FRESHWATER INFLOW EFFECTS ON FISHES AND INVERTEBRATES IN THE CHASSAHOWITZKA RIVER AND ESTUARY

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Prepared for

The Southwest Florida Water Management District
2379 Broad Street
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SWFWMD Agreement No. 05CON000117

September 2008

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SUMMARY

Quantitative ecological criteria are needed to establish minimum flows and levels for rivers and streams within the Southwest Florida Water Management District (SWFWMD), as well as for the more general purpose of improving overall management of aquatic ecosystems. As part of the approach to obtaining these criteria, the impacts of managed freshwater inflows on downstream estuaries are being assessed. A two year study of freshwater inflow effects on habitat use by estuarine organisms in the Chassahowitzka River estuary was undertaken from August 2005 to July 2007.

The general objective of the present data analysis was to identify patterns of estuarine habitat use and organism abundance under variable freshwater inflow conditions and to evaluate responses. Systematic monitoring was performed to develop a predictive capability for evaluating potential impacts of proposed freshwater withdrawals and, in the process, to contribute to baseline data. The predictive aspect involves development of regressions that describe variation in organism distribution and abundance as a function of natural variation in inflows. These regressions can be applied to any proposed alterations of freshwater inflows that fall within the range of natural variation documented during the data collection period.

For sampling purposes, the Chassahowitzka River estuary was divided into five zones from which plankton net, seine net and trawl samples were taken. Sampling was conducted on a monthly basis for the first year of the study (August 2005 to July 2006) and every six weeks for the remainder of the study (August 2006 to July 2007). Salinity, water temperature, dissolved oxygen and pH measurements were taken in association with each net deployment. Daily freshwater inflow estimates for the Chassahowitzka River estuary were derived from gauged streamflow records (USGS gauge 02310650) with missing data estimated by interpolation or from maximum daily stage in the Chassahowitzka River and water level at the Weeki Wachee well. A large body of descriptive habitat-use information was generated and is presented in accompanying appendices.

Larval gobies and anchovies dominated the plankton net's larval fish catch. *Gobiosoma* and *Microgobius* were the dominant goby taxa, and the anchovies were strongly dominated by the bay anchovy (*Anchoa mitchilli*). Other abundant larval fishes included silversides (*Menidia* spp.), rainwater killifish (*Lucania parva*), eucinostomus mojarras (*Eucinostomus* spp.), and blennies. Juvenile spot (*Leiostomus xanthurus*) and pinfish (*Lagodon rhomboides*) were abundant relative to other tidal rivers in west-central Florida. These two species spawn far offshore and move landward during the late larval and early juvenile stages. One possibility is that the proximity of the Chassahowitzka survey area to the Gulf of Mexico resulted in relatively high juvenile recruitment of offshore-spawned spot and pinfish into the area. Many other strongly estuary-dependent species such as bay anchovy, sand seatrout (*Cynoscion arenarius*), and hogchoker (*Trinectes maculatus*) were low relative to other survey areas The plankton-net invertebrate catch was dominated by gammaridean amphipods, larval crabs (decapod zoeae and megalopae), cumaceans, the mysids *Americamysis almyra* and *Bowmaniella dissimilis*, prosobranch snails, and larval shrimps (decapod mysis). River-plume-associated taxa, with the exception of the calanoid copepod *Acartia tonsa*, were less common than they typically are in more nutrient-rich estuarine plumes along the west-central Florida coast.

Over 90% of the seine catch was comprised of rainwater killifish, menidia silversides, bay anchovy, coastal shiner (*Notropis petersoni*), eucinostomus mojarras, pinfish, blue killifish (*Lucania goodei*), tidewater mojarra (*Eucinostomus harengulus*), and goldspotted killifish (*Cyprinodon variegatus*). Fish collections from deeper, trawled areas were dominated by pinfish and eucinostomus mojarras. These taxa comprised over 58% of total trawl catch of fishes. Invertebrates collected by seines were dominated by dominated by brackish grass shrimp (*Palaemonetes intermedius*), blue crab (*Callinectes sapidus*), and pink shrimp (*Farfantepenaeus duorarum*), which together comprised over 98% of total invertebrate catch in seines. Nearly 95% of the trawl catch was comprised of these same three species (brackish grass shrimp, blue crab, and pink shrimp).

Use of the area as spawning habitat was indicated by the presence of fish eggs or newly hatched larvae. The eggs of the bay anchovy, silversides, rainwater killifish, other killifishes (*Fundulus* spp.), unidentified gobies, and unidentified percomorph (primarily sciaenid) fishes were collected from the survey area. None of these fish eggs were abundant, but the bay anchovy and sciaenid eggs were more abundant than the other types – both were most abundant near the river mouth. If it is assumed that the relative abundances of different species of early-stage sciaenid larvae reflect relative spawning intensity, then the kingfishes (*Menticirrhus* spp.) are the sciaenids that are most likely to have spawned in this area. Larval distributions also suggest that skilletfish (*Gobiesox strumosus*) spawn near the river mouth and that gobies (primarily *Microgobius* spp. and *Gobiosoma* spp.) and silversides have spawned throughout much of the interior of the tidal river. The presence of rainwater killifish eggs upstream suggests upstream spawning by this species, a pattern that is supported by the distribution of subsequent developmental stages. The collection of very small juveniles of live-bearing pipefishes (*Syngnathus scovelli, S. louisianae, S, floridae*) near the river mouth and in the interior tidal river (*S. scovelli*) suggests that these species also reproduce within the local area.

Estuary-dependent taxa are spawned at seaward locations and migrate into tidal rivers during the late larval or early juvenile stage. Overall, six of the ten most abundant taxa in the trawl catch (44% of total abundance of the top ten) and four of the ten most abundant taxa in the seine catch (13% of total abundance of the top ten) can be considered estuary-dependent. These estuary-dependents included taxa of commercial importance (i.e., blue crab and pink shrimp) and taxa of ecological importance due to high abundance (i.e., pinfish, eucinostomus mojarras, tidewater mojarra, and silver jenny).

Based on plankton-net data, alteration of flows would appear to have the lowest potential for impacting many taxa during the period from December and January, which are the months when the fewest estuarine taxa were present. The highest potential to impact many species would appear to be from March through October. Some species were present throughout the year, whereas others had more seasonal spawning and recruitment patterns.

Taxon richness was lowest from January to April in the Chassahowitzka River estuary for the nearshore habitat sampled with seine nets. There were no clear seasonal patterns of taxon richness in the deeper-water habitats sampled with trawls. Abundance data from both the seine and trawl nets suggested that the Chassahowitzka River estuary was important to nekton throughout the year, with no obvious period where flow alterations would have the least potential to impact the nekton community.

Nine (14%) of the 66 plankton-net taxa evaluated for distribution responses to freshwater inflow exhibited significant responses. Six of these were positive responses, wherein animals moved upstream as inflows increased. The remaining three taxa demonstrated negative responses, moving downstream as freshwater flows increased. The time lags for these responses were highly variable, ranging from 1 to 74 days.

Five (10.9%) of the 46 seine- or trawl-caught pseudo-species evaluated for distributional responses to freshwater inflow exhibited significant responses for at least one lagged flow period. Four of the five pseudo-species moved upstream in response to decreasing inflow (negative response) whereas the fifth pseudo-species moved upstream in response to increased inflow (positive response). The change in centers of abundance ranged from 1.7 to 3.8km and occurred over a relatively small inflow change (13 to 27 cfs). The lag period for four of the pseudo species were relatively short (<21 days), while the remaining species had a moderately long (49 day) lag period.

Thirteen (20%) of the 66 plankton-net taxa evaluated for abundance relationships with freshwater inflow exhibited significant responses. Negative responses were common, occurring in 10 of the 13 taxa; these are usually caused by elevated flows washing marine-derived taxa out of the survey area. Bay anchovy juveniles had a positive abundance response to inflow. This response had a relatively long lag of 106 days, which is more than twice the typical age of the bay anchovy juveniles themselves. During high inflow periods, the Chassahowitzka River estuary apparently becomes more attractive as nursery habitat for the bay anchovy, and the juveniles seek out the middle reaches of the tidal river, much as they do in more strongly surface-fed estuaries. The estuarine tanaid *Hargeria rapax* exhibited a similar pattern.

Twenty-three (50%) of the 46 pseudo-species analyzed from the seine and trawl catches had a significant abundance response to average inflow. Nine of these pseudo-species had linear responses and the remaining 14 demonstrated quadratic responses of abundance to inflow. Six of the linear responses (*Callinectes sapidus* [seines and trawls], *Synodus foetens*, *Syngnathus scovelli*, *Eucinostomus harengulus*, and *Lagodon rhomboides*) were negative such that abundance increased with decreasing inflow. The negative response in these pseudo-species most likely indicates an increase in the amount of slightly higher salinity habitats as flows decreased. Similarly, two of the three positive linear responses (*Lucania goodei* and *Lepomis punctatus*) were observed for freshwater taxa that would be expected to move downstream with increases in inflow and subsequent increases in the amount of freshwater habitat. The most common quadratic response was an intermediate-maximum where the maximum abundance occurred at intermediate inflows and abundance was lower at both lower and higher inflows. The percentage of significant abundance responses to inflow ranged from 35.3% of tested pseudo-species in estuarine spawners to 85.7% in offshore spawners. Tidal river residents most commonly exhibited 'intermediate-maximum' relationships to flow, while offshore spawners were between 'intermediate-maximum' (3), negative (2), and intermediate-minimum (1) responses to inflow. All three of the nearshore spawners that had significant regressions demonstrated negative responses to flow.

There was no indication of a relationship between flow and community heterogeneity in the plankton-net data. The inflows that occurred during the survey period were large enough and stable enough to prevent strong, landward invasions of planktonic, marine-derived organisms from seaward waters. A fairly strong community gradient was always present along the Chassahowitzka's survey transect, even during the collection that had the lowest fish community heterogeneity (July 2007).

There were significant differences in seine- and trawl-caught nekton community structure between the zones of the study area and also between year-months. Most notable was the difference between the uppermost zone of the study area (km 6.9–8.6), which tended to have relatively high abundance of species that occupy low-salinity habitats (i.e., bluefin killifish and coastal shiner) and the more seaward zones. Changes in community structure over the study period exhibited annual cycles, which tended to be more regular than the correlation with physicochemical variables, including inflow. As with the plankton-net data, there was no discernible relationship between inflow and heterogeneity, or dispersion, of the community, most likely because of the relatively strong, stable inflows and masking of an inflow response due to the strong seasonality in community structure. Comparison of the same month between years with different flows aimed to overcome this difficulty and was successful in showing that similarity in community between the uppermost and lowermost zones of the study area increased as flows decreased.

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1.0 INTRODUCTION

Rivers export nutrients, detritus, and other productivity promoting materials to the estuary and sea. Freshwater inflows also strongly influence the stratification and circulation of coastal waters, which in itself may have profound effects on coastal ecosystems (Mann and Lazier 1996). Estuary-related fisheries constitute a very large portion of the total weight of the U.S. fisheries yield (66% of finfish and shellfish harvest, Day et al. 1989; 82% of finfish harvest, Imperial et al. 1992). The contribution of estuary-related fisheries is consistently high among U.S. states that border the Gulf of Mexico, where the estimates typically exceed 80% of the total weight of the catch (Day et al. 1989). Examples from around the world indicate that these high fisheries productivities are not guaranteed, however. In many locations, large amounts of fresh water have been diverted from estuaries to generate hydroelectric power or to provide water for agricultural and municipal use. Mann and Lazier (1996) reviewed cases where freshwater diversions were followed by the collapse of downstream fisheries in San Francisco Bay, the Nile River delta, James Bay, Canada, and at several inland seas in the former U.S.S.R. Sinha et al. (1996) documented a reversal of this trend where an increase in fisheries landings followed an increase in freshwater delivery to the coast.

Fishery yields around the world are often positively correlated with freshwater discharge at the coast (Drinkwater 1986). These correlations are often strongest when they are lagged by the age of the harvested animal. In south Florida, Browder (1985) correlated 14 years of pink shrimp landings with lagged water levels in the Everglades. Associations between river discharge and fisheries harvests have also been identified for various locations in the northern and western Gulf of Mexico (Day et al. 1989, Grimes 2001). Surprisingly, discharge-harvest correlations sometimes extend to non-estuarine species. Sutcliffe (1972, 1973) reported lagged correlations between discharge of the St. Lawrence River and the harvest of non-estuarine species such as American lobster and haddock. In recognition of the potential complexities behind these correlations, Drinkwater (1986) advised that the effect of freshwater inflows be considered on a species-by-species basis.

Freshwater influence on coastal ecosystems extends beyond its immediate effects on fisheries. Because of the intricate nature of many food web interactions, changes in the abundance of even a single species may be propagated along numerous pathways, some anticipated and some not, eventually causing potentially large changes in the abundance of birds, marine mammals and other groups of special concern (Christensen 1998, Okey and Pauly 1999). Mann and Lazier (1996) concluded "one lesson is clear: a major change in the circulation pattern of an estuary brought about by damming the freshwater flows, a tidal dam, or other engineering projects may well have far reaching effects on the primary and secondary productivity of the system."

This project was conducted to support the establishment of minimum flows for the Chassahowitzka River by the Southwest Florida Water Management District (SWFWMD). Minimum flows are defined in Florida Statutes (373.042) as the "limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area." In the process of establishing minimum flows for an estuarine system, the SWFWMD evaluates the effects of the freshwater inflows on ecological resources and processes in the receiving estuary. The findings of this project will be used by the SWFWMD to evaluate the fish nursery function of the Chassahowitzka River and its receiving estuary in relation to freshwater inflows. It is not the purpose of this project to determine the level of effect that constitutes significant harm, as that determination will be made by the Governing Board of the SWFWMD.

1.1 Objectives

This project uses plankton-net, seine and trawl surveys to document the abundance and distribution of fishes and invertebrates that use the Chassahowitzka River and receiving bay as habitat. There were several objectives for this project. One was to produce a descriptive database that could serve as a baseline for comparison with future ecological change. These baseline data also provide seasonality records that identify the times of year when the risk of adverse impacts would be greatest for specific organisms.

Another principal objective was to develop regressions to model the responses of estuarine organisms to variations in freshwater inflows. The resulting models would then be available for evaluating proposed minimum flows or the potential impacts of proposed freshwater management plans. These models were developed for both estuarine fishes and the invertebrate prey groups that sustain young fishes while they occupy estuarine nursery habitats. A third objective was to evaluate changes in community structure that are associated with variations in freshwater inflow.

2.0 METHODS

2.1 Study Area

The Chassahowitzka River is a 9-km-long, spring-fed coastal stream located in southwest Citrus county, Florida (*Fig. 2.1.1*). It is designated an Outstanding Florida Water and the lower half of the river is part of the 12,550-ha Chassahowitzka National Wildlife Refuge (CNWR). Mean depth is approx. 0.9 m and mean flow is < 0.2 ms^{-1} (Notestein et al. 2001). The headwaters for the Chassahowitzka River are formed by the Chassahowitzka main spring (28° 42' 55.87" N., Long. 82° 34' 34.33" W), with Chassahowitzka Spring #1 (also known as Bubba Spring) located 106.7 m upstream (Scott et al. 2004). More than a dozen springs discharge additional flow into the Chassahowitzka River (*Fig. 2.1.1*). All the Chassahowitzka springs discharge water from the Floridan aquifer. Stream flows from the main spring average 141 cfs (4 m^3s^{-1}; Estevez et al. 1991), and ranged between 70.6 cfs and 282.5 cfs from 1998 to 2000 (2–8 m^3s^{-1}; Notestein et al. 20012001). Additional discharge from the smaller springs amounts to nearly 130 cfs (3.7 m^3s^{-1}; Dixon and Estevez 2001). Tides in the area are semidiurnal and unequal, generally ranging from 0.6 to 1.4 m (Wolfe et al. 1990). Tidal water level fluctuations affect discharges and the 0.5-‰ isohaline may reach above km 6 (Estevez et al. 1991). In common with other streams along the springs coast of Florida, the Chassahowitzka River flows over and drains a predominantly carbonate terrain, resulting in clear waters upstream and little or no sediment transport to the Gulf of Mexico at Chassahowitzka Bay (Wolfe et al. 1990). The lower river has a brown color of dissolved humics, presumably as they are precipitated with increasing salinity (Dixon and Estevez 2001).

The upper 4 km of the Chassahowitzka River are surrounded by a deciduous tidal freshwater floodplain forest, which ends at the boundary of the CNWR (Dixon and Estevez 2001). Cattail (*Typha* sp.) and reeds (*Phragmites* sp.) line some portions of shoreline in the upper river, with floating mats of senescent filamentous vegetation evident (Dixon and Estevez 2001). Terrestrial canopy cover shades only about

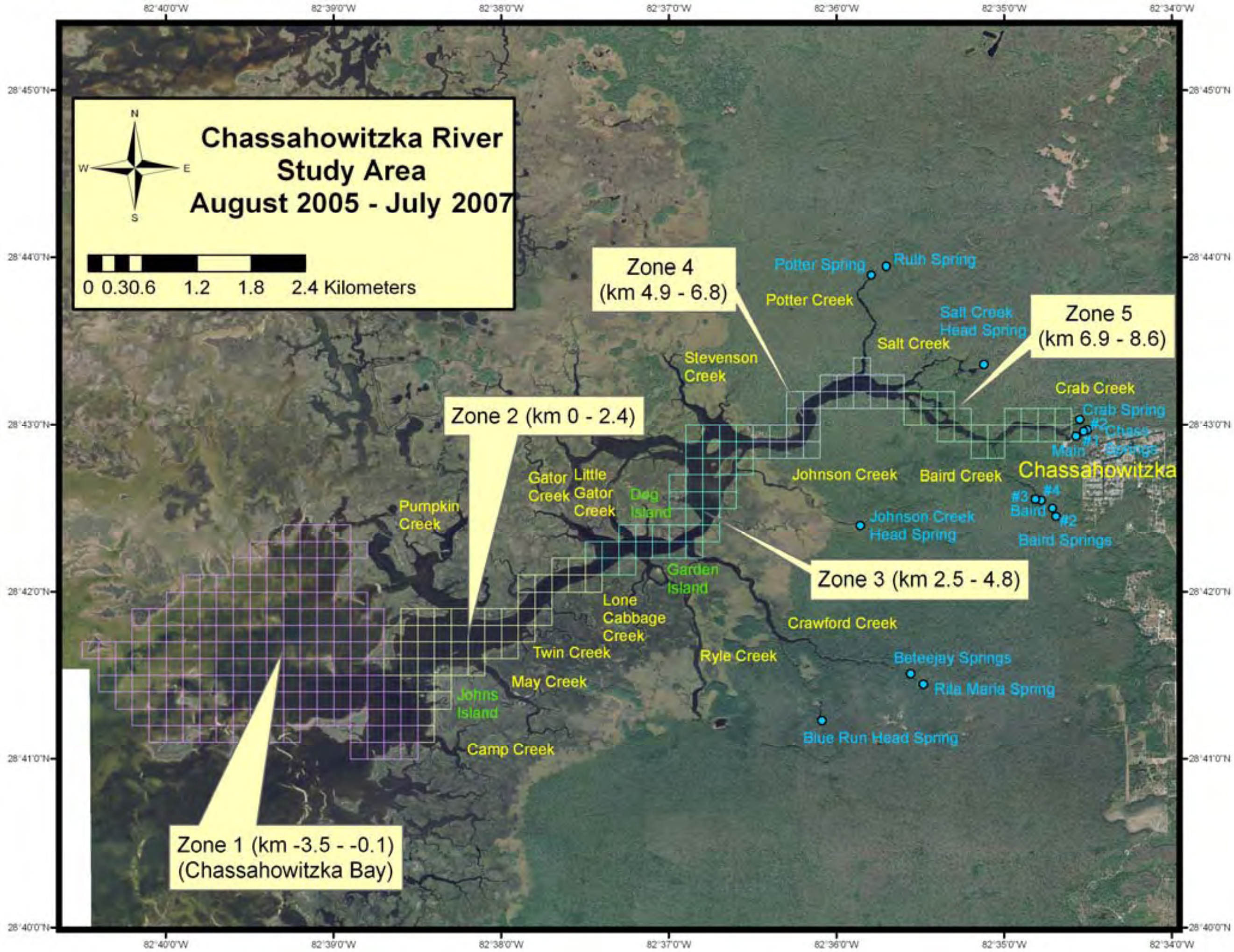

Fig. 2.1.1. Map of the study area.

3% of the total river area, permitting submersed aquatic vegetation to grow (Notestein et al. 20012001). In the upper river, this includes tapeweed (*Vallisneria* sp.), pondweed (*Potamogeton* sp.), and some *Hydrilla verticillata* (Dixon and Estevez 2001). At the boundary of the CNWR, the river bank vegetation is dominated by sawgrass (*Cladium jamaicensis*) and cattail, with cabbage palm (*Sabal palmetto*) hammocks and some black needlerush (*Juncus roemerianus*). Dixon and Estevez (2001) noted enteromorpha-like algae, Eurasian water milfoil (*Myriophyllum spicatum*), and *Hydrilla verticillata* as being very dense in 1996 but much reduced by 2000 (a drought period). In the vicinity of Crawford Creek and Dog Island, sawgrass and black needlerush line the shore, with some cattails present and *Ruppia maritima* occasionally present on the bottom (Dixon and Estevez 2001). In the lowermost portions of the river and in Chassahowitzka Bay, black needlerush is the dominant shore vegetation, with smooth cordgrass (*Spartina alterniflora*) occasionally present. Eastern oyster (*Crassostrea virginica*) forms bars in some areas and red mangrove (*Rhizophora mangle*) is also present to a limited extent. Seagrasses abound in Chassahowitzka Bay, in particular turtlegrass (*Thalassia testudinum*), shoalgrass (*Halodule wrightii*) and *R. maritima* (Dixon and Estevez 2001).

There is little development along the Chassahowitzka River, with only occasional boat docks and abandoned houses at some locations. The town of Chassahowitzka surrounds tidal canals above the river's headwaters; elevated nitrate levels due to fertilizer use and bacterial contamination because of leaking septic tanks have been measured in these canals (*http://www.swfwmd.state.fl.us/education/interactive/springscoast/3.shtml*). Nitrate-nitrite-nitrogen concentrations in the spring discharge were nearly fifty times pristine levels, attributable to anthropogenic activities in the groundwater recharge basin (Dixon and Estevez 2001). There are no water withdrawals from the Chassahowitzka River.

2.2 Survey Design

Three gear types were implemented to monitor organism distributions: a plankton net deployed during nighttime flood tides and a bag seine and otter trawl deployed during the day under variable tide stages. The plankton net surveys were conducted by the University of South Florida College of Marine Science, and the seine and trawl surveys were conducted by the Fisheries-Independent Monitoring (FIM) program of the Fish and Wildlife Research Institute (Florida Fish and Wildlife Conservation Commission).

The small organisms collected at night by the plankton net represent a combination of the zooplankton and hyperbenthos communities. The term *zooplankton* includes all weakly swimming animals that suspend in the water column during one or more life stages. The distribution of such animals is largely subject to the motion of the waters in which they live. The term *hyperbenthos* applies to animals that are associated with the bottom but tend to suspend above it, rising higher into the water column at night or during certain times of year (vertical migrators). The permanent hyperbenthos of estuaries (non-transient hyperbenthos) tends to be dominated by peracarid crustaceans, especially mysids and amphipods (Mees et al. 1993). Many types of hyperbenthos are capable of actively positioning themselves at different places along the estuarine gradient by selectively occupying opposing tidal flows.

The faunal mixture that forms in the nighttime water column includes the planktonic eggs and larvae of fishes (ichthyoplankton). One of the most common reasons for using plankton nets to survey estuarine waters is to study ichthyoplankton. Although fish eggs and larvae are the intended focus of such studies, invertebrate plankton and hyperbenthos almost always dominate the samples numerically. The invertebrate catch largely consists of organisms that serve as important food for juvenile estuary-dependent and estuarine-resident fishes. In an effort to characterize the invertebrate catch more completely, all water-column animals collected by the plankton net were enumerated at a practical taxonomic level.

Seines and trawls were used to survey larger organisms that typically evade plankton nets. Generally speaking, the data from seine hauls document habitat use by shallow-water organisms whereas the data from trawls document habitat use in deeper areas. The dominant catch for both gear types is juvenile fishes, although the adults of smaller species are also commonly caught. The seines and trawls also regularly collect a few of the larger macroinvertebrate species from tidal rivers, notably juvenile and adult blue crabs (*Callinectes sapidus*) and juvenile pink shrimp (*Farfantepenaeus duorarum*), as well as smaller invertebrates such as grass shrimp (*Palaemonetes* spp.).

Monthly sampling in the Chassahowitzka River and Chassahowitzka Bay began in August 2005 and ended in July 2007. The study area was divided into five collection zones (*Fig. 2.1.1*, *Table 2.2.1*). Ten plankton tows were conducted monthly. Within each zone, two boat-set seine hauls were undertaken monthly from August 2005 to July 2006 and every six weeks from August 2006 to July 2007; two offshore seines were set in the bay zone with the same frequency. One monthly trawl was undertaken in the bay zone (zone 1) and lowermost river zone (zone 2), with two monthly trawls in river zone 3. No trawling was undertaken in the upper two zones due to unsuitable conditions.

Table 2.2.1.Number of samples collected within each zone of the Chassahowitzka River system (August 2005–July 2007). Zone position is measured relative to the river mouth.

Zone (river km)	**Plankton**	**Seine**	**Trawl**
-3.5 – -0.1 (Bay)	40	84	42
0.0–2.4	60	42	21
2.5–4.8	40	42	42
4.9–6.8	40	42	0
6.9–8.6	20	42	0
Totals	200	252	105

The locations for seine and trawl deployment were randomly selected within each zone during each survey, whereas the plankton-net collections were made at fixed stations within each zone. The longitudinal position of each station was measured as the distance from the mouth of the tidal river, following the geometric centerline of the channel.

2.3 Plankton Net Specifications and Deployment

The plankton gear consisted of a 0.5-m-mouth-diameter 500-µm-mesh conical (3:1) plankton net equipped with a 3-pt nylon bridle, a calibrated flow meter (General Oceanics model 2030R), a 1-liter plastic cod-end jar, and a 9-kg (20-lb.) weight. The net was deployed between low slack and high slack tide, with sampling beginning within two hours after sunset and typically ending less than four hours later. Tow duration was 5 min, with tow time being divided equally among bottom, mid-water and surface depths. The boat towed the net along a nearly constant depth contour that was estimated to be close to the average cross-sectional depth for the local river reach. The fishing depth of the weighted net was controlled by adjusting the length of the tow line while using tachometer readings to maintain a constant line angle. The tow line was attached to a winch located on the gunnel near the transom. Placement of the winch in this location caused asymmetry in the steering of the boat, which caused propeller turbulence to be directed away from the towed net. Tow speed was approximately 1.3 m s^{-1}, resulting in a tow length of >400 m over water and a typical filtration of 70-80 m^3. Upon retrieval of the net, the flowmeter reading was recorded and the contents of the net were rinsed into the cod-end jar using an electric wash-down pump and hose with an adjustable nozzle. The samples were preserved in 6-10% formalin in ambient saline.

When ctenophore (comb jelly) volumes exceeded the cod-end jar's capacity, volume indicators on the net panel seams were used to estimate the total volume of ctenophores in the net. If the total volume was <3.0 liters, only the material in the cod-end jar was preserved. If the total volume was >3.0 liters, a second cod-end jar was filled and preserved by ladling material from inside the net. Abundances of all organisms in the sample were later adjusted to reflect this subsampling method. The net was cleaned between surveys using an enzyme solution that dissolves organic deposits. Salinity, temperature, pH and dissolved oxygen were measured at one-meter intervals from surface to bottom after each plankton-net deployment.

2.4 Seine and Trawl Specifications and Deployment

The gear used in all seine collections was a 21.3-m center-bag seine with 3.2-mm mesh and leads spaced every 150 mm. To deploy the seine along shoreline habitats (i.e., shorelines with water depth ≤1.8 m in the Chassahowitzka River and bay), the boat dropped off a member of the seine crew near the shoreline with one end of the seine, and the boat then payed out the net in a semicircle until the boat reached a second drop-off point near the shoreline. The lead line was retrieved simultaneously from both ends, with effort made to keep the lead line in contact with the bottom. This process forced the catch into the bag portion of the seine. Area sampled by each boat-deployed seine collection was approximately 68 m^2. In shallow waters (≤ 1.5 m) of the bay zone, sampling offshore involved two crewmembers setting the seine into the prevailing current (determined by tide or wind) and hauling the seine by foot over a distance of 9.1 m while maintaining a constant 15.5-m distance between seine poles; after completing this distance, the two ends of the net were brought together and the sample was collected by pulling the ends of the net past a pivot pole to isolate and invert the center bag. Area sampled by each seine collection in the bay zone was approximately 140 m^2.

The 6.1-m otter trawl had 38-mm stretched mesh, a 3.2-mm mesh liner, and a tickler chain. It was towed for five minutes in either an arc or a straight line. Tow speed averaged 0.6 m s^{-1}, resulting in a typical tow length of about 180 m. Trawl width averaged 4 m, giving an approximate area sampled by a typical tow of 720 m^2. Salinity, temperature, pH, and dissolved oxygen were measured at the surface and at 1-m intervals to the bottom in association with each gear deployment.

2.5 Plankton Sample Processing

All aquatic taxa collected by the plankton net were identified and counted, except for invertebrate eggs and organisms that were attached to debris (sessile stages of barnacles, bryozoans, sponges, tunicates and sessile coelenterates). During sorting, the data were entered directly into an electronic database via programmable keyboards that interfaced with a macro-driven spreadsheet. Photomicrographs of representative specimens were compiled into a reference atlas that was used for quality-control purposes.

Most organisms collected by the plankton net fell within the size range of 0.5-50 mm. This size range spans three orders of magnitude, and includes mesoplankton, macroplankton, micronekton and analogous sizes of hyperbenthos. To prevent larger objects from visually obscuring smaller ones during sample processing, all samples were separated into two size fractions using stacked sieves with mesh openings of 4 mm and 250 µm. The >4 mm fraction primarily consisted of juvenile and adult fishes, large macroinvertebrates and large particulate organic matter. In most cases, the fishes and macroinvertebrates in the >4 mm fraction could be identified and enumerated without the aid of microscopes. When bay anchovy juveniles were encountered in high numbers (>300), the number present was estimated by counting specimens in a weighed fraction.

A microscope magnification of 7-12X was used to enumerate organisms in the >250 µm fraction, with zoom magnifications as high as 90X being available for identifying individual specimens. The >250 µm fraction was usually sorted in two stages. In the first sorting stage, the entire sample was processed as 10-15 ml aliquots that were scanned in succession using a gridded petri dish. Only relatively uncommon taxa (*n*<50) were enumerated during this first stage. After the entire sample had been processed in this manner, the collective volume of the aliquots was recorded within a graduated mixing cylinder, the sample was inverted repeatedly, and then a single 30-60 ml aliquot was poured. The aliquot volume typically represented about 12-50% of the entire sample volume. The second sorting stage consisted of enumerating the relatively abundant taxa within this single aliquot. The second sorting stage was not required for all samples. The second stage was, however, sometimes extended to less abundant taxa (*n*<50) that were exceptionally small or were otherwise difficult to enumerate (e.g., some copepods, barnacle nauplii, and the larvacean *Oikopleura dioica*).

2.5.1 Staging Conventions

All fishes were classified according to developmental stage (*Fig. 2.5.1.1*), where

> **preflexion** larval stage = the period between hatching and notochord flexion; the tip of the straight notochord is the most distal osteological feature.
>
> **flexion** larval stage = the period during notochord flexion; the upturned notochord or urostyle is the most distal osteological feature.
>
> **postflexion** larval stage = the period between completion of flexion and the juvenile stage; the hypural bones are the most distal osteological feature.

metamorphic stage (clupeid fishes) = the stage after postflexion stage during which body depth increases to adult proportions (ends at juvenile stage).

juvenile stage = the period beginning with attainment of meristic characters and body shape comparable to adult fish and ending with sexual maturity.

Decapod larvae were classified as zoea, megalopa or mysis stages. These terms are used as terms of convenience and should not be interpreted as technical definitions. Planktonic larvae belonging to Anomura and Brachyura (crabs) were called zoea. Individuals from these groups displaying the planktonic to benthic transitional morphologies were classified as megalopae. All other decapod larvae (shrimps) were classified as mysis stages until the uropods differentiated into exopods and endopods (5 total elements in the telsonic fan), after which they were classified as postlarvae until they reached the juvenile stage. The juvenile stage was characterized by resemblance to small (immature) adults. Under this system, the juvenile shrimp stage (e.g., for *Palaemonetes*) is equivalent to the postlarval designation used by some authors.

In many fish species, the juvenile stage is difficult to distinguish from other stages. At its lower limit, the juvenile stage may lack a clear developmental juncture that distinguishes it from the postflexion or metamorphic stage. Likewise, at its upper limit, more than one length at maturity may be reported for a single species or the reported length at maturity may differ between males and females. To avoid inconsistency in the staging process, length-based staging conventions were applied to the more common taxa. These staging conventions agree with stage designations used by the U.S. Fish and Wildlife Service (e.g., Jones et al. 1978). The list in *Table 2.5.1.1* is comprehensive, representing the conventions that have been required to date by various surveys. Some of the species or stages in the list were not encountered during the surveys covered by this report.

Table 2.5.1.1. Length-based staging conventions used to define developmental stage limits. Fish lengths are standard length (SL) and shrimp length is total length.

Postflexion-juvenile transition (mm):

Lucania parva	10
Menidia spp.	10
Eucinostomus spp.	10
Lagodon rhomboides	10
Bairdiella chrysoura	10
Cynoscion arenarius	10
Cynoscion nebulosus	10
Sciaenops ocellatus	10
Menticirrhus spp.	10
Leiostomus xanthurus	15
Orthopristis chrysoptera	15
Achirus lineatus	5
Trinectes maculatus	5
Gobiesox strumosus	5
Diapterus plumieri	10
Prionotus spp.	10
Symphurus plagiusa	10
Anchoa mitchilli	15
Sphoeroides spp.	10
Chilomycterus schoepfi	10
Lepomis spp.	10
Micropterus salmoides	10
Membras martinica	10
Chloroscombrus chrysurus	10
Hemicaranx amblyrhynchus	10
Micropogonias undulatus	15
Chaetodipterus faber	5

Juvenile-adult transition (mm):

Anchoa mitchilli	30
Lucania parva	15
Gambusia holbrooki	15
Heterandria formosa	10
Menidia spp.	35
Eucinostomus spp.	50
Gobiosoma bosc	20
Gobiosoma robustum	20
Microgobius gulosus	20
Microgobius thalassinus	20
Gobiesox strumosus	35
Trinectes maculatus	35
Palaemonetes pugio	20
Membras martinica	50
Syngnathus spp.	80
Poecilia latipinna	30
Anchoa hepsetus	75

Metamorph-juvenile transition (mm):

Brevoortia spp.	30
Dorosoma petenense	30

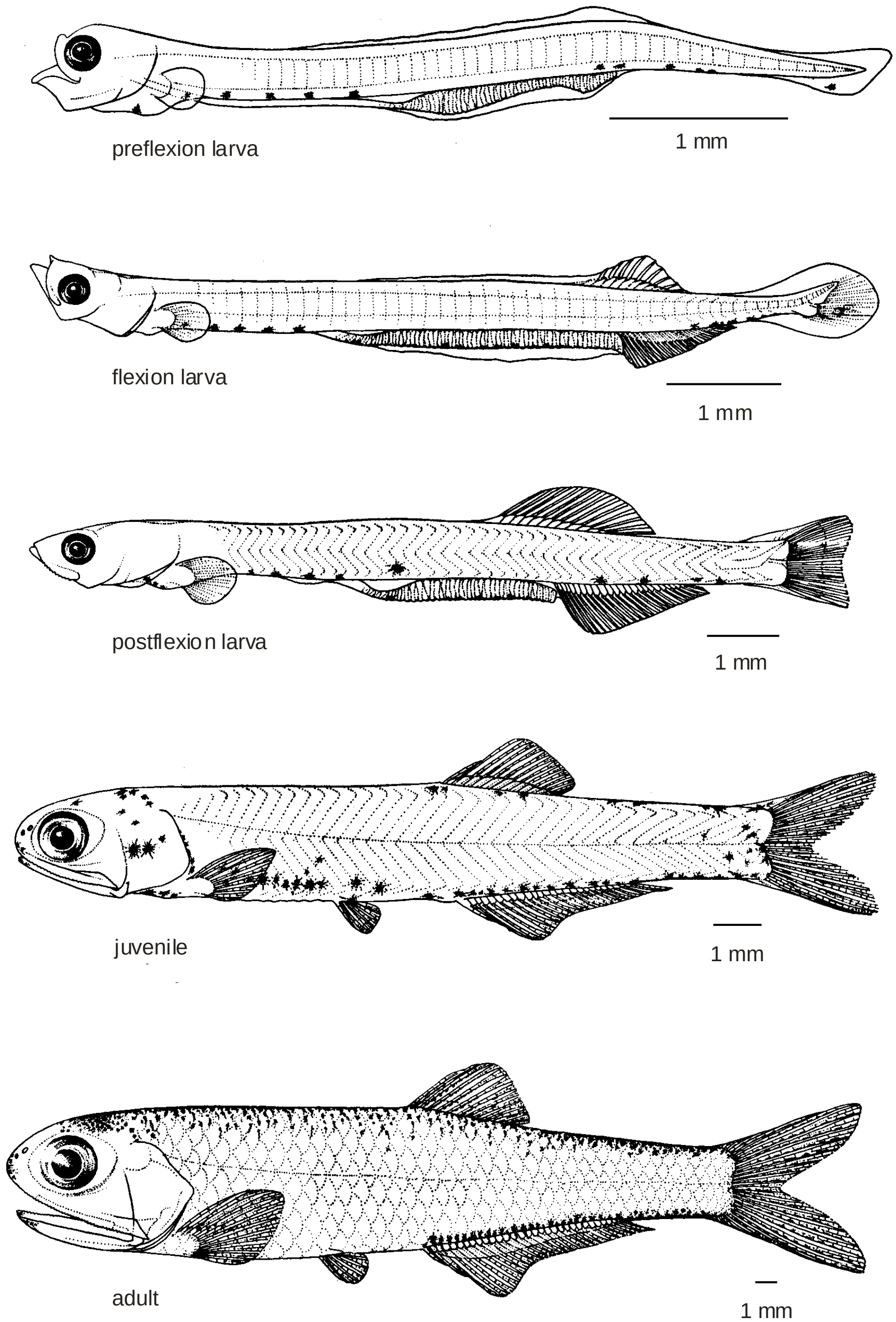

Fig. 2.5.1.1. Fish-stage designations, using the bay anchovy as an example. Specimens measured 4.6, 7.0, 10.5, 16, and 33 mm standard length.

2.6 Seine and Trawl Sample Processing.

Fish and selected crustaceans collected in seine and trawl samples were removed from the net into a bucket and processed onboard. Animals were identified to the lowest practical taxonomic category, generally species. Representative samples (three individuals of each species from each gear on each sampling trip) were brought back to the FWC/FWRI laboratory to confirm field identification. Species for which field identification was uncertain were also brought back to the laboratory. A maximum of 10 measurements (mm) were made per taxon, unless distinct cohorts were identifiable, in which case a maximum of 10 measurements were taken from each cohort; for certain economically valuable fish species, twenty individuals were measured. Standard length (SL) was used for fish (total length [TL] for seahorses and disk width [DW] for rays), post-orbital head length (POHL) for pink shrimp, and carapace width (CW) for crabs. Animals that were not measured were identified and counted. When large numbers of individuals (>> 1,000) were captured, the total number was estimated by fractional expansion of sub-sampled portions of the total catch split with a modified Motoda box splitter (Winner and McMichael 1997). Animals not chosen for further laboratory examination were returned to the river.

Due to frequent hybridization and/or extreme difficulty in the identification of smaller individuals, members of several abundant species complexes were not identified to species. We did not separate menhaden, *Brevoortia*, species. *Brevoortia patronus* and *B. smithi* frequently hybridize, and juveniles of the hybrids and the parent species are difficult to identify (Dahlberg 1970). *Brevoortia smithi* and hybrids may be the most abundant forms on the Gulf coast of the Florida peninsula, especially in coastal embayments (Dahlberg 1970), and we treated them as one functional group. The two abundant silverside species (genus *Menidia*) tend to hybridize, form all-female clones, and occur in great abundance that renders identification to species impractical due to the nature of the diagnostic characters (Duggins et al. 1986; Echelle and Echelle 1997; Chernoff, personal communication). Species-level identification of mojarras (genus *Eucinostomus*) was limited to individuals ≥ 40 mm SL due to great difficulty in separating *E. gula* and *E. harengulus* below this size (Matheson, personal observation). The term “eucinostomus mojarras” is used for these small specimens. Species-level identification of gobies of the genus *Gobiosoma* (i.e., *G. robustum* and *G. bosc*) used in analyses was limited to individuals ≥ 20 mm SL for the same reason; smaller individuals are hereafter referred to as "gobiosoma gobies". Similarly, needlefishes (*Strongylura* spp.) other than *S. notata* were only identified to species at lengths ≥ 100 mm SL.

2.7 Data Analysis

2.7.1 Freshwater Inflow (F)

Inflow data were primarily based on the USGS gauge at 02310650 (Chassahowitzka River near Homosassa FL). For days with missing data, flows were estimated either by interpolation or else by prediction from maximum daily stage in the Chassahowitzka River and water level at the Weeki Wachee well (M.S. Heyl, SWFWMD, personal communication):

$$F_{est} = 23.672 + 2.765\ WW - 3.813\ G_{max}$$

where Fest is estimated flow, WW is the water level at the Weeki Wachee well, and Gmax is the maximum daily stage in the Chassahowitzka River.

All flow rates are expressed as average daily flows in cubic feet per second (cfs).

2.7.2 Organism-Weighted Salinity (SU)

The central salinity tendency for catch-per-unit-effort (CPUE) was calculated as

$$S_U = \frac{\sum(S \cdot U)}{\sum U}$$

where U is CPUE (No. m^{-3} for plankton data and No. 100 m^{-2} for seine and trawl data) and S is water-column average salinity during deployment.

2.7.3 Center of CPUE (kmU)

The central geographic tendency for CPUE was calculated as

$$km_U = \frac{\sum (km \cdot U)}{\sum U}$$

where *km* is distance from the river mouth.

2.7.4 Organism Number (N) and Relative Abundance ($\overline{N}$)

Using plankton-net data, the total number of organisms in the Chassahowitzka study area was estimated by summing the products of mean organism density ($\overline{U}$, as No. m^{-3}) and tide-corrected water volume (V) from the six collection zones as

$$N = \sum (\overline{U} \cdot V)$$

Volumes corresponding to NAVD were contoured (Surfer 8, Golden Software, kriging method, linear semivariogram model) using bathymetric transects provided by SWFWMD, and these volumes were then adjusted to the water levels at the time of collection using data from a water-level recorder located near County Road C-480 (NOS gauge 8727246, MLLW in meters, +0.088 m to convert to NAVD). Adjoining creeks were not included in the volume estimates for the main channel (i.e., Baird, Salt, Potter, Johnson, Stevenson, Crawford, Gator, Little Gator, Ryle, Lone Cabbage, Twin, Pumpkin, and May Creeks). The volume of Zone 1, which was in open water and therefore had an ecologically arbitrary seaward boundary, was delimited based on the distribution of stations. The seaward-most station in Zone 1 was located 1.3 km offshore of the river mouth. The area of Zone 1 was conservatively approximated as a rectangle 1.5 x 0.5 km in area with an estimated average depth of 0.6 m NAVD.

For seine and trawl data, relative abundance (mean number per 100 m^2 sampled area) in the Gulf and Chassahowitzka River zones was calculated for each month as

$$\overline{N} = 100 \times \frac{N_{total}}{A_{total}}$$

where N_{total} = total number of animals captured in that month and A_{total} is the total area sampled in that month. $\overline{N}$ is also occasionally referred to as CPUE in some instances.

2.7.5 Inflow Response Regressions

Regressions were run for km_U on F, N on F, and $\overline{N}$ on F. N, $\overline{N}$, km_U (seine/trawl data only) and F were Ln-transformed prior to regression to improve normality. To avoid censoring zero values in seine and trawl regressions, a constant of 1 was added to $\overline{N}$ and F, and an additional constant, 1.79, was added to all km_U values (all gears) to adjust for negative values when taxa were centered below the mouth of the river.

Regressions using plankton-net data were limited to taxa that were encountered during a minimum of 10 of the monthly surveys. The fits of the following regression models were compared to determine if an alternative model produced consistently better fit than the linear model (Y = a + b**F*):

Square root-Y: Y = (a + b**F*)^2
Exponential: Y = exp(a + b**F*)
Reciprocal-Y: Y = 1/(a + b**F*)
Square root-*F*: Y = a + b*sqrt(*F*)
Reciprocal-*F*: Y = a + b/*F*
Double reciprocal: Y = 1/(a + b/*F*)
Logarithmic-*F*: Y = a + b*ln(*F*)
Multiplicative: Y = a**F*^b
S-curve: Y = exp(a + b/*F*)

where Y is km_U or N. In these regressions, F was represented by same-day inflow and by mean inflows extending as far back as 120 days prior to the sampling date. The combination of consecutive dates that produced the maximum regression fit was used to model the N and km_U responses to F for each taxon. This approach provided an indication of the temporal responsiveness of the various taxa to inflow variations. An organism was considered to be responsive if the regression slope was significantly different from zero at $p<0.05$.

Seine and trawl regressions were limited to taxa that were reasonably abundant (total abundance>100 in seines, >50 in trawls) and frequently collected (present in at least 3% of collections for each gear). Monthly length-frequency plots (Appendix C) were examined in order to assign appropriate size classes (‘pseudo-species’) and recruitment windows for each of these taxa. For distribution regressions (km_U), all months were considered when a pseudo-species was collected in at least one sample from that month. For abundance regressions ($\bar{N}$), all samples collected within a determined recruitment period from monthly length-frequency plots (*Appendix C*) were considered. Mean flows from the date of sampling, as well as continuously lagged weekly averages from the day of sampling to 365 d before sampling (i.e., average flow of sampling day and preceding 6 days, average flow of sampling day and preceding 13 days, etc.), were considered and linear and quadratic regressions were evaluated.

