Table 8; Fig. 6). They were caught in temperatures ranging from 20.0 - 34.0 C which was the highest temperature recorded. Most (73%) sand seatrout were caught in

temperatures ranging from 29.0 - 31.0 C which corresponds with what Moseley and Copeland (1971) found in Cox Bay. They were caught in salinities ranging from 0.8 - 20.0 ppt; however, greatest catches occurred at station 5 where salinities ranged from 3.0 - 6.0 ppt. Highest number were caught during summer (Table 15; Figure 9) with only two caught after October 1972 when temperatures fell below 20.0 C. Gunter (1945) reported sand seatrout migrate from shallow bays when water temperature declines in fall. Juveniles (20-40 mm SL) were caught from May-August of both years.

Spotted seatrout, Cynoscion nebulosus: Four spotted seatrout (100-185 mm SL) were caught. All were caught during winter at bay stations in temperatures ranging from 10.0 - 20.0 C and salinities ranging from zero to 16.0 ppt.

Spot, Leiostomus xanthurus: Spot was the third most abundant finfish caught with 3,130 specimens (Table 8; Fig. 6). Over 95% were caught at bay stations. They were caught during every month except December and January with peak catches in March, April and May (Table 16; Fig. 10). Spot were caught in salinities ranging from 3.8 - 15.0 ppt and in temperatures ranging from 18.2 - 31.0 C (Table 10). Moseley and Copeland (1971) in Cox Bay and Swingle (1971) in Alabama reported spot were most abundant in the spring. Moseley and Copeland (1971) found no positive correlation between catch rate and salinity, but they did find catch rate to be positively correlated with temperature up to about 30.0 C with a significant decrease in catch ratio above this temperature.

Atlantic croaker, Micropogon undulatus: Atlantic croaker was the second most abundant fish caught with 7,926 specimens (Table 8; Fig. 6). They were caught during every month (Table 17; Figure 11) in salinities ranging from 0.0 - 22.0 ppt and in temperatures from 9.1 - 33.0 C (Table 10). Only five (80- 110 mm SL) were caught in September - October 1972. There were 318 fish caught in November 1972 indicating immigration of juveniles. Peak catches of 1,909, 2,376 and 1,301 specimens were made in March, April and May 1973, respectively. Hoese (1965)reported this species spawns close to shore during winter. Pearson (1929) found young immigrate into bays in late winter and early spring. Moseley and Copeland (1971) found a positive correlation between numbers caught and temperature up to 30.0 C.

Southern kingfish, Menticirrhus americanus: One specimen (185 mm SL) was caught at station 2 in September 1972 (salinity = 14.4 ppt; temperature = 32.0 C).

Black drum, Pogonias cromis: Six black drum were caught (78-180 mm SL). Five during winter; two were caught at station 5 in February in a salinity of 0.0 ppt. Gunter and Hall (1963) took one specimen at 0.36 ppt salinity, but found them most common above 10.0 ppt.

Family Ephippidae

Atlantic spadefish, Chaetodipterus faber: Seven spadefish (62-95 mm SL) were caught in August - October 1972 in salinities ranging from 14.4 - 16.0 ppt and in temperatures ranging from 24.0 - 32.0 C.

Family Muglidae

Striped mullet, Mugil cephalus: Sixty nine striped mullet (43-170 mm SL) were caught; 32 were caught at station 5 in salinities ranging from 6.6 - 12.0 ppt and in temperatures ranging from 9.0 - 11.5 C. The authors noted that striped mullet were abundant, but as Gunter (1945) reported, striped mullet are extremely adept at escaping capture in trawls.

Family Polynemidae

Atlantic threadfin, Polydactylus octonemus: There were 171 Atlantic threadfin caught. They were caught at all stations except station 6 and in salinities ranging from 0.0 - 14.4 ppt and in temperatures ranging from 24.5 - 31.0 C. They were caught from May through August of both years. Gunter (1945) and Moseley and Copeland (1971) found Atlantic threadfin to be most common during late spring through summer.

Family Blenniidae

Striped blenny, Chasmodes bosquianus: One (59 mm SL)individual was caught at station 1 in August 1972 (salinity = 12.2 ppt; temperature = 31.0 C).

Family Gobiidae

Highfin goby, Gobionellus oceanicus: Two (18 and 28 mm SL) caught at stations 2 and 4 in December 1972 and January 1973 in salinities of 20.0 and 22.0 ppt and in temperatures of 9.7 and 11.0 C, respectively. Moseley and Copeland (1971) caught none in Cox Bay during winter.

Naked goby, Gobiosoma bosc: Four naked gobies (9-28 mm SL) were caught at stations 1, 3 and 6 in June 1972 and July 1973 in salinities ranging from 0.6 - 12.2 ppt and in temperatures ranging from 24.5 - 31.0 C. Hoese (1965) reported spawning occurred within the bays from March - October. Gunter and Hall (1963) found them common in grassy areas, whereas Swingle (1971) found them most common in oyster communities.

Family Trichiuridae

Atlantic cutlassfish, Trichiurus lepturus: Seven cutlassfish (276-485 mm SL) were caught during May, August and September 1972 at stations 2 and 3 in salinities ranging from 14.0 - 25.5 ppt and in temperatures ranging from 26.0 - 31.0 C.

Family Stomateidae

Harvestfish, Peprilus alepidotus: Two harvestfish (50 and 80 mm SL) were caught at station 4 in July and September 1972. They were caught in

salinities of 11.1 ppt and 15.5 ppt and in temperatures of 29.5 C and 30.6 C. Moseley and Copeland (1971) believed that low salinity was a limiting factor for this species.

Family Bothidae

Bay whiff, Citharichthys spilopterus: There were 14 fish (33-90 mm SL) caught in late spring and summer at stations 1, 2, 4 and 5 in salinities ranging from 2.2 - 14.4 ppt and in temperatures ranging from 17.0 - 33.0 C. Moseley and Copeland (1971) found them common to abundant in all seasons except winter in Cox Bay. Swingle (1971) found bay whiff most abundant from May through September in Alabama.

Southern flounder, Paralichthys lethostigma: Twelve fish (32-200 mm SL) were caught in salinities ranging from 0.0 - 15.5 ppt and in temperatures from 10.2 - 31.0 C. All were caught during February-August. Greatest numbers were collected during late winter and spring. Juveniles (34-75 mm SL) were first found in March through May (67-95 mm SL). Moseley and Copeland (1971) collected this species during all seasons except summer. Gunter (1945) reported similar findings from Aransas Bay.

Family Soleidae

Lined sole, Achirus lineatus: There were 15 lined sole caught (26-60 mm SL). They were caught at all stations and in salinities ranging from 0.0 - 17.2 ppt and in temperatures ranging from 10.2 - 32.5 C. They were most plentiful in summer and early fall with only three being caught during winter; none were caught during spring. Most (80%) were caught in salinities <7.9 ppt. Gunter (1945) reported few lined sole present <10.0 ppt.

Blackcheek tonguefish, Symphurus plagiusa: Three blackcheek tonguefish (88-90 mm SL) were caught at station 2 in July, August and November 1972 in salinities ranging from 9.7 - 16.0 ppt and in temperatures from 10.0 - 30.0 C. Swingle (1971) found over 60% of his specimens in salinities $\geq$25 ppt and agreed with Gunter (1945) that the species is more abundant in high salinities. Moseley and Copeland (1971) stated blackcheek tonguefish utilize Cox Bay and Keller Bay as nursery areas.

Hogchoker, Trinectes maculatus: There were 11 hogchoker (15-115 mm SL) caught during summer and fall in salinities ranging from 3.3 - 12.2 ppt and in temperatures ranging from 21.0 - 32.0 C; 9 were in salinities <8.3 ppt. Swingle (1971) caught most hogchokers in salinities <5.0 ppt, whereas Gunter (1945) reported them to be most abundant in salinities >30.0 ppt. Moseley and Copeland (1971) reported low salinity was a limiting factor for this fish in Cox Bay.

Family Tetrodontidae

Least puffer, Sphoeroides parvus: There were 157 specimens (29-128 mm SL) caught at stations 1 through 4 in salinities ranging from 5.6 - 25.5 ppt and in temperatures ranging from 10.0 - 31.0 C. Of these, 121 were

caught in July and August 1972 in salinities ranging from 8.3 - 14.4 ppt and in temperatures ranging from 27.5 - 31.0 C.

DISCUSSION

A great diversity of species were identified from samples collected in Big Chocolate Bay during this study. Our results show that this area is an important nursery ground for many estuarine organisms. Although the system has been altered during the past 20-30 years by activities that include drainage improvements, the bay is still a very valuable state resource. Small tertiary type estuarine areas such as Chocolate Bay are important components of the larger ecosystems (such as Matagorda Bay) found along the Texas coast.

Hydrological observations reveal that salinities were greatly affected by relatively low amounts of rainfall, which may be attributed to drainage improvements that occurred over the years in the Big Chocolate Bayou watershed. Regardless, the bay quickly reverted to higher salinity conditions after an influx of freshwater runoff.

Of all the stations, Station 1 was least influenced by moderate inflows of fresh water, probably because the spoil islands adjacent to Kingfisher Marine Service Inc.'s channel acted as a barrier against flushing. However, during periods of high inflow, recovery to a more saline condition was slowed because the spoil islands acted as a retaining barrier as observed during June 1973.

According to an anecdotal account, there were extensive communities of submerged seagrass present in the southern portion of the bay prior to 1960. However, observations conducted during this study reveal that seagrass beds were not extensive. It seems possible that increased turbidities resulting from drainage improvements may have contributed to the demise of sea grass communities in this estuarine area. Ward et al. (1980) states that densities of seagrasses in the Matagorda Bay system may have been altered over a long period of time by changes in nutrient mass being transported by reduced freshwater inflows. So, it seems likely that some changes have already occurred to the Chocolate Bay system in relatively recent years. Therefore, all persons considering future construction, development, and improvement projects in this area should be mindful of the relatively sensative nature of this vital coastal habitat.

Since this study was conducted in 1973, the only major development in the Chocolate Bay system was the construction of an aquaculture shrimp farm facility (Port Lavaca Plantation Shrimp Farm) on the south side of the bay in 1989. This facility is permitted to pump water out of and into Chocolate Bay with the restriction that all released water be within two degrees Celsius and two parts per thousand salinity of bay water. This restriction should prevent this facility from having any major impact on the system.

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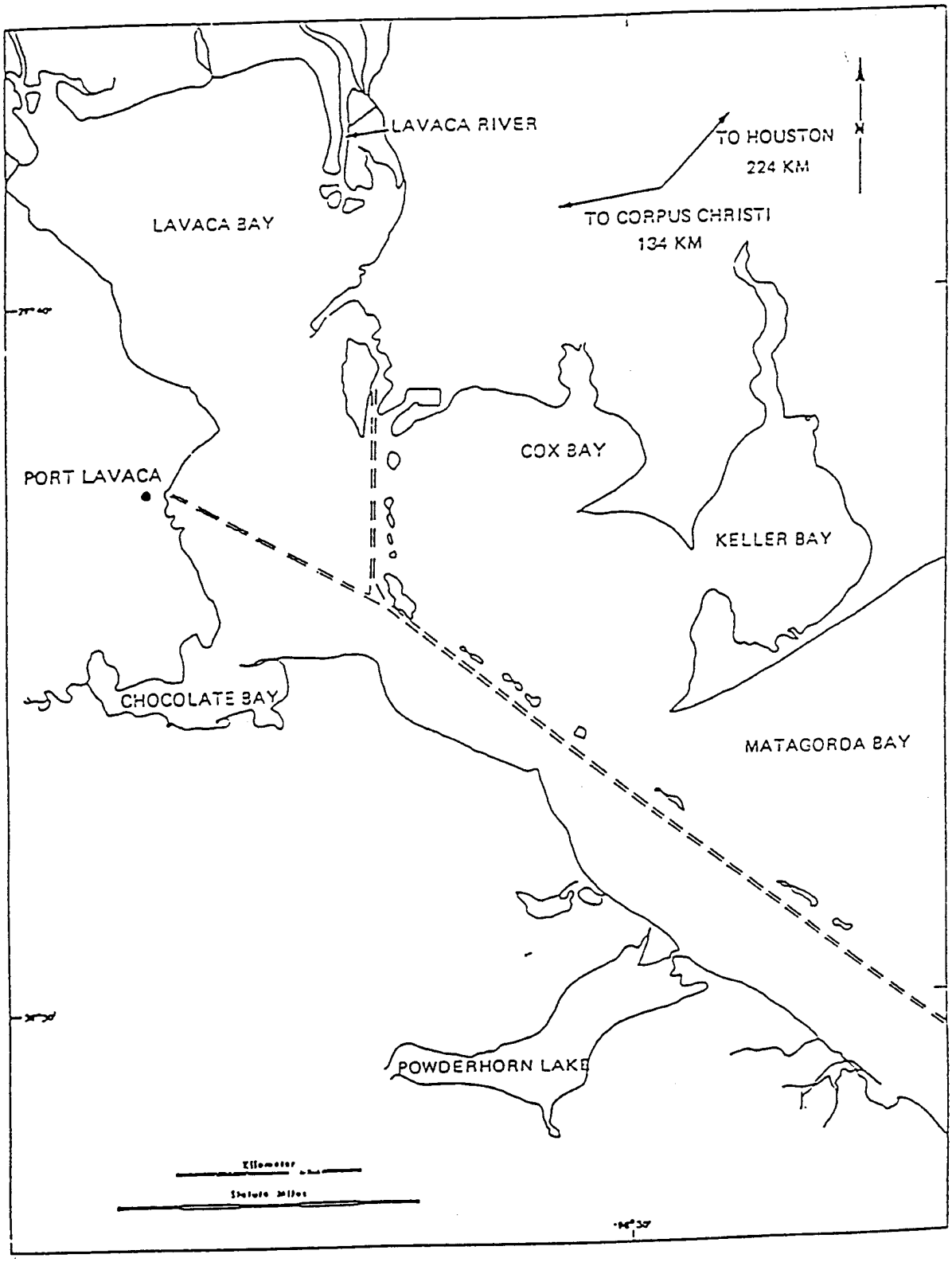

Figure 1. Lavaca Bay complex.

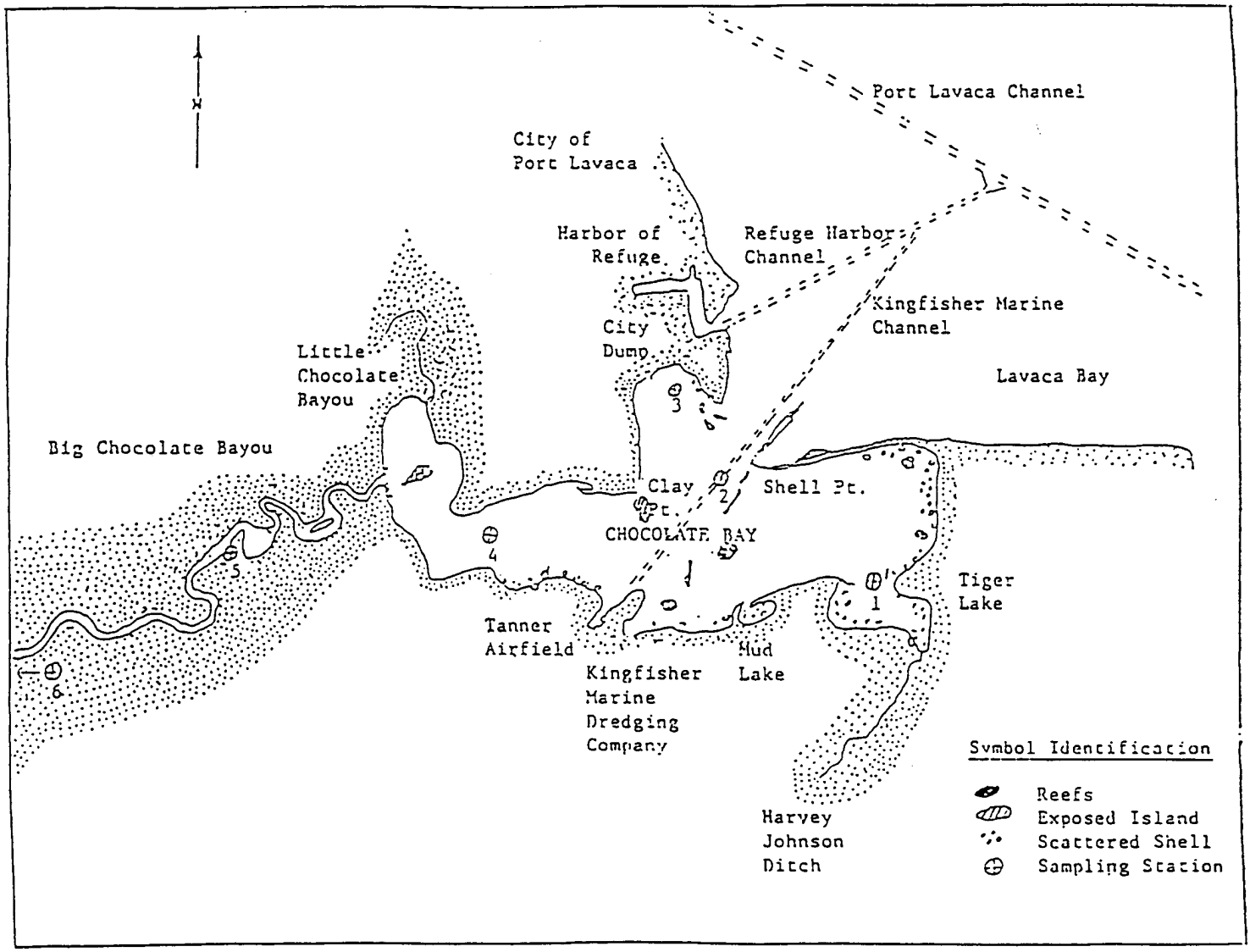

Figure 2. Chocolate Bay with reefs and sample stations.

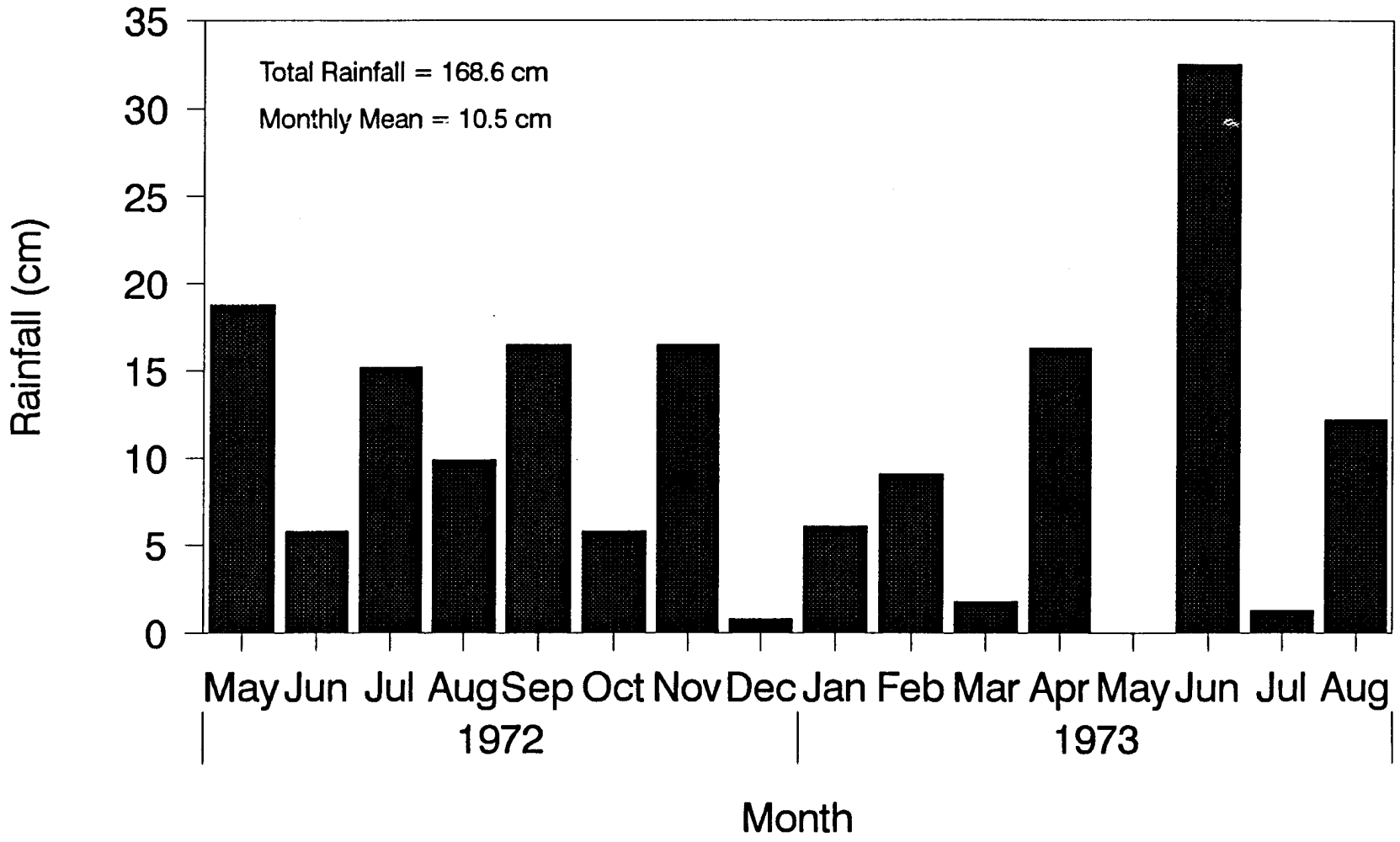

Figure 3. Monthly rainfall for Port Lavaca, Texas, May 1972 through August 1973.

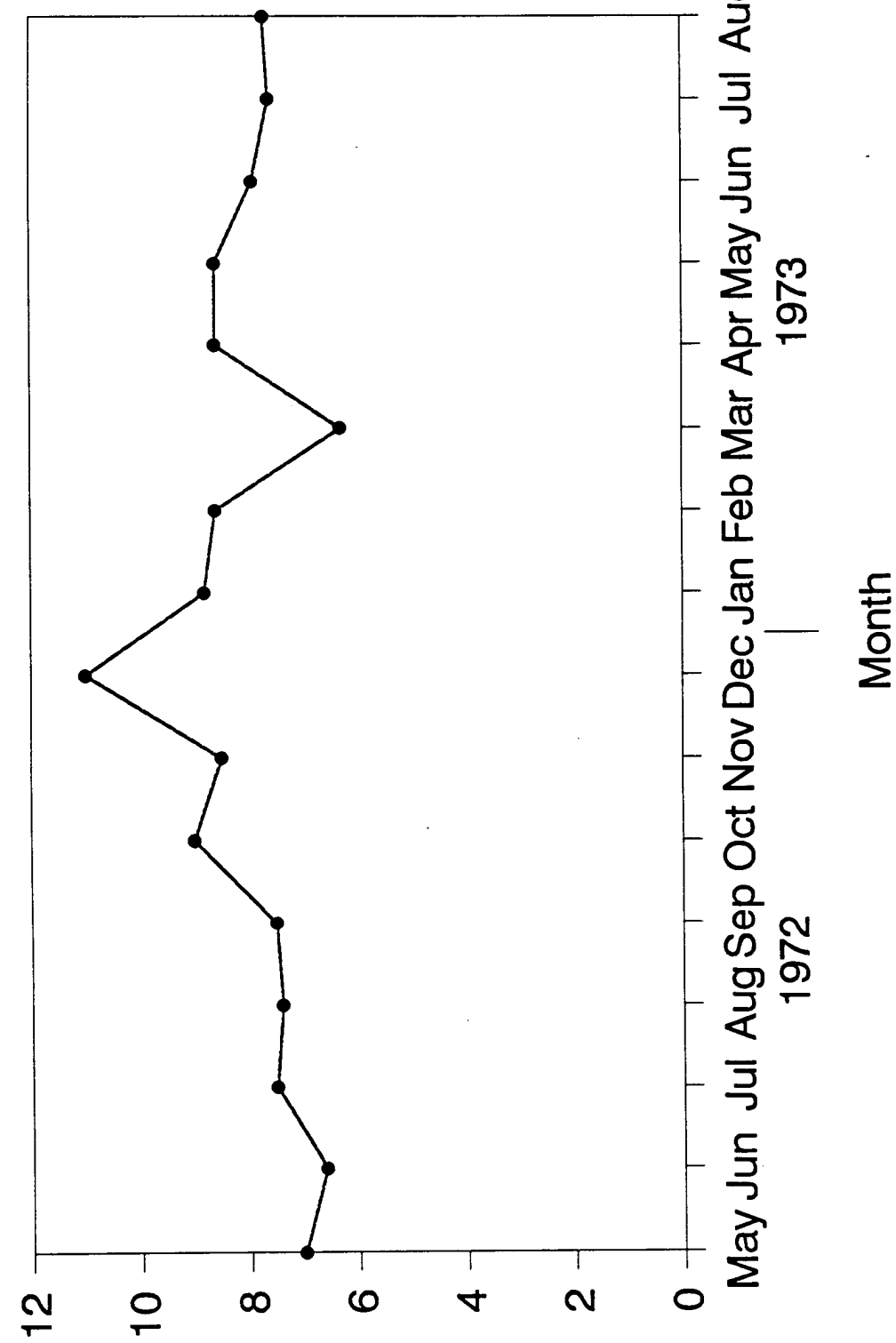

Figure 4. Mean monthly dissolved oxygen in the Chocolate Bay system May, 1972 through August, 1973.