2.7.6 Community-level Analyses

2.7.6.1. **Plankton**. To investigate the effects of varying freshwater inflow on the ichthyoplankton/zooplankton communities as a whole, an analysis of variation in community heterogeneity (beta diversity) was undertaken using PRIMER 6 software (PRIMER-E Ltd.; Clarke & Gorley 2006). A complete estuarine gradient has freshwater organisms at its upstream end and marine organisms at its downstream end. When inflows are reduced, marine organisms tend to invade riverine estuaries, causing the local community composition to resemble that of seaward locations. Under these conditions, the compositions of the samples collected along the estuarine gradient become more similar to each other. In contrast, a high degree of community heterogeneity (compositional variation among such samples) is an indication the tidal river contains a more diverse continuum of communities. The concept of community heterogeneity is well established in scientific disciplines associated with the landscape ecology of terrestrial plants. This quality was examined using the Dispersion Metric (PRIMER 6; Warwick and Clarke 1993). Although Warwick and Clarke refer to their index of community heterogeneity as a “dispersion” index, the term “community heterogeneity” will be substituted for “dispersion” to prevent confusion with dispersion as a measure of the spread within statistical probability distributions (e.g., standard deviation). Community heterogeneity was regressed against the average inflow of three days ending on the day of sampling. The strength and spatial structure of community gradients were further explored using multidimensional scaling plots (MDS routine in

PRIMER 6). All analyses were based on Bray-Curtis similarity of square-root transformed CPUE.

2.7.6.2 **Seines and Trawls**. To investigate the effects of varying freshwater inflow on the plankton and nekton communities, various multivariate analyses were undertaken using PRIMER v6 software (PRIMER-E Ltd. [UK]; Clarke and Gorley 2006). Taxa were divided into the same pseudo-species used for regression analyses. Data were ln(x+1)-transformed to reduce the influence of patchy, abundant species. Data from each deployment technique (boat-set seine, offshore [hauled] seine, and trawl) were treated separately. Inflow data were the same as used for regression analyses.

Bray-Curtis similarities (Bray and Curtis 1957) were calculated between each pair of samples. Spatial and temporal differences in community structure were investigated using two-way Analysis of Similarities (ANOSIM; Clarke 1993) with zone and year-month as factors. The data were also displayed graphically using Non-metric Multidimensional Scaling (MDS; Clarke 1993). Pseudo-species characterizing each zone of the sampling area were determined using Similarity Percentages Analysis (SIMPER; Clarke 1993).

To investigate the extent that monthly changes in community structure correlated with changes in physicochemical variables and annual cycles, the community and physicochemical data were averaged by year-month. Community similarities between months were again calculated with Bray-Curtis similarity (Bray and Curtis 1957). The extent to which change in community structure represented regular annual cycles was investigated using the RELATE routine (see Greenwood et al. [2007] for details). Correlations between nekton community change over the study period and 7-day mean inflow were assessed using the BIO-ENV routine (Clarke 1993). BIO-ENV was also used to assess the correlation between community change and physicochemical variables (temperature, salinity, dissolved oxygen, pH, water depth [at seine center bag/trawl and seine wing], and quantity of bycatch). The analysis was initially conducted for up to five physicochemical variables at once, and was then repeated to assess the highest correlating single variable. The RELATE and BIO-ENV analyses in tandem allowed the relative importance of regular annual cycles (e.g., spawning seasonality) and physicochemical variables to be elucidated.

It was hypothesized that variability in nekton community structure would increase with increasing inflow. This hypothesis was examined using the MVDISP routine in PRIMER (Warwick and Clarke 1993; Travers and Potter 2002), an index of relative dispersion that increases with increasing community variability (heterogeneity).

There was relatively little change in flow over the study period and the initial community analyses suggested that annual cycles in community structure dominated changes attributable to varying inflows or other physicochemical variables. Comparisons were therefore undertaken between the same month in different years of the study period, e.g., January 2006 with January 2007. It was hypothesized that the similarity in community structure between the uppermost and lowermost sampling zones of the study area would increase as flows decreased. For each pair of months, data from the samples in each of the zones were averaged and the Bray-Curtis similarity between the zones was calculated. The similarity between the zones in year 2 of the study was then expressed as a percentage of the similarity of the zones in year 1. The resulting index was then compared to the corresponding 7-day mean flow in year 2 of the study expressed as a percentage of flow in year 1 of the study. An inverse relationship between the two indices would indicate that Bray-Curtis similarity between the uppermost and lowermost zones had indeed increased, i.e., the community had become more homogeneous with decreasing flow.

2.7.7 Data Limitations and Gear Biases

All nets used to sample aquatic organisms are size selective. Small organisms pass through the meshes and large organisms evade the gear altogether. Intermediate-sized organisms are either fully retained or partially retained. When retention is partial, abundance becomes relative. However, temporal or spatial comparisons can still be made because, for a given deployment method and size of organism, the selection process can usually be assumed to have constant characteristics over space and time. The 500-μm plankton gear retains a wide range of organism sizes completely, yet it should be kept in mind that many estimates of organism density and total number are relative rather than absolute. Organism measurements from Little Manatee River and Tampa Bay plankton samples (Peebles 1996) indicate that the following taxa will be collected selectively by 500-µm mesh: marine-derived cyclopoid copepods, some cladocerans, some ostracods, harpacticoid copepods, cirriped nauplii and cypris larvae, the larvacean *Oikopleura dioica*, some decapod zoeae, and some adult calanoid copepods. Taxa that are more completely retained include cumaceans, chaetognaths, insect larvae, fish eggs, most fish larvae and postlarvae, some juvenile fishes, gammaridean amphipods, decapod mysis larvae, most decapod megalopae, mysids, isopods, and the juveniles and adults of most shrimps. This partitioning represents a very general guide to the relative selectivities of commonly caught organisms.

The plankton nets were deployed during nighttime flood tides because larval fishes and invertebrates are generally more abundant in the water column at night (Colton et al. 1961, Temple and Fisher 1965, Williams and Bynum 1972, Wilkins and Lewis 1971, Fore and Baxter 1972, Hobson and Chess 1976, Alldredge and King 1985, Peebles 1987, Haney 1988, Lyczkowski-Shultz and Steen 1991, Olmi 1994) and during specific tide stages (Wilkins and Lewis 1971, King 1971, Peebles 1987, Olmi 1994, Morgan 1995a, 1995b). Organisms that selectively occupy the water column during flood tides tend to move upstream, and organisms that occupy the water column during all tidal stages tend to have little net horizontal movement other than that caused by net estuarine outflow (Cronin 1982, McCleave and Kleckner 1982, Olmi 1994). The plankton catch was therefore biased toward organisms that were either invading the coastal embayments or were attempting to maintain position within the coastal embayments. This bias would tend to exclude the youngest larvae of some estuarine crabs, which are released at high tide to facilitate export downstream with the ebb tide (Morgan 1995a). However, as the young crabs undergo their return migrations at later larval stages, they become most available for collection during nighttime flood tides (Olmi 1994, Morgan 1995b).

Seines and trawls tend to primarily collect small fish, either adults of small-bodied species or juveniles of larger taxa. Trawls tend to capture larger fish than seines (Nelson and Leffler 2001), and whether this is due to gear characteristics or preferred use of channel habitat by larger fish is uncertain. Sampling efficiency inevitably varies by species and size class (Rozas and Minello 1997), but we assume reasonable consistency between samples collected with a given gear type. We acknowledge that movement of various taxa (e.g. killifishes, Fundulidae and Cyprinodontidae) into emergent vegetation at high water levels occurs (Rozas and Minello 1997) and could complicate interpretation of some results.

3.0 RESULTS AND DISCUSSION

3.1 Streamflow Status During Survey Years

Even without direct contributions from recent rainfall, springflow may vary as a function of short-term (subseasonal) changes in the height of the water table, which determines the hydrostatic pressure on the aquifer that supplies the spring. The year prior to sampling had a general decrease in spring flow that continued during the two-year study period (*Fig. 3.1.1*). Even in the presence of this general decreasing trend, there was little flow variability compared to rivers that are primarily supplied by runoff from recent rainfall. The fine scale variability evident in *Fig. 3.1.1*, which typically ranged from 10 to 25% of the total flow, was caused by tide-related changes in pressure on the Floridan aquifer, and possibly by some degree of measurement error.

3.2 Physico-chemical Conditions

Summary statistics from the electronic meter data collected during plankton sampling are presented in *Table 3.2.1*. Temperatures underwent seasonal variation within a typical range (*Fig. 3.2.1*). In examining the 20 temperature ranges presented in *Fig. 3.2.1* (top panel), it is apparent that a horizontal line could be drawn at 21-24° to connect either the minima or maxima of these ranges, depending on season. During the summer, the minima reflect the relatively cool waters of the Chassahowitzka's springs, with very warm waters >32° occurring in the Gulf of Mexico, where depths are very shallow and water is easily heated. By comparison, the surface temperature of tropical oceans is typically 24-30°. In the Chassahowitzka estuary, this thermal gradient reverses during winter, making the springs warm in comparison with the shallow Gulf. Because of this thermal stability, the spring-fed estuaries of Florida's west-central coast are often used as thermal refuges by fishes and manatees. The fishes that seek out thermal refuges are typically larger, more mobile fishes such as crevalle jack, snook, gray (mangrove) snapper, and sheepshead that are not well-represented in seine and trawl collections due to their ability to avoid these gears.

The trend in salinity (*Fig. 3.2.1*) reflects the general decrease in spring flow discussed in section 3.1, coupled with seasonal reductions caused by the summer rainy season. These were most evident in August-October of 2005 and 2006. Rain associated with cold fronts caused a salinity reduction during December, 2005. The minimum observed salinity tended to increase during the course of the study, rising to 3 psu at location 7.9 km at the study's end.

As in other estuaries on Florida's west-central coast, dissolved oxygen (DO) and pH tended to vary together (*Fig. 3.2.1*). Except in high-alkalinity estuaries where carbonate precipitation is common (e.g., Florida Bay), pH serves as a negative proxy for carbon dioxide (Yates et al. 2007), most or all of which is immediately converted to bicarbonate or carbonate at higher pH values. The temporal trends in DO and pH reflect a combination of temperature-related (seasonal) variation in gas solubility and spatio-temporal instability in the ratio of respiration (CO_2 production, DO consumption) to photosynthesis (CO_2 consumption, DO production).

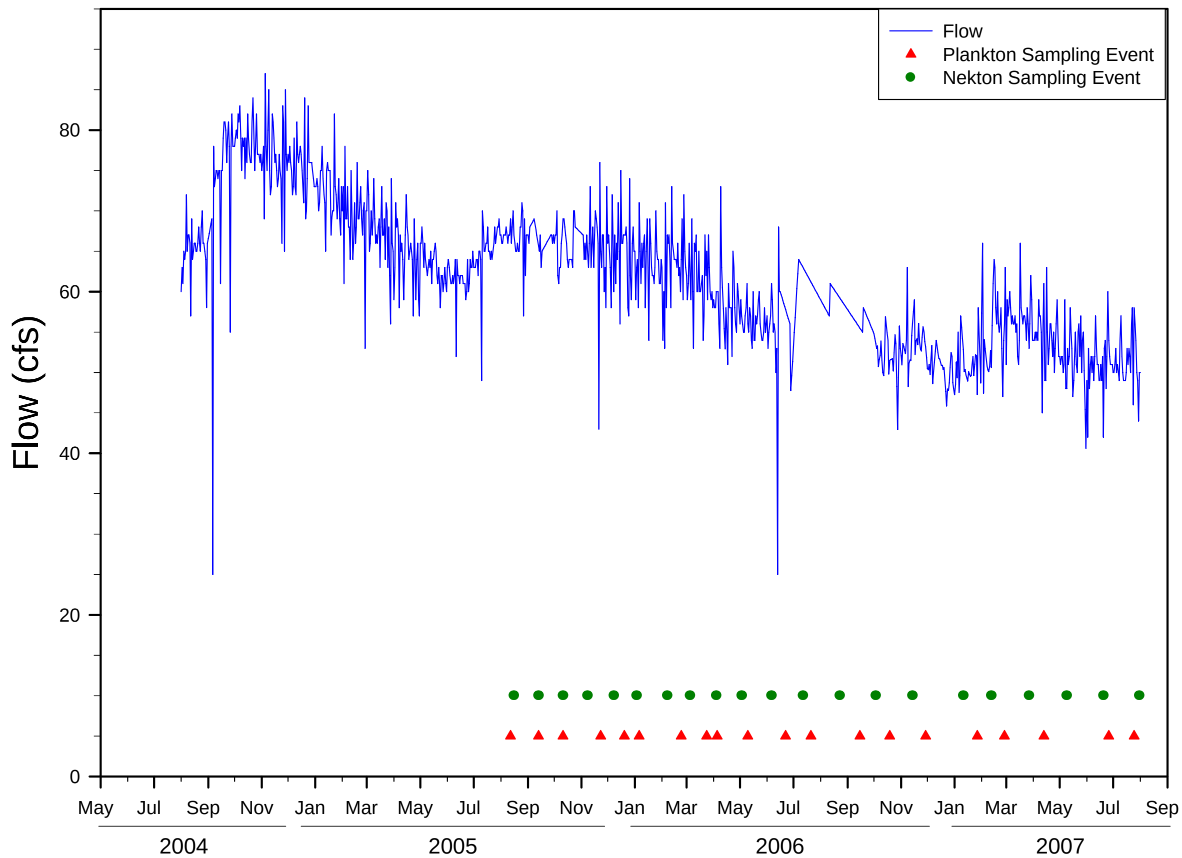

Fig. 3.1.1. Flow rates from Chassahowitzka spring and collection dates for plankton (red triangles) and nekton (green circles) surveys.

Table 3.2.1. Electronic meter summary statistics during plankton net deployment. Mean depth is mean depth at deployment. Sample sizes (n) reflect the combination of survey frequency (20 monthly surveys) and depth of measurement. Measurements were made at surface, bottom and at one-meter intervals between surface and bottom.

Location (km from mouth)	Mean Depth (m)	Salinity (psu)					Water Temperature (°C)					Dissolved Oxygen (mg/l)					pH				
		n	mean	std. dev.	min.	max.	n	mean	std. dev.	min.	max.	n	mean	std. dev.	min.	max.	n	mean	std. dev.	min.	max.
-1.3	0.7	50	13.4	3.5	6.4	18.4	50	24.7	5.4	14.4	33.4	50	8.5	2.4	5.0	13.8	50	7.8	0.3	7.1	8.4
-0.7	1.0	59	11.8	3.4	5.7	16.9	59	24.3	5.4	14.6	33.0	59	8.3	2.4	4.6	13.3	59	7.9	0.2	7.5	8.3
0.0	1.9	94	11.2	3.3	4.6	17.1	94	24.1	5.3	14.5	32.5	94	8.2	2.3	4.4	12.9	94	7.9	0.2	7.6	8.3
0.3	1.6	83	10.9	3.4	4.3	17.5	83	24.8	5.3	14.5	32.5	83	7.9	2.3	3.6	12.8	83	7.9	0.2	7.6	8.3
1.5	1.8	90	9.1	3.2	3.7	14.3	90	24.2	5.1	14.7	31.9	90	8.1	2.3	4.0	12.6	90	7.9	0.2	7.5	8.3
2.6	1.6	81	7.9	2.8	3.2	12.9	81	24.1	4.6	14.9	31.2	81	8.0	2.3	4.0	12.4	81	7.9	0.2	7.5	8.4
3.9	0.6	42	5.5	2.1	2.2	9.2	42	24.0	4.3	15.1	30.1	42	7.6	2.0	3.7	11.4	42	7.9	0.2	7.3	8.2
5.2	0.9	58	3.0	0.9	1.5	4.8	58	24.0	3.1	16.5	29.3	58	8.4	2.2	4.0	11.7	58	7.9	0.3	7.4	8.4
6.0	0.6	43	2.6	0.9	0.0	5.0	43	23.8	2.6	18.0	29.3	43	8.7	4.0	3.1	18.9	43	7.9	0.3	7.4	8.6
7.9	0.6	41	2.0	0.6	1.2	4.1	41	22.9	0.7	20.9	23.9	41	5.1	1.0	3.4	7.9	41	7.7	0.2	7.4	8.0

Chassahowitztka River

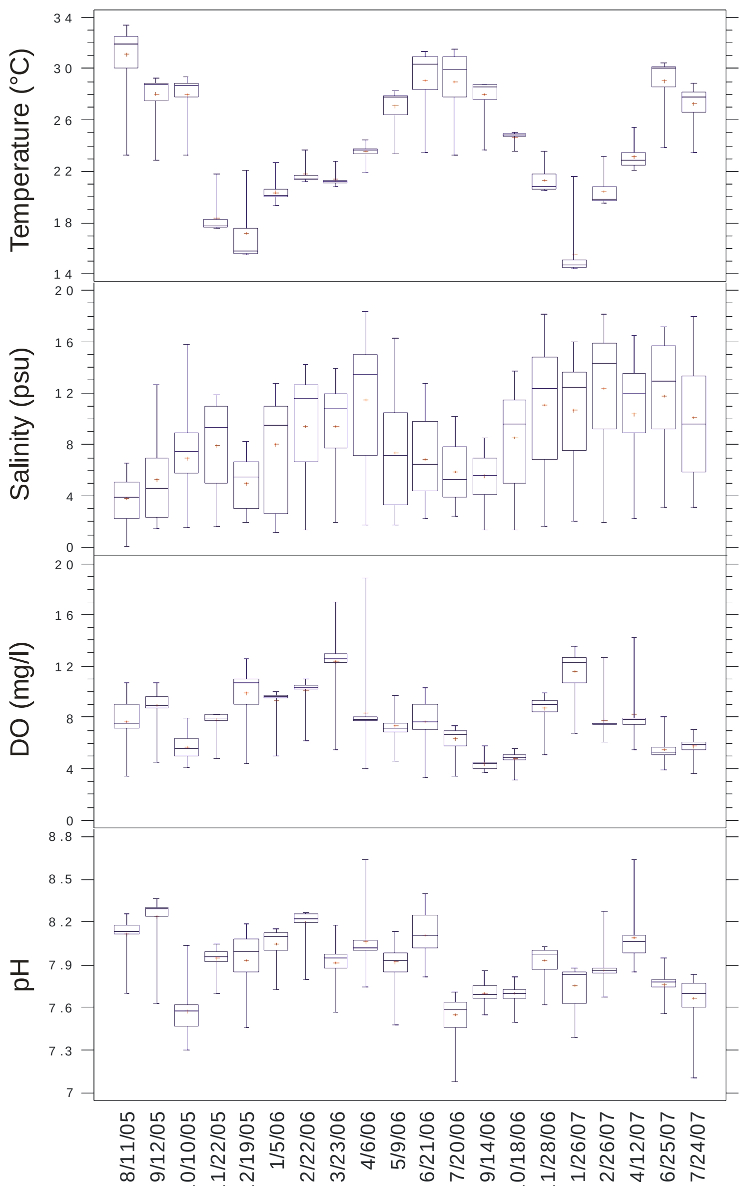

Fig. 3.2.1. Electronic meter data from the plankton-net surveys of the Chassahowitzka River, where the cross identifies the mean, the horizontal line identifies the median, the box delimits the interquartile range, and the whiskers delimit the total range.

3.3 Catch Composition

3.3.1 Fishes

3.3.1.1 **Plankton net**. Larval gobies and anchovies dominated the larval fish catch (*Table A1*). Gobies of the genera *Gobiosoma* and *Microgobius* were the dominant gobies, and the bay anchovy (*Anchoa mitchilli*) was the only anchovy that was positively identified – other species may be present in the taxon Anchoa spp., however. Other abundant larval fishes included silversides (*Menidia* spp.), rainwater killifish (*Lucania parva*), eucinostomus mojarras (*Eucinostomus* spp.), and blennies (only the Florida blenny, *Chasmodes saburrae*, and highfin blenny, *Lupinoblennius nicholsi* were positively identified). *Menidia* can be exceptionally abundant within estuaries, but can also complete its life cycle within fresh water. Juvenile spot (*Leiostomus xanthurus*) and pinfish (*Lagodon rhomboides*) were abundant relative to other tidal rivers in west-central Florida. These two species spawn far offshore and move landward during the late larval and early juvenile stages. Perhaps the proximity of the Chassahowitzka survey area to the Gulf of Mexico resulted in relatively high juvenile recruitment of offshore-spawned spot and pinfish into the area. The catches of strongly estuary-dependent species such as bay anchovy, sand seatrout (*Cynoscion arenarius*), and hogchoker (*Trinectes maculatus*) were low relative to other survey areas – no sand seatrout of any stage were collected by the plankton net, which is unusual.

3.3.1.2 **Seine.** The seine catch (*Table B1*) was dominated by rainwater killifish (*Lucania parva*), menidia silversides (*Menidia* spp.), bay anchovy (*Anchoa mitchilli*), coastal shiner (*Notropis petersoni*), eucinostomus mojarras (*Eucinostomus* spp.), pinfish (*Lagodon rhomboides*), blue killifish (*Lucania goodei*), tidewater mojarra (*Eucinostomus harengulus*), and goldspotted killifish (*Cyprinodon variegatus*). These taxa comprised over 90% of the total seine catch of fishes.

3.3.1.3 **Trawl.** The trawl catch (*Table B1*) was dominated by pinfish and eucinostomus mojarras. These taxa comprised nearly 58% of the total trawl catch of fishes.

3.3.2. Invertebrates.

3.3.2.1. **Plankton net.** The plankton-net invertebrate catch (*Table A1*) was dominated by gammaridean amphipods, larval crabs (decapod zoeae and megalopae), cumaceans, the mysids *Americamysis almyra* and *Bowmaniella dissimilis*, prosobranch snails, and larval shrimps (decapod mysis). The phantom midge larva *Chaoborus puntipinnis* and cyclopoid copepod *Mesocyclops edax*, which are indicative of reservoir waters and other lacustrine settings, were rare or absent from the spring-fed Chassahowitzka estuary. The river-plume-associated calanoid copepod *Acartia tonsa* was regularly encountered near the river mouth in low to moderate numbers, but other plume-associated taxa such as the calanoid coepod *Labidocera aestiva*, the chaetognaths *Sagitta* spp., the planktonic shrimp *Lucifer faxoni*, and the ostracod *Parasterope pollex*, were less common than they typically are in more nutrient-rich estuarine plumes along the west-central Florida coast.

3.3.2.2. **Seine.** The seine catch (*Table B1*) was dominated by brackish grass shrimp (*Palaemonetes intermedius*), blue crab (*Callinectes sapidus*), and pink shrimp (*Farfantepenaeus duorarum*), which together comprised over 98% of the invertebrate catch.

3.3.2.3. **Trawl.** The trawl catch (*Table B1*) was dominated by brackish grass shrimp (*Palaemonetes intermedius*), blue crab (*Callinectes sapidus*), and pink shrimp (*Farfantepenaeus duorarum*), which together comprised nearly 95% of the invertebrate catch.

3.4 Use of Area as Spawning Habitat

This analysis is restricted to estuarine and marine fishes – a diversity of freshwater fishes also reproduce within the freshwater reaches of the survey area (i. e., Florida gar, freshwater livebearers, freshwater killifishes, various minnows and sunfishes, largemouth bass). The eggs of the bay anchovy (*Anchoa mitchilli*), silversides (*Menidia* spp.), the rainwater killifish (*Lucania parva*), other killifishes (*Fundulus* spp.), unidentified gobies, and unidentified percomorph (primarily sciaenid) fishes were collected from the survey area (*Table A1*). None of these fish eggs were abundant, but the bay anchovy and sciaenid eggs were more abundant than the other types – both were most abundant near the river mouth (*Table A3*). If it is assumed that the relative abundances of different species of early-stage sciaenid larvae reflect relative spawning intensity, then kingfishes (*Menticirrhus* spp.) are the sciaenids that are most likely to have spawned in this area (*Table A3* and *3.4.1*). The data in *Table A3* and *3.4.1* also suggest blennies and skilletfish (*Gobiesox strumosus*) spawned near the river mouth – probably in association with oyster-shell substrates. Gobies (primarily Gobiosoma spp. and *Microgobius* spp.) and *Menidia* appear to have spawned throughout much of the interior of the tidal river. The presence of rainwater killifish eggs upstream (*Table A3*) suggests upstream spawning by this species, a pattern that is supported by the distribution of subsequent developmental stages (*Table A3*). The collection of very small juveniles of live-bearing pipefishes (*Syngnathus scovelli, S. louisianae, S, floridae*) near the river mouth and in the interior tidal river (*S. scovelli*) suggests that these species also reproduce within the local area. *Table 3.4.1* indicates menhaden (*Brevoortia* pp.) and spot (*Leiostomus xanthurus*) migrated into the survey area from distant spawning locations, which is a pattern that agrees with the published literature. On the other hand, this table's indication that the rainwater killifish also spawned at a distant location is misleading – as discussed above, the rainwater killifish appears to have spawned within the survey area. A review of trends in spawning habitat among coastal fishes is presented by Peebles and Flannery (1992).

Table 3.4.1. Relative abundance of larval stages for non-freshwater fishes with a collection frequency >10 for the larval-stage aggregate, where *Pre* = preflexion (youngest larval stage), *Flex* = flexion stage (intermediate larval stage) and *Post* = postflexion (oldest larval stage). **X** identifies the most abundant stage and x indicates that the stage was present.

Taxon	**Common Name**	**Pre**	**Flex**	**Post**
Anchoa spp.	anchovies	**X**	x	x
Gobiesox strumosus	skilletfish	**X**	X	x
Menidia spp.	silversides	**X**	X	x
gobiids	gobies	**X**	x	x
blenniids	blennies	**X**	x	
Lucania parva	rainwater killifish		x	**X**
Brevoortia spp.	menhaden			**X**
Leiostomus xanthurus	spot			**X**

3.5 Use of Area as Nursery Habitat

Estuary-dependent offshore-spawning taxa using the study area as a nursery were prominent in our samples: overall, six of the ten most abundant taxa in deeper habitats (44% of total abundance of the top ten) and four of the ten most abundant taxa in nearshore habitats (13% of total abundance of the top ten) can be considered estuary-dependent. These dependents included taxa of commercial importance (i.e., blue crab and pink shrimp) and taxa of ecological importance due to high abundance (i.e., pinfish, eucinostomus mojarras, tidewater mojarra, and silver jenny).

3.6 Seasonality

3.6.1. Plankton Net

The number of taxa collected during an individual survey is not a true measure of species richness because many taxa could not be identified to species level. Nevertheless, this index produces a clear seasonal pattern. Specifically, more taxa tend to be collected during the warmer months than during winter (*Fig. 3.6.1.1*).

Species diversity tends to be highest near the mouths of tidal rivers due to an increased presence of marine-derived species and at the upstream end due to the presence of freshwater species. This creates a low-diversity zone in the middle reaches of tidal rivers (Merriner et al. 1976). Changes in streamflow can shift this pattern downstream or upstream.

For a given species of fish, the length of the spawning season tends to become shorter at the more northerly locations within a species' geographic range, but the time of year when spawning takes place is otherwise consistent for a given species. Among species with long or year-round spawning seasons, local conditions have been observed to have a strong influence on egg production within the spawning season (Peebles 2002). Local influences include seasonally anomalous water temperature, seasonal variation in the abundance of prey, and seasonal variation in retention or transport of eggs and larvae after spawning. The latter processes (prey availability and retention and transport) are influenced by freshwater inflows at the coast.

Alteration of flows would appear to have the lowest potential for impacting many taxa during December and January, which are the months when the fewest estuarine taxa were present. The highest potential to impact many species would appear to be from March through October. Some species were present throughout the year (bay anchovy, *Fig. 3.6.1.2*), whereas others had more seasonal spawning and recruitment patterns (menhaden and kingfish, *Fig. 3.6.1.2*).

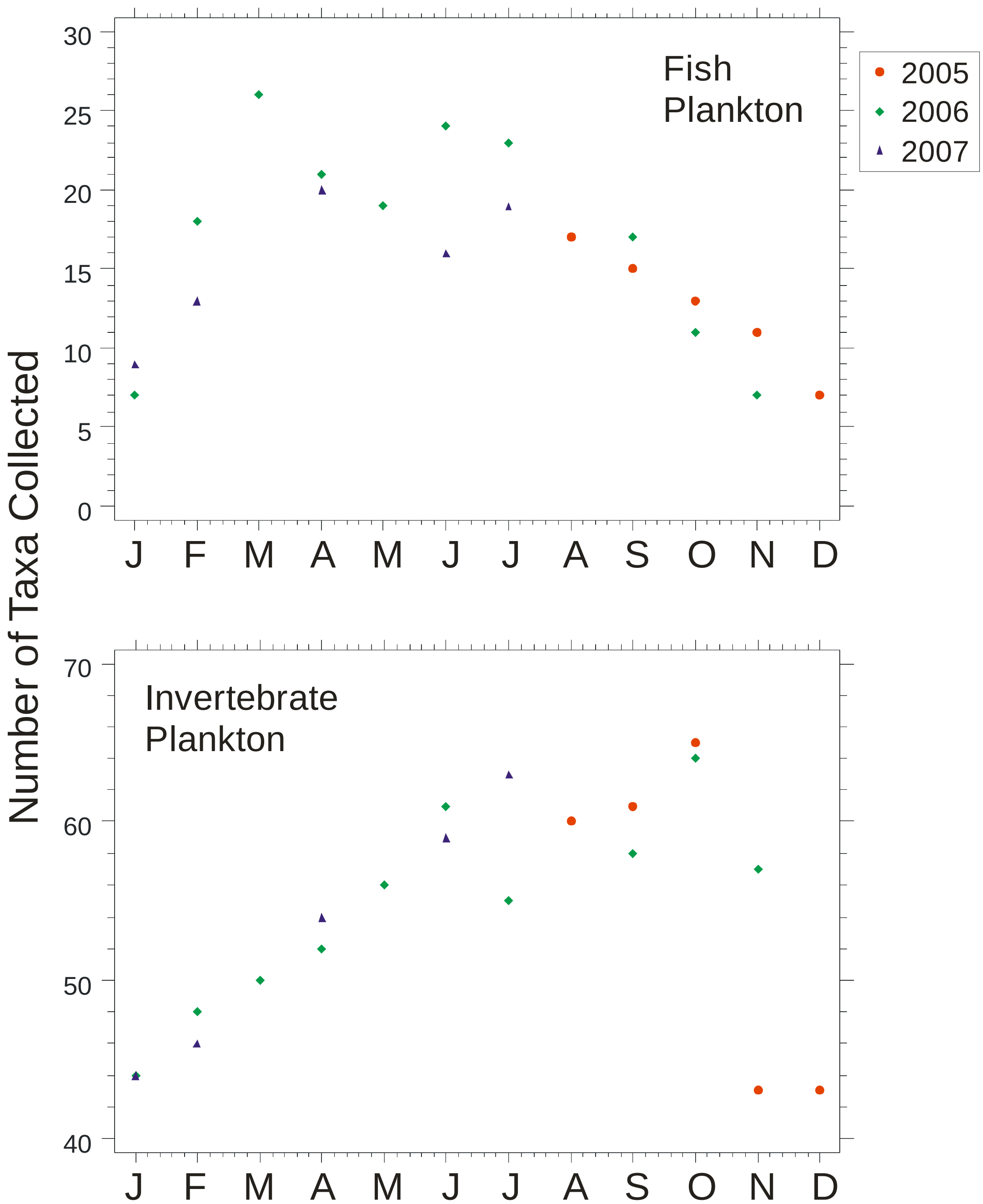

Fig. 3.6.1.1. Number of taxa collected per month by plankton net.

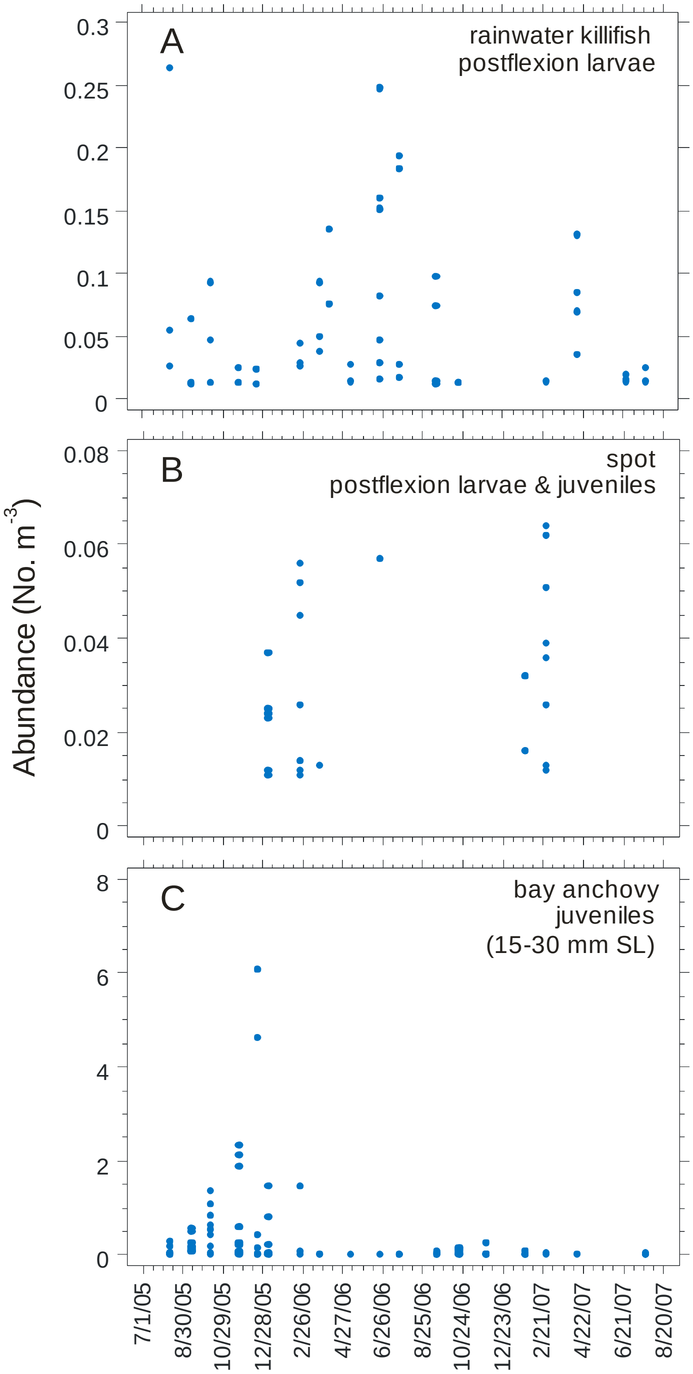

Fig. 3.6.1.2. Examples of species-specific seasonality from individual plankton-net tows, including species that spawn most heavily A) during spring and summer, B) during winter, and C) when surface runoff was highest.

3.6.2. Seine and Trawl

Seasonal patterns of taxon richness were evident in the Chassahowitzka River estuary (*Fig. 3.6.2.1*), at least for the nearshore (seined) area. Richness in the nearshore area was low from January to April, increased in May, was particularly high in June–July and October, and remained elevated until December. There were no clear patterns of taxon richness in the deeper (trawled) regions of the study area. Overall abundances and abundances of new recruits of nekton taxa indicate extensive use of the study area during all months (see *Appendix C*). Thirty-two relatively abundant and frequently occurring taxa were assessed to determine seasonality in either the deeper, trawled habitats or in shallow, seined habitats. If the top three months with maximum abundance for each of these taxa are considered (*Fig. 3.6.2.2*), then most peaks for tidal river residents occurred from June to October. Nearshore spawners (species spawning in coastal waters outside the estuary) were most abundant in August, October, and December. Estuarine spawners had peaks of abundance from March to July. Among new recruits (i.e., the smallest two or three 5-mm size classes captured by our gears), recruitment occurred throughout the year (Fig. 3.6.2.3): of the 27 taxa for which these trends were assessed, offshore spawners recruited to the study area mostly from January to March, nearshore spawners had most recruitment peaks in July and November, estuarine spawners had most peaks from June to August, and peaks in tidal-river residents' recruitment were concentrated in May–July and October. Overall, the results suggested that the study area was important for nekton throughout the year.

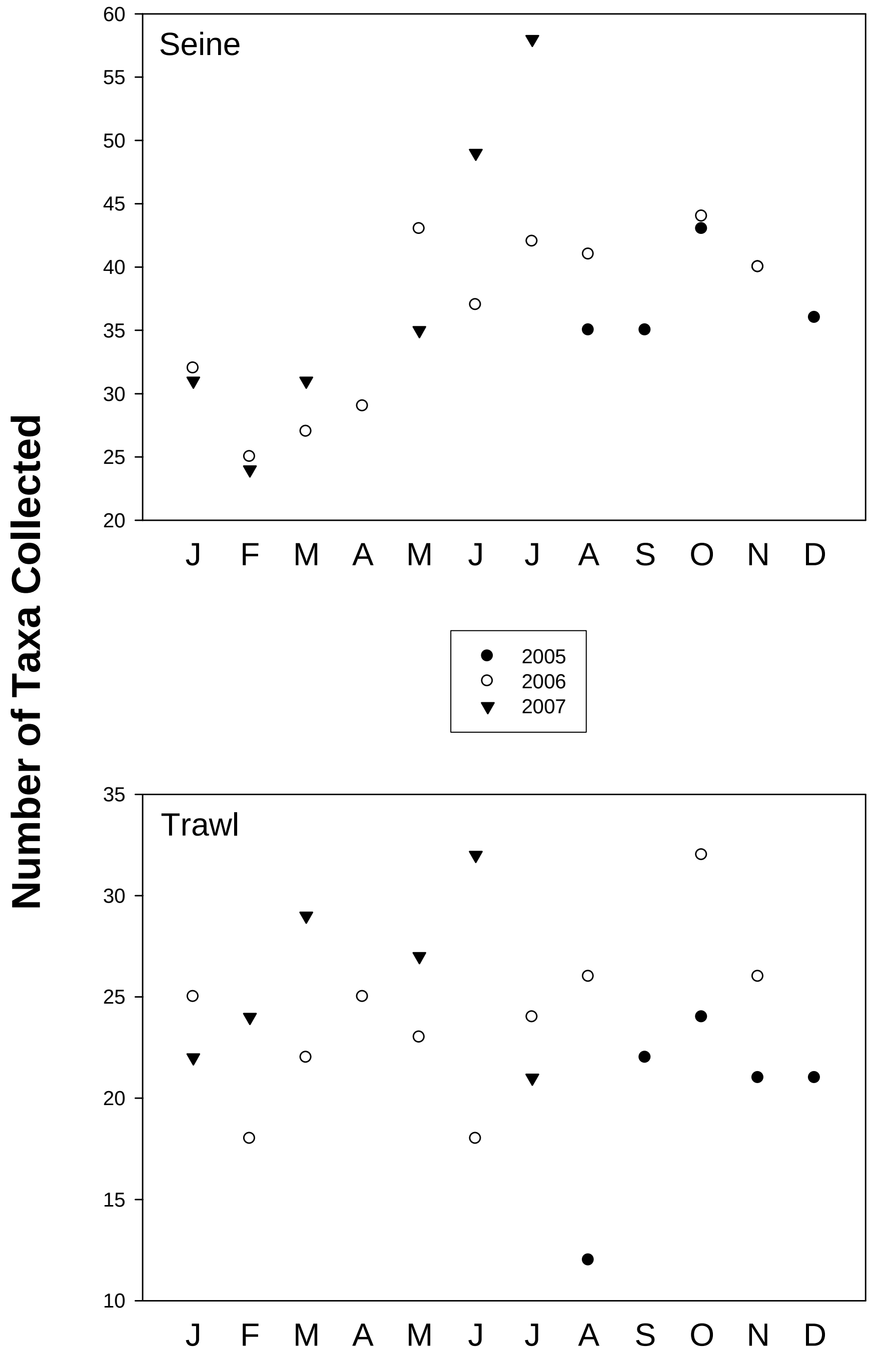

Fig. 3.6.2.1 Number of taxa collected per month by seine and trawl.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Offshore Spawners												
F. duorarum			T				ST	T		S	S	
S. foetens					S	ST	S				T	T
L. rhomboides		T	T		ST	S				S		
L. xanthurus			S		S	S						
M. cephalus	S	S	S									
Total Peaks	**1**	**2**	**4**		**4**	**4**	**3**	**1**		**2**	**2**	**1**
Nearshore Spawners												
C. sapidus	S		T		T					S	S	T
E. gula	T							S		ST	S	T
E. harengulus	T			S			T	ST		S		
S. plagiusa			T				T					T
Total Peaks	**3**		**2**	**1**	**1**		**2**	**3**		**4**	**2**	**3**
Estuarine Spawners												
P. intermedius	T	T	T			S				S	S	
Alpheidae spp.		T	T	T								
A. mitchilli	T								ST	S		ST
O. beta				T	T			T				
S. notata							S	S		S		
S. timucu	S										S	S
F. carpio			S								S	S
S. scovelli		T	T			T	S			S		S
G. robustum		T	T	T								
T. maculatus			S	T			T	ST		S		
S. nephelus					ST	ST					T	S
Total Peaks	**3**	**4**	**6**	**4**	**3**	**4**	**3**	**4**	**2**	**5**	**4**	**6**
Tidal-River Residents												
N. petersoni						S		S		S		
C. variegatus	S						S	S				
F. grandis	S										S	S
F. seminolis						S	S	S				
L. parva		T				S		S	T	ST		
L. goodei						S		S	S			
G. holbrooki					S		S			S		
P. latipinna							S	S		S		
Menidia spp.						S			S	S		
L. punctatus						S		S		S		
M. salmoides					S	S		S				
M. gulosus			T			S	ST	T		S		
Total Peaks	**2**	**1**	**1**		**2**	**8**	**6**	**9**	**3**	**8**	**1**	**1**

Fig. 3.6.2.2. Top months of relative abundance for all individuals collected in seines (S) and trawls (T).

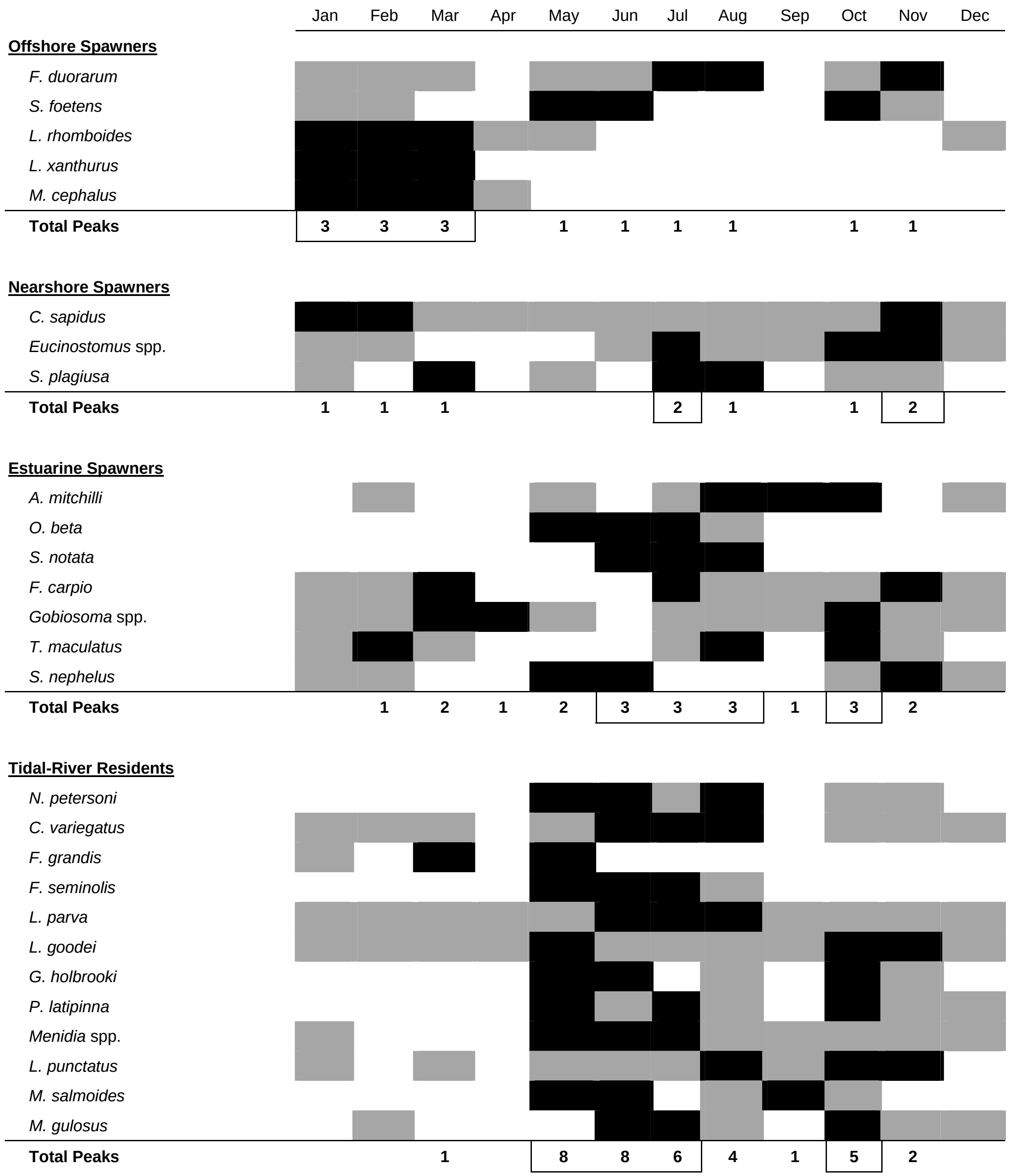

Fig. 3.6.2.3. Months of occurrence (■) and peak abundance (■) for new recruits collected by seine and trawl.

3.7 Distribution (kmu) Responses to Freshwater Inflow

3.7.1 Plankton Net

Nine (14%) of the 66 plankton-net taxa evaluated for distribution responses to freshwater inflow exhibited significant responses. Six of these were positive responses, wherein animals moved upstream as inflows increased (*Table 3.7.1.1*). The remaining three taxa moved downstream as freshwater flows increased. Downstream movement is the typical inflow response seen in tidal rivers on Florida's west coast. The time lags for these nine taxa were highly variable, ranging from 1 to 74 days.