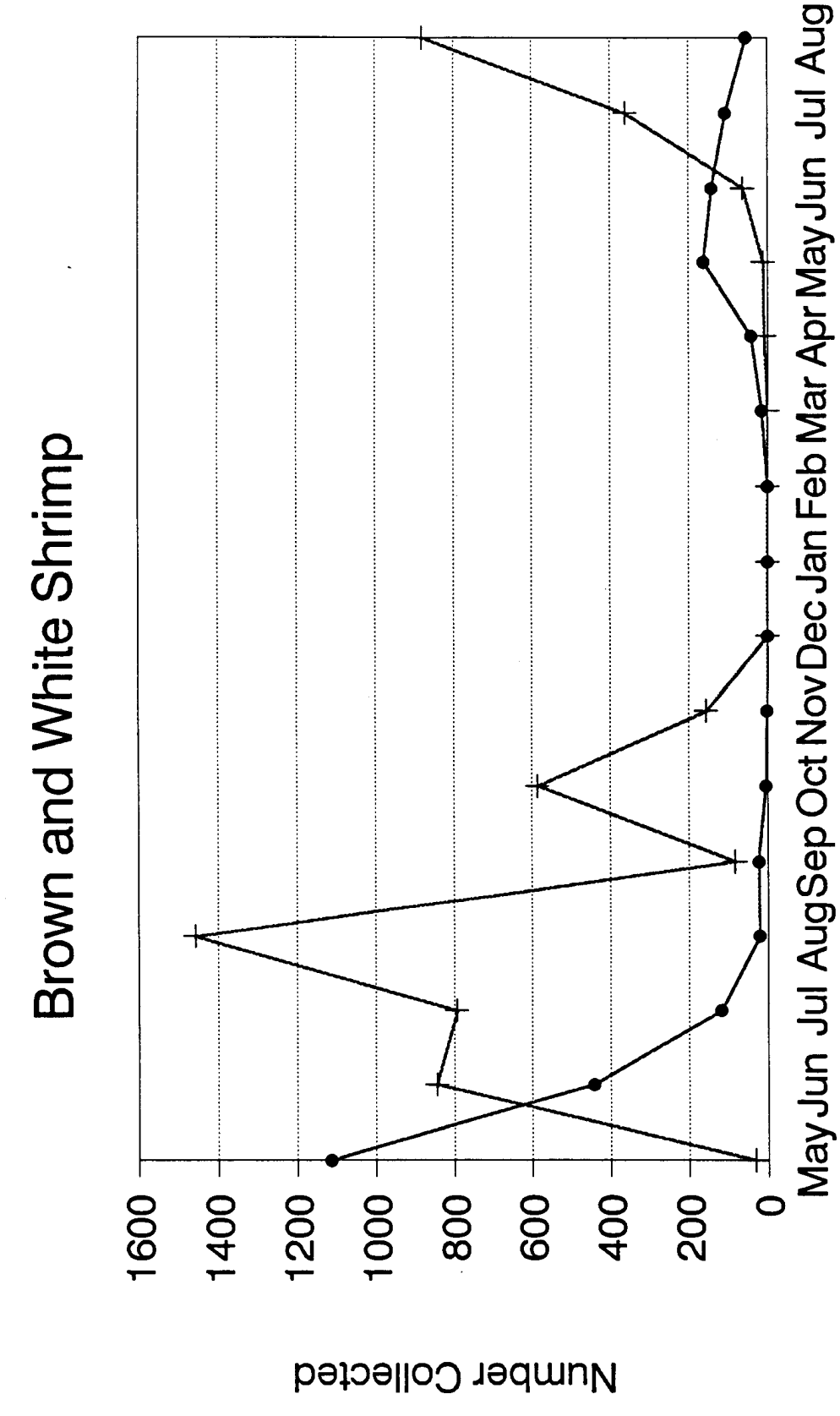

Figure 5. Total catch by month of brown and white shrimp in the Chocolate Bay system, May 1972 through August 1973.

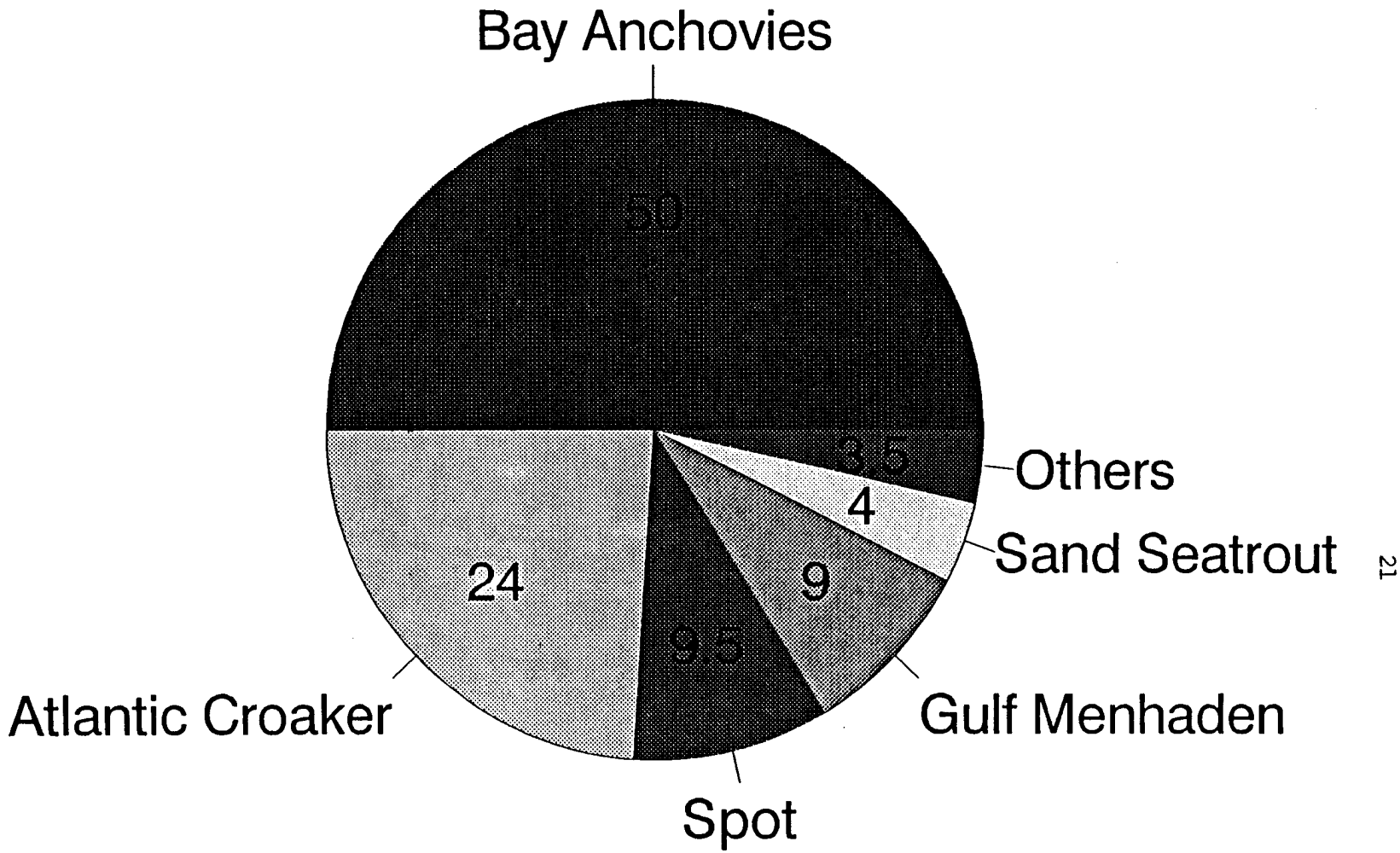

Figure 6. Percent species caught with a 3.1 m otter trawl in the Chocolate Bay system May, 1972 through August, 1973.

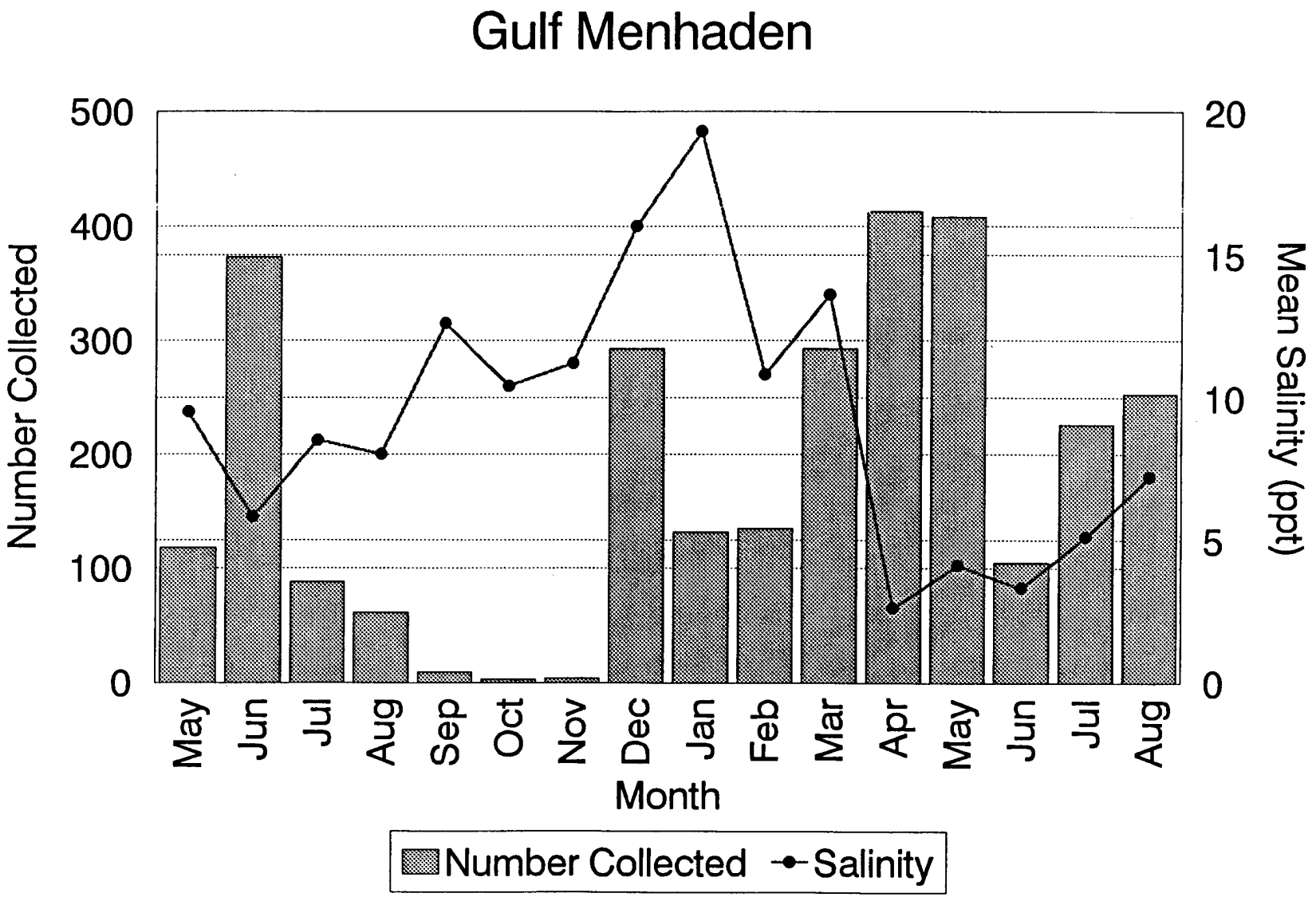

Figure 7. Total catch by month of gulf menhaden and mean monthly saliiities in the Chocolate Bay system, May 1972 through August 1973.