Table 3.7.1.1. Plankton-net organism distribution (km_U) responses to mean freshwater inflow (Ln F), ranked by linear regression slope. Other regression statistics are sample size (n), intercept (*Int.*), slope probability (P) and fit (r^2, as %). D is the number of daily inflow values used to calculate mean freshwater inflow. None of the time series data appeared to be serially correlated (Durbin-Watson statistic, p>0.05 for all taxa).

Description	***Common Name***	***n***	***Int.***	***Slope***	***P***	r^2	***D***
Parasterope pollex	ostracod, seed shrimp	11	-119.803	29.851	0.0048	61	43
Cyathura polita	isopod	11	-87.352	22.371	0.0154	50	15
polychaetes	sand worms, tube worms	20	-47.680	12.162	0.0249	25	5
pelecypods	clams, mussels, oysters	16	-44.340	11.173	0.0432	26	4
trichopteran larvae	caddisflies	15	-37.573	10.765	0.0016	55	1
Sarsiella zostericola	ostracod, seed shrimp	13	-24.075	5.867	0.0300	36	42
gastropods, opisthobranch	sea slugs	15	39.239	-9.464	0.0007	60	2
Gobiosoma spp. postflexion larvae	gobies	12	39.937	-9.606	0.0479	34	2
Lucania parva adults	rainwater killifish	11	120.274	-28.283	0.0276	43	74

3.7.2 Seine and Trawl

Just over 10% of the 46 pseudo-species/gear combinations (hereafter simply referred to as 'pseudo-species') evaluated for distributional responses to freshwater inflow exhibited significant response for at least one lagged flow period. For the purposes of this discussion, we refer only to the best models for each of the five pseudo-species (i.e., statistically significant [α<0.05] models with normally distributed residuals that explain the greatest proportion of the variance [highest r^2 value] for each pseudo-species) (*Table 3.7.2.1*). Best models are plotted in *Appendix G*.

Four of the five pseudo-species with distributional responses to inflow showed the typical pattern of upstream movement in response to decreasing inflow. Changes in the centers of abundance ranged from 1.7 km for *Fundulus seminolis* to 3.80 km for *Mugil cephalus* over inflow changes of 13 to 27.0 cfs. The lag periods for four of the pseudo-species were relatively short (1 to 21 days; *Callinectes sapidus*, *Fundulus seminolis*, *Poecilia latipinna* and *Mugil cephalus*) and moderately long (49 days) for *Lucania parva*.

Table 3.7.2.1. Best-fit seine and trawl-based pseudo-species distributional response to continuously-lagged mean freshwater inflow (ln(km_U) vs. ln(inflow)) for the Chassahowitzka River estuary. Degrees of freedom (*df*), intercept (Int.), slope, probability that the slope is significant (*P*), and fit (Adj-r^2) are provided. The number of days in the continuously-lagged mean inflow is represented by *D*. An "x" in *DW* indicates that the Durbin-Watson statistic was significant (p<0.05), a possible indication that serial correlation was present.

Species	*Common name*	*Gear*	*Size (mm)*	*Period*	*df*	*Int.*	*Slope*	*P*	*Adj. r^2*	*DW*	*D*
Callinectes sapidus	Blue crab	Trawl	0 to 30	Jan. to Dec.	19	4.352	-0.523	0.0488	0.1464		1
Fundulus seminolis	Seminole killifish	Seine	0 to 999	Jan. to Dec.	10	4.295	-0.376	0.0308	0.3255		1
Lucania parva	Rainwater killifish	Seine	0 to 999	Jan. to Dec.	19	5.044	-0.589	0.0461	0.1509	x	49
Poecilia latipinna	Sailfin molly	Seine	0 to 30	Jan. to Dec.	9	6.554	-0.945	0.0210	0.4045		21
Mugil cephalus	Striped mullet	Seine	0 to 999	Jan. to Dec.	7	-4.129	1.560	0.0349	0.4207		7

3.8 Abundance (N, $\bar{N}$) Responses to Freshwater Inflow

3.8.1 Plankton Net

Thirteen (20%) of the 66 plankton-net taxa evaluated for abundance relationships with freshwater inflow exhibited significant responses (*Table 3.8.1.1*). Only three of these were positive responses. Negative responses were more common; these are usually caused by elevated flows washing marine-derived taxa out of the survey area. The most noteworthy observation is that bay anchovy juveniles, a taxon that typically congregates within the interiors of tidal rivers, had a positive abundance response to inflow. This response had a relatively long lag of 106 days, which is more than twice the typical age of the bay anchovy juveniles themselves (approx. 40 d, Peebles 2002). During high inflow periods, the Chassahowitzka River estuary apparently becomes more attractive as nursery habitat for the bay anchovy, and the juveniles seek out the middle reaches of the tidal river (*Table A3*), much as they do in more strongly surface-fed estuaries. The estuarine tanaid *Hargeria rapax* exhibited a similar pattern (*Table 3.8.1.1*). The positive response by chironomid larvae, which are primarily freshwater organisms in this case, reflects the creation of more freshwater habitat during high-inflow periods.

Table 3.8.1.1. Plankton-net organism abundance responses to mean freshwater inflow (Ln *F*), ranked by linear regression slope. Other regression statistics are sample size (*n*), intercept (*Int.*), slope probability (*P*) and fit (r^2, as %). *DW* identifies where serial correlation is possible (x indicates p<0.05 for Durbin-Watson statistic). *D* is the number of daily inflow values used to calculate mean freshwater inflow.

Description	*Common Name*	*n*	*Int.*	*Slope*	*P*	r^2	*DW*	*D*
Anchoa mitchilli juveniles	bay anchovy	18	-52.561	15.666	0.0066	38	x	106
Hargeria rapax	tanaid	20	-22.269	8.521	0.0024	41		4
dipterans, chironomid larvae	midges	20	-16.140	7.029	0.0115	31		47
unidentified Americamysis juveniles	opossum shrimps, mysids	20	40.506	-5.959	0.0003	53		106
Harrieta faxoni	isopod	20	46.556	-8.190	0.0213	26		26
Cumaceans	cumaceans	20	55.616	-9.591	0.0361	22	x	5
Polychaetes	sand worms, tube worms	20	60.455	-11.705	0.0012	45		90
Sarsiella zostericola	ostracod, seed shrimp	13	61.622	-12.625	0.0033	56		2
gobiid flexion larvae	gobies	14	76.866	-15.711	0.0098	44		104
Pseudodiaptomus coronatus	copepod	18	75.415	-15.879	0.0006	53		2
Acartia tonsa	copepod	20	82.060	-16.877	0.0035	39		93
Parasterope pollex	ostracod, seed shrimp	11	78.838	-16.922	0.0022	67		14
Microgobius spp. postflexion larvae	gobies	15	91.591	-19.607	0.0019	54		115

3.8.2 Seine and Trawl

Among the 46 pseudo-species considered in these analyses, abundances of 50% were significantly related to average inflow (*Table 3.8.2.1*). The greatest proportion of variance in abundance (best model; *Appendix I*) was explained by linear regressions for nine pseudo-species and by quadratic regressions for 14 pseudo-species. Of the nine linear models, six were negative relationships, indicating increasing abundance with decreasing inflow while the remaining three showed positive relationships. The negative response in these pseudo-species most likely indicates an increase in the amount of slightly higher salinity habitats as flows decreased. Similarly, two of the three positive linear responses (*Lucania goodei* and *Lepomis punctatus*) were observed for freshwater taxa that would be expected to respond favorably to increases in inflow and subsequent increases in the amount of freshwater habitat. The most common quadratic relationship, occurring in 71.4% of significant quadratic regressions, suggested greatest abundance at intermediate inflows (‘intermediate-maximum’). The remaining four best-fit quadratic models suggested lowest abundance at intermediate inflows (‘intermediate-minimum’). The percentage of significant abundance responses to inflow ranged from 35.3% of tested pseudo-species in estuarine spawners to 85.7% in offshore spawners. Tidal-river residents most commonly exhibited ‘intermediate-maximum’ relationships to flow, while offshore spawners were split between ‘intermediate-maximum’ (3), negative (2), and intermediate-minimum (1) responses to inflow (*Fig. 3.8.2.1*). All three of the nearshore spawners that had significant regressions demonstrated negative responses to flow. There were no clearly discernible trends for the remaining life-history category, estuarine spawners.

Best-fit regression models tended to incorporate long (98 to 364 day) lag periods for all life-history categories. Long lags were especially prevalent (≥50% of pseudo-species) in offshore spawners and tidal river residents (*Fig. 3.8.2.2*). Best models incorporated lagged inflows ranging from 21 to 259 days for tidal river residents, 1 to 364 days for estuarine spawners, 1 to 231 days for nearshore spawners, and 1 to 182 days for offshore spawners.

The ten strongest abundance-inflow relationships—those where inflow explained a sizeable portion of variance (r^2>~30%) – included pseudo-species from all life-history categories, with the offshore life-history category represented at nearly double its proportion (40%) in relation to its percent contribution to the total number of significant regressions (26%). Of these ten strongest relationships, eight were analyses conducted on data collected by seines in the shoreline habitat. Relationships of abundance to flow in these ten pseudo-species included positive, negative, and 'intermediate-maximum' patterns. An increase in abundance with increased flow may suggest beneficial aspects of increased nutrient input, for example, or perhaps better detection of the tidal-river nursery area. Intermediate-maximum relationships, where abundance is greatest at mid-range flows and is lower at both lower and higher flows, perhaps indicate differing forces operating at opposite ends of the inflow spectrum. At low flows, opportunities for either chemical detection of tidal nursery habitats or selective tidal-stream transport may be reduced, and at high flows, physical displacement may occur, or perhaps undesirable properties of fresher water (e.g., low pH) become more prominent.

Table 3.8.2.1. Best-fit seine and trawl-based pseudo-species abundance ($\bar{N}$) response to continuously-lagged mean freshwater inflow (ln(cpue) vs. ln(inflow)) for the Chassahowitzka River estuary. The type of response (*Resp.*) is either linear (L) or quadratic (Q). Degrees of freedom (*df*), intercept (*Int.*), slope (*Linear coef.*), probability that the slope is significant (*Linear P*), quadratic coefficient (*Quad. coef.*), probability that the quadratic coefficient is significant (*Quad. P*) and fit (*Adj. r^2*) are provided. The number of days in the continuously-lagged mean inflow is represented by *D*. An "x" in *DW* indicates that the Durbin-Watson statistic was significant (p<0.05), a possible indication that serial correlation was present.

								Linear		Quadratic				
Species	***Common name***	***Gear***	***Size***	***Period***	***Resp.***	***df***	***Int.***	***Coef.***	***P***	***Coef.***	***P***	***Adj-r^2***	***DW***	***D***
Farfantepenaeus duorarum	Pink shrimp	Seines	0 to 30	Jan. to Dec.	Q	18	-1703.294	836.585	0.0065	-102.638	0.0063	0.3549	x	126
Farfantepenaeus duorarum	Pink shrimp	Trawls	0 to 30	Jan. to Dec.	Q	18	-1189.429	583.947	0.0101	-71.609	0.0099	0.3667		182
Palaemonetes intermedius	Brackish grass shrimp	Trawls	0 to 999	Jan. to Dec.	Q	18	1730.790	-846.220	0.0136	103.517	0.0135	0.2421	x	168
Callinectes sapidus	Blue crab	Seines	0 to 30	Sep. to Mar.	L	10	36.273	-8.263	0.0089	.	.	0.4629		231
Callinectes sapidus	Blue crab	Trawls	0 to 30	Jan. to Dec.	L	19	13.895	-3.245	0.0341	.	.	0.1741	x	168
Anchoa mitchilli	Bay anchovy	Seines	31 to 50	Jan. to Dec.	Q	18	1708.789	-844.512	0.0249	104.349	0.0238	0.3310		28
Synodus foetens	Inshore lizardfish	Trawls	0 to 130	May to Jan.	L	14	2.807	-0.646	0.0157	.	.	0.3043	x	1
Opsanus beta	Gulf toadfish	Trawls	0 to 100	May to Aug.	L	6	-10.522	2.661	0.0047	.	.	0.7223		21
Strongylura timucu	Timucu	Seines	150 to 450	Aug. to Feb.	Q	9	720.658	-350.662	0.0272	42.669	0.0276	0.3340		1
Fundulus grandis	Gulf killifish	Seines	51 to 100	Jan. to Dec.	Q	18	-2066.955	1009.809	0.0094	-123.219	0.0093	0.2542		259
Fundulus seminolis	Seminole killifish	Seines	51 to 100	Mar. to Jan.	Q	16	-1434.682	700.034	0.0180	-85.339	0.0181	0.2228	x	161
Lucania parva	Rainwater killifish	Seines	0 to 999	Jan. to Dec.	Q	18	-3528.129	1726.775	0.0050	-210.951	0.0050	0.2951	x	168
Lucania goodei	Bluefin killifish	Seines	0 to 50	May to Nov.	L	11	-52.731	13.461	0.0258	.	.	0.3196	x	175
Poecilia latipinna	Sailfin molly	Seines	31 to 999	Jan. to Dec.	Q	18	-2398.600	1171.567	0.0039	-142.961	0.0039	0.3088		189
Syngnathus scovelli	Gulf pipefish	Trawls	0 to 130	Jan. to Dec.	L	19	2.969	-0.676	0.0376	.	.	0.1665	x	364
Lepomis punctatus	Spotted sunfish	Seines	0 to 100	May to Nov.	L	11	-21.945	5.625	0.0056	.	.	0.4726		21
Eucinostomus harengulus	Tidewater mojarra	Seines	40 to 999	Jan. to Dec.	L	19	34.402	-7.972	0.0020	.	.	0.3713	x	1
Lagodon rhomboides	Pinfish	Seines	0 to 50	Jan. to Jun.	Q	8	-3124.943	1536.565	0.0012	-188.679	0.0011	0.7134	x	98
Lagodon rhomboides	Pinfish	Seines	51 to 100	Apr. to Sep.	L	8	35.657	-8.196	0.0411	.	.	0.3531		168
Mugil cephalus	Striped mullet	Seines	0 to 999	Jan. to Apr.	Q	4	1753.678	-852.732	0.0024	103.658	0.0024	0.8963	x	1
Microgobius gulosus	Clown goby	Seines	0 to 30	Jan. to Dec.	Q	18	-1333.869	652.338	0.0206	-79.680	0.0205	0.1839		168
Microgobius gulosus	Clown goby	Seines	31 to 50	Jan. to Dec.	Q	18	-678.194	333.212	0.0149	-40.858	0.0147	0.2224		56
Trinectes maculatus	Hogchoker	Seines	0 to 999	Jan. to Dec.	Q	18	-1268.484	618.386	0.0153	-75.308	0.0153	0.2062	x	280

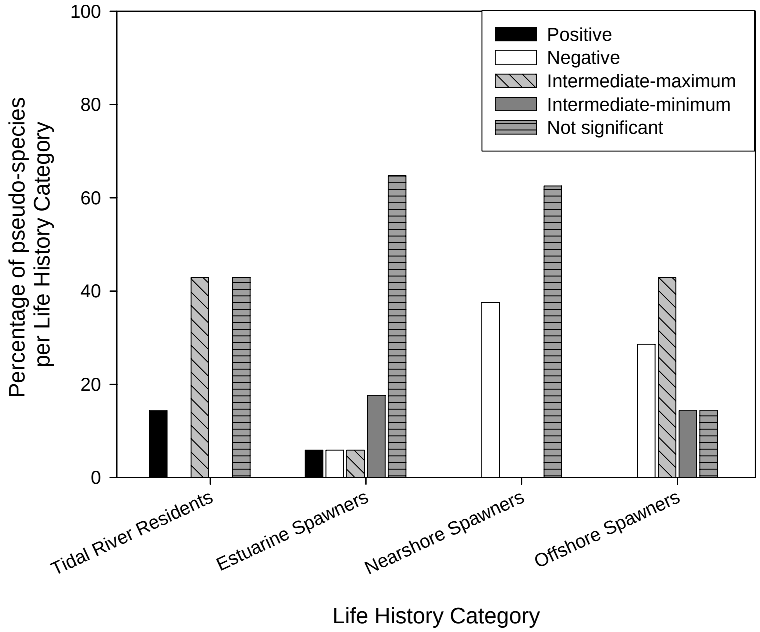

Fig. 3.8.2.1. Summary of regression results by response type for the 46 pseudo-species collected in seines and trawls for which an abundance (N̅) response to inflow was assessed from the Chassahowitzka River estuary. Positive and negative indicate increase and decrease in abundance with increasing inflow, respectively, while intermediate-maximum and intermediate-minimum indicate maximum and minimum abundance at intermediate inflows, respectively. Not significant indicates that a significant regression was not reached for a pseudo-species.

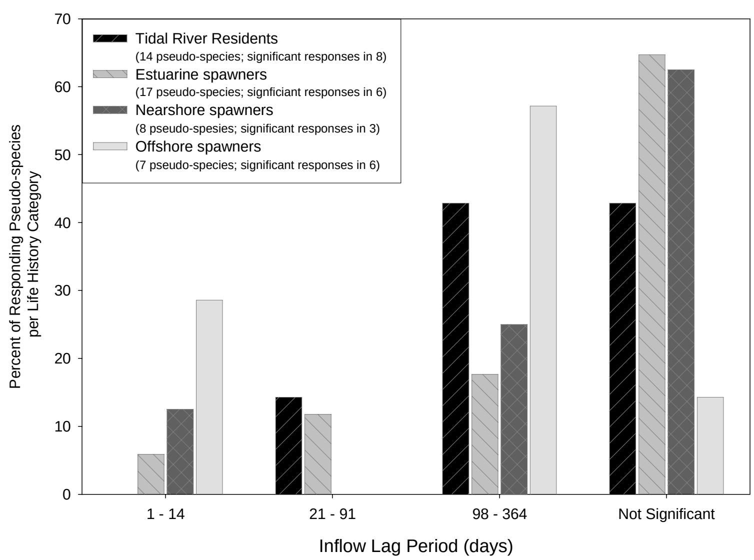

Fig. 3.8.2.2. Summary of regression results by inflow lag period for the 46 pseudo-species collected in seines and trawls for which an abundance (N̅) response to inflow was assessed from the Chassahowitzka River estuary

3.9 Community Structure

3.9.1 Plankton Net Community Heterogeneity (H) Responses to Freshwater Inflow (F_3)

There was no indication of a relationship between flow and community heterogeneity (H) – as indicated by plankton-net data – in the Chassahowitzka estuary. A diversity of linear and nonlinear regression models was fit to the data in *Fig. 3.9.1* (right-hand panels), and none was significant. The principal reason for the significant relationships between inflow and H in surface-fed rivers (left-hand panels of *Fig. 3.9.1*) is the invasion of planktonic, marine-derived organisms from seaward waters that occurs during low-inflow periods. As these planktonic, marine-derived organisms move farther into the interiors of tidal rivers, the overall community composition of the tidal rivers becomes more uniform, reducing community heterogeneity. The inflows that occurred during the survey period were apparently large enough and stable enough to prevent this from happening in the Chassahowitzka.

There was, however, substantial variation in H over time (*Fig. 3.9.2*). Fish and invertebrate community heterogeneity appeared to track each other somewhat, but this relationship was not significant (Pearson's $r = 0.31$, $n = 20$, $p = 0.18$). The highest fish heterogeneity occurred during both winters, which is the season with the least amount of local spawning activity and lowest taxonomic richness. The lowest fish heterogeneity occurred during July 2007. The difference between these high and low points was primarily caused by reduced local spawning by gobies during winter, coupled with the presence of winter-spawned spot and pinfish arriving from offshore spawning sites. There were also more bay anchovy juveniles present during the relatively higher flows of the 2005-06 winter, and these tended to aggregate in the central part of the estuary, contributing to heterogeneity along the transect.

A fairly strong community gradient was always present along the Chassahowitzka's survey transect, even during the collection with the lowest fish community heterogeneity (July 2007, *Fig. 3.9.3*). Much of the variation in community heterogeneity apparent in *Figs. 3.9.1* and *Fig. 3.9.2* was caused by presence or absence of a community gradient within zones 2-4, as there was always a strong difference between zones 1 and 5. In some months, zones 2-4 had very similar compositions (*Fig. 3.9.3*) and in others, these interior zones were ordered along the expected gradient (*Fig. 3.9.4*). Community heterogeneity was less variable for invertebrates than fishes, with the strongest difference being caused by differences in the distribution and abundance of various peracarid crustaceans: gammaridean amphipods, the mysids *Americamysis almyra* and *Bowmaniella dissimilis*, the tanaid *Hargeria rapax*, and cumaceans.

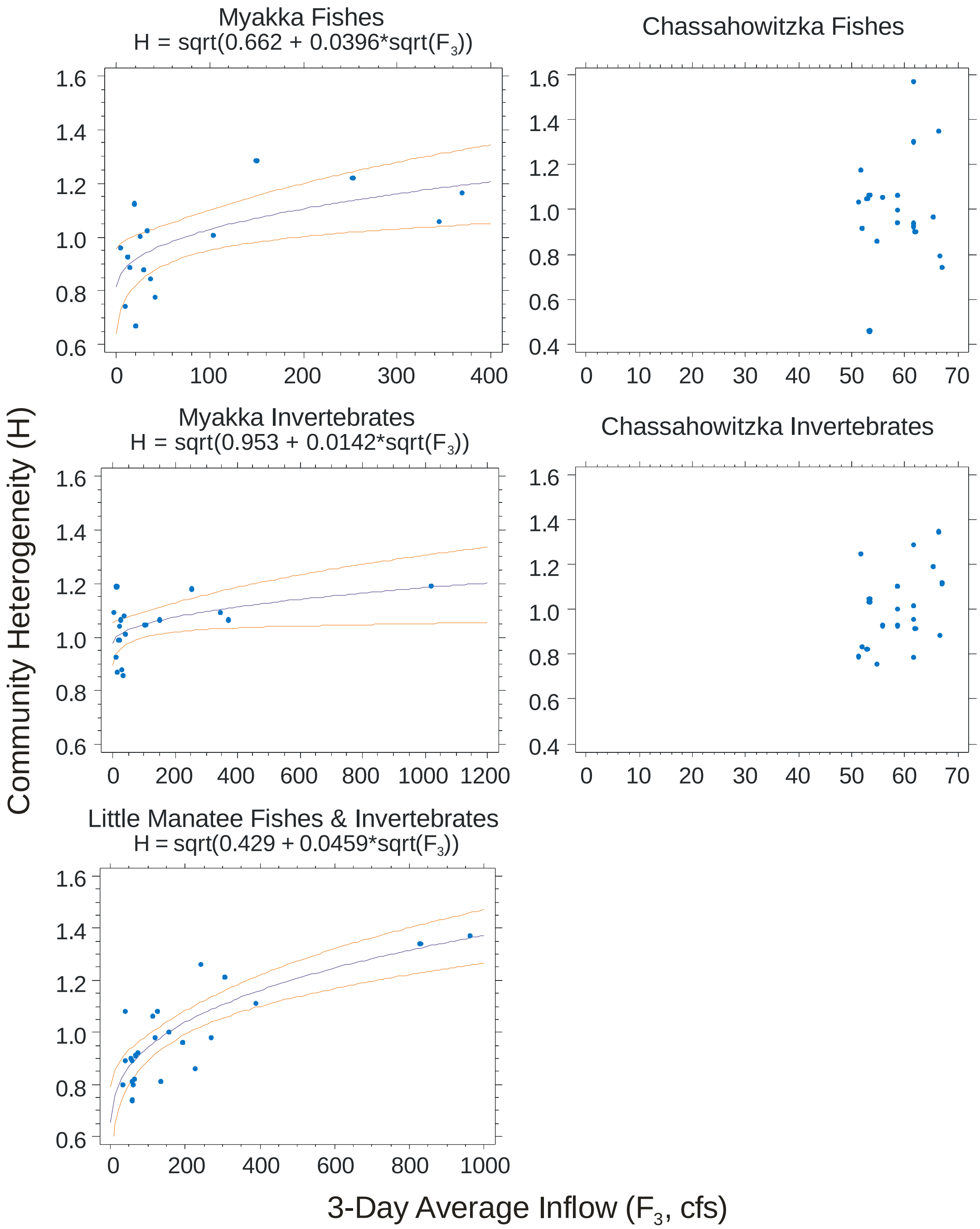

Fig. 3.9.1. Comparison of interactions between community heterogeneity, as indicated by plankton-net catch, and freshwater inflows into different estuaries. Each data point represents a single survey along a longitudinal transect. Community heterogeneity (H) is the community dispersion metric from the Index of Multivariate Dispersion (MVDISP) routine in PRIMER v6 (Clarke and Warwick 2001). H identifies the degree of variability in the composition of the catch along the sampled transect; it is a measure of how well the estuarine community gradient is established. F3 is the mean gauged inflow during the three-day period ending on the day on sampling. Myakka F3 includes the combined flows from the Myakka near Sarasota and Big Slough gauges.

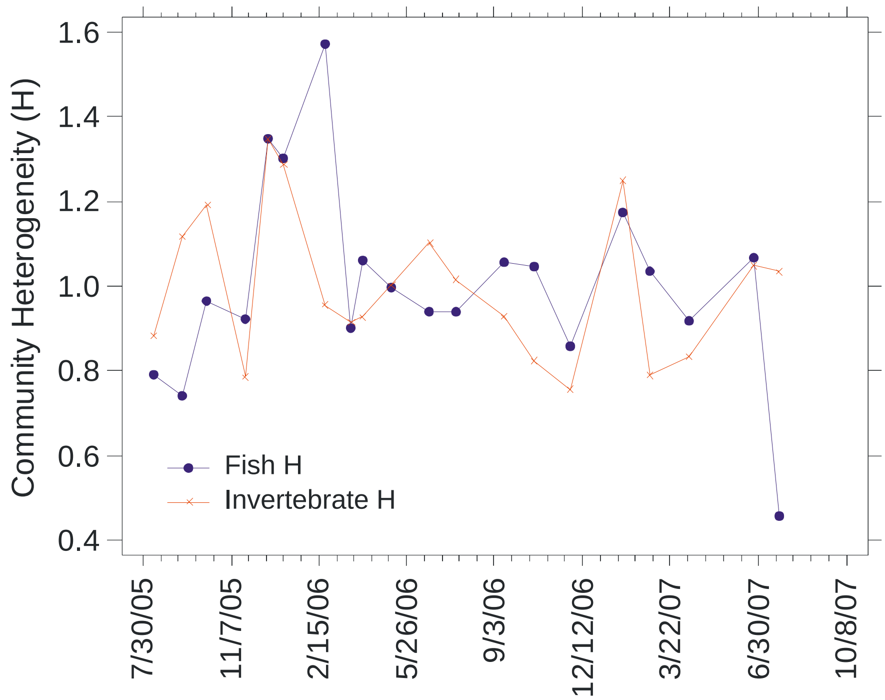

Fig. 3.9.2. Variation in community heterogeneity in the Chassahowitzka estuary over time (same data as in Fig. 3.9.1).

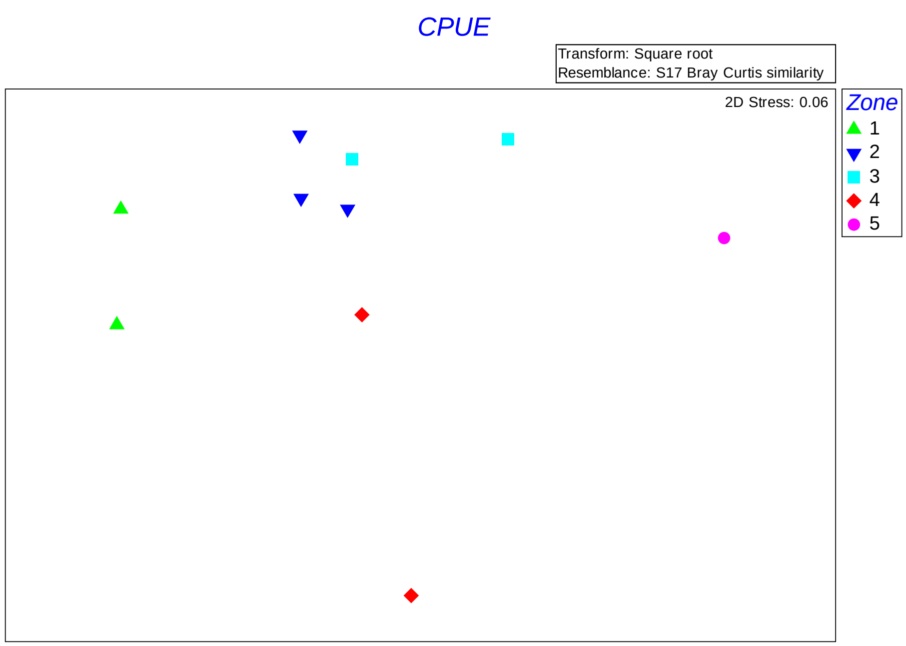

Fig. 3.9.3. Multidimensional scaling (MDS) plot for plankton-net collected fish on the date when the minimum fish community heterogeneity was observed (July 2007, see Fig. 3.9.2). Note that the two samples from shallow Gulf of Mexico waters (Zone 1) are most different (i.e., most distant) from the single sample from the upstream-most zone (Zone 5). Most samples from middle reaches (Zones 2-4) were compositionally very similar, except for one sample from Zone 4.

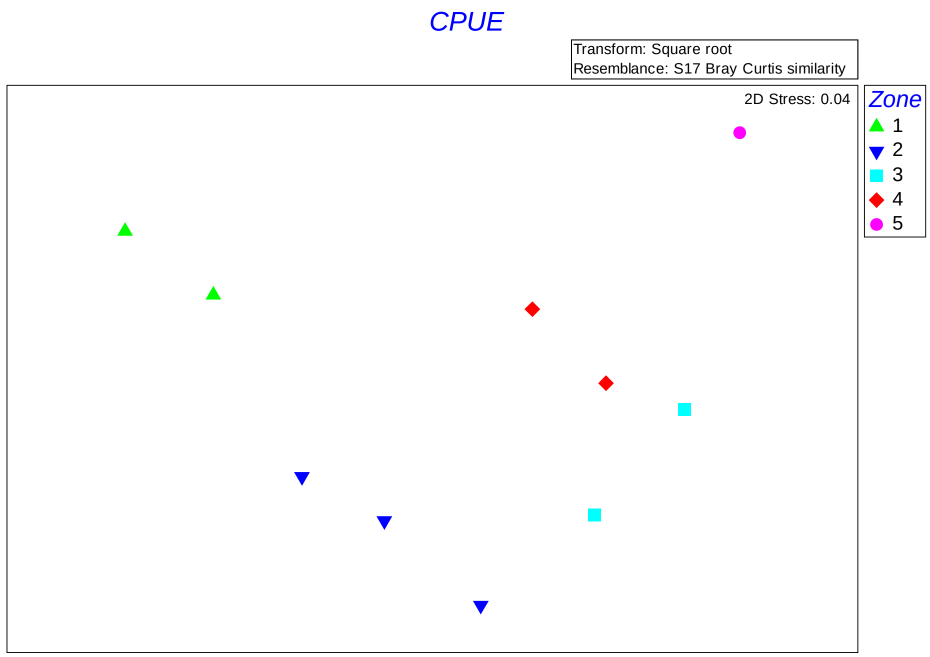

Fig. 3.9.4. Multidimensional scaling (MDS) plot for plankton-net collected fish on the date when the community heterogeneity was highest. Unlike Fig. 3.9.3, all five zones are well-ordered along the collective gradient, which results in a high level of community heterogeneity.

3.9.2. Community structure: seine and trawl

Community structure changed spatially and temporally in all of the surveyed habitats of the Chassahowitzka River and bay. In the shoreline (seined) area, community structure was significantly different between zones (ANOSIM R = 0.527, P = 0.001). Pairwise comparisons revealed that the difference in community structure between adjacent zones increased with movement upstream: there was relatively little difference between the bay and km 0.0–2.4 (ANOSIM R = 0.155, P = 0.049), whereas there was considerable difference in community structure between km 4.9–6.8 and 6.9–8.6 (ANOSIM R = 0.75, P = 0.001) (*Table 3.9.2.1*). This was reflected in the MDS plot, wherein the samples from km 6.9–8.6 did not overlap with the samples from the other zones to as great an extent as the other zones (*Fig. 3.9.2.1*). Both size classes of *Lucania goodei* and *Notropis petersoni* were very abundant in km 6.9–8.6 which, along with high abundance of *Lucania parva*, mainly drove differences in community structure (*Table 3.9.2.2*). There were also significant differences in community structure between month-years in the shoreline habitat (ANOSIM R = 0.584, P = 0.001). Community structure in this habitat changed annually in a regular, cyclical manner (RELATE ρ = 0.688, P = 0.001); the correlation with an annual cycle was considerably greater than the correlation with monthly physicochemical changes or changes in flow (*Table 3.9.2.3*).

Table 3.9.2.1. Pairwise differences in community structure from 21.3-m seines set along shorelines of the Chassahowitzka River and bay.

Zone pairs	**ANOSIM *R***	***P***
bay, 0.0–2.4 km	0.155	0.049
bay, 2.5–4.8 km	0.560	0.001
bay, 4.9–6.8 km	0.673	0.001
bay, 6.9–8.6 km	0.815	0.001
0.0–2.4 km, 2.5–4.8 km	0.274	0.014
0.0–2.4 km, 4.9–6.8 km	0.619	0.001
0.0–2.4 km, 6.9–8.6 km	0.690	0.001
2.5–4.8 km, 4.9–6.8 km	0.452	0.001
2.5–4.8 km, 6.9–8.6 km	0.607	0.001
4.9–6.8 km, 6.9–8.6 km	0.750	0.001

The nekton community in the offshore, seined area of Chassahowitzka bay underwent significant annual cyclical changes in structure; the correlation with a cyclical matrix was of a similar magnitude to the correlation with environmental variables, and much greater than the correlation with flow (*Table 3.9.2.3*).

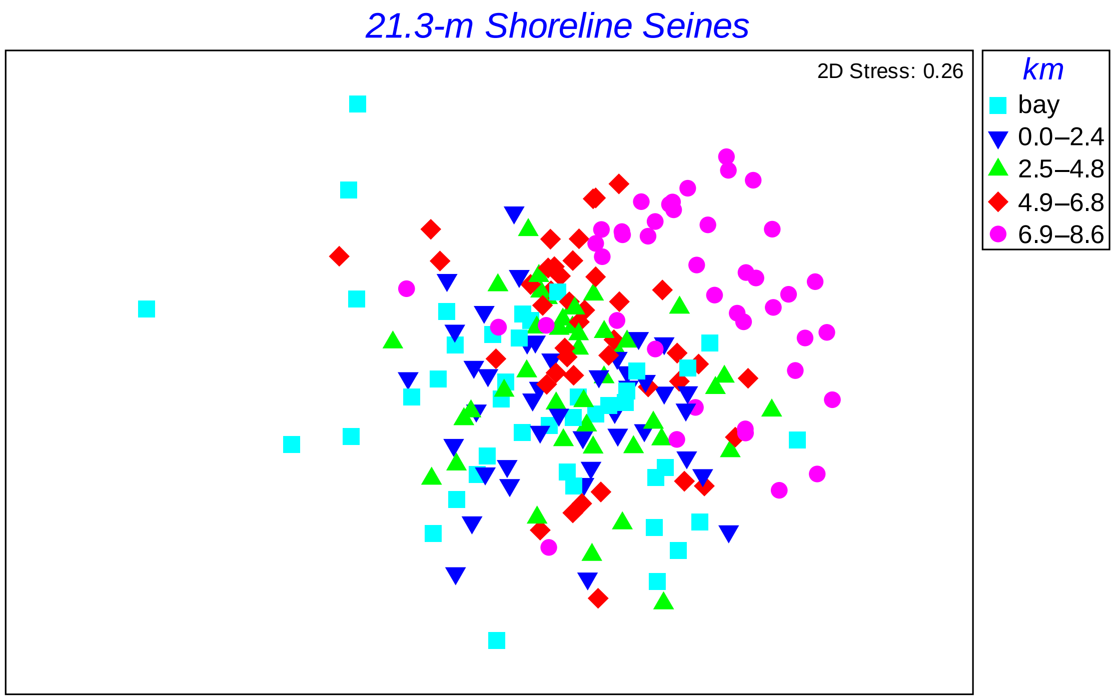

Fig. 3.9.2.1. Nonmetric Multidimensional Scaling (MDS) ordination plot of the shoreline 21.3-m-seine nekton community structure in the Chassahowitzka River and bay.

Table 3.9.2.2. Pseudo-species characterizing each of the sampling zones in the Chassahowitzka River and bay. Abundance index represents the mean of the ln(x+1)-transformed abundance per seine or per 720 m^2 trawled.

21.3-m	bay		0.0-2.4 km		2.5-4.8 km		4.9-6.8 km		6.9-8.6 km	
shoreline	Species	Abund. Index	Species	Abund. Index	Species	Abund. Index	Species	Abund. Index	Species	Abund. Index
seines	*Pal. intermedius*	1.83	*Pal. intermedius*	1.78	Luc. parva < 31 mm	2.1	*Luc. parva* < 31 mm	3.3	*Luc. parva* < 31 mm	2.89
	Luc. parva < 31 mm	1.54	*Luc. parva* < 31 mm	1.58	*Menidia* spp. 31-50 mm	2.11	*Menidia spp.* 31-50 mm	2.66	*Luc. goodei* < 31 mm	2.14
	Euc. gula 51-80 mm	0.91	*Menidia* spp. 31-50 mm	1.13	*Cal. sapidus* < 31 mm	1.37	*Cal. sapidus* < 31 mm	1.59	*Euc. harengulus* 51-80 mm	0.97
	Lag. rhomboides 51-80 mm	0.91	*Lag. rhomboides* 51-80 mm	0.83	*Euc. harengulus* 51-80 mm	1.18	*Pal. intermedius*	2.14	*Not. petersoni* 31-50 mm	1.97
	Eucinostomus spp. < 31 mm	0.97	*Cal. sapidus* < 31 mm	0.86	*Lag. rhomboides* 51-80 mm	1.23	*Eucinostomus* spp. 31-39 mm	1.53	*Not. petersoni* < 31 mm	1.3
	Euc. gula 31-50 mm	0.79	*Eucinostomus* spp. 31-39 mm	0.66	*Pal. intermedius*	1.36	*Menidia* spp. < 31 mm	1.8	*Luc. goodei* 31-50 mm	0.85
	Flo. carpio 31-50 mm	0.64	*Eucinostomus* spp. < 31 mm	0.82	*Eucinostomus* spp. < 31 mm	0.91	*Luc. parva* 31-50 mm	1.9	*Menidia* spp. 31-50 mm	0.95
	Menidia spp. 31-50 mm	0.7	*Lag. rhomboides* 31-50 mm	0.57	*Lag. rhomboides* 31-50 mm	0.6	*Eucinostomus* spp. < 31 mm	1.26	*Eucinostomus* spp. 31-39 mm	0.6
	Far. duorarum < 31 mm	0.53	*Euc. harengulus* 51-80 mm	0.63	*Eucinostomus* spp. 31-39 mm	0.89	*Menidia* spp. 51-80 mm	0.99	*Lag. rhomboides* < 31 mm	0.09
	Str. notata > 100 mm	0.47	*Menidia* spp. < 31 mm	0.49	*Fun. grandis* 51-80 mm	0.51	*Cyp. variegatus* < 31 mm	0.82	*Str. timucu* > 100 mm	0.35

6.1-m trawls

Species	Abund. Index	Species	Abund. Index	Species	Abund. Index
Pal. intermedius	3.87	*Pal. intermedius*	2.97	*Cal. sapidus* > 100 mm	1.29
Far. duorarum < 31 mm	1.56	*Cal. sapidus* > 100 mm	1.37	*Eucinostomus* spp. < 31 mm	1.13
Cal. sapidus 51-80 mm	1.27	*Cal. sapidus* 51-80 mm	1.16	*Cal. sapidus* 51-80 mm	1.21
Cal. sapidus < 31 mm	1.41	*Luc. parva* < 31 mm	1.24	*Eucinostomus* spp. 31-39 mm	0.68
Lag. rhomboides < 31 mm	1.12	*Cal. sapidus* < 31 mm	1.25	*Far. duorarum* < 31 mm	0.81
Cal. sapidus > 100 mm	0.98	*Eucinostomus* spp. < 31 mm	0.69	*Pal. intermedius*	1.59
Gob. robustum < 31 mm	0.76	*Cal. sapidus* 31-50 mm	0.69	*Lag. rhomboides* < 31 mm	0.79
Luc. parva < 31 mm	0.79	*Far. duorarum* < 31 mm	1.13	*Cal. sapidus* < 31 mm	0.85
Gobiosoma spp. < 31 mm	0.8	*Euc. gula* 51-80 mm	0.53	*Lag. rhomboides* 31-50 mm	0.56
Euc. gula 51-80 mm	0.76	*Lag. rhomboides* 51-80 mm	0.6	*Sph. nephelus* < 31 mm	0.35

Table 3.9.2.3. Summary of results correlating monthly change in nekton community structure with seasonal and physicochemical changes in the shoreline habitat (21.3-m seines) of the Chassahowitzka River and bay.

Gear	Correlation with regular annual cycle (RELATE)	BIO-ENV (up to five variables)	BIO-ENV (single variable)	BIO-ENV (7-d mean flow)
Offshore seine	0.404	0.428 (temp., salinity, DO, km)	0.348 (temp.)	0.062
Boat seine	0.688	0.551 (bottom temp., wing depth)	0.547 (bottom temp.)	0.067
Trawl	0.492	0.274 (depth, bycatch, surface pH, surface sal., bottom temp.)	0.321 (pH)	0.149

The trawled, deeper nekton community significantly differed between year-months (ANOSIM *R* = 0.545, *P* = 0.001) and zones (ANOSIM *R* = 0.274). There was no significant difference in community structure between the bay and km 0.0–2.4 (ANOSIM *R* = -0.039, *P* = 0.624), whereas the km 2.5–4.8 segment of the river had a nekton community significantly different to the bay (ANOSIM *R* = 0.502, *P* = 0.001) but not to km 0.0–2.4 (ANOSIM *R* = 0.209, *P* = 0.095) (see *Fig. 3.9.2.2*). Differences in nekton community between the bay and km 2.5–4.8 were because of the decline in abundance with movement into the river of pseudo-species including *Palaemonetes intermedius*, various size classes of *Farfantepenaeus duorarum*, *L. rhomboides*, and the increase in abundance in the river of juvenile *Eucinostomus* spp. (*Table 3.9.2.2*). The trawled nekton community demonstrated significant annual cycles in structural change, with this pattern correlating to a considerably greater extent with monthly changes in community than any combination of physicochemical variables or flow (*Table 3.9.2.3*).

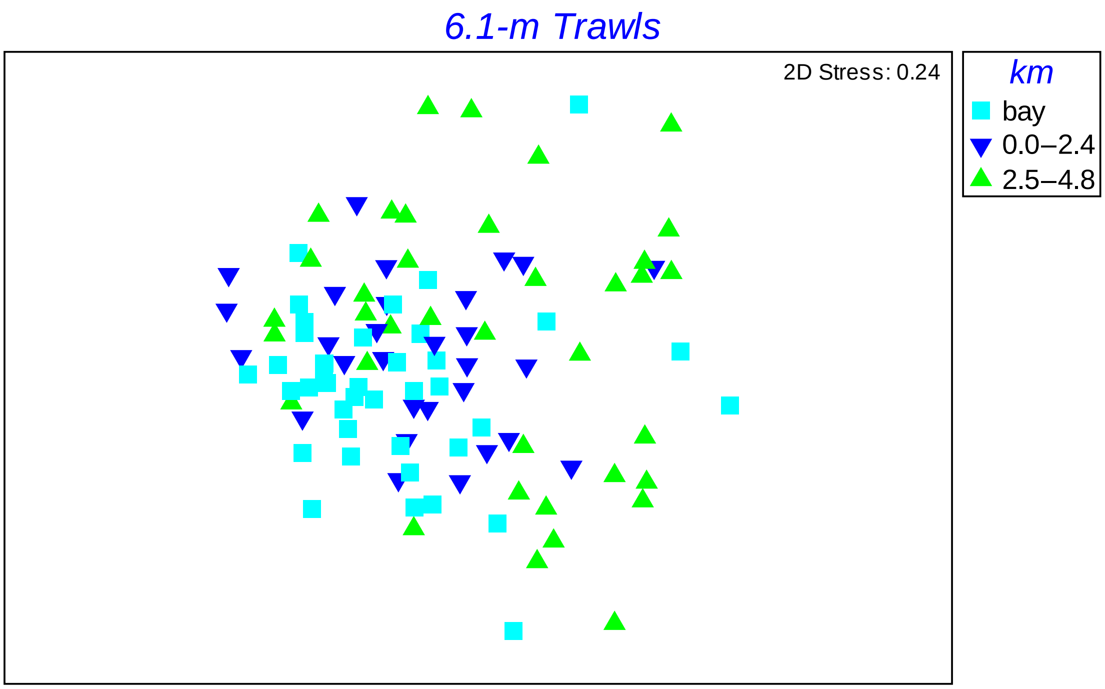

Fig. 3.9.2.2. Nonmetric Multidimensional Scaling (MDS) ordination plot of the 6.1-m-trawl nekton community structure in the Chassahowitzka River and bay.

The heterogeneity in nekton community structure of the shoreline habitat of the Chassahowitzka River and bay was not significantly related to freshwater inflow (although there was a non-significant positive trend, at $P = 0.10$; *Fig. 3.9.2.2*). Neither offshore seines nor trawling displayed any such pattern. Comparison of the same month with different flows between years did show the hypothesized trend of increasing similarity between the shoreline bay nekton community and the uppermost Chassahowitzka River zone as flows decreased (*Fig. 3.9.2.3*). There was no linear trend in these data for the deeper, trawled habitat; although a convex, 'intermediate-maximum' relationship was observed, we believe that this was spurious as we cannot provide an ecologically plausible explanation for this pattern.