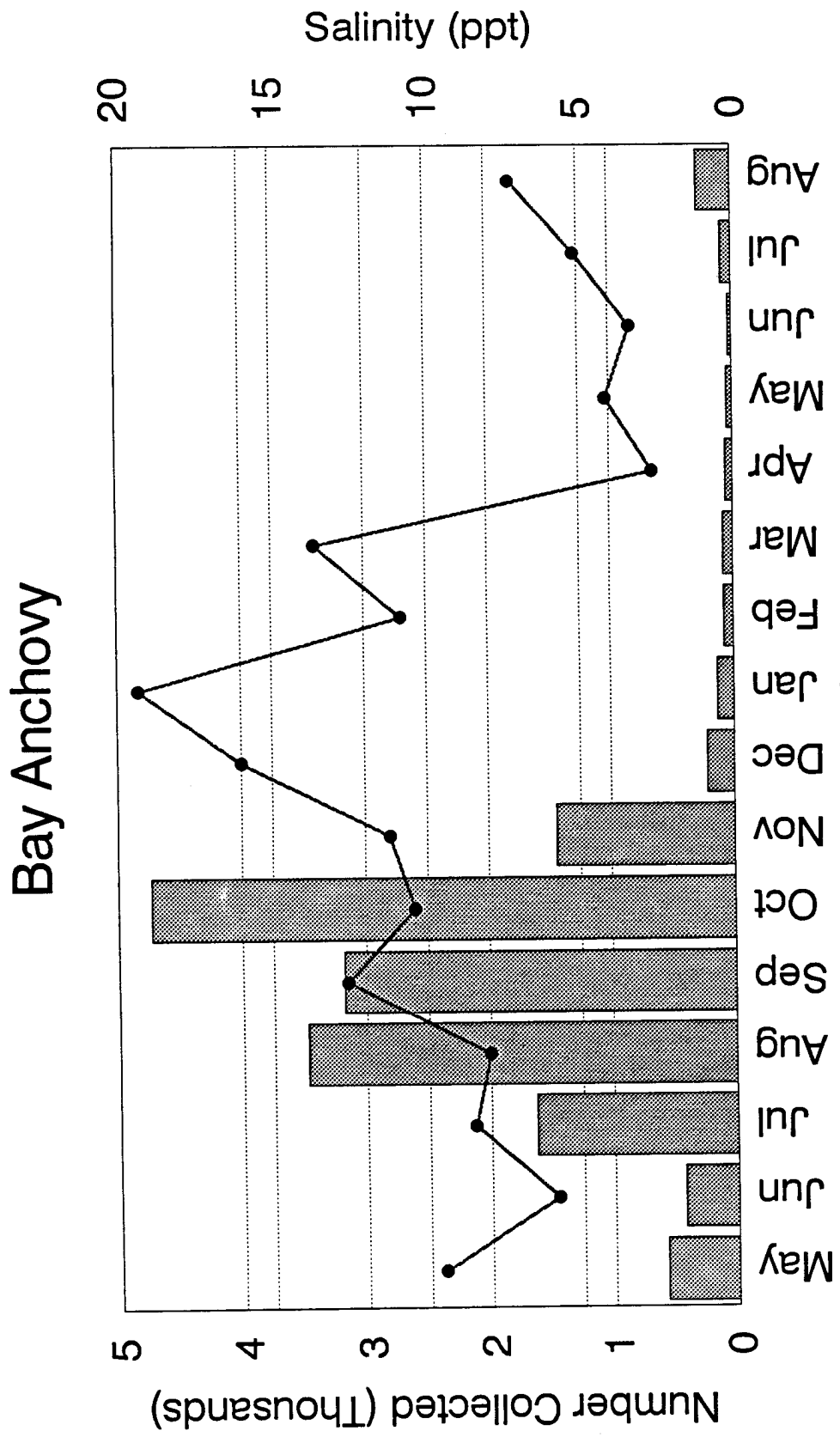

Figure 8. Total catch by month of bay anchovies and mean monthly saliities in the Chocolate Bay system, May 1972 through August 1973.

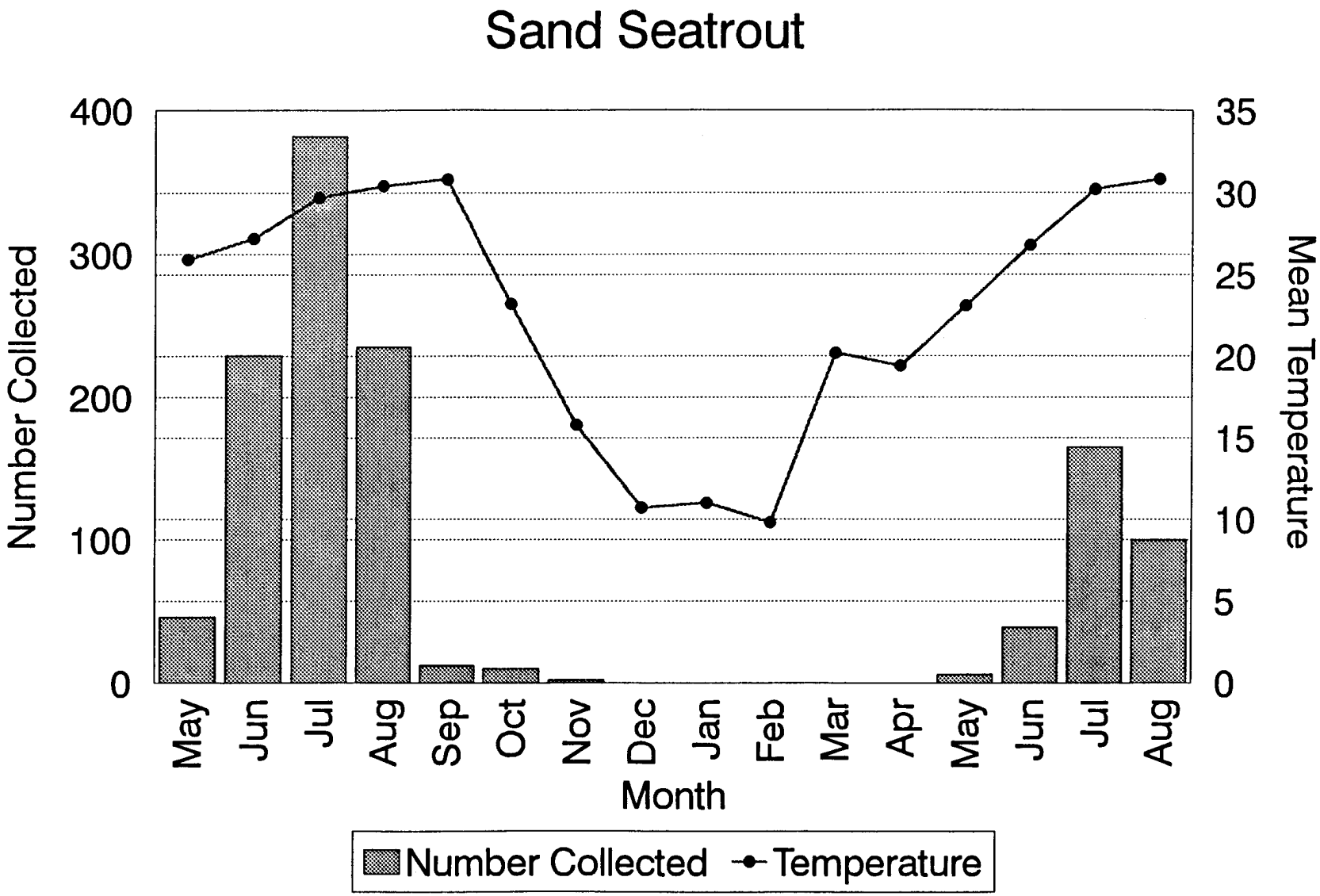

Figure 9. Total catch by month of sand seatrout and mean monthly temperature (Celcius) in the Chocolate Bay system, May 1972 through August 1973.

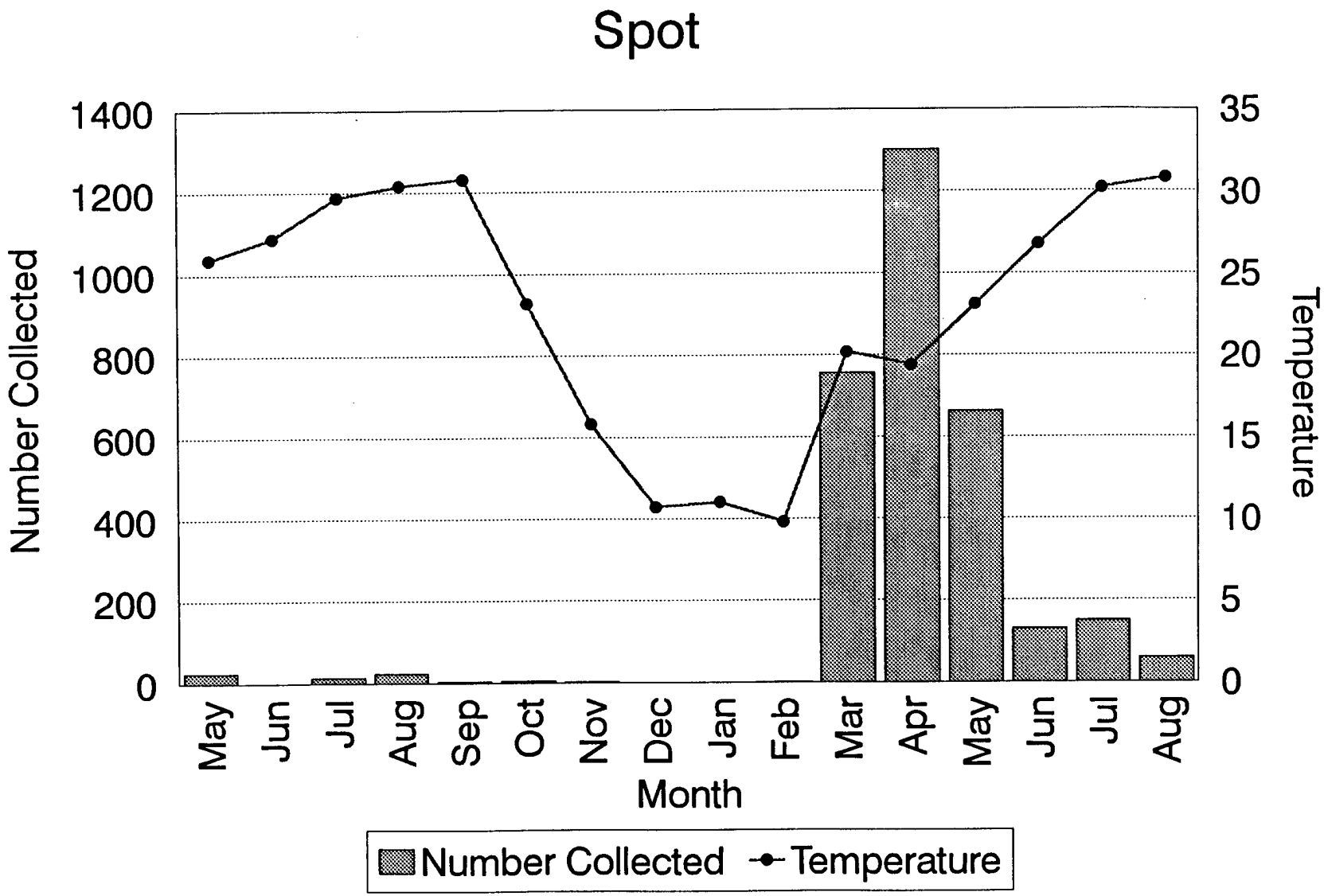

Figure 10. Total catch by month of spot and mean monthly temperature (Celcius) in the Chocolate Bay system, May 1972 through August 1973.

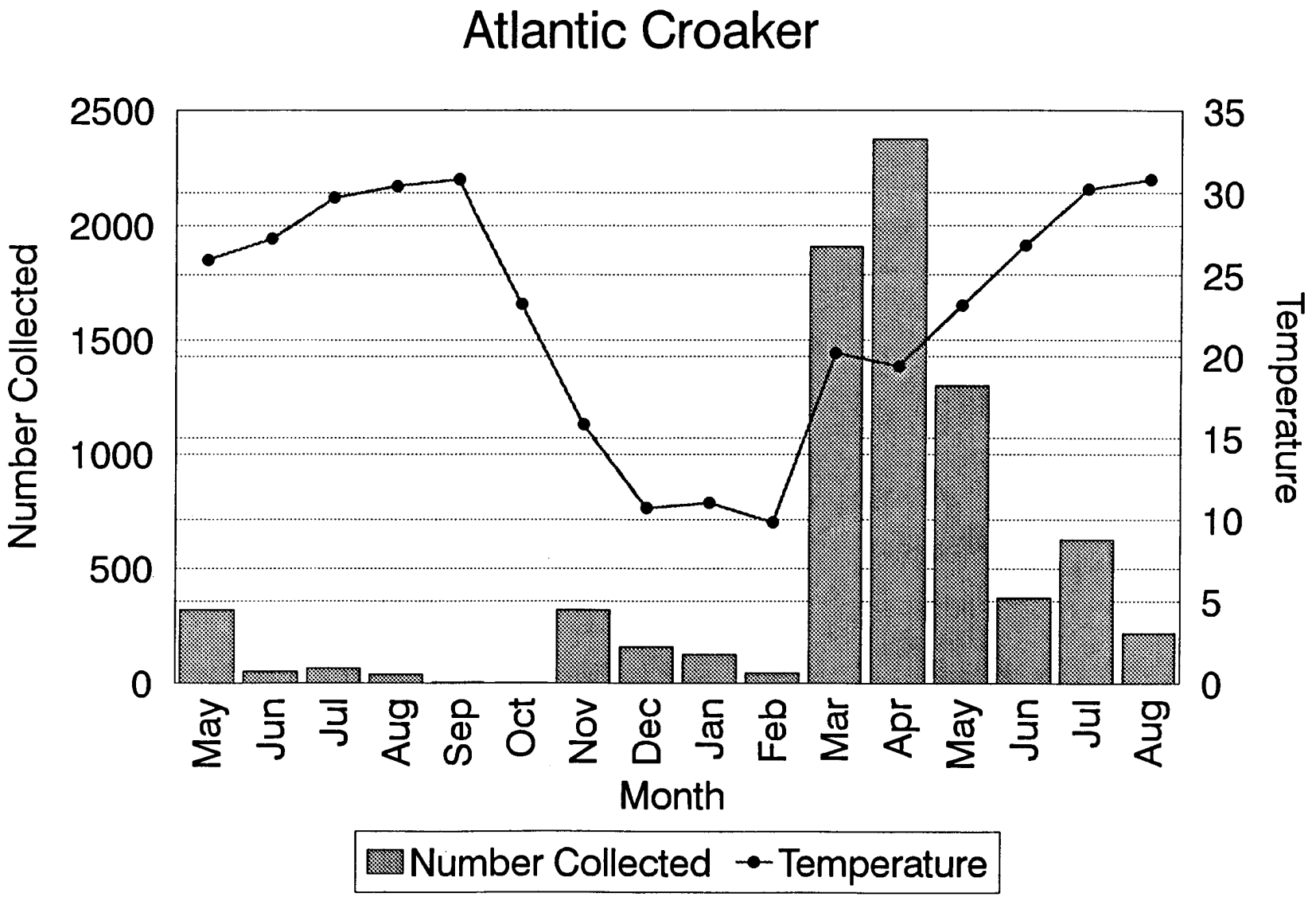

Figure 11. Total catch by month of Atlantic croaker and mean monthly temperature (Celcius) in the Chocolate Bay system, May 1972 through August 1973.

Table 1. Hydrologic parameters at station 1 in the Chocolate Bay system, May 1972 through August 1973. ND = no data.

Date	Temperature (C)	Dissolved oxygen (mg/l)	Turbidity (JTU)	Salinity (ppt)	pH	Nitrates (mg/l)	Meta-phosphates (mg/l)
May 04 1972	26.0	8.0	74	20.0	ND	3.1	ND
29	24.5	6.6	45	3.3	8.4	0.5	ND
Jun 12	24.0	5.0	53	6.7	7.7	4.0	ND
19	30.0	8.0	30	7.5	7.0	2.0	0.17
Jul 03	30.0	8.0	54	10.5	8.1	3.0	0.09
18	29.0	8.0	48	12.2	8.4	4.0	0.18
Aug 01	31.0	8.0	55	12.2	7.6	4.0	0.18
18	29.5	7.0	65	9.9	8.2	1.9	0.20
Sep 06	32.0	8.0	47	14.4	7.8	4.1	0.22
21	30.0	7.0	43	16.7	8.1	3.5	0.37
Oct 02	24.5	10.0	28	13.3	8.2	4.5	0.19
23	23.0	9.0	20	14.0	8.3	3.5	0.20
Nov 09	21.0	10.0	33	15.0	7.8	3.4	0.23
30	10.0	8.0	32	16.0	8.0	2.8	0.15
Dec 18	9.7	11.0	20	18.3	6.9	3.0	0.12
Jan 04 1973	10.5	9.0	ND	22.0	8.0	2.2	0.07
Feb 19	10.0	9.2	38	19.0	8.1	3.5	0.20
Mar 09	21.3	6.6	25	18.9	7.9	5.0	0.33
27	18.0	6.4	75	17.8	7.9	5.0	0.33
Apr 12	18.0	9.5	37	8.3	8.0	3.7	0.25
27	20.0	8.0	145	0.0	7.6	3.0	1.23

May 08	25.0	8.0	60	3.3	ND	3.0	0.38
16	19.0	9.0	55	5.6	ND	3.0	0.32
Jun 08	27.0	9.0	55	10.0	ND	3.0	0.32
27	26.5	10.0	60	2.2	8.3	3.5	0.43
Jul 03	29.0	7.7	19	6.7	8.3	4.0	0.75
17	31.0	8.6	33	6.7	8.3	4.0	0.75
Aug 02	28.0	7.4	120	7.2	ND	ND	ND
20	33.0	8.6	52	8.3	8.2	3.0	0.30

Table 2. Hydrologic parameters at station 2 in the Chocolate Bay system, May 1972 through August 1973. Single reading = mid column water samples. Double reading = top and bottom water samples.ND = no data.

Date	Temperature (C)	Dissolved oxygen (mg/l)	Turbidity (JTU)	Salinity (ppt)	pH	Nitrates (mg/l)	Meta-phosphates (mg/l)
May 04 1972	26.0	6.0	62	23.3	ND	4.0	ND
29	26.0	5.6	62	5.6	8.3	0.7	ND
Jun 12	24.0	7.0	62	8.3	7.1	2.0	ND
19	29.0	2.4	35	14.0	7.4	2.8	0.14
Jul 03	29.5	7.2	43	11.6	8.0	2.5	0.06
18	29.5	7.0	37	12.2	8.3	3.5	0.27
Aug 01	31.0	7.0	48	14.4	7.2	2.5	0.14
18	30.0	6.0	40	11.1	8.4	1.8	0.27
Sep 06	32.0	4.0	33	14.4	7.6	2.6	0.13
21	30.0	8.0	43	17.2	8.2	3.8	0.23
Oct 02	24.5	11.0	29	14.9	6.8	4.0	0.24
23	22.0	9.0	18	16.0	8.4	4.1	0.17
Nov 09	20.5	11.0	40	20.0	8.0	4.5	0.42
30	10.0	9.0	44	17.0	8.1	1.9	0.17
Dec 18	9.7	11.0	40	20.0	6.3	3.0	0.18
Jan 04 1973	11.0	9.0	ND	22.0	8.0	2.3	0.18
Feb 19	9.5/9.0	9.2/9.2	14.0/29.0	14.0/18.0	8.2/8.1	5.0	0.40
Mar 09	21.5/22.0	6.5/7.1	33.0/31.0	13.3/17.8	8.0/8.0	4.8	0.46
27	18.3/18.5	6.2/5.4	49.0/47.0	5.5/16.7	7.8/7.9	4.5	0.23
Apr 12	17.0/17.0	9.6/8.7	41.0/47.0	9.4/9.4	8.2/8.2	3.8	0.20
27	19.5/19.5	8.5/8.5	130.0/140.0	0.0/1.1	7.7/7.7	3.5	0.97

May 08	25.0/26.0	8.4/8.4	60.0/70.0	3.3/3.9	ND	2.0	0.34
16	20.0/20.0	9.0/9.0	40.0/70.0	5.6/6.0	ND	3.0	0.29
Jun 08	25.0/25.0	7.4/7.5	50.0/55.0	ND/10.0	ND	3.0	0.28
27	27.5/26.5	9.6/9.8	70.0/80.0	1.1/1.1	8.0/8.0	4.0	0.45
Jul 03	29.5/29.2	8.3/8.8	42.0/158.0	6.7/6.7	8.3/8.0	4.0	0.50
17	31.0/30.0	8.0/6.0	45.0/150.0	6.7/6.7	8.3/8.0	4.0	0.50
Aug 02	28.0/28.0	7.4/7.2	30.0/60.0	8.3/11.1	8.3/8.3	ND	ND
20	33.0/33.0	8.7/8.3	20.0/40.0	8.3/10.5	8.4/8.2	3.0	0.48

Table 3. Hydrologic parameters at station 3 in the Chocolate Bay system, May 1972 through August 1973. ND = no data.

Date	Temperature (C)	Dissolved oxygen (mg/l)	Turbidity (JTU)	Salinity (ppt)	pH	Nitrates (mg/l)	Meta-phosphates (mg/l)
May 04 1972	26.0	8.0	75	25.5	ND	3.7	ND
29	26.0	7.0	60	3.9	8.1	0.5	ND
Jun 12	25.0	7.4	77	7.2	7.6	3.0	ND
19	30.5	7.2	55	8.0	7.8	4.9	0.17
Jul 03	29.5	8.2	65	11.0	8.3	3.5	0.04
18	29.5	7.0	34	12.2	8.4	3.1	0.13
Aug 01	31.0	7.0	67	12.2	7.8	3.5	0.26
18	29.7	8.0	50	9.9	8.3	1.7	0.25
Sep 06	30.0	9.0	38	15.5	7.7	3.7	0.27
21	30.0	7/0	54	17.2	8.4	3.7	0.17
Oct 02	23.0	11.0	42	13.8	8.3	5.5	0.24
23	22.0	9.0	18	16.0	8.4	3.6	0.18
Nov 09	21.0	8.0	39	16.0	8.4	4.2	0.28
30	10.0	8.0	42	17.0	8.2	2.3	0.18
Dec 18	10.0	12.0	30	19.0	7.4	3.3	0.14
Jan 04 1973	11.0	10.1	ND	22.0	8.1	1.7	0.07
Feb 19	10.0	9.2	30	18.0	8.2	3.4	0.48
Mar 09	22.0	7.0	22	17.2	8.0	5.0	0.13
27	18.5	6.8	69	11.1	7.8	4.0	0.30
Apr 12	18.5	10.7	63	7.8	8.2	3.8	1.0
27	20.0	8.2	130	0.0	7.6	2.0	0.56

May 08	24.0	9.2	43	4.4	ND	2.0	0.25
16	20.0	10.0	40	6.7	ND	3.0	0.27
Jun 08	27.0	8.0	55	10.0	ND	3.0	0.25
27	26.5	9.2	80	1.1	8.0	3.0	0.35
Jul 03	30.0	8.7	69	6.7	8.3	3.0	0.38
17	31.5	7.9	50	6.7	8.3	3.0	0.38
Aug 02	28.5	7.4	30	11.1	8.4	ND	ND
20	34.0	8.7	36	10.5	8.3	5.0	0.27

Table 4. Hydrologic parameters at station 4 in the Chocolate Bay system, May 1972 through August 1973. ND = no data.