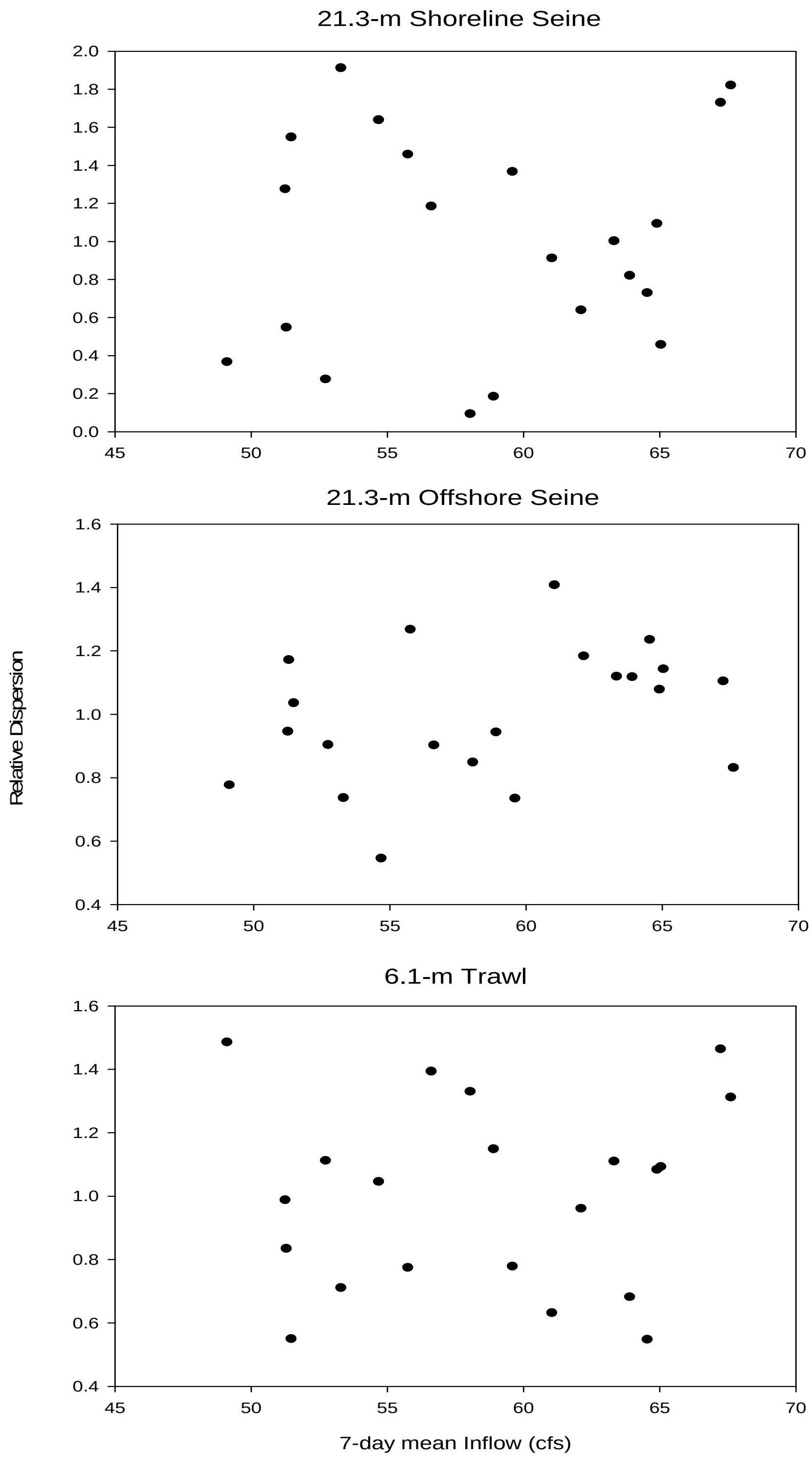

Fig. 3.9.2.2. Relationship between spring inflows and nekton community heterogeneity in the Chassahowitzka River and bay (measured as relative dispersion).

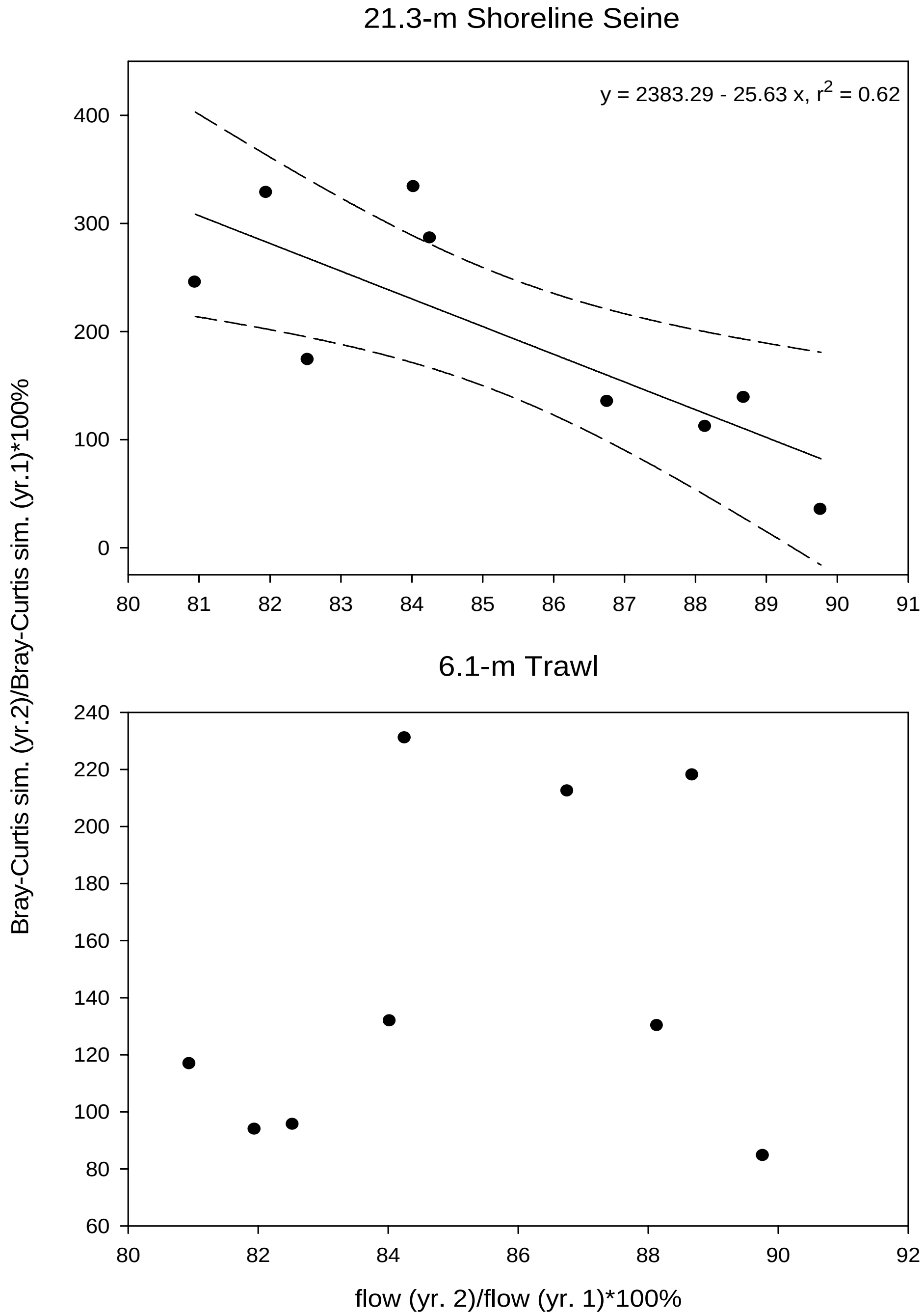

Fig. 3.9.2.3. Bray-Curtis similarity of nekton community structure between Chassahowitzka bay (km -3.5 – -0.1) and the upper Chassahowitzka River (km 6.9–8.6) from a given month in year 2 of the study compared to the same month in year 2 (with similarity in year 2 expressed as a percentage of year 1), in relation to flows in year 2 expressed as a percentage of flows in year 1.

4.0 CONCLUSIONS

4.1 Descriptive Observations

1) **Dominant Catch.** Gobies of the genera *Gobiosoma* and *Microgobius* and the bay anchovy (*Anchoa mitchilli*) dominated the plankton net's fish catch. Other abundant larval fishes included silversides (*Menidia* spp.), rainwater killifish (*Lucania parva*), eucinostomus mojarras (*Eucinostomus* spp.), and blennies. Catches of strongly estuary-dependent species such as bay anchovy, sand seatrout (*Cynoscion arenarius*), and hogchoker (*Trinectes maculatus*) were low relative to other survey areas.

The plankton-net invertebrate catch was dominated by gammaridean amphipods, larval crabs (decapod zoeae and megalopae), cumaceans, the mysids *Americamysis almyra* and *Bowmaniella dissimilis*, prosobranch snails, and larval shrimps (decapod mysis). Organisms that are indicative of reservoir or lake discharges, such as phantom midge larva *Chaoborus puntipinnis* and cyclopoid copepod *Mesocyclops edax*, were rare or absent, as would be expected. River-plume-associated taxa such as the calanoid coepod *Labidocera aestiva*, the chaetognaths *Sagitta* spp., the planktonic shrimp *Lucifer faxoni*, and the ostracod *Parasterope pollex*, were less common than they typically are in more nutrient-rich estuarine plumes along the west-central Florida coast.

Seine collections of fish were dominated by a mixture of small-bodied resident and transient taxa, including species characteristic of estuaries such as rainwater killifish (*Lucania parva*), silversides (*Menidia* spp.), and bay anchovy (*Anchoa mitchilli*), as well as more freshwater-oriented species that tend to be limited to the upper, oligohaline or limnetic reaches of estuaries, e.g., coastal shiner (*Notropis petersoni*) and bluefin killifish (*Lucania goodei*). Two species (pinfish, *Lagodon rhomboides*, and juvenile mojarras, *Eucinostomus* spp.) dominated the trawl catch. Invertebrate catches in both seines and trawls were largely composed of three species: brackish grass shrimp (*Palaemonetes intermedius*), blue crab (*Callinectes sapidus*), and pink shrimp (*Farfantepenaeus duorarum*).

2) **Use of Area as Spawning Habitat.** The eggs of the bay anchovy (*Anchoa mitchilli*), silversides (*Menidia* spp.), the rainwater killifish (*Lucania parva*), other killifishes (*Fundulus* spp.), unidentified gobies, and unidentified percomorph (primarily sciaenid) fishes were collected from the survey area (*Table A1*). Larval distributions suggested blennies and skilletfish (*Gobiesox strumosus*) spawned near the river mouth – probably in association with oyster-shell substrates. Gobies (primarily Gobiosoma spp. and *Microgobius* spp.) and *Menidia* appeared to spawn throughout much of the interior of the tidal river. The presence of rainwater killifish eggs upstream (*Table A3*) suggests upstream spawning by this species, a pattern that was also supported by the distribution of subsequent developmental stages. The collection of very small juveniles of live-bearing pipefishes (*Syngnathus scovelli, S. louisianae, S, floridae*) near the river mouth and in the interior tidal river (*S. scovelli*) suggests that these species also reproduce within the local area. Larval distributions indicated menhaden (*Brevoortia* pp.) and spot (*Leiostomus xanthurus*) migrated into the survey area from distant spawning locations.

3) **Use of Area as Nursery Habitat.** Estuary-dependent taxa spawned outside the Chassahowitzka River that use the study area as a nursery were prevalent in the samples. These included numerically abundant taxa that undoubtedly play a vital ecological role in the Chassahowitzka River ecosystem, e.g., pinfish, and juvenile mojarras. Also prominent were taxa of commercial importance, i.e., juvenile blue crab and pink shrimp. Compared to other locations in southwest Florida, some taxa were notably reduced in abundance or absent, e.g., red drum (*Sciaenops ocellatus*) and sand seatrout (*Cynoscion arenarius*). The juvenile nursery habitats for selected species were characterized from seine and trawl data in terms of preference for shallower or deeper areas, zone of the study area, type of shoreline, and salinity (*Appendix D*).

4) **Plankton Catch Seasonality.** More taxa were collected during the warmer months than during winter – this seasonal trend was highly consistent from year to year. Alteration of flows would appear to have the lowest potential for impacting many taxa during December and January, which are the months when the fewest estuarine taxa were present. The highest potential to impact many species would appear to be from

March through October. The early stages of some species were present throughout the year, whereas others had more seasonal spawning and recruitment patterns.

5) **Seine and Trawl Catch Seasonality.** Seasonality was most evident in the nearshore (seined) habitat of the Chassahowitzka River, with highest values during the summer period. For species spawning far offshore, the January–March period was a very important period of juvenile recruitment, whereas May–August had the most peaks in recruitment for those species spawning in the estuary and those residing in the river throughout the year. The succession of species throughout the annual cycle meant that recruitment of species occurred year-round, with the result that flow alterations to the study area have the potential to affect aquatic organisms at any time of the year.

4.2 Responses to Freshwater Inflow

1) **Plankton Catch Distribution Responses.** Nine (14%) of the 66 plankton-net taxa evaluated for distribution responses to freshwater inflow exhibited significant responses. Six of these were positive responses, wherein animals moved upstream as inflows increased. Three taxa moved downstream as freshwater flows increased. Downstream movement is the typical inflow response seen in tidal rivers on Florida's west coast. The time lags for these responses were highly variable, ranging from 1 to 74 days.

2) **Seine and Trawl Catch Distribution Responses.** For seine and trawl data, five (10.9%) of the 46 pseudo-species evaluated for distributional responses to freshwater inflow exhibited a significant response for at least one lagged flow period. The best models tended to involve relatively short lag periods (21 days or less). All but one of the significant responses were negative (i.e., animals moved upstream with decreasing freshwater inflow). Typically, a pseudo-species' center of abundance will shift downstream during periods of higher inflow and upstream during periods of lower inflow because individuals tend to occupy areas with suitable salinities or food sources.

3) **Plankton Catch Abundance Responses.** Thirteen (20%) of the 66 plankton-net taxa evaluated for abundance relationships with freshwater inflow exhibited significant responses. Only three of these were positive responses. Negative responses were more common; these are usually caused by elevated flows washing marine-derived taxa out of the survey area. Bay anchovy juveniles, a taxon which typically congregates within the interiors of surface-fed tidal rivers, had a positive abundance response to inflow. This response had a relatively long lag of 106 days, which is more than twice the typical age of the bay anchovy juveniles. During high inflow periods, the Chassahowitzka River estuary apparently becomes more attractive as nursery habitat for the bay anchovy; the juveniles seek out the middle reaches of the tidal river, much as they do in surface-fed estuaries. The estuarine tanaid *Hargeria rapax* exhibited a similar pattern. A positive abundance response by chironomid (midge) larvae reflected the creation of more freshwater habitat during high-inflow periods.

4) **Seine and Trawl Catch Abundance Responses.** Twenty-three (50%) of the 46 pseudo-species examined from the seine and trawl data demonstrated significant relationships between abundance and average inflow. The majority (14) of these responses were non-linear and most (10) exhibited an ‘intermediate-maximum’ scenario (highest abundance during intermediate inflows). Of the nine linear responses, six exhibited a negative abundance response to inflow (i.e., abundance increased with decreasing flow) and the remaining three indicated a positive abundance response to inflow. The percentage of significant abundance responses to inflow ranged from 29% of tested pseudo-species in estuarine spawners to 86% in offshore spawners. Nearshore spawners (n=3) only exhibited negative relationships to flow, whereas the majority of tidal river residents demonstrated ‘intermediate-maximum’ trends and offshore spawners were evenly divided between negative and ‘intermediate-maximum’ responses to inflow. The ten strongest abundance-inflow relationships included pseudo-species from all life-history categories and 80% of these were analyses conducted on data collected by seines along the shoreline habitat. Relationships of abundance to flow in these ten pseudo-species were positive, negative, or ‘intermediate-maximum’. An increase in abundance with increased flow may suggest beneficial aspects of increased nutrient input, for example, or perhaps better detection

of the tidal-river nursery area. Intermediate-maximum relationships may indicate that opportunities for either chemical detection of tidal nursery habitats or selective tidal-stream transport may be reduced at low flows, and at high flows, physical displacement may occur, or perhaps undesirable properties of fresher water (e.g., low pH) become more prominent.

4.3 Community Structure

As noted above, the variation in inflow was rather low during the study period. This generally limited the ability to predicted responses of fish and invertebrates to changes in flow, although the results were invaluable as baselines for future comparisons.

1) **Plankton Net Community Responses to Freshwater Inflow.** There was no indication of a relationship between flow and community heterogeneity in the plankton-net data. The inflows that occurred during the survey period were large enough and stable enough to prevent strong, landward invasions of planktonic, marine-derived organisms from seaward waters. A fairly strong community gradient was always present along the Chassahowitzka's survey transect, even during the collection that had the lowest fish community heterogeneity (July 2007). Variation in community heterogeneity over time was caused by the presence or absence of a community gradient within the middle reaches of the tidal river. During some months, samples from the middle reaches had similar, overlapping compositions, whereas in other months, samples from this area varied according to their relative position on the transect, adding heterogeneity to the overall community structure. Community heterogeneity was less variable for invertebrates than fishes, with the strongest variations being caused by variation in the abundance and distribution of peracarid crustaceans along the transect.

2) **Seine and Trawl Catch Community Analyses.** There were significant differences in community structure between the zones of the study area and also between year-months. Most notable was the difference between the uppermost zone of the study area (km 6.9–8.6) and the remainder of the study area; this zone was characterized by relatively high abundance of species that tend to occupy low-salinity

areas, i.e., bluefin killifish and coastal shiner. Changes in community structure over the study period exhibited annual cycles, which tended to be more regular than the correlation with physicochemical variables, including inflow. There was no discernible relationship between inflow and relative dispersion (heterogeneity) of the community, possibly because of the complications arising from the strong seasonality in community structure and the relatively high and stable inflow during the study period. Adoption of a technique that compared the same month between years with different flows aimed to overcome this difficulty and was successful in showing that similarity in community between the uppermost and lowermost zones of the study area increased as flows decreased.

4.4 Synthesis

There was little variability in the flows into the Chassahowitzka River estuary during this study period. Although this lack of variability may have hindered the development of predictive relationships, it is likely indicative of the natural inflow pattern for spring-fed systems with relatively small drainage basin. Regardless, several distributional and abundance responses to inflow that could be successfully applied in a management context were developed from both the plankton and nekton catches. Caution, however, needs to be taken so that these regressions are applied within the range of flows represented by this study; these results may not be representative of flows that are either lower or higher than those encountered here.

The majority of the nekton (4 of 5) and 33% of the plankton (3 of 9) taxa with significant distributional responses to inflow demonstrated the typical pattern of a negative response to inflow, such that the center of abundance tended to move upstream with decreasing inflows. Centers of abundance most likely shifted upstream during periods of lower inflow because lower salinity habitat was shifted upstream and individuals relocated to areas with optimal salinities. Taxa that shifted upstream in response to increased inflow (6 plankton and 1 nekton taxa) may suggest 1) creation of two-layered circulation in the tidal river as more saline bottom water moves upstream to replace surface water movement downstream; 2) beneficial aspects of increased nutrient input; or 3) better detection of the tidal-river nursery area during periods where freshwater runoff represents a higher percentage of the overall freshwater inflow. Relatively rapid distributional responses to inflow (lag times <10 days) were demonstrated by more than half of the plankton (56%) and nekton (60%) taxa. Abundance responses to inflow tended to be negative for most plankton-net collected taxa (10 of 13), with *A. mitchilli* juveniles being the most notable exception. *Anchoa mitchilli* juveniles, which typically congregate within the interiors of tidal rivers, apparently find the Chassahowitzka River estuary more suitable as nursery habitat during periods of high inflow and seek out the middle reaches of this river, much as they do in estuaries with a stronger surface inflow signature. The nekton collected with seines and trawls tended to have either negative linear or intermediate-maximum responses to inflow. Three taxa (one collected by plankton net and two collected by seines) demonstrated a positive linear response of abundance to inflow; these were primarily freshwater organisms which appear to be responding positively to an increase in freshwater habitat during high inflow periods.

Community structure changed spatially and temporally in all of the surveyed habitats of the Chassahowitzka River estuary with a community gradient evident from the uppermost area sampled to the bay. A relationship between flow and community heterogeneity (H) in the Chassahowitzka River estuary was not evident in either the plankton or nekton (seine and trawl) data. It is likely that the inflows during the survey period were large and stable enough to prevent the invasion of planktonic, marine-derived organisms into the interior of the Chassahowitzka and that the strong seasonal component in community structure may have masked any flow related influence.

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Appendix A:

Plankton data summary tables

Table A1, page 1 of 5.

Plankton-net catch statistics (August 2005 through July 2007, n = 200 samples)

Organisms are listed in phylogenetic order.

Taxon	Common Name	Number Collected	Collection Frequency	Kmu (km)	Su (psu)	Mean CPUE (No./10^3 m^3)	Max CPUE (No./10^3 m^3)
foraminiferans	foraminiferans	419	33	-0.6	9.3	28.14	2,666.04
medusa sp. d	hydromedusa	70	10	-0.6	15.6	4.53	476.35
medusa sp. e	hydromedusa	43	9	-0.5	10.9	2.68	300.65
medusa, Obelia sp.	hydromedusa	8	3	-0.8	10.4	0.48	62.64
medusa, Bougainvillia sp.	hydromedusa	1	1	0.0	15.5	0.08	15.97
Clytia sp.	hydromedusa	356	8	1.8	11.2	26.24	3,851.53
turbellarians	flatworms	73	16	5.8	3.6	4.66	329.71
nematodes	roundworms, threadworms	4,401	62	-0.6	7.4	301.29	35,500.38
polychaetes	sand worms, tube worms	4,379	148	1.0	12.0	285.98	9,281.42
oligochaetes	freshwater worms	89	21	6.2	4.2	6.35	439.33
hirudinoideans	leeches	296	76	4.7	4.6	19.96	302.39
Limulus polyphemus larvae	horsehoe crab	3	3	0.3	11.7	0.19	12.57
pycnogonids	sea spiders	6	2	-0.6	15.7	0.47	78.11
acari	water mites	1,082	51	6.1	2.3	77.33	6,558.93
collembolas, podurid	springtails	4	1	-1.3	16.9	0.30	60.71
ephemeropteran larvae	mayflies	800	44	5.8	2.7	62.68	5,469.51
odonates, zygopteran larvae	damselflies	78	31	5.6	2.8	5.26	95.49
odonates, anisopteran larvae	dragonflies	1	1	7.9	1.2	0.13	26.45
hemipterans, corixid juveniles	water boatmen	18	7	6.6	2.5	1.63	152.78
hemipterans, corixid adults	water boatmen	80	5	7.8	1.3	10.01	1,851.36
hemipterans, gerrid adults	water striders	195	25	6.9	2.8	14.85	1,297.05
coleopterans, noterid adults	burrowing water beetles	1	1	-1.3	17.6	0.06	12.85
coleopterans, dytiscid adults	predaceous diving beetles	1	1	3.9	2.3	0.07	13.22
coleopterans, chrysomelid larvae	beetles	1	1	7.9	1.7	0.07	13.34
dipterans, pupae	flies, mosquitoes	2,971	96	6.0	3.0	234.88	20,110.17
dipteran, Chaoborus punctipennis larvae	phantom midge	11	8	5.8	4.0	0.73	37.75
dipterans, chironomid larvae	midges	5,879	103	7.1	2.0	462.36	25,125.63
dipterans, tabanid larvae	deer flies	3	2	0.7	11.1	0.22	30.33
dipterans, ceratopogonid larvae	biting midges	161	43	4.7	5.1	10.65	193.49
dipterans, tipulid larvae	crane flies	1	1	5.2	1.8	0.06	11.07
dipterans, stratiomyid larvae	soldier flies	2	2	5.2	2.0	0.12	12.09
dipterans, syrphid larvae	hoverflies	3	2	7.9	1.7	0.29	32.50
dipterans, ephydrid larvae	shore flies	1	1	5.2	2.7	0.07	13.87
trichopteran larvae	caddisflies	109	29	7.2	2.2	8.62	370.27
lepidopterans, pyralid larvae	aquatic caterpillars	11	6	5.5	2.4	0.71	38.89
Simocephalus vetulus	water flea	34	9	7.5	2.1	2.40	126.23
Sida crystallina	water flea	11	2	7.9	1.9	0.73	132.68
Leydigia sp.	water flea	1	1	6.0	0.9	0.06	12.96
Eurycercus lamellatus	water flea	1	1	7.9	1.6	0.07	13.13
branchiurans, Argulus spp.	fish lice	47	31	1.7	7.8	3.01	40.95
Labidocera aestiva	copepod	35	17	-0.1	14.0	2.28	53.19
Acartia tonsa	copepod	30,043	126	0.5	13.2	2,059.85	51,447.60
Pseudodiaptomus coronatus	copepod	1,070	82	0.5	12.0	70.26	1,105.15
paracalanids	copepods	8	4	-0.9	13.0	0.56	59.25
Calanopia americana	copepod	35	7	-0.7	13.0	2.19	163.51
Eurytemora affinis	copepod	896	80	3.7	6.9	61.50	1,293.81
Temora turbinata	copepod	270	27	-0.5	14.3	16.68	650.21
Osphranticum labronectum	copepod	15	1	7.9	2.4	1.43	286.11
unidentified freshwater cyclopoids	copepods	7	3	7.9	2.6	0.55	57.22
Orthocyclops modestus	copepod	42	7	5.6	2.8	2.85	365.97
Macrocyclops albidus	copepods	42	12	7.0	2.3	3.61	228.89
Mesocyclops leuckarti	copepod	1	1	1.5	13.3	0.06	12.17
Saphirella spp.	copepods	1	1	2.6	9.9	0.07	13.48
unidentified harpacticoids	copepods	155	40	0.1	11.7	10.43	303.27
siphonostomatids	parasitic copepods	15	9	-0.7	12.8	1.00	59.25

Plankton-net catch statistics (August 2005 through July 2007, n = 200 samples)

Organisms are listed in phylogenetic order.

Taxon	Common Name	Number Collected	Collection Frequency	Kmu (km)	Su (psu)	Mean CPUE (No./10^3 m^3)	Max CPUE (No./10^3 m^3)
Monstrilla sp.	copepod	44	12	-0.8	15.5	2.81	136.60
Parasterope pollex	ostracod, seed shrimp	380	29	-0.4	14.2	25.10	942.80
Sarsiella zostericola	ostracod, seed shrimp	329	44	-0.2	13.7	20.79	433.93
myodocopod sp. a	ostracod, seed shrimp	6	3	-0.4	15.8	0.40	52.16
ostracods, podocopid	ostracods, seed shrimps	1,440	68	6.8	3.0	115.32	5,487.71
unidentified Americamysis juveniles	opossum shrimps, mysids	70,438	188	2.2	8.1	4,758.47	51,108.24
Americamysis almyra	opossum shrimp, mysid	85,969	179	3.1	6.1	5,683.05	95,196.54
Americamysis bahia	opossum shrimp, mysid	31	5	-0.9	16.4	2.07	229.73
Americamysis stucki	opossum shrimp, mysid	3	3	-1.3	15.4	0.21	15.75
Bowmaniella dissimilis	opossum shrimp, mysid	95,887	156	0.7	10.2	6,480.54	151,536.30
Taphromysis bowmani	opossum shrimp, mysid	6,806	136	1.7	9.1	446.50	8,144.07
amphipods, gammaridean	amphipods	401,703	199	3.3	6.6	26,633.41	407,433.51
amphipods, caprellid	skeleton shrimps	200	28	-0.3	13.0	13.09	520.17
Munna reynoldsi	isopod	1,177	64	5.5	4.2	83.99	4,494.22
Xenanthura brevitelson	isopod	49	24	1.5	9.8	3.06	98.90
Cyathura polita	isopod	139	31	4.5	4.6	9.47	934.66
Sphaeroma quadridentata	isopod	10	6	3.7	5.6	0.65	37.15
Harrieta faxoni	isopod	5,503	112	-0.4	12.4	389.72	14,752.44
Cassidinidea ovalis	isopod	2,893	143	2.7	7.0	191.28	4,462.52
Sphaeroma terebrans	isopod	43	17	6.0	3.0	2.98	266.49
Edotea triloba	isopod	1,118	126	3.1	6.4	75.41	1,874.72
Erichsonella attenuata	isopod	6,907	144	0.6	10.2	467.59	13,789.46
Erichsonella filiforme	isopod	3	2	-0.4	11.9	0.18	23.96
cymothoid sp. a (Lironeca) juveniles	isopod	209	53	2.5	8.1	14.61	410.47
Anopsilana jonesi	isopod	182	35	0.4	7.5	11.74	1,145.27
Probopyrus sp. (attached)	isopod	16	3	7.4	1.6	1.98	343.82
Hargeria rapax	tanaid	4,903	161	6.3	3.4	313.49	28,072.40
Sinelobus stanfordi	tanaid	27	14	6.0	3.5	1.81	58.06
Apseudes sp.	tanaid	2,992	54	-0.4	10.2	241.31	20,494.08
cumaceans	cumaceans	195,172	175	-0.1	12.8	12,835.80	163,286.12
Lucifer faxoni juveniles and adults	shrimp	21	10	-0.3	14.2	1.36	65.02
penaeid postlarvae	penaeid shrimps	660	5	-1.3	16.4	46.27	8,887.90
penaeid metamorphs	penaeid shrimps	51	19	1.3	10.2	3.05	112.91
Farfantepenaeus duorarum juveniles	pink shrimp	44	15	1.8	7.3	2.96	131.88
Palaemonetes spp. postlarvae	grass shrimps	1,505	66	-0.3	11.6	109.02	6,167.63
Palaemonetes pugio juveniles	daggerblade grass shrimp	1,451	101	1.2	8.2	113.64	7,214.16
Palaemonetes pugio adults	daggerblade grass shrimp	262	51	1.4	9.1	20.31	515.77
Palaemonetes paludosus juveniles	grass shrimp	1	1	0.0	6.8	0.06	12.93
Palaemonetes paludosus adults	grass shrimp	5	1	7.9	1.2	0.66	132.24
Periclimenes spp. postlarvae	shrimps	33	3	-0.8	15.2	2.42	409.80
Periclimenes spp. juveniles	shrimps	1	1	6.0	2.1	0.06	12.83
Periclimenes longicaudatus juveniles	longtail grass shrimp	8	3	-0.2	12.6	0.50	37.59
alphaeid postlarvae	snapping shrimps	666	27	-0.7	13.5	46.99	2,398.52
alphaeid juveniles	snapping shrimps	51	7	-0.5	14.2	3.10	303.17
Alpheus viridari juveniles	snapping shrimp	12	2	0.2	9.2	0.95	161.90
Alpheus viridari adults	snapping shrimp	1	1	0.0	10.9	0.06	12.31
Alpheus estuariensis adults	snapping shrimp	1	1	-1.3	14.9	0.08	15.16
Hippolyte zostericola postlarvae	zostera shrimp	10	4	-0.8	15.0	0.67	75.89
Hippolyte zostericola juveniles	zostera shrimp	30	17	1.0	10.3	1.96	73.88
Hippolyte zostericola adults	zostera shrimp	15	5	0.2	8.0	1.42	197.81
Ogyrides alphaerostris postlarvae	estuarine longeye shrimp	31	4	-1.0	17.0	1.93	244.61
Ogyrides alphaerostris juveniles and adults	estuarine longeye shrimp	3	2	-0.4	15.2	0.21	31.25
astacidean juveniles	crayfish	3	1	7.9	2.4	0.29	57.22
callianassid postlarvae	ghost shrimps	2,432	14	-0.2	14.6	166.67	9,264.24
callianassid juveniles	ghost shrimps	71	3	2.8	7.8	4.34	614.74
Upogebia spp. postlarvae	mud shrimps	7	4	0.1	11.0	0.43	45.83
Upogebia spp. juveniles	mud shrimps	52	13	-0.7	10.0	4.01	181.85

Plankton-net catch statistics (August 2005 through July 2007, n = 200 samples)

Organisms are listed in phylogenetic order.

Taxon	Common Name	Number Collected	Collection Frequency	Kmu (km)	Su (psu)	Mean CPUE (No./10^3 m^3)	Max CPUE (No./10^3 m^3)
Upogebia affinis adults	coastal mud shrimp	1	1	0.0	12.8	0.06	11.26
decapod mysis	shrimp larvae	22,225	150	2.3	7.7	1,616.97	40,843.90
Callinectes sapidus juveniles	blue crab	55	22	2.1	5.8	3.47	119.01
Portunus sp. juveniles	swimming crab	11	7	4.5	5.0	0.81	42.47
xanthid juveniles	mud crabs	21	11	2.0	6.5	1.42	46.95
Rhithropanopeus harrisii juveniles	Harris mud crab	17	7	0.7	7.8	1.49	164.11
Rhithropanopeus harrisii adults	Harris mud crab	1	1	1.5	13.3	0.06	12.17
decapod zoeae	crab larvae	465,230	168	0.6	11.0	30,884.54	321,123.74
decapod megalopae	post-zoea crab larvae	47,210	122	1.4	8.2	3,229.74	52,358.19
pelecypods	clams, mussels, oysters	143	54	0.9	10.4	9.22	172.66
gastropods, prosobranch	snails	32,832	172	4.5	4.5	2,296.49	124,333.14
gastropods, opisthobranch	sea slugs	242	52	2.6	8.3	15.87	408.57
chaetognaths, sagittid	arrow worms	237	23	-0.8	16.0	15.25	1,850.48
Lepisosteus platyrhincus postflexion larvae	Florida gar	1	1	5.2	2.7	0.07	13.87
Elops saurus postflexion larvae	ladyfish	16	9	2.1	10.6	1.06	42.80
Myrophis punctatus juveniles	speckled worm eel	16	9	2.9	8.2	1.13	85.60
Anchoa mitchilli eggs	bay anchovy	324	10	-0.5	15.9	20.67	2,304.51
Anchoa mitchilli postflexion larvae	bay anchovy	25	12	2.2	7.7	1.51	66.25
Anchoa mitchilli juveniles	bay anchovy	2,684	88	2.7	5.7	164.12	6,079.70
Anchoa mitchilli adults	bay anchovy	157	34	2.5	6.8	9.92	234.55
Anchoa spp. preflexion larvae	anchovies	190	14	-0.2	14.4	12.31	632.84
Anchoa spp. flexion larvae	anchovies	36	6	1.1	11.8	2.26	126.57
Brevoortia patronus juveniles	gulf menhaden	1	1	5.2	2.8	0.06	12.38
Brevoortia spp. postflexion larvae	menhaden	71	22	4.1	5.9	4.86	212.37
Brevoortia spp. metamorphs	menhaden	14	6	4.5	4.9	0.94	56.63
Opisthonema oglinum postflexion larvae	Atlantic thread herring	3	2	0.2	13.4	0.17	21.88
Opisthonema oglinum juveniles	Atlantic thread herring	1	1	2.6	8.3	0.05	10.99
Sardinella aurita metamorphs	Spanish sardine	2	1	0.0	12.4	0.12	24.30
Notemigonus crysoleucas preflexion larvae	golden shiner	46	7	7.8	1.7	3.47	344.15
Notemigonus crysoleucas flexion larvae	golden shiner	5	1	7.9	1.7	0.33	66.71
Notropis petersoni juveniles	coastal shiner	1	1	7.9	3.6	0.07	14.17
Notropis spp. preflexion larvae	minnows	26	3	7.8	2.7	1.87	212.81
Notropis spp. postflexion larvae	minnows	2	1	7.9	2.0	0.14	28.37
Synodus foetens juveniles	inshore lizardfish	4	2	1.5	7.4	0.25	36.45
Synodus foetens metamorphs	inshore lizardfish	1	1	3.9	6.8	0.07	14.96
Opsanus beta juveniles	gulf toadfish	9	5	-0.3	8.9	0.90	117.22
Mugil cephalus juveniles	striped mullet	7	3	4.3	6.3	0.53	77.94
Membras martinica preflexion larvae	rough silverside	17	5	-0.2	13.8	1.09	77.60
Membras martinica postflexion larvae	rough silverside	1	1	0.3	4.6	0.06	12.32
Membras martinica juveniles	rough silverside	1	1	0.0	13.3	0.06	11.46
Menidia spp. eggs	silversides	6	5	2.9	6.7	0.37	27.73
Menidia spp. preflexion larvae	silversides	286	63	3.1	7.7	19.48	273.62
Menidia spp. flexion larvae	silversides	44	12	5.3	4.4	3.14	170.50
Menidia spp. postflexion larvae	silversides	14	10	5.7	3.4	1.00	42.47
Menidia spp. juveniles	silversides	49	13	6.9	3.3	4.12	449.77
Menidia spp. adults	silversides	6	3	7.6	1.6	0.65	105.79
Strongylura marina adults	Atlantic needlefish	1	1	7.9	1.7	0.06	12.28
Strongylura spp. juveniles	needlefishes	2	2	-0.5	14.0	0.13	13.18
Fundulus grandis postflexion larvae	gulf killifish	2	2	6.2	4.0	0.20	26.45
Fundulus spp. eggs	killifishes	19	7	4.0	5.5	1.35	113.07
Fundulus spp. postflexion larvae	killifishes	3	3	3.9	3.0	0.19	12.81
Lucania goodei postflexion larvae	bluefin killifish	3	2	6.7	3.3	0.18	23.22
Lucania goodei juveniles	bluefin killifish	16	7	7.1	2.2	1.15	110.38
Lucania goodei adults	bluefin killifish	32	3	7.9	1.9	2.84	394.22
Lucania parva eggs	rainwater killifish	7	3	5.9	3.0	0.47	42.47
Lucania parva flexion larvae	rainwater killifish	4	2	4.8	6.0	0.24	34.84
Lucania parva postflexion larvae	rainwater killifish	211	52	5.4	3.6	15.27	264.48

Plankton-net catch statistics (August 2005 through July 2007, n = 200 samples)

Organisms are listed in phylogenetic order.

Taxon	Common Name	Number Collected	Collection Frequency	Kmu (km)	Su (psu)	Mean CPUE (No./10^3 m^3)	Max CPUE (No./10^3 m^3)
Lucania parva juveniles	rainwater killifish	126	30	4.5	4.4	9.52	496.85
Lucania parva adults	rainwater killifish	206	23	6.0	3.4	15.82	756.89
Gambusia holbrooki juveniles	eastern mosquitofish	1	1	5.2	3.2	0.08	15.20
Poecilia latipinna juveniles	sailfin molly	4	2	-0.3	6.8	0.39	64.60
Poecilia latipinna adults	sailfin molly	2	2	0.1	6.5	0.17	21.53
Syngnathus floridae juveniles	dusky pipefish	9	5	-0.8	13.3	0.64	59.25
Syngnathus louisianae adults	chain pipefish	3	1	3.9	3.9	0.25	50.22
Syngnathus scovelli juveniles	gulf pipefish	55	34	1.5	9.6	3.75	75.89
Syngnathus scovelli adults	gulf pipefish	2	2	1.3	5.7	0.19	21.53
fish eggs, percomorph	sciaenid eggs (primarily)	79	7	0.0	15.0	5.26	429.35
Prionotus spp. postflexion larvae	searobins	1	1	0.3	14.4	0.07	13.30
Lepomis auritus postflexion larvae	redbreast sunfish	9	1	7.9	1.7	0.57	114.72
Lepomis auritus juveniles	redbreast sunfish	2	2	5.6	3.1	0.17	19.10
Lepomis punctatus juveniles	spotted sunfish	9	2	7.9	1.9	0.82	110.38
Lepomis spp. flexion larvae	sunfishes	70	4	7.9	2.0	4.76	809.34
Lepomis spp. postflexion larvae	sunfishes	7	4	7.3	2.3	0.56	38.15
Micropterus salmoides flexion larvae	largemouth bass	29	6	7.6	2.0	2.60	238.03
Lutjanus griseus juveniles	gray snapper	1	1	0.3	10.9	0.06	12.53
Eucinostomus gula juveniles	silver jenny	1	1	3.9	4.4	0.07	14.61
Eucinostomus gula adults	silver jenny	2	1	3.9	3.0	0.13	26.41
Eucinostomus harengulus juveniles	tidewater mojarra	16	7	5.2	3.4	1.40	171.88
Eucinostomus harengulus adults	tidewater mojarra	7	2	4.0	3.7	0.56	100.43
Eucinostomus spp. postflexion larvae	mojarras	93	32	3.3	6.5	6.55	167.39
Eucinostomus spp. juveniles	mojarras	142	25	4.1	4.6	10.11	870.41
gerreid preflexion larvae	mojjaras	1	1	-1.3	13.6	0.06	12.96
Orthopristis chrysoptera juveniles	pigfish	2	1	1.5	14.2	0.12	24.92
Lagodon rhomboides postflexion larvae	pinfish	5	3	2.2	8.8	0.35	44.10
Lagodon rhomboides juveniles	pinfish	125	25	1.1	11.6	8.94	560.07
Cynoscion nebulosus juveniles	spotted seatrout	5	5	1.7	6.4	0.31	13.22
Leiostomus xanthurus postflexion larvae	spot	31	14	1.1	11.5	1.99	64.24
Leiostomus xanthurus juveniles	spot	35	15	0.9	12.5	2.22	62.31
Menticirrhus spp. preflexion larvae	kingfishes	2	2	-0.3	12.0	0.13	14.13
Menticirrhus spp. postflexion larvae	kingfishes	2	1	-0.7	16.4	0.12	23.88
Sciaenops ocellatus postflexion larvae	red drum	1	1	0.3	6.7	0.06	11.62
blenniid preflexion larvae	blennies	264	24	0.0	13.9	16.74	465.62
Chasmodes saburrae flexion larvae	Florida blenny	3	2	-0.9	14.9	0.21	30.33
Chasmodes saburrae juveniles	Florida blenny	12	2	-0.7	8.8	1.36	257.89
Gobiesox strumosus preflexion larvae	skilletfish	18	10	0.0	13.3	1.17	38.62
Gobiesox strumosus flexion larvae	skilletfish	10	7	0.3	11.5	0.68	38.54
Gobiesox strumosus postflexion larvae	skilletfish	4	3	0.2	12.1	0.26	26.50
Gobiesox strumosus juveniles	skilletfish	4	2	3.5	7.4	0.25	34.99
Lupinoblennius nicholsi postflexion larvae	highfin blenny	2	2	0.5	5.0	0.13	13.94
Bathygobius soporator preflexion larvae	frillfin goby	3	2	0.1	14.7	0.19	27.04
Bathygobius soporator postflexion larvae	frillfin goby	3	2	3.0	5.2	0.19	24.72
gobiid eggs	gobies	1	1	0.0	7.2	0.06	12.45
gobiid preflexion larvae	gobies	9,489	120	2.0	7.8	634.94	23,700.03
gobiid flexion larvae	gobies	4,117	96	2.1	7.5	295.75	19,183.72
Gobiosoma bosc juveniles	naked goby	8	5	4.2	5.2	0.50	29.40
Gobiosoma robustum juveniles	code goby	5	5	3.1	6.9	0.31	13.12
Gobiosoma spp. postflexion larvae	gobies	6,091	72	3.4	5.5	437.15	53,063.15
Microgobius gulosus juveniles	clown goby	74	14	4.0	4.7	4.99	409.17
Microgobius gulosus adults	clown goby	4	3	1.5	7.7	0.24	24.63
Microgobius spp. flexion larvae	gobies	1,585	90	2.0	8.2	110.32	4,516.31
Microgobius spp. postflexion larvae	gobies	1,866	73	2.8	6.2	133.06	12,430.48
Microgobius spp. juveniles	gobies	3	2	3.9	2.7	0.19	22.65
Microgobius thalassinus juveniles	green goby	31	4	4.0	3.9	2.41	351.51
Paralichthys spp. juveniles	flounders	1	1	2.6	12.9	0.07	13.00

Table A1, page 5 of 5.

Plankton-net catch statistics (August 2005 through July 2007, n = 200 samples)

Organisms are listed in phylogenetic order.

Taxon	Common Name	Number Collected	Collection Frequency	Kmu (km)	Su (psu)	Mean CPUE (No./10^3 m^3)	Max CPUE (No./10^3 m^3)
Achirus lineatus postflexion larvae	lined sole	2	1	3.9	4.0	0.13	26.38
Trinectes maculatus flexion larvae	hogchoker	1	1	2.6	5.1	0.07	14.10
Trinectes maculatus postflexion larvae	hogchoker	12	6	2.4	6.4	0.81	52.89
Trinectes maculatus juveniles	hogchoker	19	7	3.6	4.7	1.35	117.17
Trinectes maculatus adults	hogchoker	1	1	6.0	2.7	0.07	13.75
Sphoeroides spp. preflexion larvae	puffers	1	1	0.3	11.7	0.06	12.47
Sphoeroides spp. juveniles	puffers	1	1	3.9	3.9	0.08	16.74

Table A2. Page 1 of 6.

Plankton net catch by month (August 2005 to July 2007).

Number of monthly samples is indicated in parentheses.