Date	Temperature (C)	Dissolved oxygen (mg/l)	Turbidity (JTU)	Salinity (ppt)	pH	Nitrates (mg/l)	Meta-phosphates (mg/l)
May 04 1972	28.0	10.0	72	15.0	ND	2.9	ND
29	25.0	7.2	62	3.3	6.8	0.8	ND
Jun 12	24.5	8.2	90	5.6	7.7	1.4	ND
19	30.0	8.8	55	5.5	7.8	1.0	0.30
Jul 03	29.5	7.	977	11.1	7.9	3.0	0.12
18	30.0	8.5	63	8.3	8.5	4.1	0.13
Aug 01	31.0	8.0	74	11.1	7.7	4.0	0.15
18	29.8	8.5	75	7.7	8.1	1.2	0.28
Sep 06	31.0	8.0	44	12.2	8.0	2.2	0.17
21	30.6	8.0	65	15.5	8.5	3.0	0.30
Oct 02	23.8	12.5	37	11.1	8.3	4.8	0.32
23	22.0	8.0	35	12.0	8.2	3.4	0.31
Nov 09	21.0	8.0	29	10.0	8.4	3.0	0.23
30	10.0	10.0	44	12.0	8.3	4.0	0.28
Dec 18	11.5	11.0	40	17.0	7.0	2.0	0.16
Jan 04 1973	11.0	8.8	ND	20.0	8.1	3.5	0.16
Feb 19	9.1	9.0	40	12.0	8.2	3.4	0.35
Mar 09	22.0	7.2	65	13.9	8.5	5.5	0.22
27	18.3	6.8	175	17.7	8.2	4.0	0.57
Apr 12	20.0	10.3	73	3.3	7.7	3.5	0.60
27	20.0	9.0	140	0.0	7.5	4.5	0.65

May 08	27.5	9.0	78	2.2	ND	2.0	0.82
16	20.0	9.0	50	5.6	ND	3.0	0.33
Jun 08	27.5	7.5	55	10.0	ND	3.0	0.34
27	26.5	6.8	150	0.0	7.8	3.0	0.54
Jul 03	30.0	7.9	50	5.6	8.4	2.0	0.64
17	31.5	7.9	66	5.6	8.4	2.0	0.64
Aug 02	29.0	7.4	68	ND	8.3	ND	ND
20	32.0	8.7	45	6.7	8.6	3.0	0.37

Table 5. Hydrologic parameters at station 5 in the Chocolate Bay system, May 1972 through August 1973. Single reading = mid column water samples. Double reading = top and bottom water samples. ND = no data.

Date	Temperature (C)	Dissolved oxygen (mg/l)	Turbidity (JTU)	Salinity (ppt)	pH	Nitrates (mg/l)	Meta-phosphates (mg/l)
May 04 1972	25.0	7.0	103	7.8	ND	2.7	ND
29	25.0	6.4	58	2.8	7.1	1.0	ND
Jun 12	24.0	7.4	89	3.3	7.5	3.0	ND
19	30.5	7.4	80	3.0	7.8	2.5	0.32
Jul 03	30.0	7.5	68	9.4	8.1	4.5	0.09
18	30.0	7.5	52	2.2	8.5	2.3	0.20
Aug 01	31.0	8.0	60	3.3	7.8	ND	ND
18	29.4	8.0	110	3.3	8.4	1.9	0.45
Sep 06	33.0	10.0	49	10.0	8.4	3.1	0.28
21	30.0	ND	63	12.8	8.4	4.1	0.35
Oct 02	24.5	11.0	53	5.0	8.2	2.7	0.48
23	22.0	6.0	33	6.0	8.0	2.7	0.33
Nov 09	21.5	7.0	57	5.0	8.2	2.6	0.47
30	11.0	9.0	48	6.0	8.4	3.5	0.36
Dec 18	11.5	11.0	50	14.0	8.0	2.2	0.14
Jan 04 1973	11.5	9.0	ND	16.0	8.1	3.8	0.16
Feb 19	10.2/10.2	7.8/7.2	162.0/195.0	0.0/0.0	7.8/7.6	4.7	0.60
Mar 09	21.5/21.5	7.2/7.2	40.0/47.0	7.7/10.0	8.8/8.7	4.8	0.18
27	18.0/19.0	4.5/5.0	82.0/47.0	16.6/16.6	8.2/7.5	5.0	0.19
Apr 12	18.5/18.5	7.7/7.4	103.0/106.0	1.1/2.2	7.6/7.6	4.5	1.40

30	21.0/21.0	9.0/9.0	60.0/168.0	0.0/0.0	7.5/7.5	4.5	0.88
May 08	27.0/27.0	8.0/7.5	96.0/110.0	2.2/2.2	ND	2.0	0.53
16	18.5/18.5	8.7/8.7	30.0/40.0	5.0/5.6	ND	3.0	0.35
Jun 08	27.5/27.5	6.8/6.5	55.0	ND	ND	3.0	0.35
27	27.5/27.5	7.0/7.2	190.0/220.0	0.0/0.0	7.5/7.4	2.0	0.65
Jul 03	29.0/29.0	6.4/6.1	55.0/59.0	2.8/2.8	8.5/8.4	2.0	0.72
17	31.0/30.0	8.2/7.7	41.0/63.0	2.8/2.8	8.5/8.4	2.0	0.72
Aug 02	29.0/29.0	7.0/6.9	60.0/65.0	8.3/8.3	8.2/8.2	ND	ND
20	34.0/33.0	8.7/8.3	28.0/45.0	1.1/2.2	8.2/8.0	3.0	0.47

Table 6. Hydrologic parameters at station 6 in the Chocolate Bay system, May 1972 through August 1973. Single reading = mid column water samples. Double reading = top and bottom water samples. ND = no data.

Date	Temperature (C)	Dissolved oxygen (mg/l)	Turbidity (JTU)	Salinity (ppt)	pH	Nitrates (mg/l)	Meta-phosphates (mg/l)
May 04 1972	28.0	6.0	100	2.2	ND	2.1	ND
29	25.0	5.8	40	1.7	8.3	0.6	ND
Jun 12	25.0	6.8	52	1.1	7.8	3.0	ND
19	30.5	4.0	145	0.0	6.6	4.0	0.38
Jul 03	30.0	8.0	45	0.6	7.8	1.0	0.11
18	30.0	6.0	110	1.1	7.6	7.3	0.25
Aug 01	32.5	7.0	30	1.1	8.1	2.0	0.28
18	31.1	6.0	70	0.6	7.7	1.3	0.60
Sep 06	31.0	6.0	43	2.2	8.1	3.2	0.27
21	29.7	5.0	67	3.9	8.0	4.0	0.55
Oct 02	24.5	7.0	59	0.5	7.9	4.5	0.64
23	23.0	5.0	33	2.0	7.6	3.2	0.58
Nov 09	22.3	6.0	39	0.5	7.9	2.7	0.48
30	12.0	8.0	82	0.5	7.7	3.8	0.43
Dec 18	12.0	10.0	45	8.0	7.8	4.1	0.29
Jan 04 1973	12.0	7.0	ND	12.0	8.1	4.6	0.18
Feb 19	10.5/10.2	7.8/7.8	95.0/110.0	0.0/0.0	7.3/7.3	6.0	0.58
Mar 09	21.0/21.0	5.2/5.0	50.0/55.0	1.1/1.1	8.2/7.8	5.7	0.51
27	20.0/20.0	6.0/5.0	50.0/60.0	12.2/15.5	7.7/7.7	4.2	0.19
Apr 12	18.0/18.0	6.6/7.2	78.0/104.0	0.0/0.0	7.3/7.3	4.0	0.27

30	23.0/23.0	7.0/6.5	60.0/70.0	0.0/0.0	7.2/7.2	3.0	0.55
May 08	28.0/28.0	8.0/6.5	56.0/62.0	1.1/1.1	ND	2.0	0.95
16	22.0/22.0	7.8/7.5	30.0/45.0	3.9/3.9	ND	3.0	0.37
Jun 08	27.5/27.7	6.5/6.5	55.0	ND	ND	3.0	0.38
27	27.0/27.3	7.0/6.8	140.0/160.0	0.0/0.0	7.3/7.4	4.0	0.60
Jul 03	31.0/30.0	6.2/5.5	28.0/33.0	1.1/2.8	7.6/8.0	5.0	0.71
17	33.5/31.0	7.8/4.4	18.0/31.0	1.1/2.8	7.6/8.0	5.0	0.71
Aug 02	29.5/29.5	7.0/6.8	20.0/60.0	5.0/5.0	7.3/7.4	ND	ND
20	33.0/32.5	6.8/5.4	35.0/50.0	1.1/2.2	7.6/7.9	3.0	0.58

Table 7. Annual mean ($\bar{x}$), range and number of samples (N) for hydrologic parameters collected at six stations in the Chocolate Bay system, May 1972-August 1973.

Parameter	1	2	3	4	5	6
Temperature (C)						
$\bar{x}$	23.8	23.6	24.0	24.2	24.2	24.8
Range	9.7-33.0	9.0-33.0	10.0-34.0	9.1-32.0	10.2-34.0	10.2-33.5
N	29	42	29	29	42	42
Dissolved oxygen (mg/l)						
$\bar{x}$	8.3	7.9	8.2	8.5	7.7	6.5
Range	5.0-11.0	2.4-11.0	6.8-12.0	6.8-12.5	4.5-11.0	4.0-10.0
N	29	42	29	29	41	42
Turbidity (JTU)						
$\bar{x}$	51	55	52	68	78	63
Range	19.0-145	14.0-158	18.0-130.0	29.0-175.0	28.0-220.0	18.0-160.0
N	28	41	28	28	40	40
Salinity (o/oo)						
$\bar{x}$	11.2	10.8	11.6	9.3	5.3	2.5
Range	0.0-22.0	0.0-23.3	0.0-25.5	0.0-20.0	0.0-16.6	0.0-15.5
N	29	41	29	28	40	40
pH						
$\bar{x}$	8.0	7.9	8.1	8.0	8.0	7.7
Range	6.9-8.4	6.3-8.4	7.4-8.4	6.8-8.6	7.1-8.8	6.6-8.3
N	24	35	25	25	35	35
Nitrate (mg/l)						
$\bar{x}$	3.3	3.3	3.3	3.0	3.1	3.5
Range	0.5-5.0	0.7-5.0	0.5-5.5	0.8-5.5	1.0-5.0	0.6-7.3
N	28	28	28	28	27	28
Metaphosphate (mg/l)						
$\bar{x}$	0.32	0.31	0.28	0.36	0.44	0.46
Range	0.07-1.23	0.06-0.97	0.04-1.00	0.09-0.82	0.09-1.40	0.11-0.95
N	25	25	25	25	24	25

Table 8. Species caught with a 3.1 m otter trawl in the Chocolate Bay system, May 1972-August 1973. NC = no counts taken.

Scientific name	Common name	Number caught
Invertebrates		
Acetes americanus	Sergestid shrimp	271
Alpheus heterochaelis	Pistol shrimp	3
Beroe ovata	Large combjelly	NC
Callinectes sapidus	Blue crab	332
Lolliguncula brevis	Brief squid	24
Macrobrachium ohione	River shrimp	20
Palaemonetes pugio	Grass shrimp	283
Panopeus herbstii	Xanthid crab	3
Penaeus aztecus	Brown shrimp	2,228
Peneaus setiferus	White shrimp	5,261
Procambarus clarki	Crawfish	3
Stomolophus meleagris	Cabbagehead	NC
Subtotal		8,428
Vertebrates		
Achirus lineatus	Lined sole	15
Anchoa mitchilli	Bay anchovy	16,461
Archosargus probatocephalus	Sheepshead	5
Arius felis	Hardhead catfish	232
Bagre marinus	Gafftopsail catfish	104
Bairdiella chrysura	Silver perch	183
Brevoortia patronus	Gulf menhaden	2,914
Caranx hippos	Crevalle jack	5
Centropomus undecimalis	Common snook	1
Chaetodipterus faber	Atlantic spadefish	7
Chasmodes bosquianus	Striped blenny	1
Chloroscombrus chrysurus	Atlantic bumper	7
Citharichthys spilopterus	Bay whiff	14
Cynoscion arenarius	Sand seatrout	1,226
Cynoscion nebulosus	Spotted seatrout	4
Dorosoma cepedianum	Gizzard shad	245
Dorosoma petenense	Threadfin shad	13
Eucinostomus gula	Silver jenny	3
Fundulus grandis	Gulf killifish	2
Gobionellus oceanicus	Highfin goby	2
Gobiosoma bosc	Naked goby	4
Hemicaranx amblyrhynchus	Bluntnose jack	1
Ictalurus furcatus	Blue catfish	5
Ictiobus bubalus	Smallmouth buffalo	1
Leiostomus xanthurus	Spot	3,130
Lepisosteus oculatus	Spotted gar	3
Lepisosteus spatula	Alligator gar	1
Lepomis cyanellus	Green sunfish	1
Lepomis macrochirus	Bluegill	6
Menidia beryllina	Inland silverside	1
Menticirrhus americanus	Southern kingfish	1

Table 8. (Cont'd.)

Scientific name	Common name	Number caught
Micropogonias undulatus	Atlantic croaker	7,926
Mugil cephalus	Striped mullet	69
Paralichthys lethostigma	Southern flounder	12
Peprilus alepidotus	Harvestfish	2
Pogonias cromis	Black drum	6
Polydactylus octonemus	Atlantic threadfin	171
Pomoxis nigromaculatus	Black crappie	1
Porichthys plectrodon	Atlantic midshipmen	9
Sphoeroides parvus	Least puffer	157
Symphurus plagiusa	Blackcheek tonguefish	3
Trichiurus lepturus	Atlantic cutlassfish	7
Trinectes maculatus	Hogchoker	11
Subtotal		32,972
Total		41,400

Table 9. Monthly catch (N), mean standard length (ML) and size range (SR) in mm of Penaeus setiferus by station in the Chocolate Bay system, May 1972-August 1973. Blanks = no data.

Site	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Station 1																
N	14	40	24	47	1	12	21	0	0	0	0	0	5	24	126	189
ML	40	39	96	83	115	66	48						116	41	56	69
SR	(27-151)	(25-64)	(46-127)	(33-144)	(115)	(26-89)	(32-65)						(105-130)	(28-116)	(30-100)	(31-118)
Station 2																
N	5	27	24	12	0	49	64	0	0	0	0	7	2	0	70	229
ML	78	51	79	99		67	74					102	134		54	86
SR	(30-158)	(33-68)	(26-126)	(30-144)		(33-116)	(40-102)					(86-112)	(117-150)		(34-92)	(45-137)
Station 3																
N	5	56	134	53	2	3	26	0	0	0	0	1	1	33	16	24
ML	31	46	74	72	65	67	46					95	95	32	67	82
SR	(18-44)	(28-160)	(35-132)	(24-75)	(62-68)	(60-80)	(19-62)					(95)	(95)	(26-50)	(48-97)	(55-120)
Station 4																
N	3	221	90	91	8	105	1	0	0	0	0	0	3	4	133	210
ML	66	50	80	81	99	74	62						123	36	52	58
SR		(26-53)	(25-81)	(25-111)	(18-100)	(26-82)	(62)						(105-140)	(29-46)	(26-100)	(20-128)
Station 5																
N	3	497	469	1,178	42	0	0	0	0	0	0	0	0	1	12	221
ML	29	40	64	40	47									63	48	
SR	(26-33)	(25-71)	(25-111)	(18-100)	(26-82)									(63)	(42-90)	(20-117)
Station 6																
N	0	2	50	75	4	40	1	0	0	0	0	0	0	0	3	6
ML		57	58	60	65	43	60								65	73
SR		(55-58)	(25-92)	(30-95)	(31-102)	(30-90)	(60)								(42-96)	(63-67)
Combined																
N	31	843	791	1,456	82	584	155	0	0	0	0	8	11	61	360	879
ML	46	43	69	47	66	54	58					101	119	36	55	66
SR	(18-158)	(25-90)	(25-127)	(18-150)	(25-145)	(24-116)	(19-102)					(86-112)	(95-150)	(26-116)	(26-100)	(20-137)

Table 10. Mean temperature (C) and mean salinity (ppt) in the Chocolate Bay system by station and month, May 1972-August 1973.

	1		2		3		4		5		6		Combined	
Month	C	ppt	C	ppt	C	ppt	C	ppt	C	ppt	C	ppt	C	ppt
May	25.2	11.5	26.0	14.4	26.0	14.7	26.5	9.1	25.0	5.3	26.5	1.9	25.9	9.5
June	27.0	7.1	26.5	11.1	27.7	7.6	27.2	5.5	27.2	3.1	27.7	0.5	27.2	5.8
July	29.5	11.3	29.5	11.9	29.5	11.6	29.7	9.7	30.0	5.8	30.0	0.8	29.7	8.5
August	30.2	11.0	30.5	12.7	30.3	11.0	30.4	9.4	30.2	3.3	30.5	0.8	30.4	8.0
September	31.0	15.5	31.0	15.8	30.0	16.3	30.8	13.9	31.5	11.4	30.3	3.0	30.8	12.6
October	23.7	13.7	23.2	15.5	22.5	14.9	22.9	11.6	23.2	5.5	23.7	1.2	23.2	10.4
November	15.5	15.5	15.2	18.5	15.5	16.5	15.5	11.0	16.2	5.5	17.1	0.5	15.8	11.2
December	9.7	18.3	9.7	20.0	10.0	19.0	11.5	17.0	11.5	14.0	12.0	8.0	10.7	16.0
January	10.5	22.0	11.0	22.0	11.0	22.0	11.0	22.0	11.5	16.0	11.0	12.0	11.0	19.3
February	10.0	19.0	9.2	16.0	10.0	18.0	9.1	12.0	10.2	0.0	10.2	0.0	9.8	10.8
March	19.7	18.3	20.2	13.3	20.2	14.1	20.1	15.8	20.2	12.7	20.5	7.5	20.2	13.6
April	19.0	4.1	18.2	5.2	19.2	3.9	20.0	1.6	19.7	0.8	20.5	0.0	19.4	2.6
May	22.0	4.4	23.0	4.7	22.2	5.5	23.7	3.8	22.7	3.8	25.0	2.5	23.1	4.1
June	26.7	6.1	25.7	3.3	26.7	5.6	27.0	5.0	27.5	0.0	27.4	0.0	26.8	3.3
July	30.0	6.7	29.5	6.7	30.7	6.7	30.7	5.6	29.5	2.8	30.5	2.0	30.2	5.1
August	30.5	7.7	30.5	9.6	31.2	10.8	30.5	6.7	31.0	5.0	31.0	3.3	30.8	7.2

Table 11. Monthly catch (N), mean standard length (ML) and size range (SR) in mm of Penaeus aztecus by station in the Chocolate Bay system, May 1972-August 1973. Blanks = no data.

Site	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Station 1																
N	282	17	4	2	0	0	0	0	0	0	1	13	82	26	53	2
ML	60	63	74	38							18	45	30	78	83	70
SR	(33-104)	(33-85)	(67-82)	(38-38)							(18)	(27-61)	(29-80)	(56-116)	(50-116)	(46-95)
Station 2																
N	422	124	40	2	0	3	2	0	0	0	0	1	3	34	25	41
ML	66	63	66	47		42	67					27	61	84	82	79
SR	(45-98)	(33-97)	(42-107)	(46-48)		(42-61)	(64-61)					(27)	(45-77)	(43-110)	(42-110)	(47-125)
Station 3																
N	165	25	7	1	0	0	0	0	0	0	12	15	27	11	20	1
ML	54	56	70	73							21	31	55	78	85	107
SR	(28-91)	(27-82)	(41-81)	(73)							(18-24)	(18-46)	(30-70)	(58-100)	(73-102)	(107)
Station 4																
N	104	60	8	0	0	0	0	0	0	0	3	12	17	28	7	5
ML	53	61	59								23	27	51	81	70	39
SR	(33-79)	(39-91)	(42-90)								(18-28)	(15-40)	(26-83)	(65-119)	(60-84)	(30-50)
Station 5																
N	101	171	58	15	16	1	0	0	0	0	0	6	32	36	1	4
ML	53	54	62	51	30	70						27	62	70	86	69
SR	(30-89)	(31-106)	(30-81)	(27-76)	(20-45)	(70)						(22-33)	(47-80)	(28-121)	(86)	(40-96)
Station 6																
N	39	19	0	1	7	0	0	0	0	0	0	0	1	6	0	1
ML	48	49		59	22								63	52		25
SR	(25-72)	(37-60)		(59)	(19-25)								(63)	(40-65)		(25)
Combined																
N	1,113	442	117	21	23	4	2	0	0	0	16	42	162	141	106	54
ML	60	58	64	51	28	49	62				21	33	43	77	82	74
SR	(25-104)	(27-106)	(30-107)	(27-76)	(19-45)	(42-70)	(61-64)				(18-28)	(15-61)	(26-83)	(28-121)	(42-116)	(25-125)

Table 12. Monthly catch (N), mean standard length (ML) and size range (SR) in mm of Callinectes sapidus by station in the Chocolate Bay system, May 1972-August 1973. Blanks = no data.

Site	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Station 1																
N	1	0	1	1	0	0	0	0	0	0	1	10	2	3	4	1
ML	52		155	76							25	53	48	86	72	22
SR	(52)		(155)	(76)							(25)	(31-78)	(40-55)	(70-104)	(15-165)	(22)
Station 2																
N	3	2	5	2	1	2	2	5	2	1	0	34	6	0	6	3
ML	70	44	53	138	170	40	26	14	22	32		46	65		79	48
SR	(35-100)	(41-47)	(13-102)	(78-198)	(170)	(37-44)	(24-27)	(6-29)	(22-23)	(32)		(16-145)	(25-105)		(62-90)	(38-54)
Station 3																
N	2	0	2	2	0	0	0	1	0	0	4	12	10	1	3	0
ML	40		28	42				18			35	59	72	62	60	
SR	(20-35)		(42-43)					(18)			(23-42)	(20-115)	(43-105)	(62)	(11-140)	
Station 4																
N	3	0	0	2	0	2	0	0	0	0	8	12	6	10	14	2
ML	41			96		26					40	56	63	73	69	46
SR	(30-56)			(33-160)		(20-32)					(11-55)	(30-95)	(26-125)	(24-125)	(24-162)	(35-56)
Station 5																
N	2	2	2	4	0	0	0	2	0	4	2	5	6	3	4	0
ML	73	24	92	69				29		51	53	84	64	64	74	
SR	(65-82)	(22-25)	(62-121)	(14-191)				(20-38)		(45-60)	(6-100)	(23-180)	(42-120)	(52-81)	(43-150)	
Station 6																
N	15	15	24	2	1	3	11	3	0	7	1	9	1	1	0	8
ML	37	20	25	57	17	17	34	35		17	76	19	15	18		20
SR	(10-110)	(15-34)	(16-41)	(17-97)	(17)	(15-21)	(19-72)	(20-50)		(8-50)	(76)	(8-54)	(15)	(18)		(15-25)
Combined																
N	26	19	34	13	2	7	13	11	2	12	16	82	31	18	31	15
ML	45	23	37	78	94	26	33	23	22	30	42	50	64	70	71	28
SR	(10-110)	(15-47)	(13-155)	(14-198)	(17-170)	(15-44)	(19-72)	(6-50)	(22-23)	(8-60)	(6-100)	(8-180)	(15-125)	(18-125)	(11-165)	(15-16)

Table 13. Monthly catch (N), mean standard length (ML) and size range (SR) in mm of Brevoortia patronus by station in the Chocolate Bay system, May 1972-August 1973. Blanks = no data.