Taxon	Common Name	Jan (20)	Feb (20)	Mar (10)	Apr (20)	May (10)	Jun (20)	Jul (20)	Aug (10)	Sep (20)	Oct (20)	Nov (20)	Dec (10)
foraminiferans	foraminiferans	2	6		3	8	195	10	100	40	10	4	41
medusa sp. d	hydromedusa				50		6				14		
medusa sp. e	hydromedusa			1				10		28	4		
medusa, Obelia sp.	hydromedusa									8			
medusa, Bougainvillia sp.	hydromedusa						1						
Clytia sp.	hydromedusa		276			76	2			2			
turbellarians	flatworms	1	6	13	5	3	2	11		2	1	1	28
nematodes	roundworms, threadworms	28	19	5	8	398	112	93	2,813	877	4	20	24
polychaetes	sand worms, tube worms	50	1,361	135	724	43	323	901	55	333	105	339	10
oligochaetes	freshwater worms	4	14	19			6	32		4	6	3	1
hirudinoideans	leeches	8	30	16	44	5	25	49	12	50	10	28	19
Limulus polyphemus larvae	horsehoe crab	1									1	1	
pycnogonids	sea spiders						6						
acari	water mites	11	25	91	574	160	73	18	80	17	20	6	7
collembolas, podurid	springtails						4						
ephemeropteran larvae	mayflies	2	8	177	495	21	3	3	61	11	9	5	5
odonates, zygopteran larvae	damselflies	1	7	2			11	9	16	7	13	10	2
odonates, anisopteran larvae	dragonflies								1				
hemipterans, corixid juveniles	water boatmen				2	2	10		4				
hemipterans, corixid adults	water boatmen						3		74		2	1	
hemipterans, gerrid adults	water striders	7			95	13	3	12	3	34	25	3	
coleopterans, noterid adults	burrowing water beetles											1	
coleopterans, dytiscid adults	predaceous diving beetles									1			
coleopterans, chrysomelid larvae	beetles										1		
dipterans, pupae	flies, mosquitoes	33	203	108	130	37	1,168	725	181	212	126	41	7
dipteran, Chaoborus punctipennis larvae	phantom midge				4			2	1	2	2		
dipterans, chironomid larvae	midges	209	1,135	1,084	605	65	127	61	1,317	328	758	117	73
dipterans, tabanid larvae	deer flies					3							
dipterans, ceratopogonid larvae	biting midges	2	18	33	23		7	12	18	24	14	5	5
dipterans, tipulid larvae	crane flies								1				
dipterans, stratiomyid larvae	soldier flies									1	1		
dipterans, syrphid larvae	hoverflies	2							1				
dipterans, ephydrid larvae	shore flies					1							
trichopteran larvae	caddisflies	1	11	9	19	12	15	1	20	4	8	8	1
lepidopterans, pyralid larvae	aquatic caterpillars			3	2				4		2		
Simocephalus vetulus	water flea			3				2	3	17	9		
Sida crystallina	water flea			10							1		
Leydigia sp.	water flea								1				
Eurycercus lamellatus	water flea										1		

Table A2. Page 2 of 6.

Plankton net catch by month (August 2005 to July 2007).

Number of monthly samples is indicated in parentheses.

Taxon	Common Name	Jan (20)	Feb (20)	Mar (10)	Apr (20)	May (10)	Jun (20)	Jul (20)	Aug (10)	Sep (20)	Oct (20)	Nov (20)	Dec (10)
branchiurans, Argulus spp.	fish lice	1	1	1	5	5	3	7	2	12	7	2	1
Labidocera aestiva	copepod	2	2	3	5		1				7	15	
Acartia tonsa	copepod	6,032	164	45	16,569	46	3,148	1,419	22	113	35	2,448	2
Pseudodiaptomus coronatus	copepod	65	86	1	109	5	133	101		2	67	497	4
paracalanids	copepods		1				4			1		2	
Calanopia americana	copepod										32	3	
Eurytemora affinis	copepod	174	121	68	369	8	17	16	2	4	34	73	10
Temora turbinata	copepod	31		9	71	1	10	132	1	11	3	1	
unidentified freshwater cyclopoids	copepods				3			2					2
Orthocyclops modestus	copepod		1	2		37		1					1
Macrocyclops albidus	copepods	4	3	10	12	7			4	1	1		
Mesocyclops leuckarti	copepod				1								
Saphirella spp.	copepods											1	
unidentified harpacticoids	copepods	7	16		11	22	6	6	1	7	2	55	22
siphonostomatids	parasitic copepods	2			3	1	4	1		1	2	1	
Monstrilla sp.	copepod		5		3		11	21				4	
Parasterope pollex	ostracod, seed shrimp		3		9	38	131	174	1		5	19	
Sarsiella zostericola	ostracod, seed shrimp	2	61		63	11	15	41		1	94	41	
myodocopod sp. a	ostracod, seed shrimp						1					5	
ostracods, podocopid	ostracods, seed shrimps	18	14	27	161	52	313	395	207	34	61	104	54
unidentified Americamysis juveniles	opossum shrimps, mysids	5,164	6,624	2,323	8,632	3,612	6,286	16,350	2,083	6,152	4,170	8,073	969
Americamysis almyra	opossum shrimp, mysid	9,278	7,685	3,894	19,422	3,530	5,888	10,442	4,755	9,475	4,552	4,804	2,244
Americamysis bahia	opossum shrimp, mysid	4	24								3		
Americamysis stucki	opossum shrimp, mysid	1	1							1			
Bowmaniella dissimilis	opossum shrimp, mysid	351	1,030	689	7,558	15,403	22,333	21,591	6,941	9,808	6,797	3,030	356
Taphromysis bowmani	opossum shrimp, mysid	88	595	246	800	331	365	359	86	371	569	2,805	191
amphipods, gammaridean	amphipods	10,429	41,938	31,893	112,151	8,888	39,960	23,314	3,608	44,134	34,126	42,320	8,942
amphipods, caprellid	skeleton shrimps		2			60	55	75			8		
Munna reynoldsi	isopod	4	52	144	739	31	79	17	2	44	39	7	19
Xenanthura brevitelson	isopod		2	3	13		7	1		1	20	2	
Cyathura polita	isopod		11		9	1	24	9	9	73	3		
Sphaeroma quadridentata	isopod	2						2		4	2		
Harrieta faxoni	isopod	108	216	59	457	312	1,087	1,011	3	189	512	1,540	9
Cassidinidea ovalis	isopod	13	58	70	194	26	699	888	201	554	140	34	16
Sphaeroma terebrans	isopod			2		1	2	5	3	24	6		
Edotea triloba	isopod	5	62	26	172	6	138	252	19	261	75	97	5
Erichsonella attenuata	isopod	132	269	282	2,287	155	1,794	1,010	85	338	321	211	23
Erichsonella filiforme	isopod	1	2										
cymothoid sp. a (Lironeca) juveniles	isopod	2	2	1	21	57	60	38		9	12	6	1

Table A2. Page 3 of 6.

Plankton net catch by month (August 2005 to July 2007).

Number of monthly samples is indicated in parentheses.

Taxon	Common Name	Jan (20)	Feb (20)	Mar (10)	Apr (20)	May (10)	Jun (20)	Jul (20)	Aug (10)	Sep (20)	Oct (20)	Nov (20)	Dec (10)
Anopsilana jonesi	isopod		2	4	2		20	105	22	10	17		
Probopyrus sp. (attached)	isopod						2		13	1			
Hargeria rapax	tanaid	103	269	697	349	77	274	100	84	262	130	133	2,425
Sinelobus stanfordi	tanaid	3	1	3		1	1	10	4		1	2	1
Apseudes sp.	tanaid		1	2	2	10	2,619	264	14	29	51		
cumaceans	cumaceans	15,694	43,820	33,242	56,741	2,546	9,313	17,109	29	4,112	4,644	1,791	6,131
Lucifer faxoni juveniles and adults	shrimp	6			3			9		1		2	
penaeid postlarvae	penaeid shrimps				651	3					6		
penaeid metamorphs	penaeid shrimps							31		6	5	9	
Farfantepenaeus duorarum juveniles	pink shrimp		1				8	4	1	23	1	6	
Palaemonetes spp. postlarvae	grass shrimps	5			214	7	574	623	10	36	34	2	
Palaemonetes pugio juveniles	daggerblade grass shrimp	36	57	1	19	1	239	319	14	402	309	51	3
Palaemonetes pugio adults	daggerblade grass shrimp	5	31	7	39	23	80	24	9	13	15	14	2
Palaemonetes paludosus juveniles	grass shrimp									1			
Palaemonetes paludosus adults	grass shrimp								5				
Periclimenes spp. postlarvae	shrimps						27				6		
Periclimenes spp. juveniles	shrimps										1		
Periclimenes longicaudatus juveniles	longtail grass shrimp											8	
alphaeid postlarvae	snapping shrimps				1	6	269	384		2	4		
alphaeid juveniles	snapping shrimps						1	50					
Alpheus viridari juveniles	snapping shrimp						12						
Alpheus viridari adults	snapping shrimp											1	
Alpheus estuariensis adults	snapping shrimp					1							
Hippolyte zostericola postlarvae	zostera shrimp						5	3		1		1	
Hippolyte zostericola juveniles	zostera shrimp	2	1	1		1	6	3	2	3	2	9	
Hippolyte zostericola adults	zostera shrimp							8		3		4	
Ogyrides alphaerostris postlarvae	estuarine longeye shrimp				26			4			1		
Ogyrides alphaerostris juveniles and adults	estuarine longeye shrimp						2	1					
astacidean juveniles	crayfish				3								
callianassid postlarvae	ghost shrimps						1,495	937					
callianassid juveniles	ghost shrimps							71					
Upogebia spp. postlarvae	mud shrimps						1	4		2			
Upogebia spp. juveniles	mud shrimps						29	17	1	4	1		
Upogebia affinis adults	coastal mud shrimp		1										
decapod mysis	shrimp larvae	96	254	605	1,942	4,423	9,624	2,883	1,900	238	251	6	3
Callinectes sapidus juveniles	blue crab	4	1		1		1	3		42	2		1
Portunus sp. juveniles	swimming crab				3		4			1		3	
xanthid juveniles	mud crabs		1				3		6	7	4		
Rhithropanopeus harrisii juveniles	Harris mud crab							12				5	

Table A2. Page 4 of 6.

Plankton net catch by month (August 2005 to July 2007).

Number of monthly samples is indicated in parentheses.

Taxon	Common Name	Jan (20)	Feb (20)	Mar (10)	Apr (20)	May (10)	Jun (20)	Jul (20)	Aug (10)	Sep (20)	Oct (20)	Nov (20)	Dec (10)
Rhithropanopeus harrisii adults	Harris mud crab				1								
decapod zoeae	crab larvae	33	1,329	22,341	146,746	29,668	90,955	75,731	41,426	38,778	18,110	109	4
decapod megalopae	post-zoea crab larvae	29	5		688		13,432	9,529	1,357	20,065	1,581	520	4
pelecypods	clams, mussels, oysters	7	15	1	7		3	11	9	22	30	32	6
gastropods, prosobranch	snails	743	5,918	2,679	11,739	2,537	4,259	1,362	2,152	851	443	57	92
gastropods, opisthobranch	sea slugs	3	54	3	85	24	15	12		11	19	16	1
chaetognaths, sagittid	arrow worms		1		15	1		18	1	4	2	195	
Lepisosteus platyrhincus postflexion larvae	Florida gar					1							
Elops saurus postflexion larvae	ladyfish	2	13		1								
Myrophis punctatus juveniles	speckled worm eel		8	2	4			2					
Anchoa mitchilli eggs	bay anchovy				324								
Anchoa mitchilli postflexion larvae	bay anchovy				14			1	3	7			
Anchoa mitchilli juveniles	bay anchovy	228	114	3	2	1	1	12	55	207	466	682	913
Anchoa mitchilli adults	bay anchovy	10	27	1				1	2	3	5	55	53
Anchoa spp. preflexion larvae	anchovies			2	183			5					
Anchoa spp. flexion larvae	anchovies				36								
Brevoortia patronus juveniles	gulf menhaden									1			
Brevoortia spp. postflexion larvae	menhaden	1	8	6	38							18	
Brevoortia spp. metamorphs	menhaden		1	3	7	2	1						
Opisthonema oglinum postflexion larvae	Atlantic thread herring							3					
Opisthonema oglinum juveniles	Atlantic thread herring							1					
Sardinella aurita metamorphs	Spanish sardine										2		
Notemigonus crysoleucas preflexion larvae	golden shiner			2	3	1		5	7	28			
Notemigonus crysoleucas flexion larvae	golden shiner										5		
Notropis petersoni juveniles	coastal shiner							1					
Notropis spp. preflexion larvae	minnows					15	1	10					
Notropis spp. postflexion larvae	minnows					2							
Synodus foetens juveniles	inshore lizardfish						4						
Synodus foetens metamorphs	inshore lizardfish											1	
Opsanus beta juveniles	gulf toadfish					1	3	5					
Mugil cephalus juveniles	striped mullet	5	1									1	
Membras martinica preflexion larvae	rough silverside			7	9				1				
Membras martinica postflexion larvae	rough silverside								1				
Membras martinica juveniles	rough silverside							1					
Menidia spp. eggs	silversides					2		4					
Menidia spp. preflexion larvae	silversides	33	37		85	8	46	58	9	9	1		
Menidia spp. flexion larvae	silversides	2		3	21		15	2	1				
Menidia spp. postflexion larvae	silversides				4	1	3	3			3		
Menidia spp. juveniles	silversides				3		30	9	4	2	1		

Table A2. Page 5 of 6.

Plankton net catch by month (August 2005 to July 2007).

Number of monthly samples is indicated in parentheses.

Taxon	Common Name	Jan (20)	Feb (20)	Mar (10)	Apr (20)	May (10)	Jun (20)	Jul (20)	Aug (10)	Sep (20)	Oct (20)	Nov (20)	Dec (10)
Menidia spp. adults	silversides							1	4	1			
Strongylura marina adults	Atlantic needlefish											1	
Strongylura spp. juveniles	needlefishes			1				1					
Fundulus grandis postflexion larvae	gulf killifish			1					1				
Fundulus spp. eggs	killifishes		1	11	1		5						1
Fundulus spp. postflexion larvae	killifishes		2						1				
Lucania goodei postflexion larvae	bluefin killifish							2			1		
Lucania goodei juveniles	bluefin killifish			2	3		7	1		1	2		
Lucania goodei adults	bluefin killifish					1	25		6				
Lucania parva eggs	rainwater killifish				6								1
Lucania parva flexion larvae	rainwater killifish			1				3					
Lucania parva postflexion larvae	rainwater killifish		10	14	41	3	51	33	17	22	14	3	3
Lucania parva juveniles	rainwater killifish				2	4	74	11	16	13	5	1	
Lucania parva adults	rainwater killifish	2			5	26	106	58	5	3		1	
Gambusia holbrooki juveniles	eastern mosquitofish						1						
Poecilia latipinna juveniles	sailfin molly									4			
Poecilia latipinna adults	sailfin molly									2			
Syngnathus floridae juveniles	dusky pipefish		1	1	1		6						
Syngnathus louisianae adults	chain pipefish							3					
Syngnathus scovelli juveniles	gulf pipefish	12	2	1	5	1	17	4	5	2	4	2	
Syngnathus scovelli adults	gulf pipefish							1		1			
fish eggs, percomorph	sciaenid eggs (primarily)				35		39	5					
Prionotus spp. postflexion larvae	searobins											1	
Lepomis auritus postflexion larvae	redbreast sunfish									9			
Lepomis auritus juveniles	redbreast sunfish						2						
Lepomis punctatus juveniles	spotted sunfish						7		2				
Lepomis spp. flexion larvae	sunfishes			61	3		5			1			
Lepomis spp. postflexion larvae	sunfishes	1		1	5								
Micropterus salmoides flexion larvae	largemouth bass			1	3	10		5	9		1		
Lutjanus griseus juveniles	gray snapper											1	
Eucinostomus gula juveniles	silver jenny						1						
Eucinostomus gula adults	silver jenny												2
Eucinostomus harengulus juveniles	tidewater mojarra			1			10	2		3			
Eucinostomus harengulus adults	tidewater mojarra							6				1	
Eucinostomus spp. postflexion larvae	mojarras	2					23	16		13	9	30	
Eucinostomus spp. juveniles	mojarras						3	99		11	3	26	
gerreid preflexion larvae	mojjaras			1									
Orthopristis chrysoptera juveniles	pigfish		2										
Lagodon rhomboides postflexion larvae	pinfish		3				1						1

Table A2. Page 6 of 6.

Plankton net catch by month (August 2005 to July 2007).

Number of monthly samples is indicated in parentheses.

Taxon	Common Name	Jan (20)	Feb (20)	Mar (10)	Apr (20)	May (10)	Jun (20)	Jul (20)	Aug (10)	Sep (20)	Oct (20)	Nov (20)	Dec (10)
Lagodon rhomboides juveniles	pinfish	103	19		1			1					1
Cynoscion nebulosus juveniles	spotted seatrout							2		3			
Leiostomus xanthurus postflexion larvae	spot	16	15										
Leiostomus xanthurus juveniles	spot	2	28	1			4						
Menticirrhus spp. preflexion larvae	kingfishes					1		1					
Menticirrhus spp. postflexion larvae	kingfishes				2								
Sciaenops ocellatus postflexion larvae	red drum									1			
blenniid preflexion larvae	blennies			73	173	7	2	3	1	5			
Chasmodes saburrae flexion larvae	Florida blenny				1	2							
Chasmodes saburrae juveniles	Florida blenny							12					
Gobiesox strumosus preflexion larvae	skilletfish		1	4	9	3					1		
Gobiesox strumosus flexion larvae	skilletfish				5	3	1				1		
Gobiesox strumosus postflexion larvae	skilletfish				2	1					1		
Gobiesox strumosus juveniles	skilletfish				3		1						
Lupinoblennius nicholsi postflexion larvae	highfin blenny								2				
Bathygobius soporator preflexion larvae	frillfin goby				3								
Bathygobius soporator postflexion larvae	frillfin goby										3		
gobiid eggs	gobies							1					
gobiid preflexion larvae	gobies		33	201	3,257	2,103	744	1,352	1,022	753	24		
gobiid flexion larvae	gobies		18	28	1,647	774	538	944	71	76	21		
Gobiosoma bosc juveniles	naked goby		2					1	2			2	1
Gobiosoma robustum juveniles	code goby		1	1	1						1		1
Gobiosoma spp. postflexion larvae	gobies		1		3,821	2	745	1,153	99	102	167	1	
Microgobius gulosus juveniles	clown goby				3	1	30	26		9		5	
Microgobius gulosus adults	clown goby						1			1		2	
Microgobius spp. flexion larvae	gobies		9	84	688	67	168	413	54	85	16	1	
Microgobius spp. postflexion larvae	gobies		1	3	966	32	213	554	10	63	21	3	
Microgobius spp. juveniles	gobies					1			2				
Microgobius thalassinus juveniles	green goby							21		10			
Paralichthys spp. juveniles	flounders		1										
Achirus lineatus postflexion larvae	lined sole									2			
Trinectes maculatus flexion larvae	hogchoker									1			
Trinectes maculatus postflexion larvae	hogchoker						2	3		6	1		
Trinectes maculatus juveniles	hogchoker						3	7		6	1	2	
Trinectes maculatus adults	hogchoker									1			
Sphoeroides spp. preflexion larvae	puffers			1									
Sphoeroides spp. juveniles	puffers							1					

Table A3, page 1 of 7.

Location specific plankton-net catch.

Data are presented as mean number per 1,000 cubic meters.

Organisms are listed in phylogenetic order.

		Location (km from mouth)									
Taxon	Common Name	-1.3	-0.7	0	0.3	1.5	2.6	3.9	5.2	6	7.9
foraminiferans	foraminiferans	170.03	37.39	6.98	52.50	1.29	4.08	0.00	6.07	1.28	1.80
medusa sp. d	hydromedusa	25.83	7.83	3.87	1.27	5.90	0.65	0.00	0.00	0.00	0.00
medusa sp. e	hydromedusa	19.90	1.20	1.10	0.55	0.00	2.75	1.28	0.00	0.00	0.00
medusa, Obelia sp.	hydromedusa	3.13	0.00	1.10	0.58	0.00	0.00	0.00	0.00	0.00	0.00
medusa, Bougainvillia sp.	hydromedusa	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clytia sp.	hydromedusa	52.82	2.83	3.49	0.00	0.00	193.29	9.99	0.00	0.00	0.00
turbellarians	flatworms	0.00	0.00	4.51	3.83	0.00	1.13	0.68	8.17	0.68	27.58
nematodes	roundworms, threadworms	2,113.91	139.31	23.25	542.78	3.36	109.02	24.21	8.26	22.43	26.36
polychaetes	sand worms, tube worms	937.61	631.60	159.60	177.38	116.57	82.66	287.33	174.50	183.54	109.02
oligochaetes	freshwater worms	2.00	3.40	0.81	0.00	0.57	1.28	1.30	9.38	8.43	36.35
hirudinoideans	leeches	1.52	4.71	1.94	4.28	9.11	12.19	29.69	62.23	62.24	11.69
Limulus polyphemus larvae	horsehoe crab	0.00	0.62	0.62	0.00	0.63	0.00	0.00	0.00	0.00	0.00
pycnogonids	sea spiders	0.00	3.91	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00
acari	water mites	0.00	0.00	0.00	0.00	0.66	4.60	16.70	132.79	492.71	125.80
collembolas, podurid	springtails	3.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ephemeropteran larvae	mayflies	0.00	0.00	0.64	0.00	1.80	3.13	32.05	308.03	166.04	115.10
odonates, zygopteran larvae	damselflies	0.00	0.00	0.00	1.14	1.90	0.60	5.15	12.92	20.49	10.42
odonates, anisopteran larvae	dragonflies	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32
hemipterans, corixid juveniles	water boatmen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.07	8.29	5.97
hemipterans, corixid adults	water boatmen	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	5.46	93.90
hemipterans, gerrid adults	water striders	1.52	0.00	2.94	1.24	2.69	0.55	0.00	6.80	33.47	99.28
coleopterans, noterid adults	burrowing water beetles	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
coleopterans, dytiscid adults	predaceous diving beetles	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00
coleopterans, chrysomelid larvae	beetles	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67
dipterans, pupae	flies, mosquitoes	8.08	26.65	6.79	4.09	2.46	6.58	61.68	276.43	1,614.16	341.92
dipteran, Chaoborus punctipennis larvae	phantom midge	0.00	0.00	1.79	0.00	0.00	0.00	0.00	0.00	0.64	4.85
dipterans, chironomid larvae	midges	18.01	9.57	10.94	7.12	8.91	3.27	77.60	469.64	952.80	3,065.73
dipterans, tabanid larvae	deer flies	1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	0.00
dipterans, ceratopogonid larvae	biting midges	0.00	1.19	3.15	7.68	9.67	5.56	13.51	17.71	27.98	20.06
dipterans, tipulid larvae	crane flies	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00
dipterans, stratiomyid larvae	soldier flies	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.00	0.00
dipterans, syrphid larvae	hoverflies	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95
dipterans, ephydrid larvae	shore flies	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	0.00
trichopteran larvae	caddisflies	0.00	0.00	0.00	0.00	0.54	0.63	1.23	9.77	13.80	60.25
lepidopterans, pyralid larvae	aquatic caterpillars	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.52	2.59	0.00
Simocephalus vetulus	water flea	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.05	21.34

Location specific plankton-net catch.

Data are presented as mean number per 1,000 cubic meters.

Organisms are listed in phylogenetic order.

		Location (km from mouth)									
Taxon	Common Name	-1.3	-0.7	0	0.3	1.5	2.6	3.9	5.2	6	7.9
Sida crystallina	water flea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.29
Leydigia sp.	water flea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00
Eurycercus lamellatus	water flea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66
branchiurans, Argulus spp.	fish lice	3.35	1.89	6.28	3.83	2.22	5.68	1.41	1.34	3.40	0.70
Labidocera aestiva	copepod	7.37	4.44	3.42	4.36	1.26	1.33	0.00	0.59	0.00	0.00
Acartia tonsa	copepod	3,535.94	3,418.68	3,609.72	3,482.61	3,067.36	2,512.91	338.69	38.90	593.09	0.61
Pseudodiaptomus coronatus	copepod	206.88	92.42	114.35	96.60	44.86	35.93	76.45	6.74	26.35	2.00
paracalanids	copepods	3.64	0.60	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00
Calanopia americana	copepod	12.84	0.62	5.57	2.84	0.00	0.00	0.00	0.00	0.00	0.00
Eurytemora affinis	copepod	70.35	27.17	44.89	17.88	19.42	26.15	89.26	58.93	217.81	43.16
Temora turbinata	copepod	42.80	74.76	30.98	9.07	5.38	3.16	0.00	0.00	0.65	0.00
Osphranticum labronectum	copepod	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.31
unidentified freshwater cyclopoids	copepods	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.46
Orthocyclops modestus	copepod	0.00	0.00	0.00	0.00	0.00	0.00	3.41	5.49	19.61	0.00
Macrocyclops albidus	copepods	0.00	0.00	0.00	0.00	0.00	0.63	0.00	3.25	11.47	20.75
Mesocyclops leuckarti	copepod	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00
Saphirella spp.	copepods	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00
unidentified harpacticoids	copepods	45.34	20.44	4.35	9.20	12.62	4.58	0.00	2.34	1.30	4.17
siphonostomatids	parasitic copepods	6.82	1.26	0.00	0.00	1.90	0.00	0.00	0.00	0.00	0.00
Monstrilla sp.	copepod	11.44	10.95	3.44	2.31	0.00	0.00	0.00	0.00	0.00	0.00
Parasterope pollex	ostracod, seed shrimp	110.97	60.02	30.14	24.88	16.58	1.22	0.00	1.34	0.00	5.82
Sarsiella zostericola	ostracod, seed shrimp	54.05	62.99	33.62	26.91	12.92	11.77	5.05	0.59	0.00	0.00
myodocopod sp. a	ostracod, seed shrimp	0.64	2.61	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00
ostracods, podocopid	ostracods, seed shrimps	40.39	6.17	3.74	2.51	0.66	0.59	102.04	50.81	125.91	820.40
unidentified Americamysis juveniles	opossum shrimps, mysids	3,900.39	8,443.76	3,376.48	4,236.21	4,662.49	3,785.36	5,011.44	8,610.19	5,524.76	33.60
Americamysis almyra	opossum shrimp, mysid	4,482.84	5,582.89	2,695.38	2,656.35	3,802.21	4,722.02	8,216.72	13,476.59	11,168.38	27.10
Americamysis bahia	opossum shrimp, mysid	7.62	13.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Americamysis stucki	opossum shrimp, mysid	2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bowmaniella dissimilis	opossum shrimp, mysid	11,529.24	11,944.84	12,041.63	7,884.12	6,724.17	3,505.20	10,679.25	293.07	202.61	1.29
Taphromysis bowmani	opossum shrimp, mysid	381.19	496.23	725.42	682.28	637.41	420.74	370.96	350.83	223.87	176.11
amphipods, gammaridean	amphipods	3,912.08	12,271.01	23,901.03	24,347.98	26,368.40	30,567.52	47,464.69	33,889.97	48,012.44	15,599.02
amphipods, caprellid	skeleton shrimps	34.70	40.89	23.85	14.63	11.05	3.36	1.44	0.00	0.93	0.00
Munna reynoldsi	isopod	0.00	1.32	3.16	3.89	9.86	7.54	266.60	128.30	244.52	174.66
Xenanthura brevitelson	isopod	0.00	0.62	4.48	6.45	9.97	4.94	4.15	0.00	0.00	0.00
Cyathura polita	isopod	5.74	3.44	3.55	2.01	1.70	7.90	6.03	4.22	56.56	3.52
Sphaeroma quadridentata	isopod	0.00	0.00	0.00	2.36	0.00	0.00	0.00	3.42	0.00	0.71
Harrieta faxoni	isopod	1,311.28	1,137.19	660.52	465.22	221.93	76.78	18.50	2.60	3.17	0.00

Table A3, page 3 of 7.

Location specific plankton-net catch.

Data are presented as mean number per 1,000 cubic meters.

Organisms are listed in phylogenetic order.

Taxon	Common Name	Location (km from mouth) -1.3	-0.7	0	0.3	1.5	2.6	3.9	5.2	6	7.9
Cassidinidea ovalis	isopod	19.96	85.16	332.02	234.64	309.65	338.83	141.92	62.88	91.14	296.64
Sphaeroma terebrans	isopod	0.00	0.00	0.67	0.57	0.00	1.52	5.11	3.36	5.29	13.32
Edotea triloba	isopod	21.86	43.10	57.97	50.80	48.02	106.02	198.50	133.78	89.31	4.74
Erichsonella attenuata	isopod	343.38	818.33	808.35	999.78	1,025.80	490.99	168.06	14.34	6.23	0.66
Erichsonella filiforme	isopod	0.00	1.20	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00
cymothoid sp. a (Lironeca) juveniles	isopod	10.82	15.20	13.91	14.93	7.52	12.17	26.82	30.91	13.78	0.00
Anopsilana jonesi	isopod	3.68	1.82	75.54	16.21	7.87	8.72	3.04	0.55	0.00	0.00
Probopyrus sp. (attached)	isopod	0.00	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.77
Hargeria rapax	tanaid	56.27	64.24	90.08	116.47	72.14	64.11	112.15	215.90	284.49	2,059.02
Sinelobus stanfordi	tanaid	0.00	0.00	0.00	0.65	0.78	0.00	0.62	2.00	8.74	5.35
Apseudes sp.	tanaid	460.70	1,140.15	334.53	268.93	109.47	86.17	5.47	0.76	6.94	0.00
cumaceans	cumaceans	47,397.10	33,623.06	16,010.82	13,180.43	6,264.35	3,856.96	2,035.52	378.02	5,494.13	117.58
Lucifer faxoni juveniles and adults	shrimp	4.29	3.85	1.80	2.27	0.54	0.80	0.00	0.00	0.00	0.00
penaeid postlarvae	penaeid shrimps	450.44	0.00	10.92	1.33	0.00	0.00	0.00	0.00	0.00	0.00
penaeid metamorphs	penaeid shrimps	1.93	4.81	2.56	4.43	5.69	4.78	6.30	0.00	0.00	0.00
Farfantepenaeus duorarum juveniles	pink shrimp	6.33	1.27	3.24	1.88	0.66	4.23	8.90	3.10	0.00	0.00
Palaemonetes spp. postlarvae	grass shrimps	488.98	150.05	206.72	92.72	48.66	59.36	35.28	4.78	3.68	0.00
Palaemonetes pugio juveniles	daggerblade grass shrimp	46.15	613.53	41.81	20.76	32.36	29.27	156.01	102.37	88.92	5.18
Palaemonetes pugio adults	daggerblade grass shrimp	38.54	74.09	10.29	8.96	6.24	5.21	20.35	3.54	6.42	29.52
Palaemonetes paludosus juveniles	grass shrimp	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Palaemonetes paludosus adults	grass shrimp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.61
Periclimenes spp. postlarvae	shrimps	20.49	0.00	0.00	0.00	3.09	0.00	0.00	0.59	0.00	0.00
Periclimenes spp. juveniles	shrimps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00
Periclimenes longicaudatus juveniles	longtail grass shrimp	1.29	0.00	1.85	1.88	0.00	0.00	0.00	0.00	0.00	0.00
alphaeid postlarvae	snapping shrimps	266.21	47.78	105.84	33.31	9.28	6.80	0.65	0.00	0.00	0.00
alphaeid juveniles	snapping shrimps	15.16	8.13	4.58	0.00	0.00	1.26	1.25	0.62	0.00	0.00
Alpheus viridari juveniles	snapping shrimp	0.00	0.00	8.10	0.00	1.37	0.00	0.00	0.00	0.00	0.00
Alpheus viridari adults	snapping shrimp	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alpheus estuariensis adults	snapping shrimp	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hippolyte zostericola postlarvae	zostera shrimp	4.42	1.63	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00
Hippolyte zostericola juveniles	zostera shrimp	5.40	1.36	4.34	0.00	2.33	1.93	3.01	1.22	0.00	0.00
Hippolyte zostericola adults	zostera shrimp	0.00	9.89	0.00	0.60	1.33	1.17	1.25	0.00	0.00	0.00
Ogyrides alphaerostris postlarvae	estuarine longeye shrimp	12.86	4.18	2.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ogyrides alphaerostris juveniles and adults	estuarine longeye shrimp	0.00	1.56	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00
astacidean juveniles	crayfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.86
callianassid postlarvae	ghost shrimps	201.79	874.47	250.73	71.25	157.74	108.35	2.35	0.00	0.00	0.00
callianassid juveniles	ghost shrimps	0.00	0.00	12.03	0.00	0.00	0.00	30.74	0.62	0.00	0.00

Table A3, page 4 of 7.

Location specific plankton-net catch.

Data are presented as mean number per 1,000 cubic meters.

Organisms are listed in phylogenetic order.

Taxon	Common Name	-1.3	-0.7	0	0.3	1.5	2.6	3.9	5.2	6	7.9
		Location (km from mouth)									
Upogebia spp. postlarvae	mud shrimps	0.00	0.00	2.94	1.33	0.00	0.00	0.00	0.00	0.00	0.00
Upogebia spp. juveniles	mud shrimps	15.69	13.86	7.43	1.80	0.64	0.71	0.00	0.00	0.00	0.00
Upogebia affinis adults	coastal mud shrimp	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
decapod mysis	shrimp larvae	2,870.54	1,111.16	1,589.00	765.73	1,153.65	621.96	4,146.27	1,624.85	2,272.14	14.44
Callinectes sapidus juveniles	blue crab	0.67	4.01	5.89	1.16	3.90	7.96	7.27	2.45	1.39	0.00
Portunus sp. juveniles	swimming crab	0.00	0.00	0.00	0.00	0.63	1.42	0.73	3.77	1.52	0.00
xanthid juveniles	mud crabs	0.00	1.68	1.29	3.06	0.64	1.29	6.24	0.00	0.00	0.00
Rhithropanopeus harrisii juveniles	Harris mud crab	0.00	8.21	0.62	1.92	0.66	1.35	0.00	1.39	0.76	0.00
Rhithropanopeus harrisii adults	Harris mud crab	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00
decapod zoeae	crab larvae	47,579.53	55,954.02	58,403.32	50,364.94	33,248.89	30,721.91	15,839.11	11,639.47	3,952.23	1,141.97
decapod megalopae	post-zoea crab larvae	4,265.09	3,925.42	4,273.82	3,174.54	5,429.54	2,918.46	6,162.63	1,025.83	1,120.03	2.02
pelecypods	clams, mussels, oysters	14.91	14.04	14.55	14.74	10.97	5.90	11.62	1.25	3.66	0.59
gastropods, prosobranch	snails	682.84	1,778.81	455.39	342.23	406.35	441.11	2,617.72	9,756.02	4,901.53	1,582.93
gastropods, opisthobranch	sea slugs	6.77	1.22	12.03	10.69	21.55	30.01	67.67	8.80	0.00	0.00
chaetognaths, sagittid	arrow worms	106.76	10.09	23.21	7.39	0.63	1.77	1.31	0.00	0.00	1.32
Lepisosteus platyrhincus postflexion larvae	Florida gar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	0.00
Elops saurus postflexion larvae	ladyfish	0.00	0.79	0.00	3.57	0.78	1.47	3.38	0.64	0.00	0.00
Myrophis punctatus juveniles	speckled worm eel	0.00	0.00	1.31	0.66	1.23	1.47	5.95	0.00	0.66	0.00
Anchoa mitchilli eggs	bay anchovy	115.23	31.66	15.48	25.09	5.88	7.75	0.00	5.66	0.00	0.00
Anchoa mitchilli postflexion larvae	bay anchovy	0.00	0.60	0.64	3.86	0.48	5.28	3.07	0.60	0.61	0.00
Anchoa mitchilli juveniles	bay anchovy	12.32	24.67	26.98	89.40	399.01	622.25	241.69	173.28	50.24	1.38
Anchoa mitchilli adults	bay anchovy	0.70	2.70	3.11	19.31	18.88	18.36	18.70	11.73	5.70	0.00
Anchoa spp. preflexion larvae	anchovies	44.57	26.50	17.20	11.80	15.28	5.96	1.75	0.00	0.00	0.00
Anchoa spp. flexion larvae	anchovies	6.33	1.95	0.00	1.33	3.53	5.96	3.50	0.00	0.00	0.00
Brevoortia patronus juveniles	gulf menhaden	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.00
Brevoortia spp. postflexion larvae	menhaden	0.67	3.26	2.50	1.17	0.64	3.27	6.37	21.81	8.88	0.00
Brevoortia spp. metamorphs	menhaden	0.00	0.00	0.56	0.69	0.00	0.00	1.44	4.72	1.97	0.00
Opisthonema oglinum postflexion larvae	Atlantic thread herring	0.00	0.00	0.57	1.09	0.00	0.00	0.00	0.00	0.00	0.00
Opisthonema oglinum juveniles	Atlantic thread herring	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00
Sardinella aurita metamorphs	Spanish sardine	0.00	0.00	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Notemigonus crysoleucas preflexion larvae	golden shiner	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	33.97
Notemigonus crysoleucas flexion larvae	golden shiner	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.34
Notropis petersoni juveniles	coastal shiner	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71
Notropis spp. preflexion larvae	minnows	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93	17.73
Notropis spp. postflexion larvae	minnows	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.42
Synodus foetens juveniles	inshore lizardfish	0.71	0.00	0.00	0.00	0.00	1.82	0.00	0.00	0.00	0.00
Synodus foetens metamorphs	inshore lizardfish	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00

Table A3, page 5 of 7.

Location specific plankton-net catch.

Data are presented as mean number per 1,000 cubic meters.

Organisms are listed in phylogenetic order.

		Location (km from mouth)									
Taxon	Common Name	-1.3	-0.7	0	0.3	1.5	2.6	3.9	5.2	6	7.9
Opsanus beta juveniles	gulf toadfish	0.71	6.77	0.81	0.00	0.00	0.00	0.72	0.00	0.00	0.00
Mugil cephalus juveniles	striped mullet	0.00	0.65	0.00	0.00	0.00	0.00	0.71	3.90	0.00	0.00
Membras martinica preflexion larvae	rough silverside	5.17	0.00	3.88	0.00	0.00	1.84	0.00	0.00	0.00	0.00
Membras martinica postflexion larvae	rough silverside	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00
Membras martinica juveniles	rough silverside	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Menidia spp. eggs	silversides	0.00	0.00	0.00	1.19	0.54	0.00	0.63	1.39	0.00	0.00
Menidia spp. preflexion larvae	silversides	9.15	11.36	8.40	24.89	9.87	34.76	32.13	27.30	29.58	7.33
Menidia spp. flexion larvae	silversides	0.00	0.00	0.00	1.60	0.00	2.98	3.94	3.40	15.35	4.16
Menidia spp. postflexion larvae	silversides	0.00	0.00	0.00	0.00	0.62	0.00	0.72	4.74	1.16	2.75
Menidia spp. juveniles	silversides	0.00	0.00	1.20	0.00	0.00	0.00	4.82	1.20	5.36	28.59
Menidia spp. adults	silversides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00	5.93
Strongylura marina adults	Atlantic needlefish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61
Strongylura spp. juveniles	needlefishes	0.66	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00
Fundulus grandis postflexion larvae	gulf killifish	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	1.32
Fundulus spp. eggs	killifishes	2.96	0.00	0.00	0.00	0.00	0.00	0.68	5.65	4.16	0.00
Fundulus spp. postflexion larvae	killifishes	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.64	0.64	0.00
Lucania goodei postflexion larvae	bluefin killifish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.67
Lucania goodei juveniles	bluefin killifish	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.59	2.67	7.56
Lucania goodei adults	bluefin killifish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.35
Lucania parva eggs	rainwater killifish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.12	1.97	0.59
Lucania parva flexion larvae	rainwater killifish	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	1.74	0.00
Lucania parva postflexion larvae	rainwater killifish	1.43	0.71	0.81	2.06	4.10	7.32	32.14	36.22	25.80	42.17
Lucania parva juveniles	rainwater killifish	5.92	1.53	0.65	3.38	1.98	5.16	34.78	10.31	11.87	19.61
Lucania parva adults	rainwater killifish	1.41	4.50	0.62	7.17	0.00	0.00	37.68	5.67	11.12	89.99
Gambusia holbrooki juveniles	eastern mosquitofish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.00	0.00
Poecilia latipinna juveniles	sailfin molly	0.00	3.23	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.00
Poecilia latipinna adults	sailfin molly	0.00	1.08	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.00
Syngnathus floridae juveniles	dusky pipefish	2.96	2.16	0.67	0.58	0.00	0.00	0.00	0.00	0.00	0.00
Syngnathus louisianae adults	chain pipefish	0.00	0.00	0.00	0.00	0.00	0.00	2.51	0.00	0.00	0.00
Syngnathus scovelli juveniles	gulf pipefish	8.47	4.74	4.69	1.82	2.16	8.45	0.60	1.89	1.63	3.00
Syngnathus scovelli adults	gulf pipefish	0.00	1.08	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00
fish eggs, percomorph	sciaenid eggs (primarily)	3.57	17.31	3.28	22.05	6.38	0.00	0.00	0.00	0.00	0.00
Prionotus spp. postflexion larvae	searobins	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00
Lepomis auritus postflexion larvae	redbreast sunfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.74
Lepomis auritus juveniles	redbreast sunfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.95	0.00
Lepomis punctatus juveniles	spotted sunfish	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.16
Lepomis spp. flexion larvae	sunfishes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.55

Table A3, page 6 of 7.

Location specific plankton-net catch.

Data are presented as mean number per 1,000 cubic meters.

Organisms are listed in phylogenetic order.

		Location (km from mouth)									
Taxon	Common Name	-1.3	-0.7	0	0.3	1.5	2.6	3.9	5.2	6	7.9
Lepomis spp. postflexion larvae	sunfishes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80	3.80
Micropterus salmoides flexion larvae	largemouth bass	0.00	0.00	0.00	0.00	0.00	0.63	0.00	2.12	0.00	23.25
Lutjanus griseus juveniles	gray snapper	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.00
Eucinostomus gula juveniles	silver jenny	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00
Eucinostomus gula adults	silver jenny	0.00	0.00	0.00	0.00	0.00	0.00	1.32	0.00	0.00	0.00
Eucinostomus harengulus juveniles	tidewater mojarra	0.00	0.00	0.00	0.00	0.66	2.28	0.00	0.76	10.27	0.00
Eucinostomus harengulus adults	tidewater mojarra	0.00	0.00	0.00	0.00	0.00	0.00	5.02	0.58	0.00	0.00
Eucinostomus spp. postflexion larvae	mojarras	1.95	3.44	2.66	5.68	2.16	7.03	24.09	8.31	10.18	0.00
Eucinostomus spp. juveniles	mojarras	0.00	0.00	1.27	1.88	0.63	7.59	66.43	6.15	15.18	1.94
gerreid preflexion larvae	mojjaras	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Orthopristis chrysoptera juveniles	pigfish	0.00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00	0.00
Lagodon rhomboides postflexion larvae	pinfish	0.00	0.00	0.00	0.62	0.00	2.89	0.00	0.00	0.00	0.00
Lagodon rhomboides juveniles	pinfish	4.28	6.78	16.49	30.82	10.68	5.50	9.62	5.26	0.00	0.00
Cynoscion nebulosus juveniles	spotted seatrout	0.63	0.00	0.55	0.00	0.66	0.00	1.29	0.00	0.00	0.00
Leiostomus xanthurus postflexion larvae	spot	2.59	1.86	0.62	4.81	4.21	3.44	1.21	1.16	0.00	0.00
Leiostomus xanthurus juveniles	spot	3.52	3.15	4.60	1.35	4.33	1.30	2.67	1.28	0.00	0.00
Menticirrhus spp. preflexion larvae	kingfishes	0.00	0.71	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00
Menticirrhus spp. postflexion larvae	kingfishes	0.00	1.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sciaenops ocellatus postflexion larvae	red drum	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00
blenniid preflexion larvae	blennies	36.98	21.20	42.75	44.68	14.90	4.98	1.87	0.00	0.00	0.00
Chasmodes saburrae flexion larvae	Florida blenny	1.52	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00
Chasmodes saburrae juveniles	Florida blenny	0.71	12.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gobiesox strumosus preflexion larvae	skilletfish	2.60	0.00	5.90	1.82	0.73	0.62	0.00	0.00	0.00	0.00
Gobiesox strumosus flexion larvae	skilletfish	0.00	0.71	3.41	1.33	1.37	0.00	0.00	0.00	0.00	0.00
Gobiesox strumosus postflexion larvae	skilletfish	0.00	0.00	0.67	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Gobiesox strumosus juveniles	skilletfish	0.00	0.00	0.00	0.00	0.00	0.71	1.75	0.00	0.00	0.00
Lupinoblennius nicholsi postflexion larvae	highfin blenny	0.70	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00
Bathygobius soporator preflexion larvae	frillfin goby	0.00	0.00	1.35	0.58	0.00	0.00	0.00	0.00	0.00	0.00
Bathygobius soporator postflexion larvae	frillfin goby	0.00	0.00	0.00	0.00	1.24	0.00	0.00	0.00	0.64	0.00
gobiid eggs	gobies	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00
gobiid preflexion larvae	gobies	430.26	456.00	1,105.07	1,195.48	728.59	400.96	312.90	1,282.65	207.88	229.64
gobiid flexion larvae	gobies	143.41	402.30	332.22	500.20	368.01	118.42	41.61	976.64	13.77	60.93
Gobiosoma bosc juveniles	naked goby	0.00	0.00	0.00	0.00	0.00	2.02	1.13	0.00	1.86	0.00
Gobiosoma robustum juveniles	code goby	0.00	0.00	0.00	0.55	1.26	0.00	0.00	0.00	1.26	0.00
Gobiosoma spp. postflexion larvae	gobies	125.99	364.86	174.98	472.91	341.25	113.44	74.69	2,687.80	15.59	0.00
Microgobius gulosus juveniles	clown goby	0.00	0.00	1.43	1.88	0.00	1.09	33.23	11.38	0.00	0.90
Microgobius gulosus adults	clown goby	0.00	0.00	1.23	0.00	0.48	0.00	0.73	0.00	0.00	0.00

Table A3, page 7 of 7.

Location specific plankton-net catch.

Data are presented as mean number per 1,000 cubic meters.

Organisms are listed in phylogenetic order.

		Location (km from mouth)									
Taxon	Common Name	-1.3	-0.7	0	0.3	1.5	2.6	3.9	5.2	6	7.9
Microgobius spp. flexion larvae	gobies	71.83	181.93	140.99	170.71	126.84	47.23	44.40	232.65	21.26	65.35
Microgobius spp. postflexion larvae	gobies	253.00	100.61	62.67	25.73	47.37	69.98	108.76	653.03	9.46	0.00
Microgobius spp. juveniles	gobies	0.00	0.00	0.00	0.00	0.00	0.00	1.85	0.00	0.00	0.00
Microgobius thalassinus juveniles	green goby	0.00	0.00	0.00	0.00	0.00	1.41	20.21	2.48	0.00	0.00
Paralichthys spp. juveniles	flounders	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00
Achirus lineatus postflexion larvae	lined sole	0.00	0.00	0.00	0.00	0.00	0.00	1.32	0.00	0.00	0.00
Trinectes maculatus flexion larvae	hogchoker	0.00	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.00
Trinectes maculatus postflexion larvae	hogchoker	1.52	0.00	0.00	0.58	0.48	0.65	4.82	0.00	0.00	0.00
Trinectes maculatus juveniles	hogchoker	0.00	0.70	0.00	0.63	0.00	1.82	7.84	1.86	0.64	0.00
Trinectes maculatus adults	hogchoker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00
Sphoeroides spp. preflexion larvae	puffers	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00
Sphoeroides spp. juveniles	puffers	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00

Appendix B:

Seine and trawl summary tables

Table B1, page 1 of 3.