Site	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Station 1																
N	0	191	2	9	0	0	3	0	0	0	101	8	34	42	123	31
ML		44	38	65			48				34	28	30	66	40	48
SR		(29-62)	(37-40)	(60-76)			(43-56)				(24-47)	(25-32)	(21-55)	(52-92)	(30-60)	(28-61)
Station 2																
N	0	0	0	4	0	0	0	0	1	0	92	1	0	0	1	0
ML				55					25		29	30			87	
SR				(46-61)					(25)		(25-35)	(30)			(87)	
Station 3																
N	42	17	2	6	0	0	0	1	0	62	74	214	237	43	3	47
ML	44	56	58	53				23		25	28	28	38	48	51	52
SR	(35-65)	(46-78)	(50-66)	(47-58)				(23)		(22-30)	(24-32)	(22-32)	(25-46)	(31-60)	(51-52)	(48-58)
Station 4																
N	62	154	66	16	4	0	1	0	3	72	10	184	133	8	98	139
ML	41	38	52	56	65		46		23	32	24	29	36	60	43	44
SR	(31-72)	(25-55)	(31-90)	(41-87)	(60-73)		(46)		(23-23)	(22-40)	(22-25)	(24-40)	(34-42)	(38-79)	(35-54)	(35-60)
Station 5																
N	9	8	18	19	0	2	0	0	15	1	0	3	1	0	0	5
ML	52	50	46	42		60			25	34		26	30			45
SR	(40-60)	(35-58)	(30-55)	(34-49)		(59-61)			(22-29)	(34)		(23-28)	(30)			(37-57)
Station 6																
N	5	3	2	7	5	1	0	292	113	0	17	3	3	12	1	31
ML	34	40	54	58	45	55		24	24		29	25	30	31	42	37
SR	(30-37)	(37-44)	(48-60)	(37-60)	(37-60)	(55)		(20-28)	(22-27)		(25-37)	(24-27)	(27-33)	(27-35)	(42)	(30-43)
Combined																
N	118	373	88	61	9	3	4	293	132	135	293	413	408	105	226	253
ML	43	42	51	53	54	58	48	24	24	29	30	28	37	54	42	45
SR	(30-72)	(25-78)	(30-90)	(34-87)	(37-73)	(55-61)	(43-56)	(20-28)	(22-29)	(22-40)	(22-47)	(22-40)	(21-55)	(27-92)	(30-87)	(28-61)

Table 14. Monthly catch (N), mean standard length (ML) and size range (SR) in mm of Anchoa mitchilli by station in the Chocolate Bay system, May 1972-August 1973. Blanks = no data.

Site	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Station 1																
N	261	127	126	722	890	1,978	588	0	7	1	39	3	18	8	45	59
ML	34	34	31	30	25	26	27		23	19	34	34	29	32	31	30
SR	(16-71)	(16-64)	(22-55)	(15-47)	(17-32)	(20-40)	(16-45)		(20-28)	(19)	(22-72)	(26-50)	(22-36)	(25-37)	(22-50)	(26-45)
Station 2																
N	85	81	32	154	391	366	143	0	82	70	13	8	4	1	2	2
ML	56	49	45	33	27	28	23		25	51	32	42	38	44	35	31
SR	(32-86)	(30-67)	(30-67)	(17-58)	(18-42)	(20-45)	(19-54)		(18-44)	(30-68)	(22-56)	(30-60)	(25-60)	(44)	(30-40)	(26-36)
Station 3																
N	78	65	94	280	319	923	537	6	5	0	19	19	1	9	10	37
ML	38	33	38	32	28	25	25	23	24		42	33	25	36	30	34
SR	(19-63)	(19-59)	(16-69)	(17-42)	(16-50)	(18-36)	(20-40)	(20-26)	(20-30)		(24-58)	(21-60)	(25)	(23-45)	(23-36)	(26-55)
Station 4																
N	26	88	311	754	348	874	90	6	6	5	3	11	16	8	21	154
ML	29	39	31	29	39	28	26	27	35	23	22	29	28	33	32	38
SR	(17-56)	(20-55)	(18-75)	(16-46)	(18-58)	(17-50)	(18-47)	(21-27)	(21-35)	(20-25)	(20-25)	(20-46)	(22-36)	(30-36)	(24-50)	(21-50)
Station 5																
N	18	32	1,046	809	631	112	50	18	18	0	2	5	7	2	0	19
ML	34	49	38	33	29	40	30	23	26		36	36	27	30		35
SR	(25-52)	(30-63)	(30-52)	(17-49)	(21-45)	(20-65)	(21-61)	(19-27)	(21-39)		(23-48)	(29-43)	(27-28)	(30-31)		(30-58)
Station 6																
N	109	34	9	761	600	478	36	189	15	0	6	12	1	0	8	5
ML	42	39	34	25	27	29	34	23	22		24	29	29		28	32
SR	(22-67)	(32-54)	(27-37)	(20-41)	(20-41)	(22-39)	(22-46)	(20-33)	(19-28)		(23-26)	(23-40)	(29)		(25-37)	(30-35)
Combined																
N	577	427	1,628	3,480	3,179	4,731	1,444	219	133	76	82	58	47	28	86	276
ML	39	39	36	30	28	27	26	23	25	49	34	33	29	34	31	35
SR	(16-86)	(16-67)	(16-75)	(15-58)	(16-58)	(17-65)	(16-61)	(19-33)	(18-44)	(19-68)	(20-72)	(20-60)	(22-60)	(23-45)	(22-50)	(21-58)

Table 15. Monthly catch (N), mean standard length (ML) and size range (SR) in mm of Cynoscion arenarius by station in the Chocolate Bay system, May 1972-August 1973. Blanks = no data.

Site	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Station 1																
N	8	16	8	15	2	2	0	0	0	0	0	0	1	3	63	15
ML	48	54	67	67	88	110							55	84	39	45
SR	(25-66)	(43-87)	(51-98)	(42-122)	(85-90)	(100-120)							(55)	(63-105)	(25-65)	(21-74)
Station 2																
N	16	23	18	32	2	4	1	0	0	0	0	0	1	5	14	7
ML	34	56	71	66	97	94	75						48	41	50	80
SR	(20-85)	(23-120)	(48-111)	(24-107)	(79-115)	(70-138)	(75)						(48)	(28-80)	(30-115)	(37-122)
Station 3																
N	6	15	12	6	0	0	0	0	0	0	0	0	0	4	10	1
ML	36	49	58	70										34	28	103
SR	(31-38)	(39-105)	(25-126)	(41-126)										(25-50)	(23-35)	(103)
Station 4																
N	7	20	14	21	7	4	0	0	0	0	0	0	1	6	69	32
ML	54	54	55	68	67	82							45	84	34	49
SR	(23-96)	(33-132)	(25-82)	(15-157)	(49-87)	(71-92)							(45)	(28-110)	(22-87)	(20-150)
Station 5																
N	5	153	324	160	1	0	1	0	0	0	0	0	2	20	8	43
ML	68	48	57	52	97		52						50	38	42	46
SR	(52-81)	(35-85)	(42-75)	(24-78)	(97)		(52)						(32-69)	(21-88)	(30-88)	(24-101)
Station 6																
N	4	2	6	1	0	0	0	0	0	0	0	0	1	1	1	2
ML	50	56	59	72									24	26	30	46
SR	(43-60)	(50-63)	(39-98)	(72)									(24)	(26)	(30)	(42-50)
Combined																
N	46	229	382	235	12	10	2	0	0	0	0	0	6	39	165	100
ML	45	50	58	57	78	92	64						45	48	37	50
SR	(20-96)	(23-132)	(25-126)	(15-157)	(49-115)	(70-138)	(52-75)						(24-55)	(25-110)	(22-115)	(20-150)

Table 16. Monthly catch (N), mean standard length (ML) and size range (SR) in mm of Leiostomus xanthurus by station in the Chocolate Bay system, May 1972-August 1973. Blanks = no data.

Site	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Station 1																
N	17	0	0	0	0	0	0	0	0	0	272	39	345	73	56	4
ML	50										30	32	33	41	46	52
SR	(45-70)										(18-42)	(20-42)	(25-43)	(30-55)	(36-57)	(42-65)
Station 2																
N	0	0	2	13	2	4	1	0	0	1	3	681	6	6	6	2
ML			89	88	98	108	108			100	33	35	38	42	59	62
SR			(82-96)	(73-99)	(95-101)	(102-112)	(108)			(100)	(30-38)	(26-43)	(24-46)	(40-50)	(52-73)	(60-65)
Station 3																
N	0	0	4	4	1	1	0	0	0	0	394	332	240	24	71	11
ML			86	87	115	97					27	30	36	44	50	53
SR			(74-100)	(73-102)	(115)	(97)					(16-40)	(24-42)	(25-52)	(37-53)	(38-68)	(50-75)
Station 4																
N	5	0	6	4	0	0	0	0	0	0	66	235	55	6	3	0
ML	53		89	87							22	28	39	41	45	
SR	(45-76)		(61-120)	(65-105)							(15-28)	(22-43)	(27-50)	(33-49)	(45-45)	
Station 5																
N	2	0	1	0	0	0	0	0	0	0	16	14	10	12	11	26
ML	52		62								22	28	32	40	47	50
SR	(51-53)		(62)								(17-135)	(24-42)	(32-47)	(33-60)	(37-65)	(34-70)
Station 6																
N	0	0	0	2	0	0	1	0	0	0	5	0	7	10	3	16
ML				68			110				23		29	31	48	51
SR				(66-71)			(110)				(19-30)		(20-35)	(25-35)	(45-50)	(42-50)
Combined																
N	24	0	13	23	3	5	2	0	0	1	756	1,301	663	131	150	59
ML	51		86	86	104	106	109			100	28	32	35	41	49	51
SR	(45-76)		(61-120)	(65-105)	(95-115)	(97-112)	(108-110)			(100)	(15-135)	(20-43)	(20-52)	(25-60)	(36-73)	(34-75)

Table 17. Monthly catch (N), mean standard length (ML) and size range (SR) in mm of Micropogonias undulatus by station in the Chocolate Bay system, May 1972-August 1973. Blanks = no data.

Site	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Station 1																
N	60	10	8	5	2	0	68	1	0	10	198	91	297	119	110	56
ML	74	87	80	103	110		17	18		25	49	50	48	58	56	62
SR	(50-115)	(66-112)	(73-102)	(92-109)	(110)		(11-27)	(18)		(19-34)	(18-68)	(20-88)	(29-93)	(41-120)	(41-138)	(41-92)
Station 2																
N	165	13	30	9	0	0	128	24	51	9	51	631	134	83	222	37
ML	70	68	85	72			18	18	20	33	38	52	53	80	57	64
SR	(57-97)	(51-86)	(57-105)	(13-114)			(11-28)	(10-21)	(15-25)	(26-50)	(21-55)	(23-85)	(18-77)	(32-105)	(45-75)	(47-117)
Station 3																
N	27	13	5	13	0	1	21	5	18	11	682	441	324	31	67	9
ML	70	84	81	92		90	17	16	19	25	47	42	52	63	62	63
SR	(44-100)	(60-160)	(70-89)	(78-106)		(90)	(12-23)	(12-18)	(10-24)	(20-33)	(17-68)	(23-88)	(25-107)	(37-123)	(41-95)	(51-75)
Station 4																
N	36	9	12	10	1	0	12	0	24	8	787	378	259	113	228	87
ML	59	74	85	86	80		18		16	25	38	45	51	56	68	60
SR	(42-145)	(55-165)	(75-95)	(74-105)	(80)		(13-19)		(10-26)	(20-31)	(18-72)	(21-94)	(32-145)	(34-124)	(40-65)	(50-80)
Station 5																
N	6	4	6	0	1	0	75	113	113	7	50	629	282	24	12	15
ML	65	74	55		100		14	16	20	21	32	45	50	49	54	58
SR	(50-115)	(70-82)	(69-86)		(100)		(11-18)	(11-21)	(13-20)	(15-31)	(14-56)	(27-82)	(28-77)	(31-60)	(42-75)	(51-66)
Station 6																
N	24	1	4	0	0	0	14	15	18	0	141	206	5	3	0	15
ML	49	65	88				21	18	18		24	28	37	34		70
SR	(35-66)	(65)	(74-101)				(15-27)	(12-24)	(11-25)		(15-56)	(22-50)	(23-50)	(30-40)		(50-77)
Combined																
N	318	50	65	37	4	1	318	158	124	45	1,909	2,376	1,301	373	628	219
ML	68	77	81	87	100	90	17	17	19	26	41	45	50	62	62	62
SR	(35-145)	(51-165)	(57-105)	(13-114)	(80-110)	(90)	(11-28)	(10-24)	(10-26)	(15-50)	(14-72)	(20-94)	(18-145)	(30-124)	(40-138)	(41-117)

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