Seine catch statistics (August 2005 through July 2007, n=252 samples).

Organisms are listed in phylogenetic order.

Scientific name	Common Name	Number Collected	Collection Frequency	km_u (km)	S_u (psu)	CPUE (No./100m2) Average	Maximum
Farfantepenaeus duorarum	Pink shrimp	582	24.6	1.26	10.60	2.58	89.29
Palaemonetes spp.	Palaemonetes grass shrimps	42	8.3	2.66	9.41	0.21	5.88
Palaemonetes intermedius	Brackish grass shrimp	11,399	63.5	2.30	8.63	53.13	2,392.65
Palaemonetes paludosus	Riverine grass shrimp	89	5.2	8.09	2.73	0.52	55.88
Palaemonetes pugio	Daggerblade grass shrimp	8	0.8	5.80	4.83	0.05	7.35
Palaemonetes vulgaris	Marsh grass shrimp	14	0.8	0.36	8.14	0.08	14.71
Periclimenes longicaudatus	Longtail grass shrimp	18	1.6	-1.88	19.41	0.05	7.14
Palaemon floridanus	Florida grass shrimps	21	1.2	-2.85	18.46	0.07	11.43
Alpheidae spp.	Snapping shrimp	17	2.8	-1.90	14.02	0.07	5.88
Hippolyte zostericola	Zostera shrimp	2	0.8	-0.85	17.78	0.01	0.71
Callinectes sapidus	Blue crab	1,581	62.3	4.10	5.87	8.91	292.65
Portunus spp.	Portunus crabs	1	0.4	-0.50	13.27	0.00	0.71
Dasyatis sabina	Atlantic stingray	2	0.8	-1.30	19.98	0.01	0.71
Dasyatis say	Bluntnose stingray	1	0.4	-0.30	21.30	0.00	0.71
Myrophis punctatus	Speckled worm eel	1	0.4	-1.30	17.85	0.00	0.71
Brevoortia spp.	Menhadens	93	1.2	5.74	6.22	0.54	133.82
Opisthonema oglinum	Atlantic thread herring	109	1.2	-1.87	20.23	0.64	82.35
Harengula jaguana	Scaled sardine	3	0.8	1.25	14.90	0.01	1.47
Anchoa hepsetus	Striped anchovy	389	0.8	-0.47	16.32	1.11	277.14
Anchoa mitchilli	Bay anchovy	6,831	14.3	4.32	4.95	37.71	5,845.59
Anchoa lyolepis	Dusky anchovy	2	0.4	4.50	11.55	0.01	2.94
Synodus foetens	Inshore lizardfish	114	14.7	-0.47	16.93	0.48	22.06
Notemigonus crysoleucas	Golden shiner	204	2.4	7.52	2.63	1.19	210.29
Notropis harperi	Redeye chub	10	1.2	8.54	3.23	0.06	10.29
Notropis petersoni	Coastal shiner	4,887	10.7	7.72	2.07	28.52	914.71
Erimyzon sucetta	Lake chubsucker	44	5.6	7.81	2.26	0.26	14.71
Bagre marinus	Gafftopsail catfish	2	0.4	-0.50	21.60	0.01	1.43
Ariopsis felis	Hardhead catfish	6	1.2	-0.72	14.46	0.02	2.86
Opsanus beta	Gulf toadfish	47	9.1	0.85	12.31	0.25	17.65
Ogcocephalus cubifrons	Polka-dot batfish	1	0.4	-0.40	18.70	0.01	1.47
Hyporhamphus meeki	False silverstripe halfbeak	4	0.8	-1.88	17.86	0.01	2.14
Strongylura spp.	Needlefishes	4	1.6	5.45	6.49	0.02	1.47
Strongylura marina	Atlantic needlefish	3	1.2	0.63	14.14	0.01	1.47

Table B1, page 2 of 3.

Seine catch statistics (August 2005 through July 2007, n=252 samples).

Organisms are listed in phylogenetic order.

Scientific name	Common Name	Number Collected	Collection Frequency	km_u (km)	S_u (psu)	CPUE (No./100m2) Average	CPUE (No./100m2) Maximum
Strongylura notata	Redfin needlefish	128	15.9	-0.26	13.95	0.75	20.59
Strongylura timucu	Timucu	113	16.3	5.85	4.72	0.66	39.71
Cyprinodon variegatus	Sheepshead minnow	1,195	12.7	6.27	2.92	6.97	916.18
Fundulus confluentus	Marsh killifish	1	0.4	6.00	2.00	0.01	1.47
Fundulus grandis	Gulf killifish	787	21.8	3.87	5.29	4.59	202.94
Fundulus similis	Longnose killifish	3	1.2	0.60	9.45	0.02	1.47
Fundulus seminolis	Seminole killifish	308	10.3	6.30	2.66	1.80	80.88
Lucania parva	Rainwater killifish	28,557	77.0	5.91	3.95	163.68	10,148.53
Lucania goodei	Bluefin killifish	2,562	17.1	7.77	1.92	14.95	807.35
Floridichthys carpio	Goldspotted killifish	327	12.7	-1.30	13.98	1.88	108.82
Gambusia holbrooki	Eastern mosquitofish	154	6.0	6.86	2.15	0.90	133.82
Poecilia latipinna	Sailfin molly	436	10.3	5.58	3.12	2.54	219.12
Heterandria formosa	Least killifish	12	2.0	7.81	1.81	0.07	7.35
Membras martinica	Rough silverside	2	0.8	-3.50	16.50	0.01	0.71
Menidia spp.	Silversides	15,520	48.4	4.96	5.16	89.74	2,148.53
Syngnathus louisianae	Chain pipefish	3	1.2	0.00	11.05	0.01	1.47
Syngnathus scovelli	Gulf pipefish	176	25.0	2.75	9.56	0.82	16.43
Hippocampus erectus	Lined seahorse	1	0.4	-0.70	8.00	0.01	1.47
Anarchopterus criniger	Fringed pipefish	1	0.4	-1.80	12.10	0.00	0.71
Prionotus scitulus	Leopard searobin	8	0.8	-0.66	13.12	0.02	5.00
Prionotus tribulus	Bighead searobin	38	9.1	-0.29	11.00	0.17	5.88
Lepomis spp.	Sunfishes	50	4.8	7.34	2.95	0.29	17.65
Lepomis microlophus	Redear sunfish	6	1.6	6.68	3.28	0.04	2.94
Lepomis punctatus	Spotted sunfish	290	15.1	6.87	2.38	1.69	75.00
Micropterus salmoides	Largemouth bass	178	12.7	7.69	2.08	1.04	42.65
Caranx hippos	Crevalle jack	1	0.4	1.60	15.65	0.01	1.47
Chloroscombrus chrysurus	Atlantic bumper	2	0.8	-2.52	20.39	0.01	1.47
Oligoplites saurus	Leatherjack	17	5.2	2.22	8.94	0.10	4.41
Selene vomer	Lookdown	1	0.4	-0.30	11.45	0.01	1.47
Trachinotus falcatus	Permit	1	0.4	3.90	4.25	0.01	1.47
Lutjanus griseus	Gray snapper	19	6.7	2.54	9.93	0.11	2.94
Eucinostomus spp.	Eucinostomus mojarras	4,584	48.4	3.60	8.23	25.68	1,148.53
Eucinostomus gula	Silver jenny	580	23.8	-0.95	13.70	3.10	75.00

Table B1, page 3 of 3.

Seine catch statistics (August 2005 through July 2007, n=252 samples).

Organisms are listed in phylogenetic order.

Scientific name	Common Name	Number Collected	Collection Frequency	km_u (km)	S_u (psu)	CPUE (No./100m2) Average	Maximum
Eucinostomus harengulus	Tidewater mojarra	1,607	40.1	5.01	5.75	9.36	392.65
Orthopristis chrysoptera	Pigfish	30	4.0	-1.40	20.53	0.09	5.71
Lagodon rhomboides	Pinfish	2,903	64.3	1.60	13.16	13.54	257.35
Archosargus probatocephalus	Sheepshead	2	0.8	0.80	13.45	0.01	1.47
Cynoscion nebulosus	Spotted seatrout	75	11.1	0.89	11.18	0.34	20.59
Bairdiella chrysoura	Silver perch	47	4.4	-0.90	17.34	0.17	14.29
Leiostomus xanthurus	Spot	775	17.5	2.30	10.79	3.74	175.00
Pogonias cromis	Black drum	1	0.4	-2.80	17.45	0.01	1.47
Sciaenops ocellatus	Red drum	39	4.8	3.87	4.22	0.23	11.76
Elassoma evergladei	Everglades pygmy sunfish	3	0.4	8.60	1.00	0.02	4.41
Mugil cephalus	Striped mullet	272	9.5	-0.09	7.87	1.58	316.18
Mugil curema	White mullet	2	0.8	0.05	19.48	0.01	1.47
Mugil gyrans	Whirligig mullet	2	0.8	0.05	12.60	0.01	1.47
Chasmodes saburrae	Florida blenny	12	4.0	-2.09	16.63	0.04	2.14
Hypleurochilus caudovittatus	Zebratail blenny	2	0.4	-3.30	20.60	0.01	1.43
Paraclinus fasciatus	Banded blenny	3	0.8	-3.27	20.63	0.01	1.43
Gobiosoma spp.	Gobiosoma gobies	33	10.3	1.28	9.58	0.17	5.88
Gobiosoma bosc	Naked goby	41	12.3	2.05	9.95	0.23	4.41
Gobiosoma robustum	Code goby	66	13.5	-1.27	16.16	0.32	19.12
Microgobius gulosus	Clown goby	697	43.7	2.26	9.99	3.31	49.29
Paralichthys albigutta	Gulf flounder	9	1.6	0.29	15.42	0.04	3.57
Achiridae spp.	American soles	19	1.6	5.12	2.48	0.11	16.18
Symphurus plagiusa	Blackcheek tonguefish	17	4.0	-0.14	12.51	0.06	2.86
Trinectes maculatus	Hogchoker	160	10.3	6.90	2.34	0.93	85.29
Achirus lineatus	Lined sole	14	3.6	-0.58	12.15	0.05	4.29
Monacanthus ciliatus	Fringed filefish	1	0.4	-3.30	20.60	0.00	0.71
Stephanolepis hispidus	Planehead filefish	4	0.8	-1.20	15.05	0.01	2.14
Sphoeroides nephelus	Southern puffer	136	17.9	-0.97	16.78	0.57	19.12
Chilomycterus schoepfii	Striped burrfish	3	1.2	0.06	19.50	0.01	1.47

Table B2, page 1 of 2.

Trawl catch statistics (August 2005 through July 2007, n=105).

Organisms are listed in phylogenetic order.

Scientific name	Common Name	Number Collected	Collection Frequency	km_u (km)	S_u (psu)	CPUE (No./100m2) Average	Maximum
Argopecten spp.	Scalloops	4	1.0	-1.80	17.27	0.01	0.60
Farfantepenaeus duorarum	Pink shrimp	720	61.9	0.43	11.11	0.99	12.74
Palaemonetes spp.	Palaemonetes grass shrimps	203	12.4	-0.48	11.84	0.30	10.79
Palaemonetes intermedius	Brackish grass shrimp	7,629	79.0	-0.66	12.50	11.11	151.86
Palaemonetes paludosus	Riverine grass shrimp	11	1.9	1.82	20.15	0.01	0.81
Palaemonetes pugio	Daggerblade grass shrimp	121	1.0	-1.80	13.13	0.16	16.32
Palaemonetes vulgaris	Marsh grass shrimp	15	1.0	0.00	15.77	0.02	2.25
Periclimenes longicaudatus	Longtail grass shrimp	21	1.0	-1.80	18.60	0.03	3.15
Palaemon floridanus	Florida grass shrimps	11	1.0	4.40	5.35	0.02	2.47
Alpheidae spp.	Snapping shrimp	157	21.0	-1.62	15.98	0.22	7.95
Callinectes sapidus	Blue crab	1,571	98.1	1.31	11.66	2.47	37.55
Portunus spp.	Portunus crabs	17	1.9	-2.15	23.61	0.02	2.16
Dasyatis sabina	Atlantic stingray	22	16.2	0.16	16.56	0.03	0.40
Dasyatis say	Bluntnose stingray	2	1.0	-2.50	13.10	0.00	0.27
Lepisosteus osseus	Longnose gar	17	10.5	1.43	11.75	0.02	0.40
Lepisosteus platyrhincus	Florida gar	2	1.0	0.40	15.43	0.00	0.39
Elops saurus	Ladyfish	2	1.0	-1.80	13.60	0.00	0.45
Myrophis punctatus	Speckled worm eel	1	1.0	0.50	8.27	0.00	0.15
Anchoa mitchilli	Bay anchovy	304	6.7	3.31	12.55	0.49	46.21
Synodus foetens	Inshore lizardfish	122	38.1	-0.33	15.51	0.17	2.16
Ariopsis felis	Hardhead catfish	11	7.6	1.76	12.15	0.02	0.67
Opsanus beta	Gulf toadfish	154	42.9	-0.20	11.97	0.21	7.02
Ogcocephalus spp.	Batfishes	1	1.0	0.00	15.77	0.00	0.15
Ogcocephalus cubifrons	Polka-dot batfish	14	7.6	-1.73	16.38	0.02	0.54
Urophycis floridana	Southern hake	1	1.0	-1.80	17.27	0.00	0.15
Lucania parva	Rainwater killifish	321	51.4	0.97	10.61	0.48	6.30
Syngnathus louisianae	Chain pipefish	16	7.6	-0.19	16.03	0.02	0.60
Syngnathus scovelli	Gulf pipefish	126	43.8	0.57	12.73	0.19	1.89
Hippocampus erectus	Lined seahorse	3	2.9	0.61	17.96	0.00	0.17
Hippocampus zosterae	Dwarf seahorse	1	1.0	-2.70	16.40	0.00	0.13
Anarchopterus criniger	Fringed pipefish	4	3.8	-1.39	18.61	0.01	0.15
Prionotus scitulus	Leopard searobin	5	3.8	-1.85	13.10	0.01	0.27
Prionotus tribulus	Bighead searobin	87	34.3	0.47	11.66	0.13	1.05

Table B2, page 2 of 2.

Trawl catch statistics (August 2005 through July 2007, n=105).

Organisms are listed in phylogenetic order.

Scientific name	Common Name	Number Collected	Collection Frequency	km_u (km)	S_u (psu)	CPUE (No./100m2) Average	CPUE (No./100m2) Maximum
Echeneis spp.	Sharksuckers	1	1.0	4.20	10.68	0.00	0.13
Chloroscombrus chrysurus	Atlantic bumper	9	2.9	3.09	9.81	0.01	0.75
Lutjanus griseus	Gray snapper	35	21.0	1.03	11.62	0.05	0.67
Eucinostomus spp.	Eucinostomus mojarras	2,113	36.2	2.92	8.63	2.77	60.31
Eucinostomus gula	Silver jenny	223	38.1	-0.58	13.71	0.32	4.59
Eucinostomus harengulus	Tidewater mojarra	249	23.8	3.97	5.65	0.36	11.69
Haemulon plumierii	White grunt	2	1.0	-3.50	24.43	0.00	0.27
Orthopristis chrysoptera	Pigfish	76	6.7	-2.21	23.00	0.10	6.61
Lagodon rhomboides	Pinfish	1,807	69.5	0.65	13.37	3.01	81.17
Archosargus probatocephalus	Sheepshead	5	4.8	0.86	8.81	0.01	0.22
Cynoscion nebulosus	Spotted seatrout	18	10.5	-0.67	14.19	0.03	0.60
Bairdiella chrysoura	Silver perch	67	14.3	-1.42	19.32	0.09	2.29
Leiostomus xanthurus	Spot	63	15.2	2.64	8.18	0.12	6.30
Menticirrhus saxatilis	Northern kingfish	1	1.0	2.70	7.62	0.00	0.22
Pogonias cromis	Black drum	1	1.0	0.60	14.30	0.00	0.13
Sciaenops ocellatus	Red drum	2	1.0	0.60	14.30	0.00	0.27
Chaetodipterus faber	Atlantic spadefish	6	4.8	-1.80	13.24	0.01	0.27
Chasmodes saburrae	Florida blenny	24	13.3	-1.39	15.13	0.04	0.67
Hypleurochilus caudovittatus	Zebratail blenny	3	1.0	-2.70	16.40	0.00	0.40
Paraclinus fasciatus	Banded blenny	6	5.7	-1.82	16.01	0.01	0.17
Gobiosoma spp.	Gobiosoma gobies	119	30.5	-0.81	13.62	0.17	3.60
Gobiosoma bosc	Naked goby	8	7.6	2.58	6.41	0.01	0.22
Gobiosoma robustum	Code goby	190	26.7	-1.36	16.13	0.27	15.44
Microgobius gulosus	Clown goby	112	28.6	0.66	12.27	0.16	2.19
Etropus crossotus	Fringed flounder	4	3.8	0.26	12.42	0.01	0.27
Paralichthys albigutta	Gulf flounder	26	14.3	-0.64	17.82	0.04	0.67
Symphurus plagiusa	Blackcheek tonguefish	126	29.5	-0.52	13.96	0.19	5.55
Trinectes maculatus	Hogchoker	140	14.3	4.01	6.13	0.20	9.08
Achirus lineatus	Lined sole	14	6.7	-0.66	16.52	0.02	0.81
Stephanolepis hispidus	Planehead filefish	4	2.9	-0.78	19.30	0.01	0.27
Lactophrys spp.	Three-angled trunkfishes	1	1.0	-3.00	15.97	0.00	0.15
Acanthostracion quadricornis	Scrawled cowfish	4	2.9	-2.80	16.76	0.01	0.27
Sphoeroides nephelus	Southern puffer	126	39.0	0.69	15.65	0.19	2.47
Chilomycterus schoepfii	Striped burrfish	2	1.0	-2.20	23.80	0.00	0.27

Table B3. Page 1 of 5.

Seine catch by month (August 2005 through July 2007).

Number of monthly samples is indicated in parentheses.

Scientific name	Common Name	Jan (24)	Feb (24)	Mar (24)	Apr (12)	May (24)	Jun (24)	Jul (22)	Aug (26)	Sep (12)	Oct (24)	Nov (24)	Dec (12)	Total (252)
Farfantepenaeus duorarum	Pink shrimp	4	8	15	.	2	36	132	52	.	279	54	.	582
Palaemonetes spp.	Palaemonetes grass shrimps	5	4	.	1	4	4	4	2	1	7	6	4	42
Palaemonetes intermedius	Brackish grass shrimp	3,058	443	364	115	571	808	794	271	130	2,893	1,562	390	11,399
Palaemonetes paludosus	Riverine grass shrimp	.	.	.	.	.	51	8	18	1	1	1	9	89
Palaemonetes pugio	Daggerblade grass shrimp	3	.	.	.	.	5	.	.	.	.	.	.	8
Palaemonetes vulgaris	Marsh grass shrimp	.	.	.	.	.	.	.	.	.	.	4	10	14
Periclimenes longicaudatus	Longtail grass shrimp	.	.	10	.	.	.	8	.	.	.	.	.	18
Palaemon floridanus	Florida grass shrimps	.	.	.	.	.	.	.	.	.	.	18	3	21
Alpheidae spp.	Snapping shrimp	.	.	.	1	.	.	3	6	.	7	.	.	17
Hippolyte zostericola	Zostera shrimp	.	1	.	.	.	1	.	.	.	.	.	.	2
Callinectes sapidus	Blue crab	167	245	266	21	43	112	67	96	6	252	251	55	1,581
Portunus spp.	Portunus crabs	.	.	.	.	.	.	1	.	.	.	.	.	1
Dasyatis sabina	Atlantic stingray	.	.	.	.	.	1	.	.	1	.	.	.	2
Dasyatis say	Bluntnose stingray	.	.	.	.	1	.	.	.	.	.	.	.	1
Myrophis punctatus	Speckled worm eel	.	.	.	.	1	.	.	.	.	.	.	.	1
Brevoortia spp.	Menhadens	.	.	.	.	2	91	.	.	.	.	.	.	93
Opisthonema oglinum	Atlantic thread herring	.	.	.	.	.	.	51	.	56	2	.	.	109
Harengula jaguana	Scaled sardine	.	.	.	.	.	1	.	.	2	.	.	.	3
Anchoa hepsetus	Striped anchovy	.	.	.	.	.	1	.	.	.	388	.	.	389

Table B3. Page 2 of 5.

Seine catch by month (August 2005 through July 2007).

Number of monthly samples is indicated in parentheses.

Scientific name	Common Name	Jan (24)	Feb (24)	Mar (24)	Apr (12)	May (24)	Jun (24)	Jul (22)	Aug (26)	Sep (12)	Oct (24)	Nov (24)	Dec (12)	Total (252)
Anchoa mitchilli	Bay anchovy	6	360	1	.	82	151	49	364	770	4,966	56	26	6,831
Anchoa lyolepis	Dusky anchovy	.	.	.	.	.	2	.	.	.	.	.	.	2
Synodus foetens	Inshore lizardfish	6	2	1	.	18	34	11	5	.	25	10	2	114
Notemigonus crysoleucas	Golden shiner	1	.	.	.	5	49	5	.	.	1	143	.	204
Notropis harperi	Redeye chub	.	.	3	.	.	7	.	.	.	.	.	.	10
Notropis petersoni	Coastal shiner	19	.	15	.	671	931	232	1,731	110	982	196	.	4,887
Erimyzon sucetta	Lake chubsucker	.	.	.	.	.	12	10	13	2	2	2	3	44
Bagre marinus	Gafftopsail catfish	.	.	.	.	.	2	.	.	.	.	.	.	2
Ariopsis felis	Hardhead catfish	.	.	.	.	.	1	4	1	.	.	.	.	6
Opsanus beta	Gulf toadfish	2	.	.	.	7	20	7	4	.	4	.	3	47
Ogcocephalus cubifrons	Polka-dot batfish	.	.	1	.	.	.	.	.	.	.	.	.	1
Hyporhamphus meeki	False silverstripe halfbeak	.	.	.	.	.	.	3	1	.	.	.	.	4
Strongylura spp.	Needlefishes	.	.	.	.	2	.	1	1	.	.	.	.	4
Strongylura marina	Atlantic needlefish	.	.	.	.	1	.	.	1	1	.	.	.	3
Strongylura notata	Redfin needlefish	.	.	1	.	1	13	41	34	14	12	6	6	128
Strongylura timucu	Timucu	33	9	1	1	4	5	3	10	4	8	11	24	113
Cyprinodon variegatus	Sheepshead minnow	33	9	15	.	8	89	646	366	.	5	20	4	1,195
Fundulus confluentus	Marsh killifish	.	.	.	.	.	.	.	.	.	.	1	.	1
Fundulus grandis	Gulf killifish	199	27	28	6	22	.	185	93	.	140	49	38	787
Fundulus similis	Longnose killifish	1	.	.	.	.	.	.	.	.	1	1	.	3
Fundulus seminolis	Seminole killifish	.	.	.	3	8	83	111	86	14	2	.	1	308

Table B3. Page 3 of 5.

Seine catch by month (August 2005 through July 2007).

Number of monthly samples is indicated in parentheses.

Scientific name	Common Name	Jan (24)	Feb (24)	Mar (24)	Apr (12)	May (24)	Jun (24)	Jul (22)	Aug (26)	Sep (12)	Oct (24)	Nov (24)	Dec (12)	Total (252)
Lucania parva	Rainwater killifish	300	226	339	247	639	2,468	9,603	11,904	212	1,642	766	211	28,557
Lucania goodei	Bluefin killifish	51	5	13	2	574	468	149	498	150	97	549	6	2,562
Floridichthys carpio	Goldspotted killifish	18	5	114	9	4	11	8	7	1	19	91	40	327
Gambusia holbrooki	Eastern mosquitofish	.	3	.	.	93	8	12	3	.	29	6	.	154
Poecilia latipinna	Sailfin molly	5	36	.	12	9	1	155	48	.	157	12	1	436
Heterandria formosa	Least killifish	.	.	1	.	5	.	.	.	1	.	5	.	12
Membras martinica	Rough silverside	.	.	.	.	.	.	.	.	1	.	.	1	2
Menidia spp.	Silversides	115	137	156	41	1,340	3,970	2,539	5,005	818	1,054	316	29	15,520
Syngnathus louisianae	Chain pipefish	2	.	.	.	.	.	.	.	.	.	1	.	3
Syngnathus scovelli	Gulf pipefish	1	2	3	6	11	25	48	22	3	30	11	14	176
Hippocampus erectus	Lined seahorse	1	.	.	.	.	.	.	.	.	.	.	.	1
Anarchopterus criniger	Fringed pipefish	.	.	.	.	.	.	.	1	.	.	.	.	1
Prionotus scitulus	Leopard searobin	.	.	.	.	.	.	7	1	.	.	.	.	8
Prionotus tribulus	Bighead searobin	6	6	1	1	.	1	.	2	.	6	6	9	38
Lepomis spp.	Sunfishes	.	.	2	1	19	7	.	16	.	2	3	.	50
Lepomis microlophus	Redear sunfish	.	.	.	.	.	2	.	4	.	.	.	.	6
Lepomis punctatus	Spotted sunfish	5	8	2	.	8	32	9	103	7	68	48	.	290
Micropterus salmoides	Largemouth bass	.	1	1	1	27	62	23	36	4	15	6	2	178
Caranx hippos	Crevalle jack	.	.	.	.	.	.	.	.	1	.	.	.	1
Chloroscombrus chrysurus	Atlantic bumper	.	.	.	.	.	.	.	.	1	1	.	.	2
Oligoplites saurus	Leatherjack	.	.	.	.	.	.	4	5	2	6	.	.	17

Table B3. Page 4 of 5.

Seine catch by month (August 2005 through July 2007).

Number of monthly samples is indicated in parentheses.

Scientific name	Common Name	Jan (24)	Feb (24)	Mar (24)	Apr (12)	May (24)	Jun (24)	Jul (22)	Aug (26)	Sep (12)	Oct (24)	Nov (24)	Dec (12)	Total (252)
Selene vomer	Lookdown	.	.	.	.	.	.	.	.	.	1	.	.	1
Trachinotus falcatus	Permit	.	.	.	.	.	.	.	1	.	.	.	.	1
Lutjanus griseus	Gray snapper	1	.	1	.	4	1	2	.	1	7	2	.	19
Eucinostomus spp.	Eucinostomus mojarras	173	25	23	8	12	42	1,228	991	121	1,125	814	22	4,584
Eucinostomus gula	Silver jenny	17	18	18	3	19	17	14	136	10	164	144	20	580
Eucinostomus harengulus	Tidewater mojarra	62	96	90	52	73	43	163	293	.	537	198	.	1,607
Orthopristis chrysoptera	Pigfish	.	.	.	1	10	14	4	.	.	.	1	.	30
Lagodon rhomboides	Pinfish	261	71	281	95	841	696	136	174	50	251	40	7	2,903
Archosargus probatocephalus	Sheepshead	.	.	.	.	1	.	1	.	.	.	.	.	2
Cynoscion nebulosus	Spotted seatrout	.	.	1	.	.	10	11	9	6	38	.	.	75
Bairdiella chrysoura	Silver perch	.	.	.	.	20	10	2	9	.	5	1	.	47
Leiostomus xanthurus	Spot	16	52	421	2	184	81	1	17	.	1	.	.	775
Pogonias cromis	Black drum	.	.	.	.	.	.	1	.	.	.	.	.	1
Sciaenops ocellatus	Red drum	1	.	.	.	1	.	.	1	1	17	9	9	39
Elassoma evergladei	Everglades pygmy sunfish	.	.	.	.	.	3	.	.	.	.	.	.	3
Mugil cephalus	Striped mullet	224	11	29	2	1	.	.	.	1	.	.	4	272
Mugil curema	White mullet	.	.	.	.	1	1	.	.	.	.	.	.	2
Mugil gyrans	Whirligig mullet	.	.	1	.	.	.	.	.	.	1	.	.	2
Chasmodes saburrae	Florida blenny	1	.	.	.	3	1	.	.	1	4	1	1	12
Hypleurochilus caudovittatus	Zebratail blenny	.	.	.	.	.	.	.	.	.	.	2	.	2
Paraclinus fasciatus	Banded blenny	.	.	.	.	.	.	1	.	.	.	2	.	3

Table B3. Page 5 of 5.

Seine catch by month (August 2005 through July 2007).

Number of monthly samples is indicated in parentheses.

Scientific name	Common Name	Jan (24)	Feb (24)	Mar (24)	Apr (12)	May (24)	Jun (24)	Jul (22)	Aug (26)	Sep (12)	Oct (24)	Nov (24)	Dec (12)	Total (252)
Gobiosoma spp.	Gobiosoma gobies	2	5	3	4	.	.	.	7	.	9	2	1	33
Gobiosoma bosc	Naked goby	2	4	5	3	7	5	.	4	.	6	2	3	41
Gobiosoma robustum	Code goby	4	3	3	21	11	12	2	4	.	2	1	3	66
Microgobius gulosus	Clown goby	7	22	42	22	73	71	97	139	1	179	20	24	697
Paralichthys albigutta	Gulf flounder	.	.	5	.	1	2	.	1	.	.	.	.	9
Achiridae spp.	American soles	.	.	.	.	.	.	.	.	.	4	15	.	19
Symphurus plagiusa	Blackcheek tonguefish	1	.	.	.	1	.	2	2	.	8	2	1	17
Trinectes maculatus	Hogchoker	8	16	24	1	.	2	5	13	.	80	11	.	160
Achirus lineatus	Lined sole	1	.	.	.	1	.	2	.	.	9	1	.	14
Monacanthus ciliatus	Fringed filefish	.	.	.	.	.	.	.	.	.	.	1	.	1
Stephanolepis hispidus	Planehead filefish	3	.	.	.	.	.	.	.	.	.	1	.	4
Sphoeroides nephelus	Southern puffer	10	4	1	3	42	35	4	4	.	7	16	10	136
Chilomycterus schoepfii	Striped burrfish	.	.	.	.	1	2	.	.	.	.	.	.	3
Totals		4,835	1,864	2,301	685	5,489	10,613	16,609	22,615	2,505	15,557	5,497	996	89,566

Table B4. Page 1 of 3.

Trawl catch by month (August 2005 through July 2007).

Number of monthly samples is indicated in parentheses.

Scientific name	Common Name	Jan (10)	Feb (10)	Mar (10)	Apr (5)	May (10)	Jun (10)	Jul (10)	Aug (10)	Sep (5)	Oct (10)	Nov (10)	Dec (5)	Total (105)
Argopecten spp.	Scallops	.	.	4	.	.	.	.	.	.	.	.	.	4
Farfantepenaeus duorarum	Pink shrimp	38	11	62	2	9	25	170	305	5	54	34	5	720
Palaemonetes spp.	Palaemonetes grass shrimps	1	3	2	11	.	4	4	1	.	5	71	101	203
Palaemonetes intermedius	Brackish grass shrimp	1,290	2,706	802	161	334	532	259	245	147	634	274	245	7,629
Palaemonetes paludosus	Riverine grass shrimp	.	.	.	.	.	11	.	.	.	.	.	.	11
Palaemonetes pugio	Daggerblade grass shrimp	121	.	.	.	.	.	.	.	.	.	.	.	121
Palaemonetes vulgaris	Marsh grass shrimp	.	.	.	.	.	.	.	.	.	.	15	.	15
Periclimenes longicaudatus	Longtail grass shrimp	.	.	21	.	.	.	.	.	.	.	.	.	21
Palaemon floridanus	Florida grass shrimps	.	11	.	.	.	.	.	.	.	.	.	.	11
Alpheidae spp.	Snapping shrimp	3	11	70	24	8	2	16	8	.	7	8	.	157
Callinectes sapidus	Blue crab	151	234	303	30	150	142	118	85	52	102	126	78	1,571
Portunus spp.	Portunus crabs	.	.	.	.	.	17	.	.	.	.	.	.	17
Dasyatis sabina	Atlantic stingray	1	.	3	1	1	5	3	.	3	.	5	.	22
Dasyatis say	Bluntnose stingray	.	.	.	.	.	.	.	2	.	.	.	.	2
Lepisosteus osseus	Longnose gar	2	3	.	2	2	1	.	.	4	1	2	.	17
Lepisosteus platyrhincus	Florida gar	.	.	.	.	.	.	2	.	.	.	.	.	2
Elops saurus	Ladyfish	.	.	2	.	.	.	.	.	.	.	.	.	2
Myrophis punctatus	Speckled worm eel	.	.	.	.	.	.	.	.	.	1	.	.	1
Anchoa mitchilli	Bay anchovy	5	.	.	.	.	.	.	.	274	2	.	23	304
Synodus foetens	Inshore lizardfish	11	2	.	.	14	38	17	7	1	8	17	7	122
Ariopsis felis	Hardhead catfish	.	.	1	.	3	1	2	1	3	.	.	.	11
Opsanus beta	Gulf toadfish	9	2	14	12	16	11	12	64	.	10	1	3	154
Ogcocephalus spp.	Batfishes	.	.	.	.	.	.	.	.	.	.	1	.	1

Table B4. Page 2 of 3.

Trawl catch by month (August 2005 through July 2007).

Number of monthly samples is indicated in parentheses.

Scientific name	Common Name	Jan (24)	Feb (24)	Mar (24)	Apr (12)	May (24)	Jun (24)	Jul (22)	Aug (26)	Sep (12)	Oct (24)	Nov (24)	Dec (12)	Total (252)
Ogcocephalus cubifrons	Polka-dot batfish	.	.	1	.	2	2	.	4	.	2	3	.	14
Urophycis floridana	Southern hake	.	.	1	.	.	.	.	.	.	.	.	.	1
Lucania parva	Rainwater killifish	16	73	36	2	14	7	15	31	18	81	13	15	321
Syngnathus louisianae	Chain pipefish	2	.	.	.	2	3	.	.	.	.	8	1	16
Syngnathus scovelli	Gulf pipefish	16	25	17	2	14	24	8	5	1	6	2	6	126
Hippocampus erectus	Lined seahorse	.	.	.	.	.	1	.	.	.	1	1	.	3
Hippocampus zosterae	Dwarf seahorse	.	.	.	.	.	.	.	.	.	1	.	.	1
Anarchopterus criniger	Fringed pipefish	.	.	.	.	1	.	.	.	.	1	2	.	4
Prionotus scitulus	Leopard searobin	.	.	.	1	.	.	1	3	.	.	.	.	5
Prionotus tribulus	Bighead searobin	18	7	5	1	2	5	1	3	.	9	25	11	87
Echeneis spp.	Sharksuckers	.	.	.	.	.	.	.	.	.	.	1	.	1
Chloroscombrus chrysurus	Atlantic bumper	.	.	.	.	.	.	1	.	.	8	.	.	9
Lutjanus griseus	Gray snapper	1	2	3	.	1	2	1	3	4	15	3	.	35
Eucinostomus spp.	Eucinostomus mojarras	11	3	.	.	.	2	881	390	13	512	300	1	2,113
Eucinostomus gula	Silver jenny	27	5	7	.	.	21	11	5	8	75	27	37	223
Eucinostomus harengulus	Tidewater mojarra	86	2	1	.	.	1	28	106	.	14	11	.	249
Haemulon plumierii	White grunt	.	.	.	.	2	.	.	.	.	.	.	.	2
Orthopristis chrysoptera	Pigfish	.	.	.	.	5	49	.	1	21	.	.	.	76
Lagodon rhomboides	Pinfish	80	298	628	82	351	224	5	10	67	32	8	22	1,807
Archosargus probatocephalus	Sheepshead	2	1	1	.	.	.	.	.	.	1	.	.	5
Cynoscion nebulosus	Spotted seatrout	3	.	.	.	.	1	4	1	5	4	.	.	18
Bairdiella chrysoura	Silver perch	3	.	1	.	8	27	12	.	15	.	.	1	67
Leiostomus xanthurus	Spot	1	3	7	35	3	2	.	.	3	1	.	8	63

Table B4. Page 3 of 3.

Trawl catch by month (August 2005 through July 2007).

Number of monthly samples is indicated in parentheses.

Scientific name	Common Name	Jan (24)	Feb (24)	Mar (24)	Apr (12)	May (24)	Jun (24)	Jul (22)	Aug (26)	Sep (12)	Oct (24)	Nov (24)	Dec (12)	Total (252)
Menticirrhus saxatilis	Northern kingfish	.	.	.	1	.	.	.	.	.	.	.	.	1
Pogonias cromis	Black drum	.	.	.	.	.	.	.	.	.	1	.	.	1
Sciaenops ocellatus	Red drum	.	.	.	.	.	.	.	.	.	2	.	.	2
Chaetodipterus faber	Atlantic spadefish	.	.	.	.	1	.	.	4	.	1	.	.	6
Chasmodes saburrae	Florida blenny	3	2	6	2	2	3	2	.	1	1	.	2	24
Hypleurochilus caudovittatus	Zebratail blenny	.	.	.	.	.	.	.	.	.	3	.	.	3
Paraclinus fasciatus	Banded blenny	.	2	1	.	1	.	1	.	.	.	.	1	6
Gobiosoma spp.	Gobiosoma gobies	5	15	36	9	1	.	12	12	1	23	3	2	119
Gobiosoma bosc	Naked goby	1	5	1	1	.	.	.	.	.	.	.	.	8
Gobiosoma robustum	Code goby	5	20	127	17	8	6	3	.	.	3	1	.	190
Microgobius gulosus	Clown goby	2	2	16	1	8	11	47	14	.	9	2	.	112
Etropus crossotus	Fringed flounder	.	.	.	1	.	.	2	.	.	.	1	.	4
Paralichthys albigutta	Gulf flounder	2	.	1	1	9	6	.	.	2	4	1	.	26
Symphurus plagiusa	Blackcheek tonguefish	4	1	41	3	13	8	24	9	3	4	8	8	126
Trinectes maculatus	Hogchoker	15	4	7	9	1	.	25	75	.	4	.	.	140
Achirus lineatus	Lined sole	.	.	3	.	.	7	2	1	.	1	.	.	14
Stephanolepis hispidus	Planehead filefish	.	.	.	.	1	.	.	.	.	.	3	.	4
Lactophrys spp.	Three-angled trunkfishes	.	.	.	.	.	.	.	.	.	1	.	.	1
Acanthostracion quadricornis	Scrawled cowfish	.	.	.	.	1	.	.	2	.	1	.	.	4
Sphoeroides nephelus	Southern puffer	9	2	2	2	33	34	3	3	.	.	33	5	126
Chilomycterus schoepfii	Striped burrfish	.	.	.	.	.	2	.	.	.	.	.	.	2
Totals		1,944	3,455	2,233	413	1,021	1,237	1,692	1,400	651	1,645	1,010	582	17,283

Table B5, page 1 of 2.

Location-specific seine catch.

Data are presented as mean number per 100m^2.

Organisms are listed in phylogenetic order.

Scientific name	Common Name	-3.5 – -0.1 km (84)	0.0–2.4 km (42)	2.5–4.8 km (42)	4.9–6.8 km (42)	6.9–8.6 km (42)	Total (252)
Farfantepenaeus duorarum	Pink shrimp	3.7900	1.6800	2.0300	4.1700	0.0400	2.5800
Palaemonetes spp.	Palaemonetes grass shrimps	0.2300	0.1100	0.2800	0.1800	0.2500	0.2100
Palaemonetes intermedius	Brackish grass shrimp	56.4600	33.4000	70.1700	100.0400	2.2400	53.1300
Palaemonetes paludosus	Riverine grass shrimp	0.0100	0.0000	0.0000	0.2500	2.8400	0.5200
Palaemonetes pugio	Daggerblade grass shrimp	0.0000	0.0000	0.0000	0.2800	0.0000	0.0500
Palaemonetes vulgaris	Marsh grass shrimp	0.1800	0.0000	0.0000	0.1400	0.0000	0.0800
Periclimenes longicaudatus	Longtail grass shrimp	0.1600	0.0000	0.0000	0.0000	0.0000	0.0500
Palaemon floridanus	Florida grass shrimps	0.2000	0.0000	0.0000	0.0000	0.0000	0.0700
Alpheidae spp.	Snapping shrimp	0.2100	0.0000	0.0000	0.0000	0.0000	0.0700
Hippolyte zostericola	Zostera shrimp	0.0200	0.0000	0.0000	0.0000	0.0000	0.0100
Callinectes sapidus	Blue crab	2.5900	5.9900	12.1100	28.8900	1.3000	8.9100
Portunus spp.	Portunus crabs	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000
Dasyatis sabina	Atlantic stingray	0.0200	0.0000	0.0000	0.0000	0.0000	0.0100
Dasyatis say	Bluntnose stingray	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000
Myrophis punctatus	Speckled worm eel	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000
Brevoortia spp.	Menhadens	0.0000	0.0400	0.0400	3.1900	0.0000	0.5400
Opisthonema oglinum	Atlantic thread herring	1.9100	0.0000	0.0000	0.0000	0.0000	0.6400
Harengula jaguana	Scaled sardine	0.0200	0.0000	0.0400	0.0000	0.0000	0.0100
Anchoa hepsetus	Striped anchovy	3.3000	0.0000	0.0400	0.0000	0.0000	1.1100
Anchoa mitchilli	Bay anchovy	9.9900	13.1000	9.0700	184.1000	0.0400	37.7100
Anchoa lyolepis	Dusky anchovy	0.0000	0.0000	0.0700	0.0000	0.0000	0.0100
Synodus foetens	Inshore lizardfish	1.0800	0.4600	0.2800	0.0000	0.0000	0.4800
Notemigonus crysoleucas	Golden shiner	0.0000	0.0000	0.0000	1.7200	5.4300	1.1900
Notropis harperi	Redeye chub	0.0000	0.0000	0.0000	0.0000	0.3500	0.0600
Notropis petersoni	Coastal shiner	0.0000	0.0000	0.0000	6.4800	164.6400	28.5200
Erimyzon sucetta	Lake chubsucker	0.0000	0.0000	0.0000	0.0700	1.4700	0.2600
Bagre marinus	Gafftopsail catfish	0.0200	0.0000	0.0000	0.0000	0.0000	0.0100
Ariopsis felis	Hardhead catfish	0.0500	0.0000	0.0000	0.0000	0.0000	0.0200
Opsanus beta	Gulf toadfish	0.3100	0.4600	0.3200	0.1100	0.0000	0.2500
Ogcocephalus cubifrons	Polka-dot batfish	0.0200	0.0000	0.0000	0.0000	0.0000	0.0100
Hyporhamphus meeki	False silverstripe halfbeak	0.0300	0.0000	0.0000	0.0000	0.0000	0.0100

Table B5, page 2 of 3.

Location-specific seine catch.

Data are presented as mean number per $100m^2$.

Organisms are listed in phylogenetic order.

Scientific name	Common Name	-3.5 – -0.1 km (84)	0.0–2.4 km (42)	2.5–4.8 km (42)	4.9–6.8 km (42)	6.9–8.6 km (42)	Total (252)
Strongylura spp.	Needlefishes	0.0000	0.0000	0.0400	0.0700	0.0400	0.0200
Strongylura marina	Atlantic needlefish	0.0300	0.0000	0.0400	0.0000	0.0000	0.0100
Strongylura notata	Redfin needlefish	1.3800	0.9100	0.4600	0.2800	0.0700	0.7500
Strongylura timucu	Timucu	0.2500	0.1400	0.4600	0.6300	2.2400	0.6600
Cyprinodon variegatus	Sheepshead minnow	0.0700	0.1100	0.4200	40.1600	1.0200	6.9700
Fundulus confluentus	Marsh killifish	0.0000	0.0000	0.0000	0.0400	0.0000	0.0100
Fundulus grandis	Gulf killifish	1.2100	6.0600	4.4800	12.9600	1.6500	4.5900
Fundulus similis	Longnose killifish	0.0200	0.0700	0.0000	0.0000	0.0000	0.0200
Fundulus seminolis	Seminole killifish	0.0000	0.0000	0.0000	7.3500	3.4300	1.8000
Lucania parva	Rainwater killifish	22.0600	18.8400	60.1900	639.6400	219.3300	163.6800
Lucania goodei	Bluefin killifish	0.0000	0.0000	0.1400	2.8700	86.6900	14.9500
Floridichthys carpio	Goldspotted killifish	5.1300	0.4200	0.2500	0.3500	0.0400	1.8800
Gambusia holbrooki	Eastern mosquitofish	0.0000	0.0000	0.3500	1.2300	3.8200	0.9000
Poecilia latipinna	Sailfin molly	0.0000	0.5300	1.7200	12.4300	0.6000	2.5400
Heterandria formosa	Least killifish	0.0000	0.0000	0.0000	0.0000	0.4200	0.0700
Membras martinica	Rough silverside	0.0200	0.0000	0.0000	0.0000	0.0000	0.0100
Menidia spp.	Silversides	11.7000	20.8300	153.7800	287.9600	52.4500	89.7400
Syngnathus louisianae	Chain pipefish	0.0200	0.0000	0.0400	0.0000	0.0000	0.0100
Syngnathus scovelli	Gulf pipefish	1.0700	0.1800	0.3900	0.5600	1.6800	0.8200
Hippocampus erectus	Lined seahorse	0.0200	0.0000	0.0000	0.0000	0.0000	0.0100
Anarchopterus criniger	Fringed pipefish	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000
Prionotus scitulus	Leopard searobin	0.0700	0.0000	0.0000	0.0000	0.0000	0.0200
Prionotus tribulus	Bighead searobin	0.3500	0.3200	0.0400	0.0000	0.0000	0.1700
Lepomis spp.	Sunfishes	0.0000	0.0000	0.0000	0.5600	1.1700	0.2900
Lepomis microlophus	Redear sunfish	0.0000	0.0000	0.0000	0.1100	0.1100	0.0400
Lepomis punctatus	Spotted sunfish	0.0000	0.0400	0.3900	2.9100	6.8100	1.6900
Micropterus salmoides	Largemouth bass	0.0000	0.0000	0.0700	0.2500	5.9200	1.0400
Caranx hippos	Crevalle jack	0.0000	0.0400	0.0000	0.0000	0.0000	0.0100
Chloroscombrus chrysurus	Atlantic bumper	0.0300	0.0000	0.0000	0.0000	0.0000	0.0100
Oligoplites saurus	Leatherjack	0.1200	0.1100	0.0700	0.1400	0.0400	0.1000
Selene vomer	Lookdown	0.0200	0.0000	0.0000	0.0000	0.0000	0.0100
Trachinotus falcatus	Permit	0.0000	0.0000	0.0400	0.0000	0.0000	0.0100
Lutjanus griseus	Gray snapper	0.0900	0.1800	0.1400	0.0700	0.1100	0.1100

Table B5, page 3 of 3.

Location-specific seine catch.

Data are presented as mean number per $100m^2$.

Organisms are listed in phylogenetic order.

Scientific name	Common Name	-3.5 – -0.1 km (84)	0.0–2.4 km (42)	2.5–4.8 km (42)	4.9–6.8 km (42)	6.9–8.6 km (42)	Total (252)
Eucinostomus spp.	Eucinostomus mojarras	17.4300	18.8700	19.9500	71.3900	9.0000	25.6800
Eucinostomus gula	Silver jenny	7.2700	3.5700	0.4900	0.0000	0.0000	3.1000
Eucinostomus harengulus	Tidewater mojarra	2.1700	4.7600	11.4900	16.2100	19.3300	9.3600
Orthopristis chrysoptera	Pigfish	0.2800	0.0000	0.0000	0.0000	0.0000	0.0900
Lagodon rhomboides	Pinfish	17.4400	14.6000	20.3800	6.6500	4.7300	13.5400
Archosargus probatocephalus	Sheepshead	0.0000	0.0700	0.0000	0.0000	0.0000	0.0100
Cynoscion nebulosus	Spotted seatrout	0.6500	0.0700	0.3200	0.3500	0.0000	0.3400
Bairdiella chrysoura	Silver perch	0.4800	0.0000	0.0400	0.0000	0.0000	0.1700
Leiostomus xanthurus	Spot	2.6500	6.7900	6.9700	3.4000	0.0000	3.7400
Pogonias cromis	Black drum	0.0200	0.0000	0.0000	0.0000	0.0000	0.0100
Sciaenops ocellatus	Red drum	0.0400	0.3200	0.3900	0.6000	0.0000	0.2300
Elassoma evergladei	Everglades pygmy sunfish	0.0000	0.0000	0.0000	0.0000	0.1100	0.0200
Mugil cephalus	Striped mullet	4.0700	0.4600	0.8800	0.0400	0.0000	1.5800
Mugil curema	White mullet	0.0200	0.0400	0.0000	0.0000	0.0000	0.0100
Mugil gyrans	Whirligig mullet	0.0200	0.0400	0.0000	0.0000	0.0000	0.0100
Chasmodes saburrae	Florida blenny	0.1200	0.0000	0.0000	0.0000	0.0000	0.0400
Hypleurochilus caudovittatus	Zebratail blenny	0.0200	0.0000	0.0000	0.0000	0.0000	0.0100
Paraclinus fasciatus	Banded blenny	0.0300	0.0000	0.0000	0.0000	0.0000	0.0100
Gobiosoma spp.	Gobiosoma gobies	0.2400	0.1800	0.0700	0.2100	0.0700	0.1700
Gobiosoma bosc	Naked goby	0.1700	0.3200	0.4200	0.2800	0.0000	0.2300
Gobiosoma robustum	Code goby	0.7900	0.2800	0.0000	0.0400	0.0000	0.3200
Microgobius gulosus	Clown goby	3.6600	2.5900	3.6100	3.7500	2.6300	3.3100
Paralichthys albigutta	Gulf flounder	0.0800	0.0700	0.0000	0.0000	0.0000	0.0400
Achiridae spp.	American soles	0.0000	0.0000	0.2800	0.3900	0.0000	0.1100
Symphurus plagiusa	Blackcheek tonguefish	0.1100	0.0700	0.0700	0.0000	0.0000	0.0600
Trinectes maculatus	Hogchoker	0.0000	0.0000	0.1800	2.5200	2.9100	0.9300
Achirus lineatus	Lined sole	0.1100	0.0700	0.0400	0.0000	0.0000	0.0500
Monacanthus ciliatus	Fringed filefish	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000
Stephanolepis hispidus	Planehead filefish	0.0300	0.0000	0.0000	0.0000	0.0000	0.0100
Sphoeroides nephelus	Southern puffer	1.4500	0.3200	0.2100	0.0000	0.0000	0.5700
Chilomycterus schoepfii	Striped burrfish	0.0200	0.0400	0.0000	0.0000	0.0000	0.0100
Totals		183.6200	157.4600	383.6500	1,445.9400	604.9400	493.2000

Table B6, page 1 of 2.

Location-specific trawl catch.

Data are presented as mean number per 100m^2.

Organisms are listed in phylogenetic order.

Scientific name	Common Name	-3.5 – -0.1 km (84)	0.0–2.4 km (42)	2.5–4.8 km (42)	Total (105)
Argopecten spp.	Scallops	0.0200	0.0000	0.0000	0.0100
Farfantepenaeus duorarum	Pink shrimp	1.3600	0.9600	0.6100	0.9900
Palaemonetes spp.	Palaemonetes grass shrimps	0.5700	0.2600	0.0400	0.3000
Palaemonetes intermedius	Brackish grass shrimp	20.9800	8.9800	2.3900	11.1100
Palaemonetes paludosus	Riverine grass shrimp	0.0000	0.0300	0.0200	0.0100
Palaemonetes pugio	Daggerblade grass shrimp	0.4200	0.0000	0.0000	0.1600
Palaemonetes vulgaris	Marsh grass shrimp	0.0000	0.0800	0.0000	0.0200
Periclimenes longicaudatus	Longtail grass shrimp	0.0800	0.0000	0.0000	0.0300
Palaemon floridanus	Florida grass shrimps	0.0000	0.0000	0.0700	0.0200
Alpheidae spp.	Snapping shrimp	0.5700	0.0400	0.0000	0.2200
Callinectes sapidus	Blue crab	2.2000	2.4200	2.8000	2.4700
Portunus spp.	Portunus crabs	0.0600	0.0000	0.0000	0.0200
Dasyatis sabina	Atlantic stingray	0.0400	0.0300	0.0200	0.0300
Dasyatis say	Bluntnose stingray	0.0100	0.0000	0.0000	0.0000
Lepisosteus osseus	Longnose gar	0.0100	0.0500	0.0200	0.0200
Lepisosteus platyrhincus	Florida gar	0.0000	0.0100	0.0000	0.0000
Elops saurus	Ladyfish	0.0100	0.0000	0.0000	0.0000
Myrophis punctatus	Speckled worm eel	0.0000	0.0100	0.0000	0.0000
Anchoa mitchilli	Bay anchovy	0.0600	0.0400	1.2900	0.4900
Synodus foetens	Inshore lizardfish	0.2600	0.2100	0.0500	0.1700
Ariopsis felis	Hardhead catfish	0.0200	0.0100	0.0300	0.0200
Opsanus beta	Gulf toadfish	0.4000	0.1300	0.0700	0.2100
Ogcocephalus spp.	Batfishes	0.0000	0.0100	0.0000	0.0000
Ogcocephalus cubifrons	Polka-dot batfish	0.0500	0.0000	0.0000	0.0200
Urophycis floridana	Southern hake	0.0000	0.0000	0.0000	0.0000
Lucania parva	Rainwater killifish	0.3800	0.7300	0.3800	0.4800
Syngnathus louisianae	Chain pipefish	0.0400	0.0200	0.0100	0.0200
Syngnathus scovelli	Gulf pipefish	0.2600	0.1200	0.1800	0.1900
Hippocampus erectus	Lined seahorse	0.0100	0.0000	0.0000	0.0000
Hippocampus zosterae	Dwarf seahorse	0.0000	0.0000	0.0000	0.0000
Anarchopterus criniger	Fringed pipefish	0.0100	0.0000	0.0000	0.0100
Prionotus scitulus	Leopard searobin	0.0200	0.0000	0.0000	0.0100
Prionotus tribulus	Bighead searobin	0.1600	0.1200	0.1000	0.1300
Echeneis spp.	Sharksuckers	0.0000	0.0000	0.0000	0.0000
Chloroscombrus chrysurus	Atlantic bumper	0.0000	0.0000	0.0200	0.0100
Lutjanus griseus	Gray snapper	0.0300	0.0800	0.0400	0.0500
Eucinostomus spp.	Eucinostomus mojarras	1.0200	1.0800	5.9300	2.7700

Table B6, page 2 of 2.

Location-specific trawl catch.

Data are presented as mean number per 100m^2.

Organisms are listed in phylogenetic order.

Scientific name	Common Name	-3.5 – -0.1 km (84)	0.0–2.4 km (42)	2.5–4.8 km (42)	Total (105)
Eucinostomus gula	Silver jenny	0.5500	0.3800	0.0400	0.3200
Eucinostomus harengulus	Tidewater mojarra	0.0800	0.0700	0.8800	0.3600
Haemulon plumierii	White grunt	0.0100	0.0000	0.0000	0.0000
Orthopristis chrysoptera	Pigfish	0.2600	0.0000	0.0100	0.1000
Lagodon rhomboides	Pinfish	3.4600	1.1800	3.9600	3.0100
Archosargus probatocephalus	Sheepshead	0.0000	0.0300	0.0000	0.0100
Cynoscion nebulosus	Spotted seatrout	0.0400	0.0300	0.0000	0.0300
Bairdiella chrysoura	Silver perch	0.2100	0.0300	0.0200	0.0900
Leiostomus xanthurus	Spot	0.0400	0.0700	0.2300	0.1200
Menticirrhus saxatilis	Northern kingfish	0.0000	0.0000	0.0100	0.0000
Pogonias cromis	Black drum	0.0000	0.0000	0.0000	0.0000
Sciaenops ocellatus	Red drum	0.0000	0.0100	0.0000	0.0000
Chaetodipterus faber	Atlantic spadefish	0.0200	0.0000	0.0000	0.0100
Chasmodes saburrae	Florida blenny	0.0700	0.0300	0.0000	0.0400
Hypleurochilus caudovittatus	Zebratail blenny	0.0100	0.0000	0.0000	0.0000
Paraclinus fasciatus	Banded blenny	0.0200	0.0000	0.0000	0.0100
Gobiosoma spp.	Gobiosoma gobies	0.3600	0.1200	0.0200	0.1700
Gobiosoma bosc	Naked goby	0.0000	0.0100	0.0200	0.0100
Gobiosoma robustum	Code goby	0.6600	0.0900	0.0100	0.2700
Microgobius gulosus	Clown goby	0.2000	0.1400	0.1300	0.1600
Etropus crossotus	Fringed flounder	0.0100	0.0000	0.0100	0.0100
Paralichthys albigutta	Gulf flounder	0.0700	0.0200	0.0200	0.0400
Symphurus plagiusa	Blackcheek tonguefish	0.3100	0.2100	0.0400	0.1900
Trinectes maculatus	Hogchoker	0.0200	0.0700	0.4800	0.2000
Achirus lineatus	Lined sole	0.0300	0.0200	0.0100	0.0200
Stephanolepis hispidus	Planehead filefish	0.0100	0.0000	0.0000	0.0100
Lactophrys spp.	Three-angled trunkfishes	0.0000	0.0000	0.0000	0.0000
Acanthostracion quadricornis	Scrawled cowfish	0.0100	0.0000	0.0000	0.0100
Sphoeroides nephelus	Southern puffer	0.2100	0.2000	0.1600	0.1900
Chilomycterus schoepfii	Striped burrfish	0.0100	0.0000	0.0000	0.0000
Totals		35.7500	18.1100	20.1400	25.3800

Appendix C:

Length-frequency plots for selected taxa

***Farfantepenaeus duorarum* (pink shrimp)**

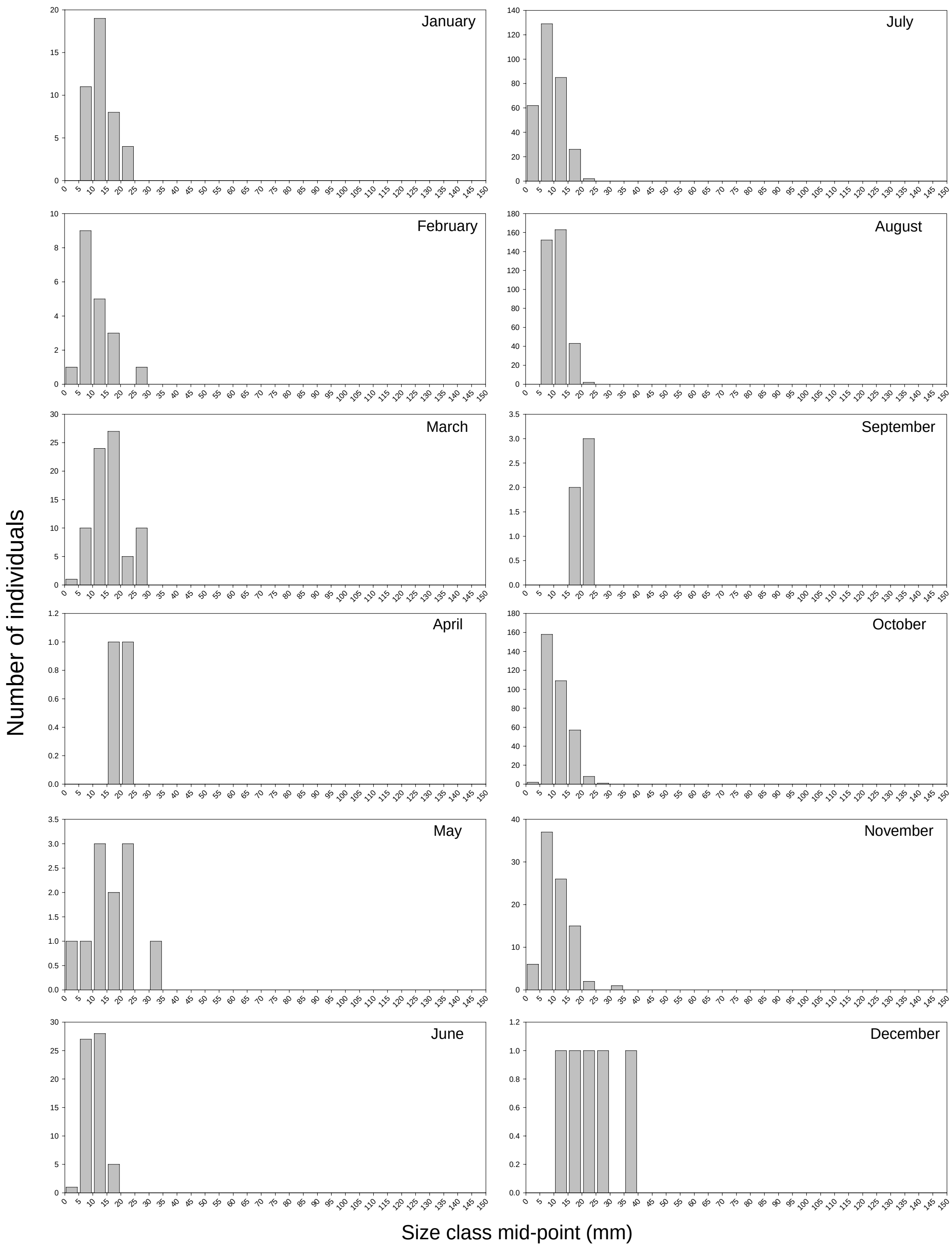


Fig. C1. Monthly length frequencies of pink shrimp collected in the Chassahowitzka River estuary.

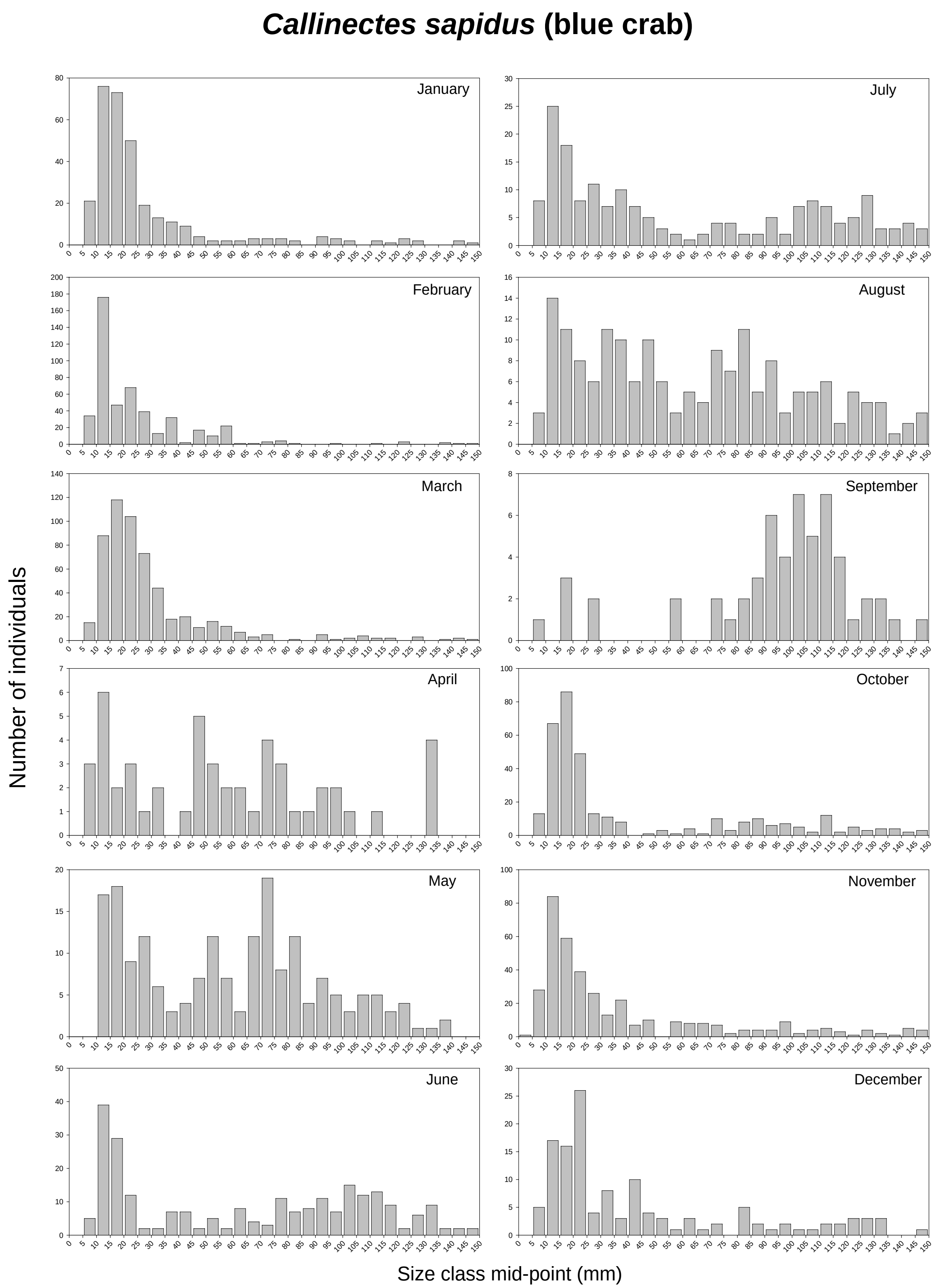


Fig. C2. Monthly length frequencies of blue crab collected in the Chassahowitzka River estuary.

Anchoa mitchilli (bay anchovy)

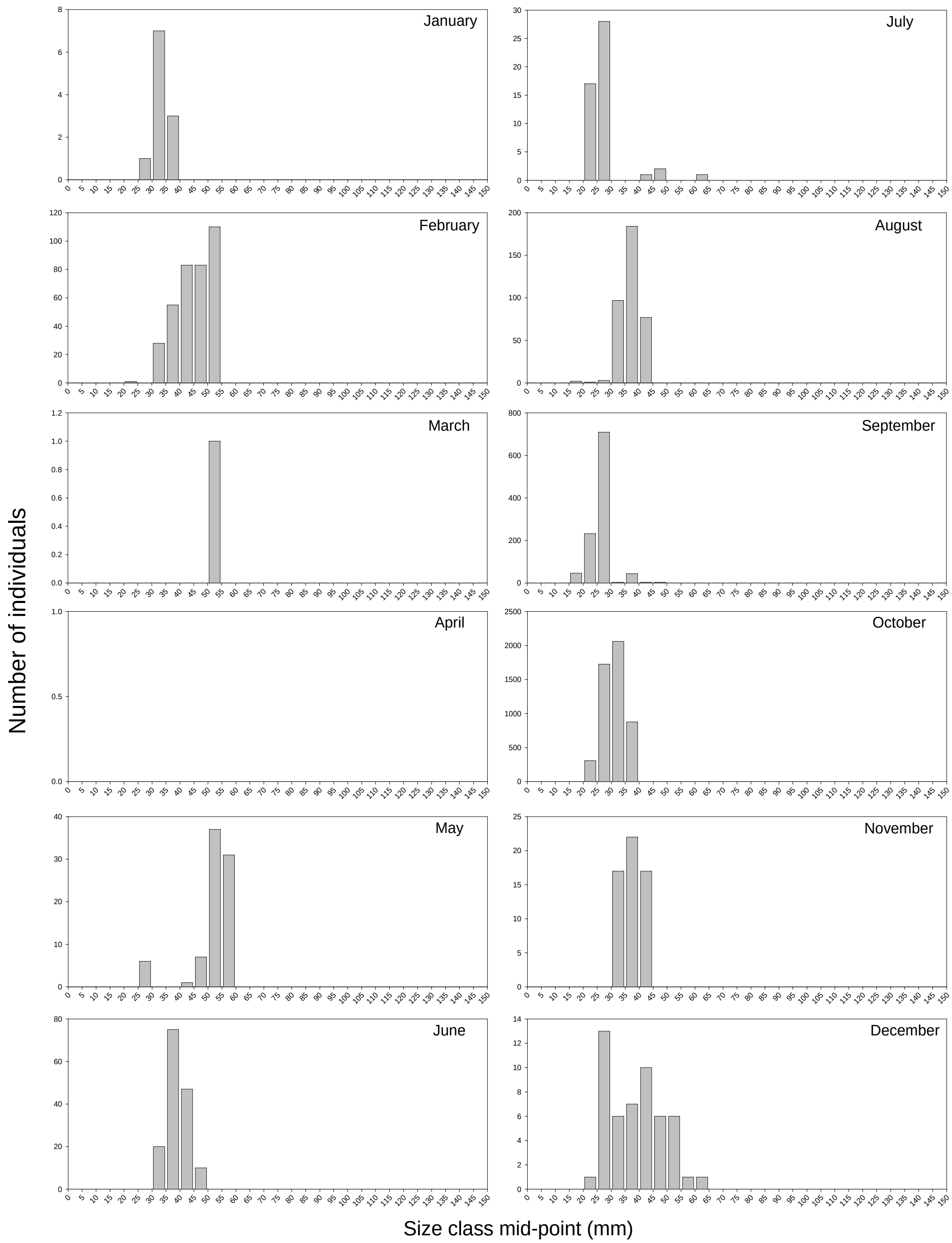


Fig. C3. Monthly length frequencies of bay anchovy collected in the Chassahowitzka River estuary.

Synodus foetens (inshore lizardfish)

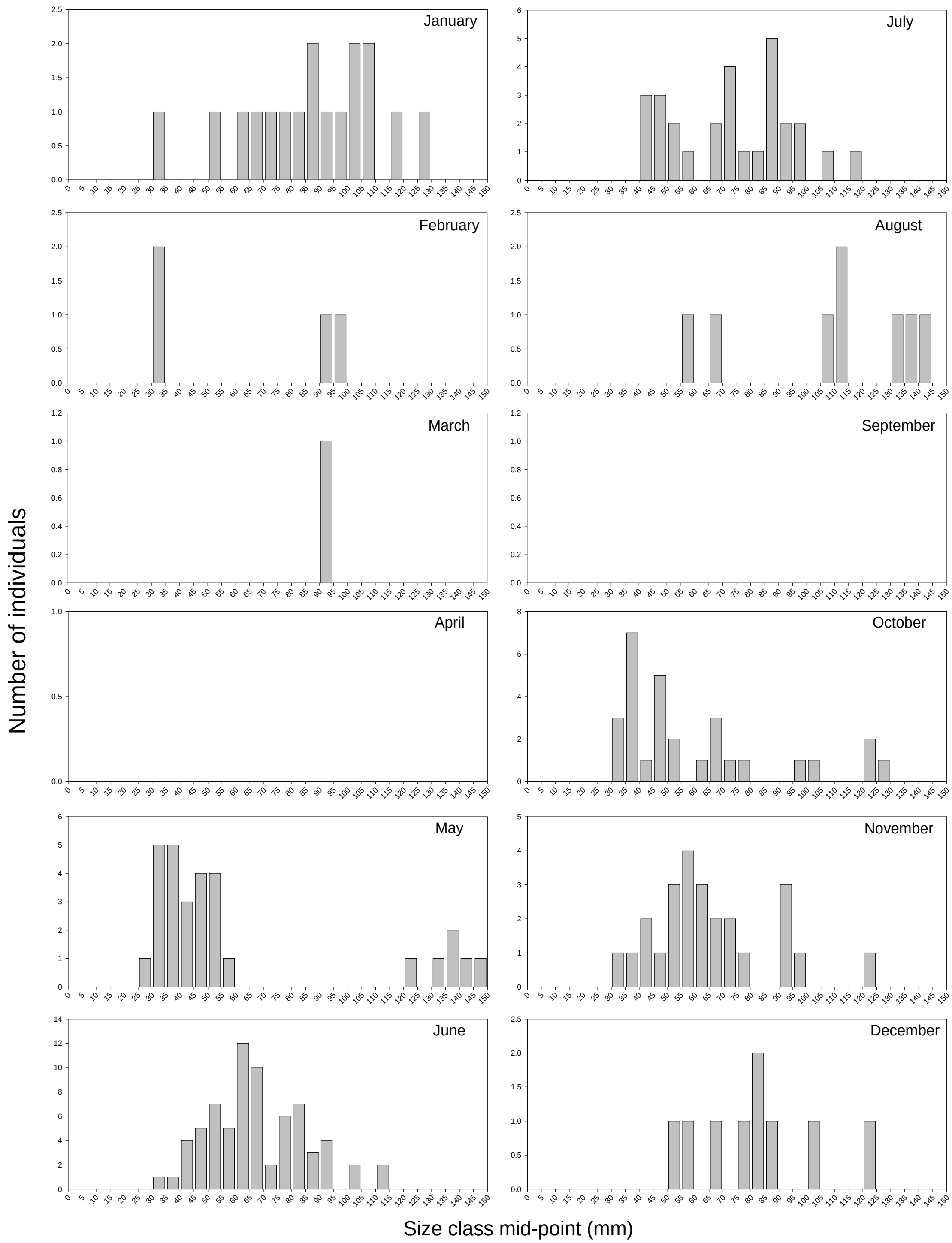


Fig. C4. Monthly length frequencies of inshore lizardfish collected in the Chassahowitzka River estuary.

Notropis petersoni (coastal shiner)

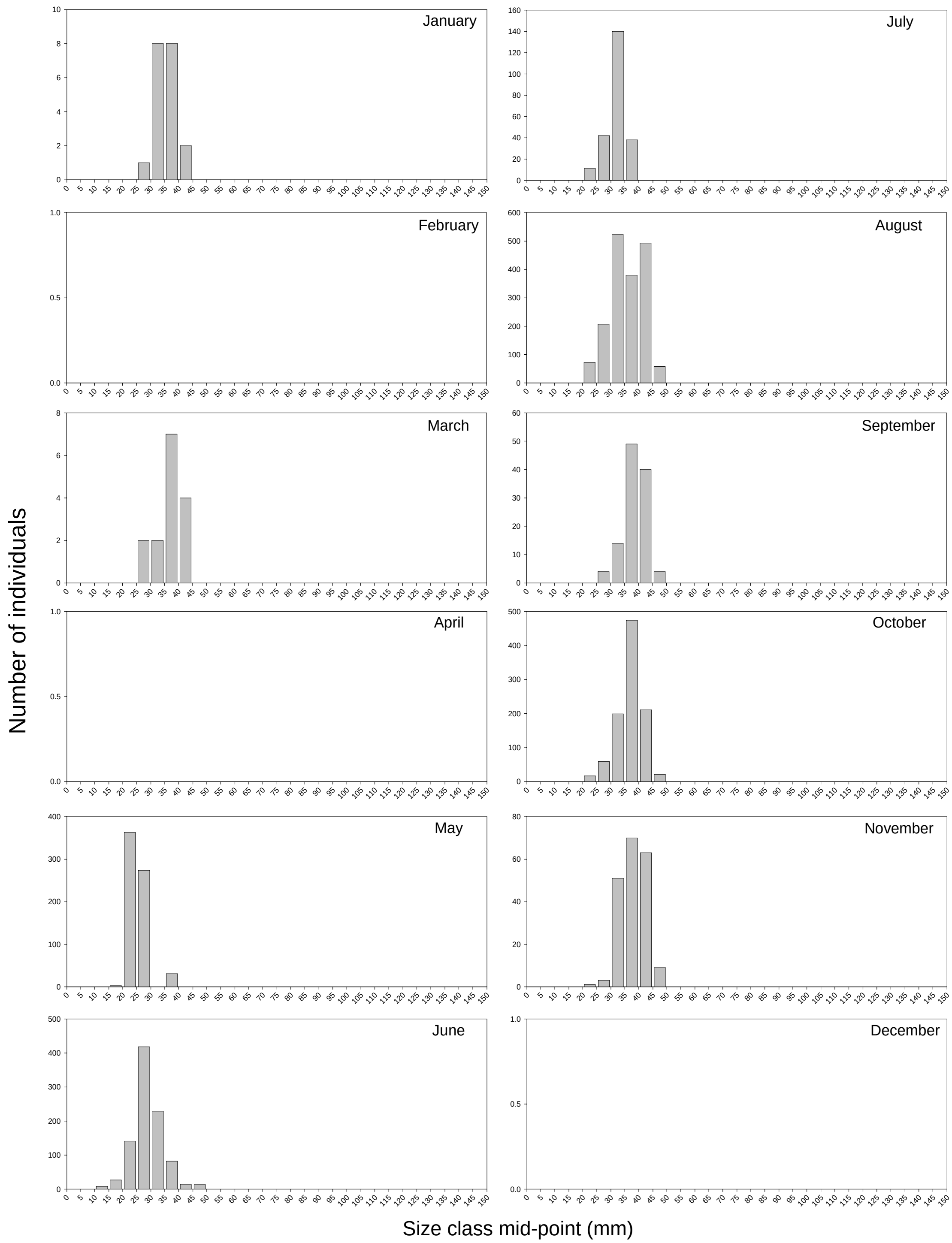


Fig. C5. Monthly length frequencies of coastal shiner collected in the Chassahowitzka River estuary.

Opsanus beta (Gulf toadfish)

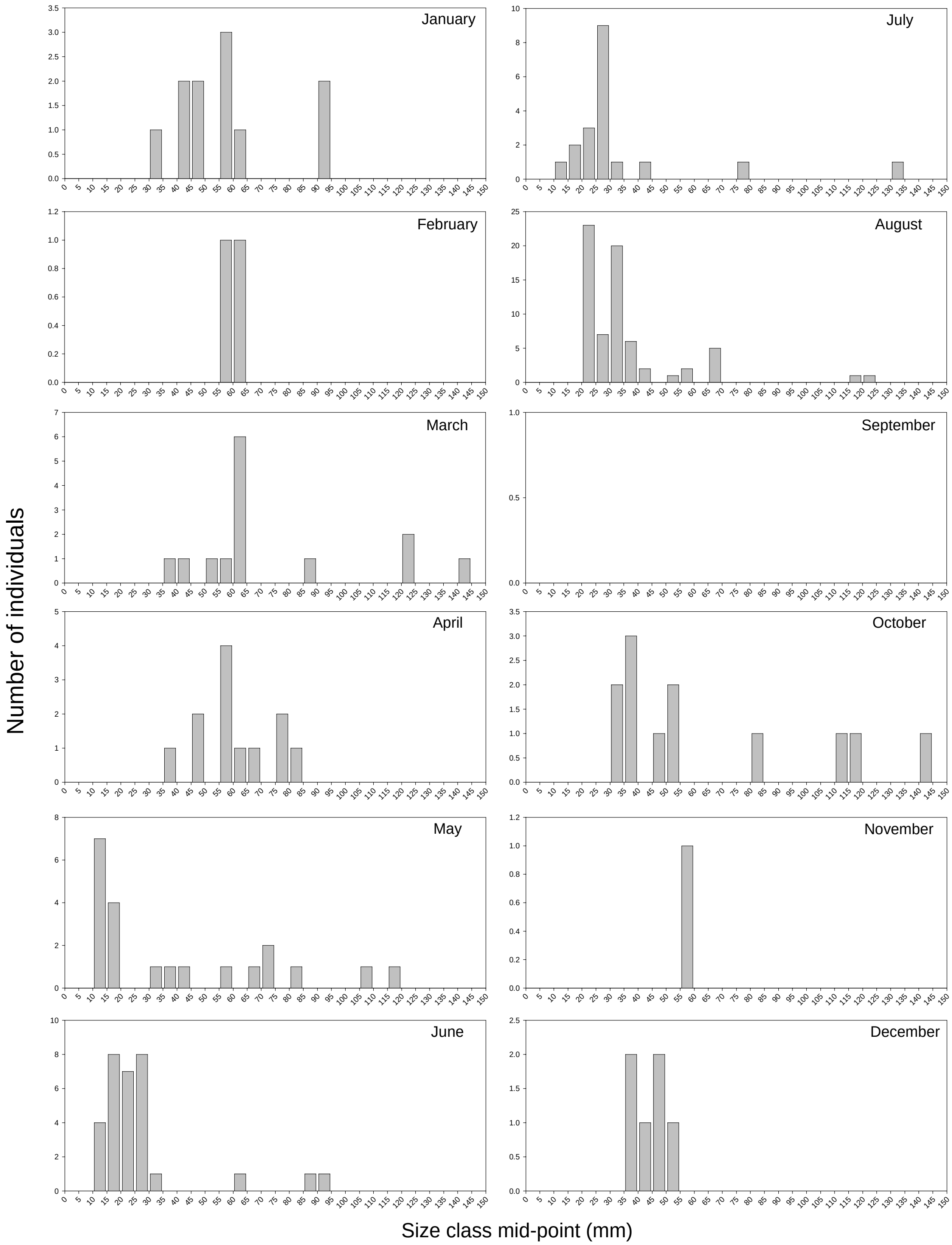


Fig. C6. Monthly length frequencies of gulf toadfish collected in the Chassahowitzka River estuary.

Strongylura notata (redfin needlefish)

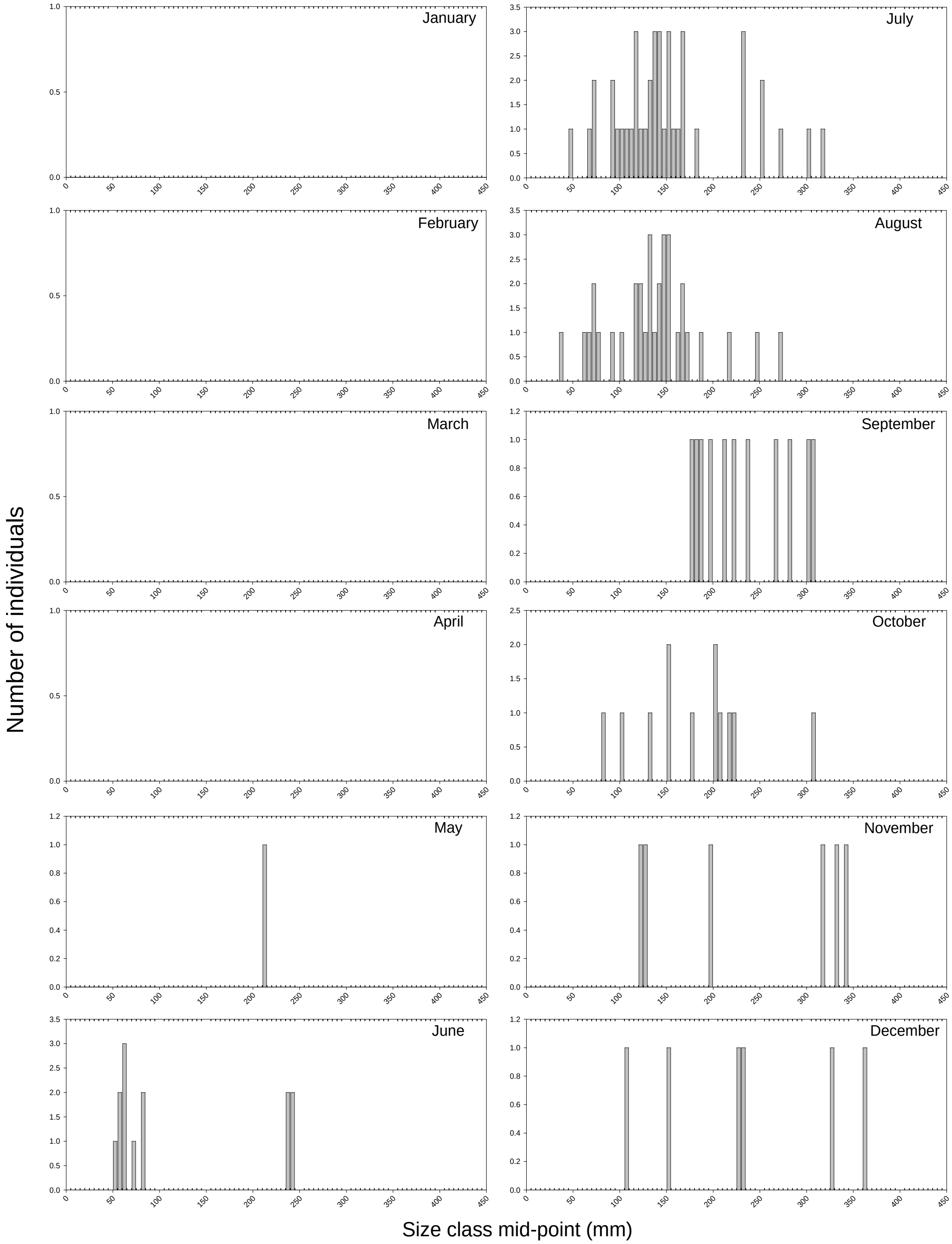


Fig. C7. Monthly length frequencies of redfin needlefish collected in the Chassahowitzka River estuary.

Strongylura timucu (timucu)

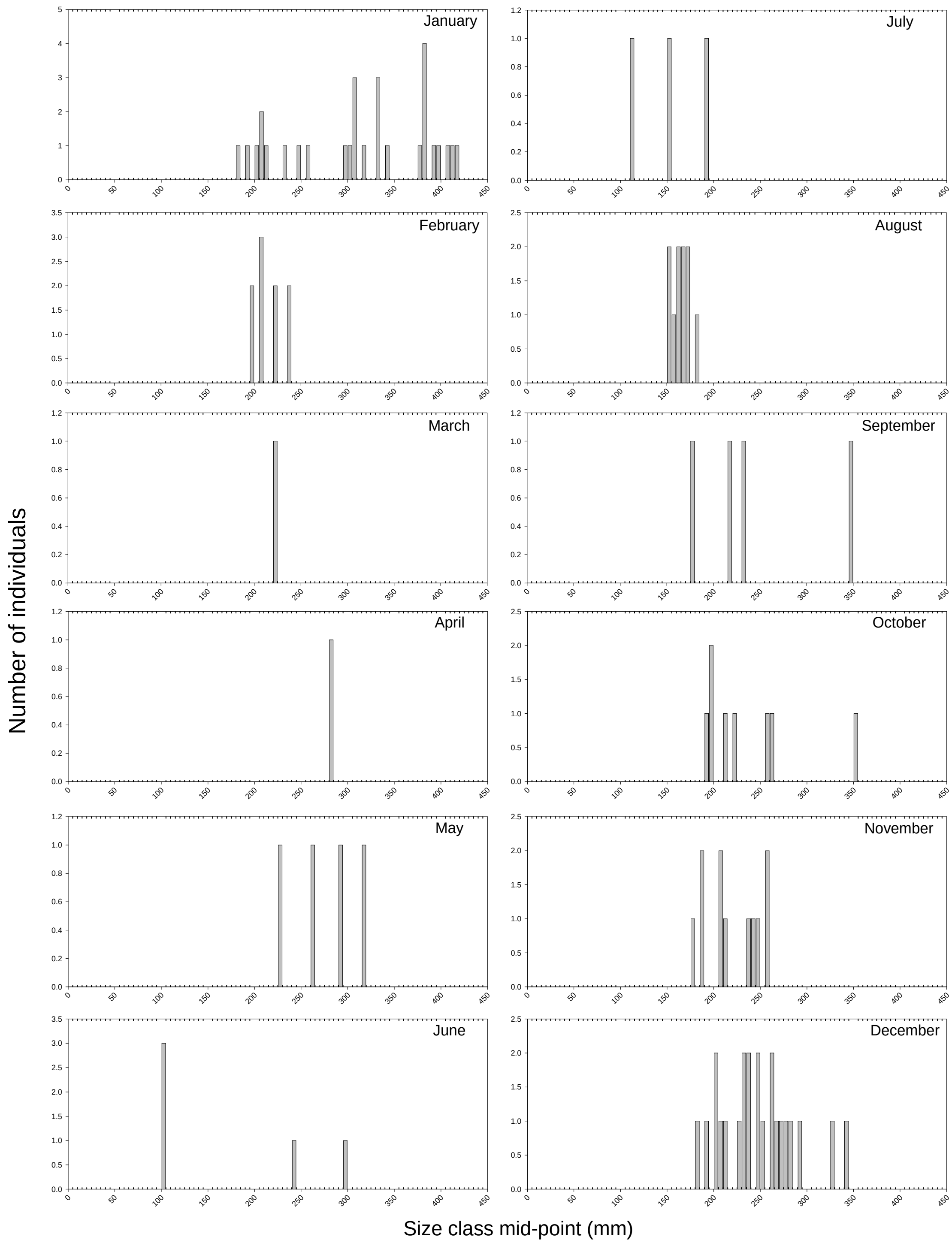


Fig. C8. Monthly length frequencies of timucu collected in the Chassahowitzka River estuary.

Cyprinodon variegatus (sheepshead minnow)

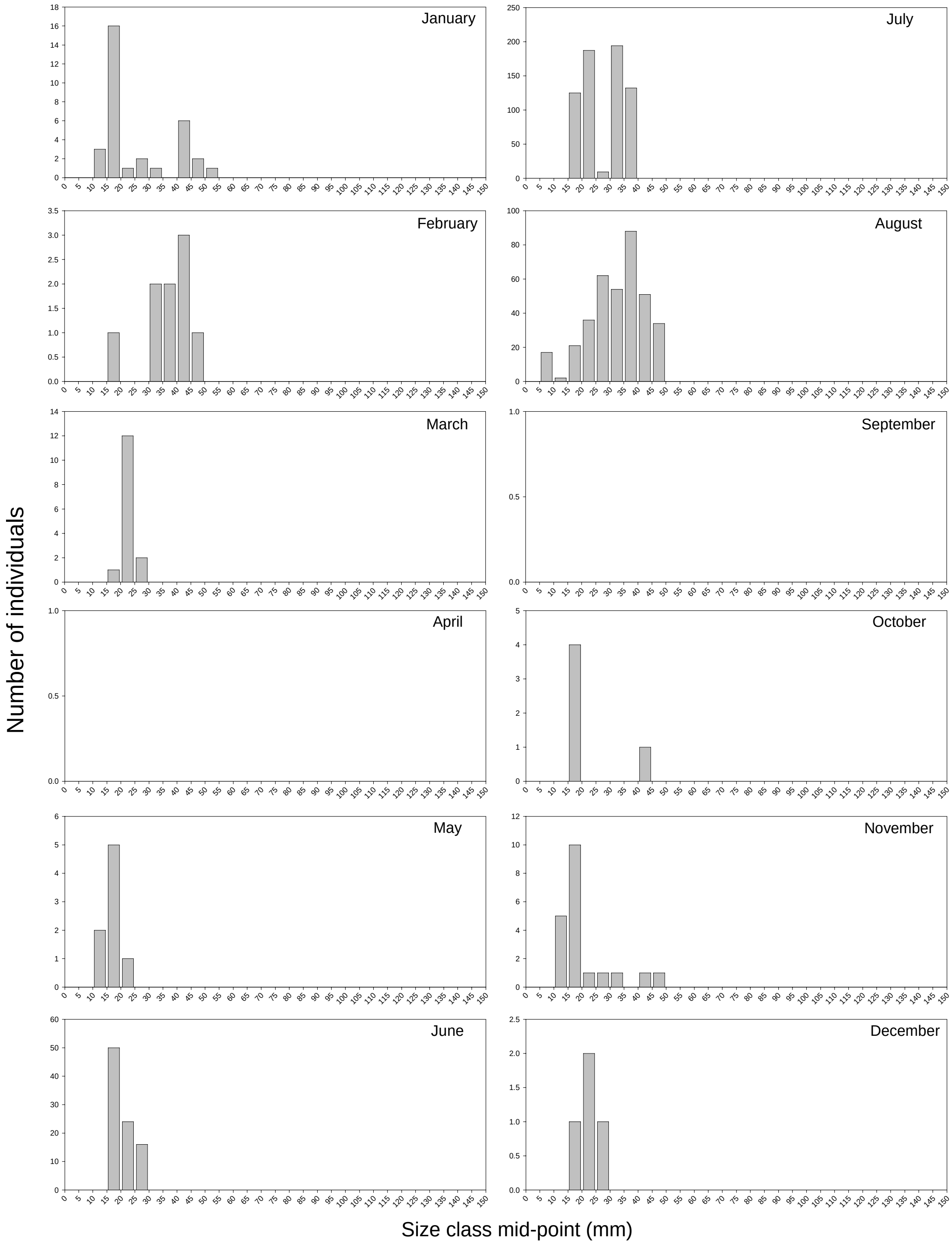


Fig. C9. Monthly length frequencies of sheepshead minnow collected in the Chassahowitzka River estuary.

Fundulus grandis (Gulf killifish)

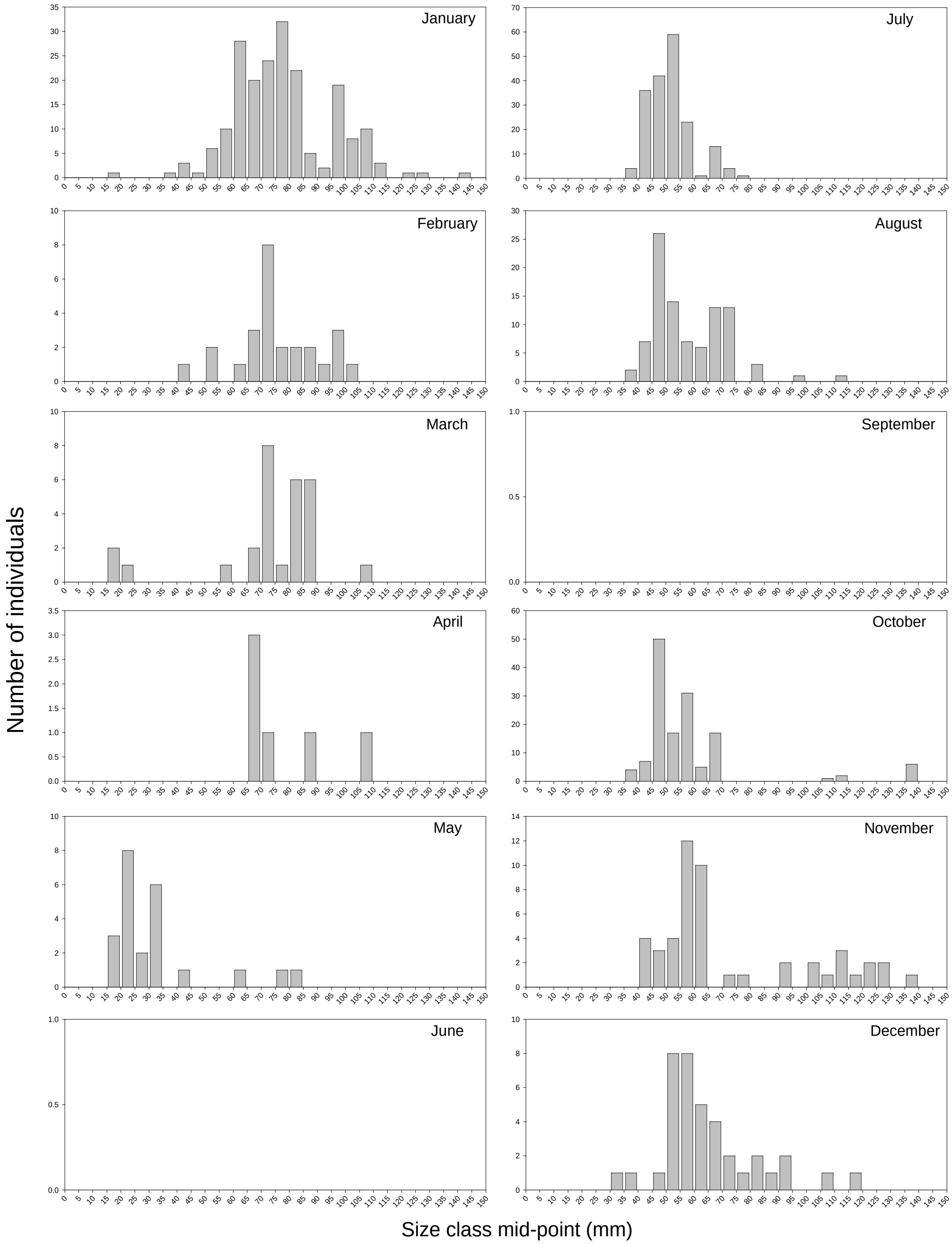


Fig. C10. Monthly length frequencies of Gulf killifish collected in the Chassahowitzka River estuary.

Fundulus seminolis (Seminole killifish)

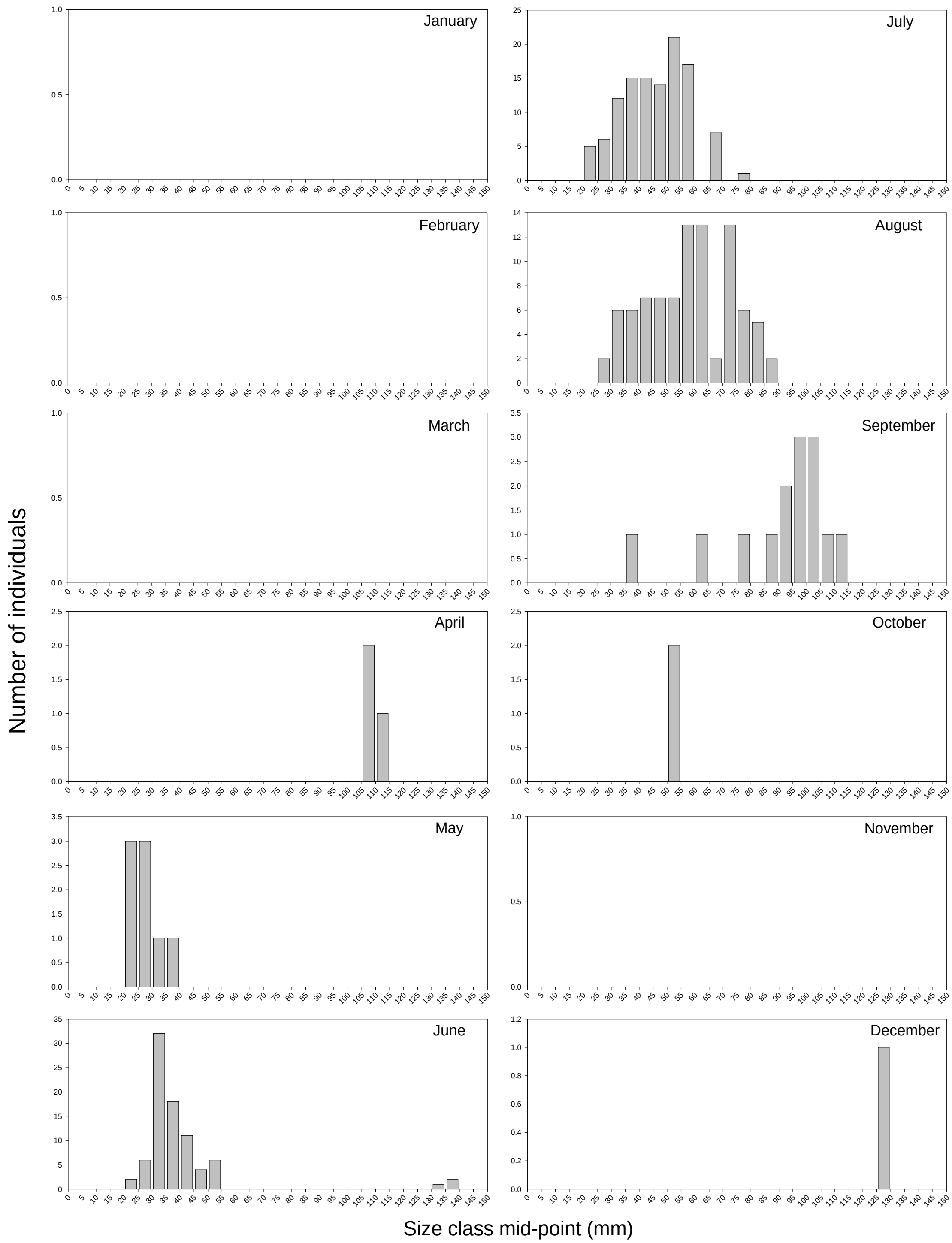


Fig. C11. Monthly length frequencies of Seminole killifish collected in the Chassahowitzka River estuary.

Lucania parva (rainwater killifish)

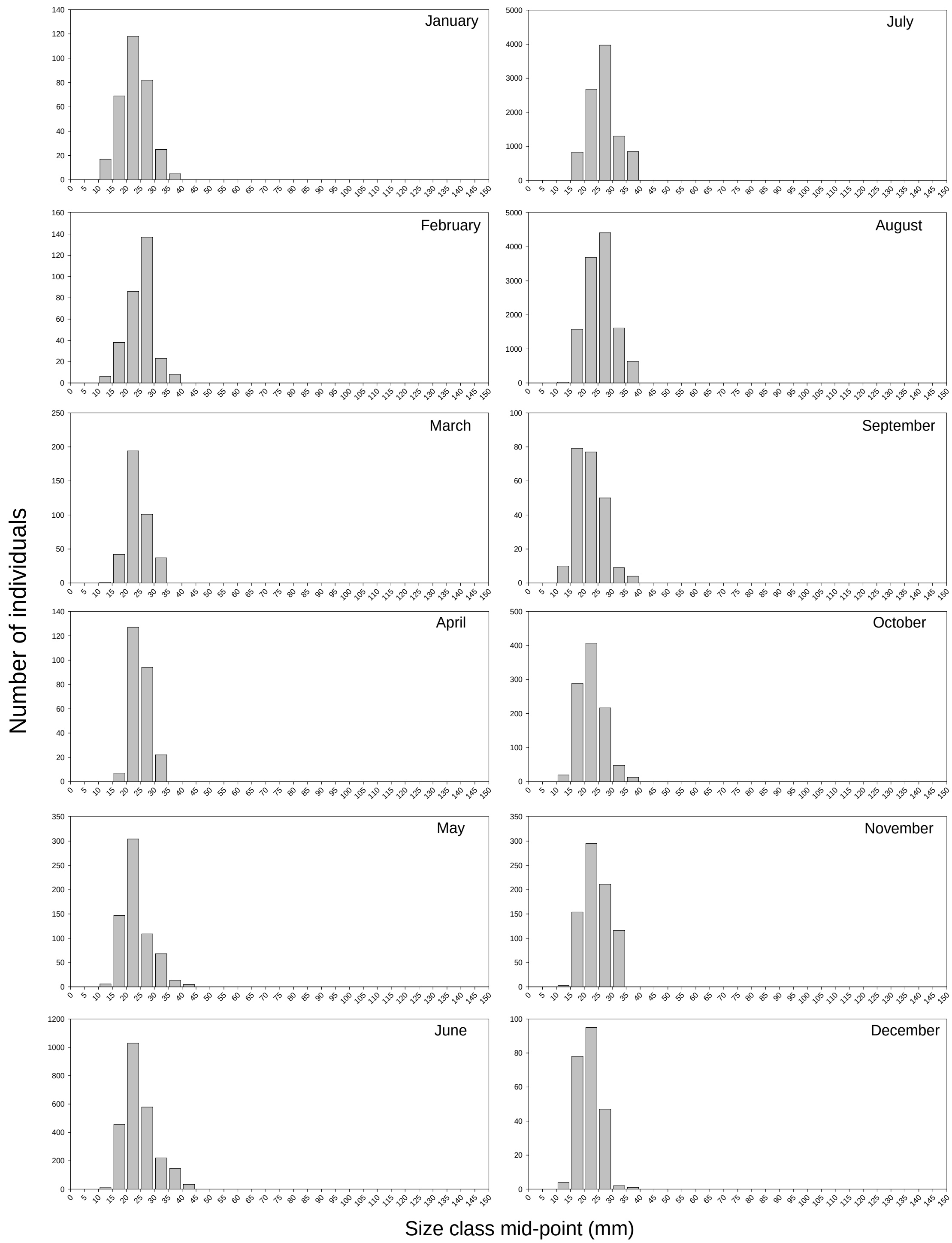


Fig. C12. Monthly length frequencies of rainwater killifish collected in the Chassahowitzka River estuary.

Lucania goodei (bluefin killifish)

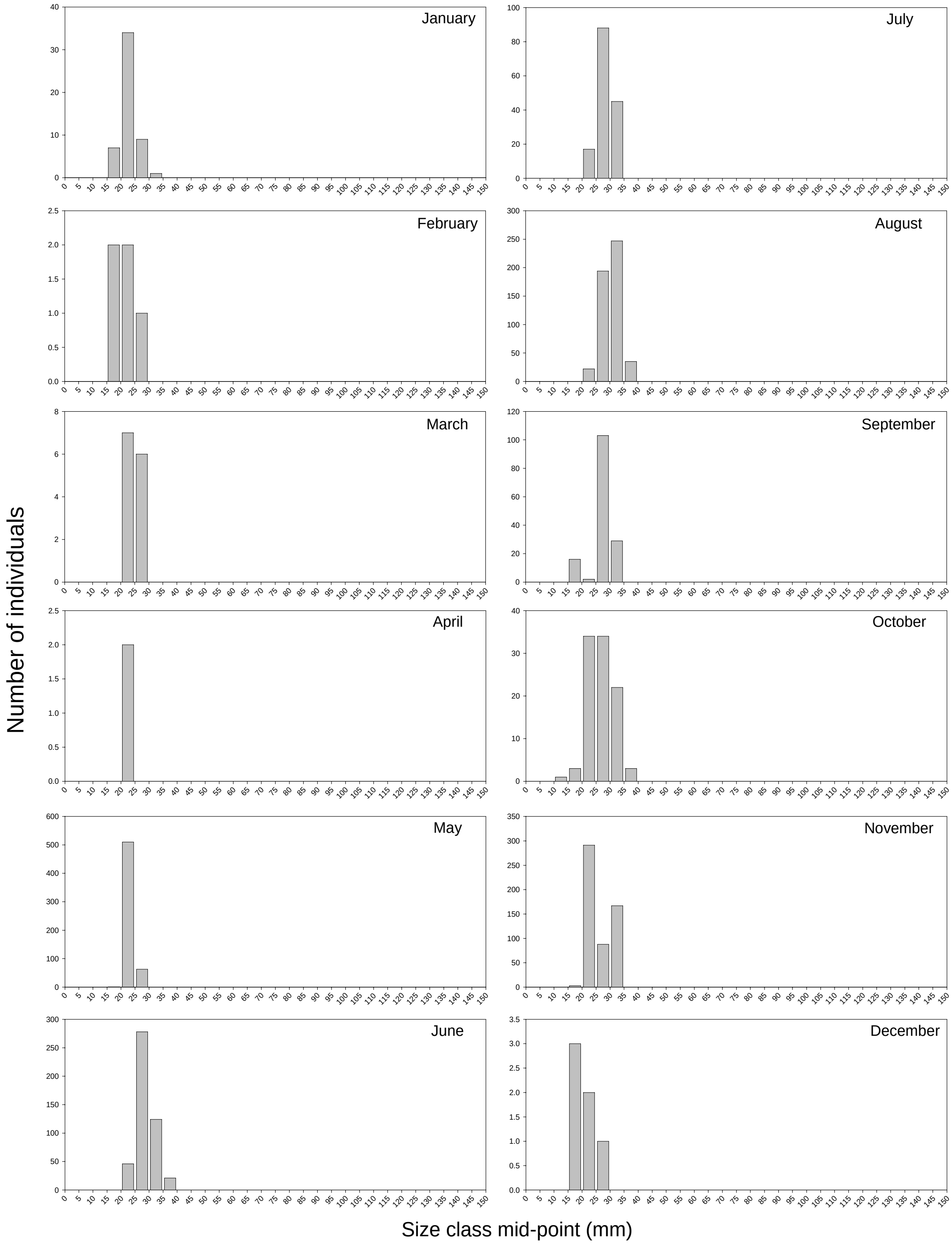


Fig. C13. Monthly length frequencies of bluefin killifish collected in the Chassahowitzka River estuary.

Floridichthys carpio (goldspotted killifish)

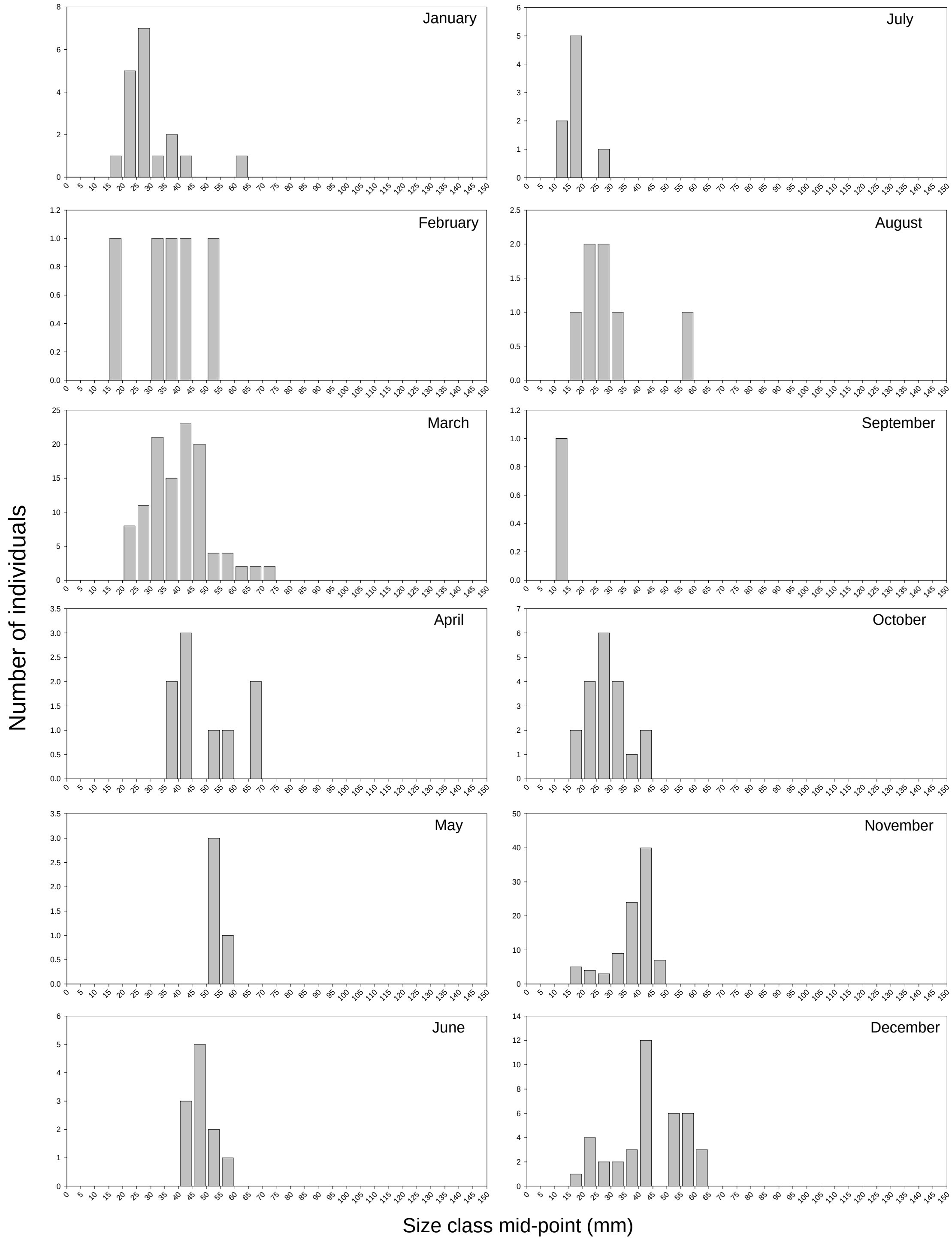


Fig. C14. Monthly length frequencies of goldspotted killifish collected in the Chassahowitzka River estuary.

Gambusia holbrooki (Eastern mosquitofish)

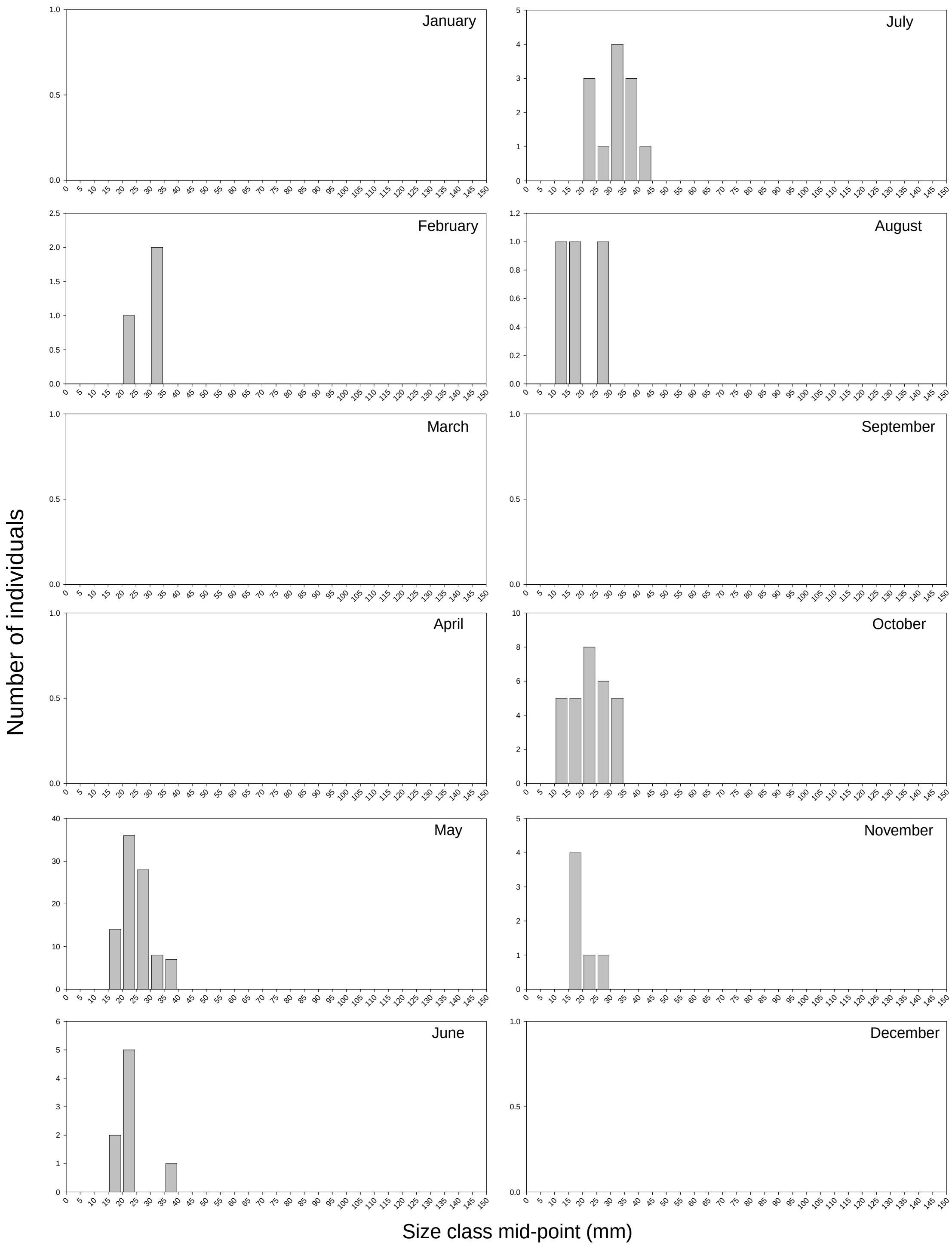


Fig. C15. Monthly length frequencies of Eastern mosquitofish collected in the Chassahowitzka River estuary.

Poecilia latipinna (sailfin molly)

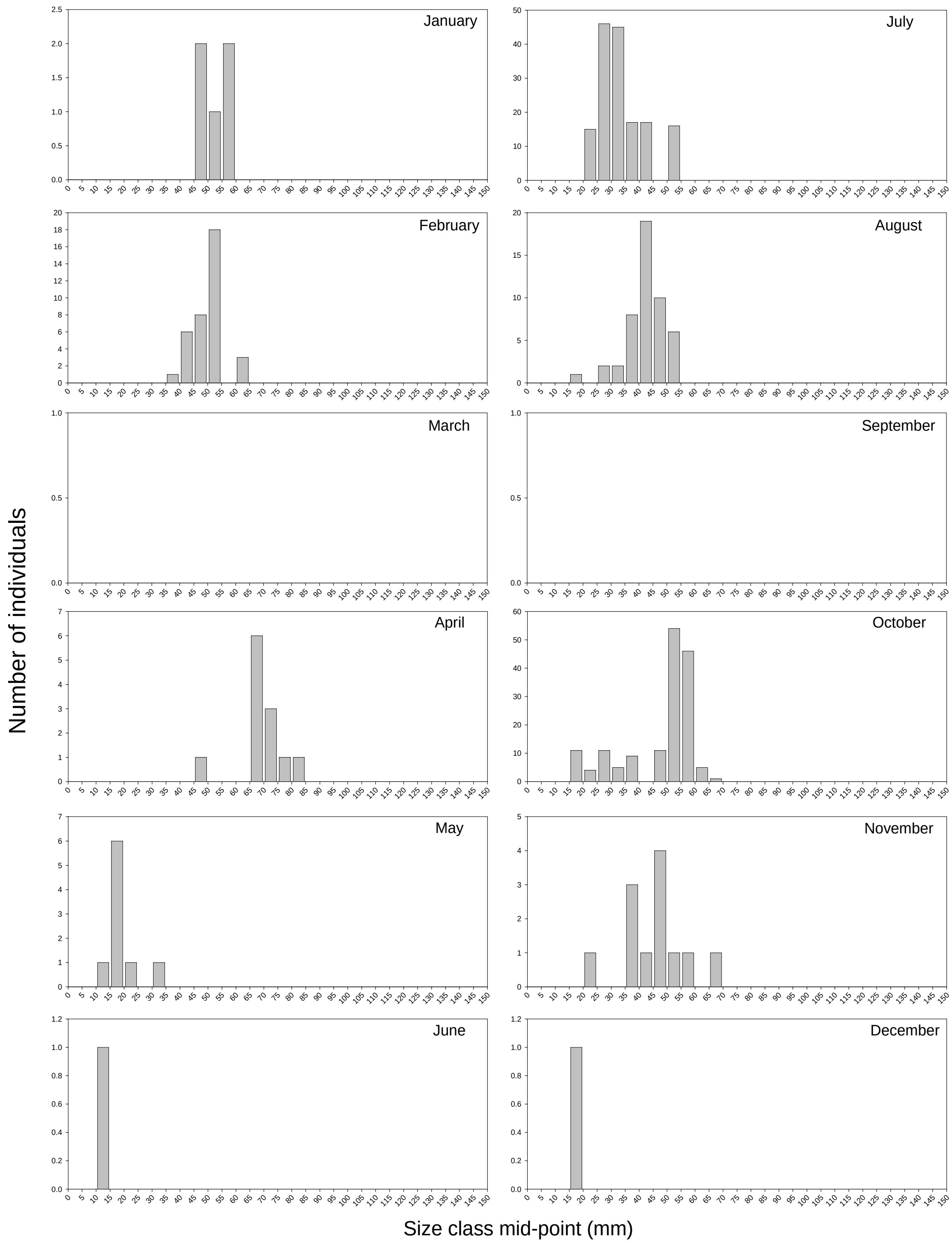


Fig. C16. Monthly length frequencies of sailfin molly collected in the Chassahowitzka River estuary.

Menidia spp. (silverside menidia)

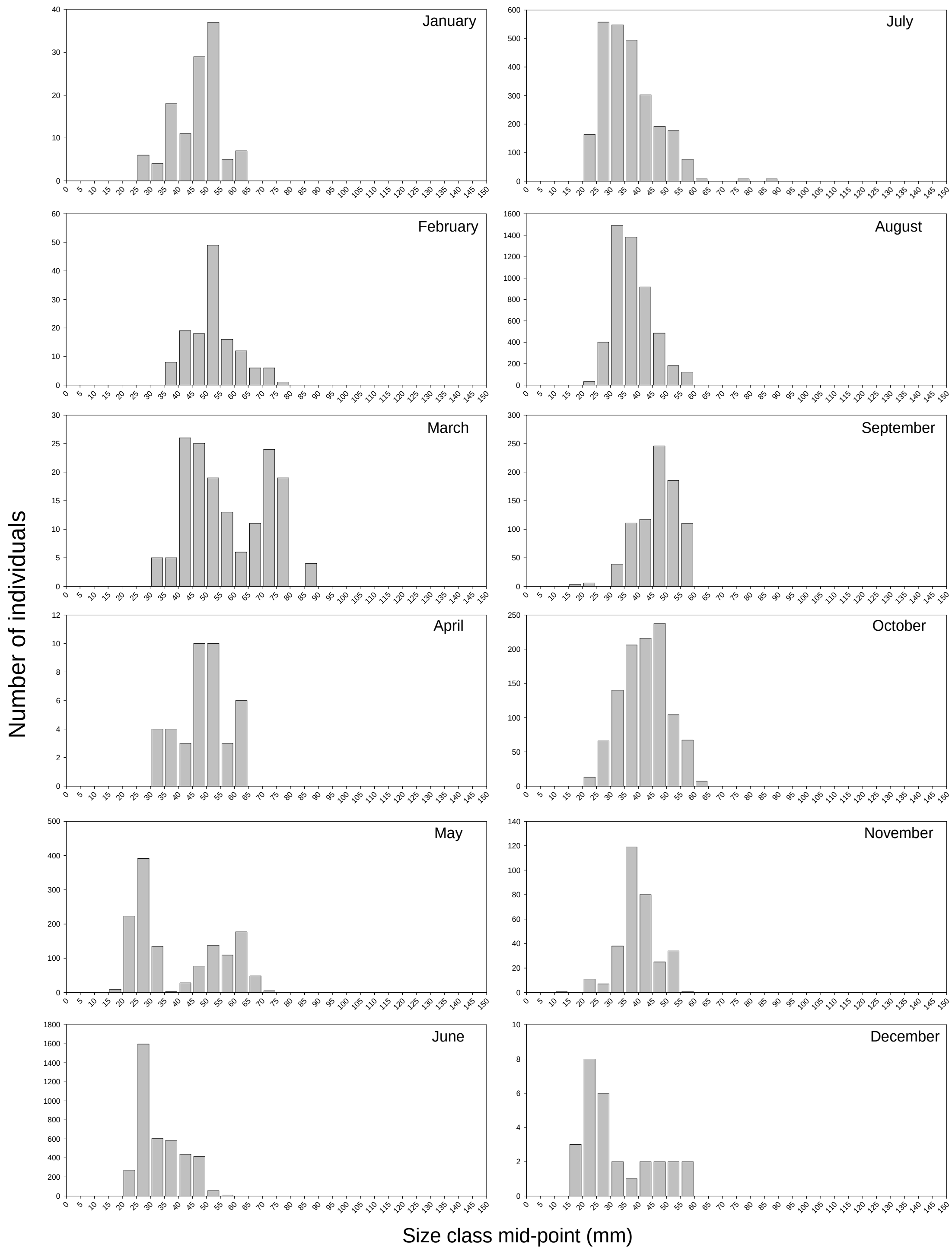


Fig. C17. Monthly length frequencies of silverside menidia collected in the Chassahowitzka River estuary.

Syngnathus scovelli (Gulf pipefish)

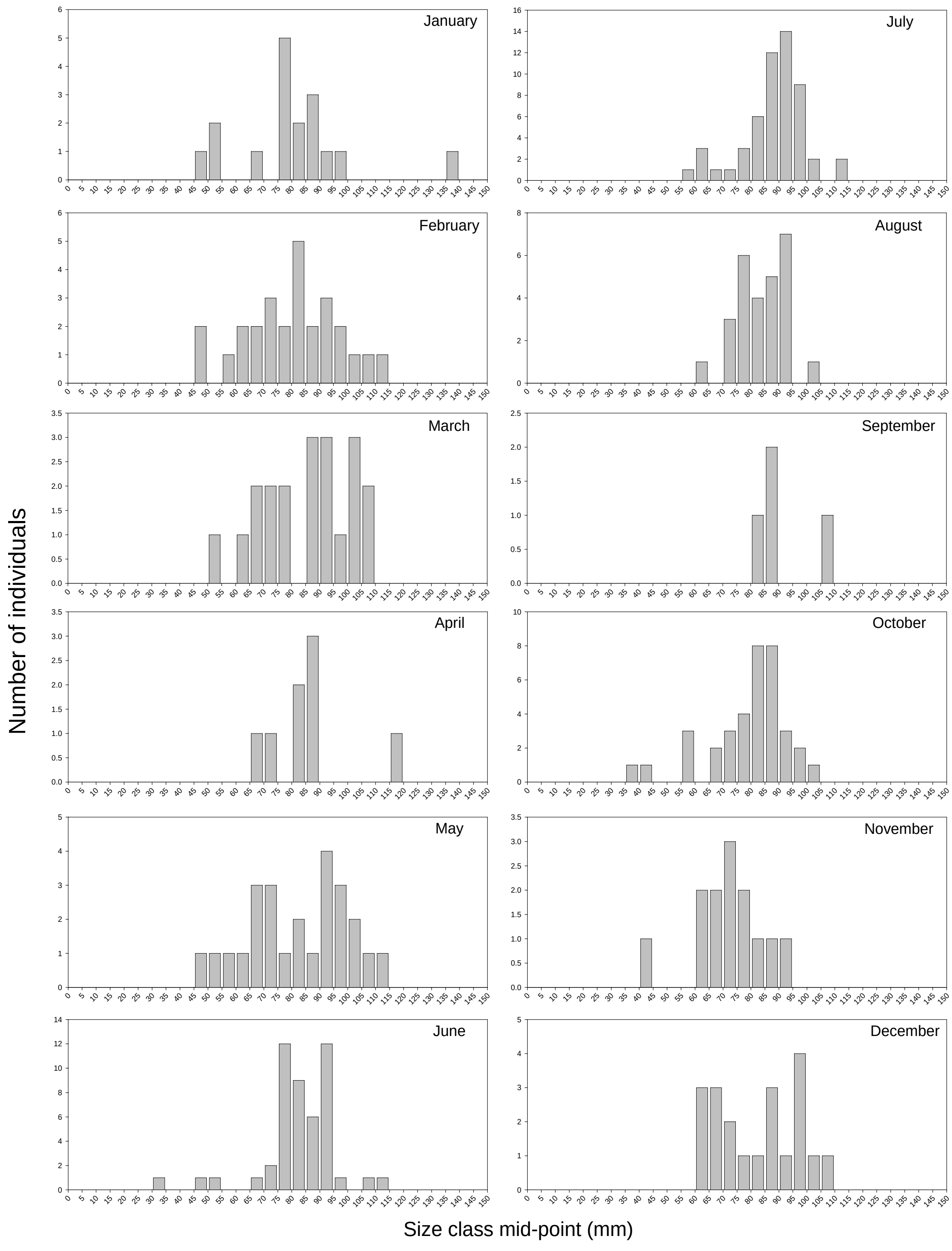


Fig. C18. Monthly length frequencies of Gulf pipefish collected in the Chassahowitzka River estuary.

Lepomis punctatus (spotted sunfish)

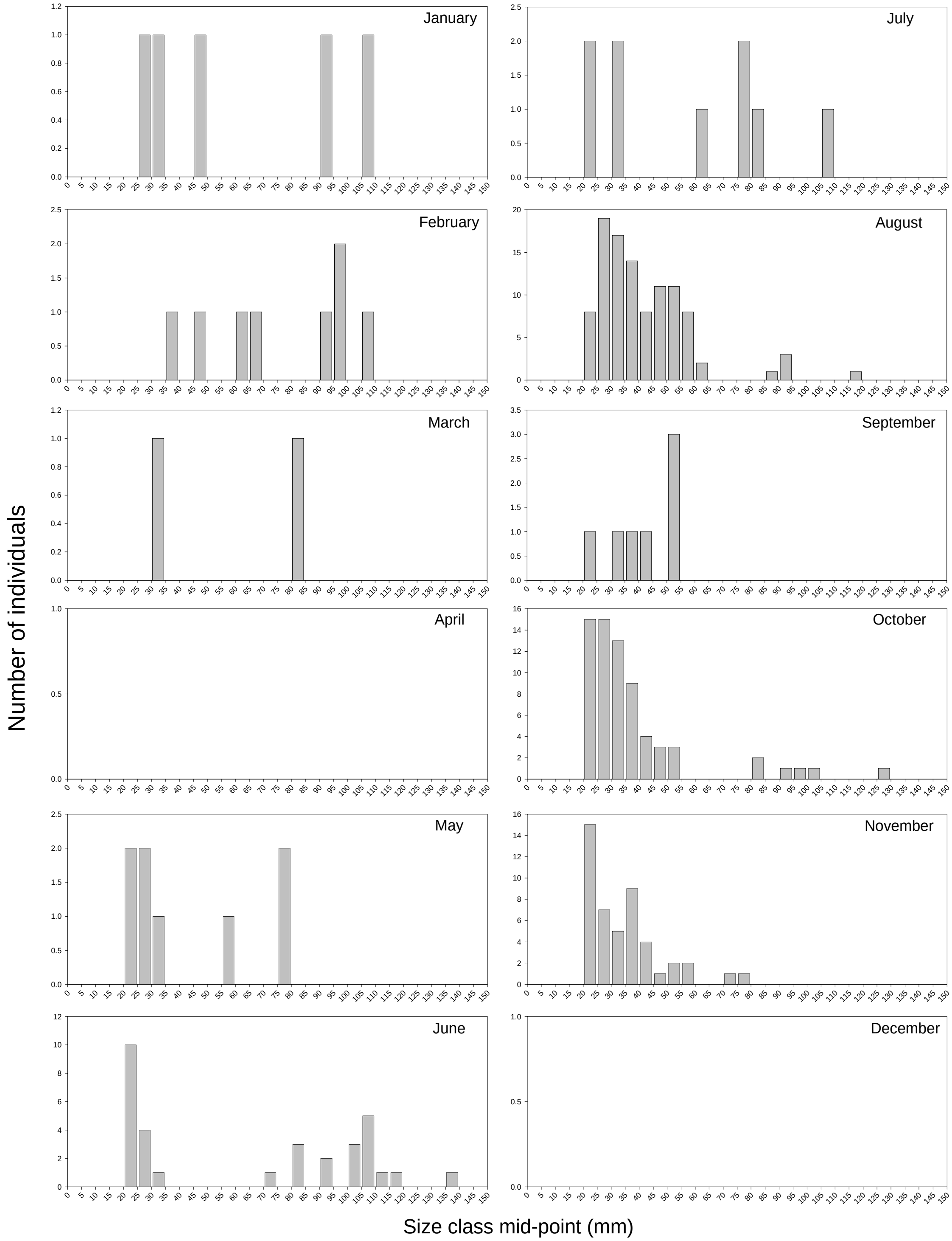


Fig. C19. Monthly length frequencies of spotted sunfish collected in the Chassahowitzka River estuary.

Micropterus salmoides (largemouth bass)

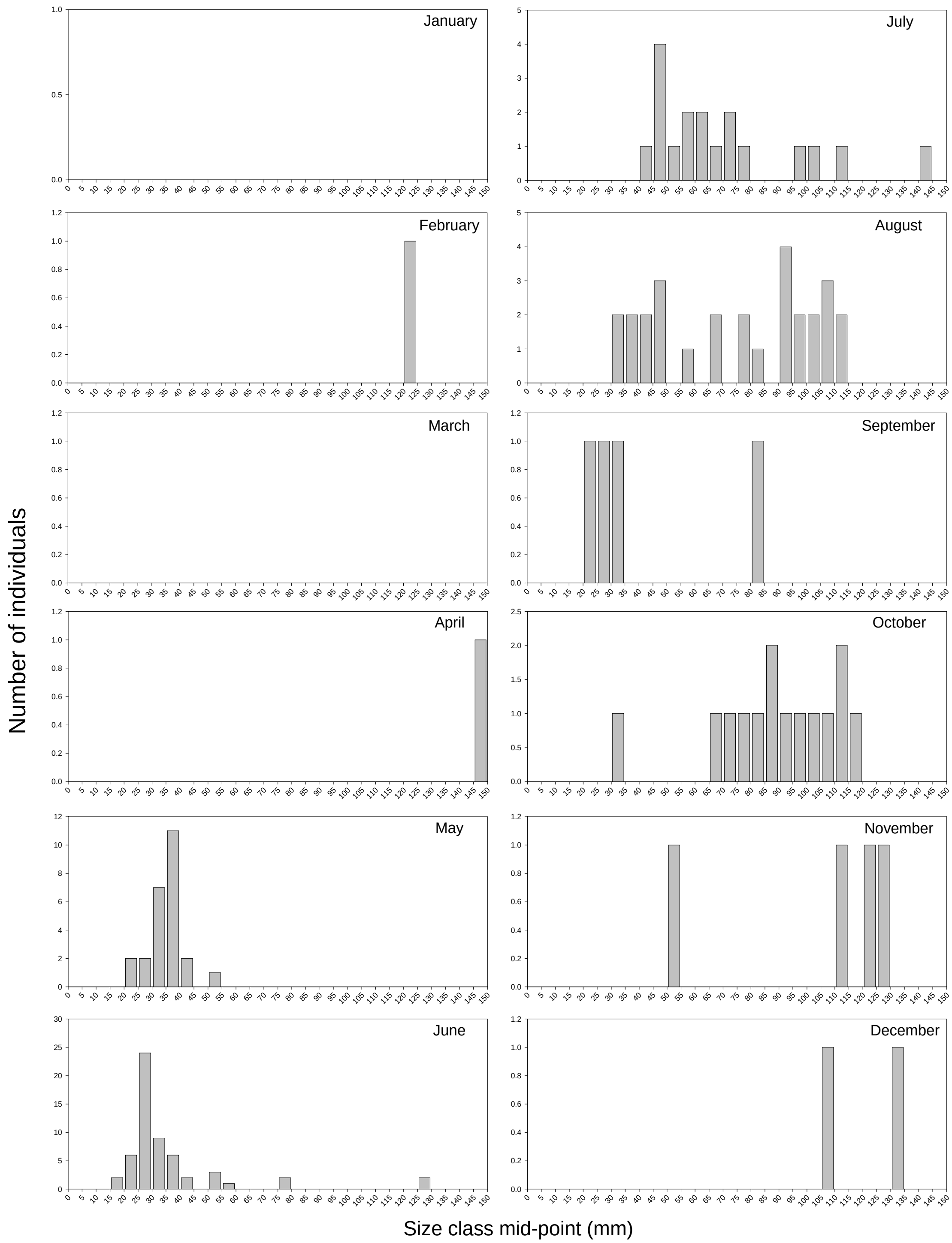


Fig. C20. Monthly length frequencies of largemouth bass collected in the Chassahowitzka River estuary.

Eucinostomus spp. (Eucinostomus mojarras)

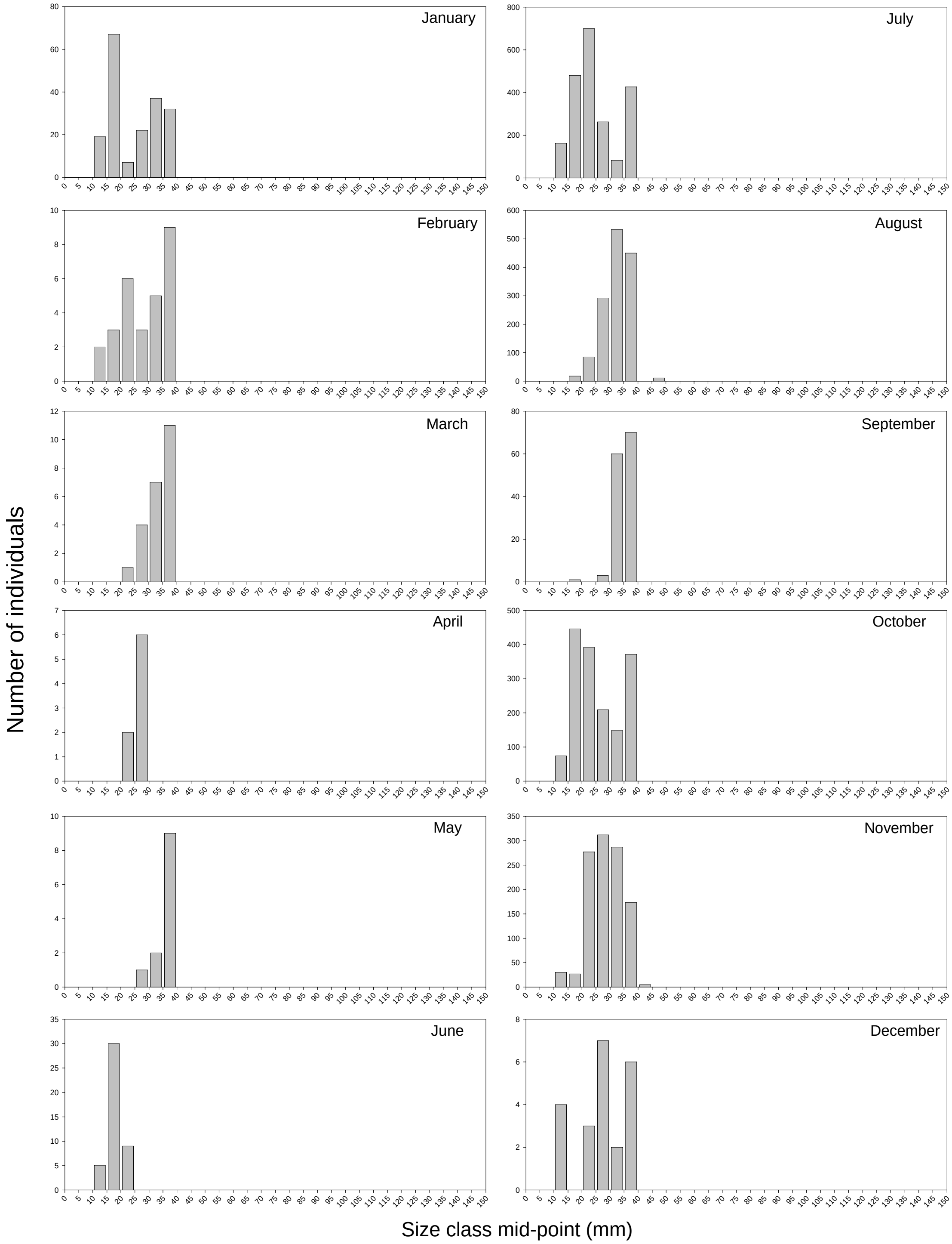


Fig. C21. Monthly length frequencies of Eucinostomus mojarras collected in the Chassahowitzka River estuary.

Eucinostomus gula (silver jenny)

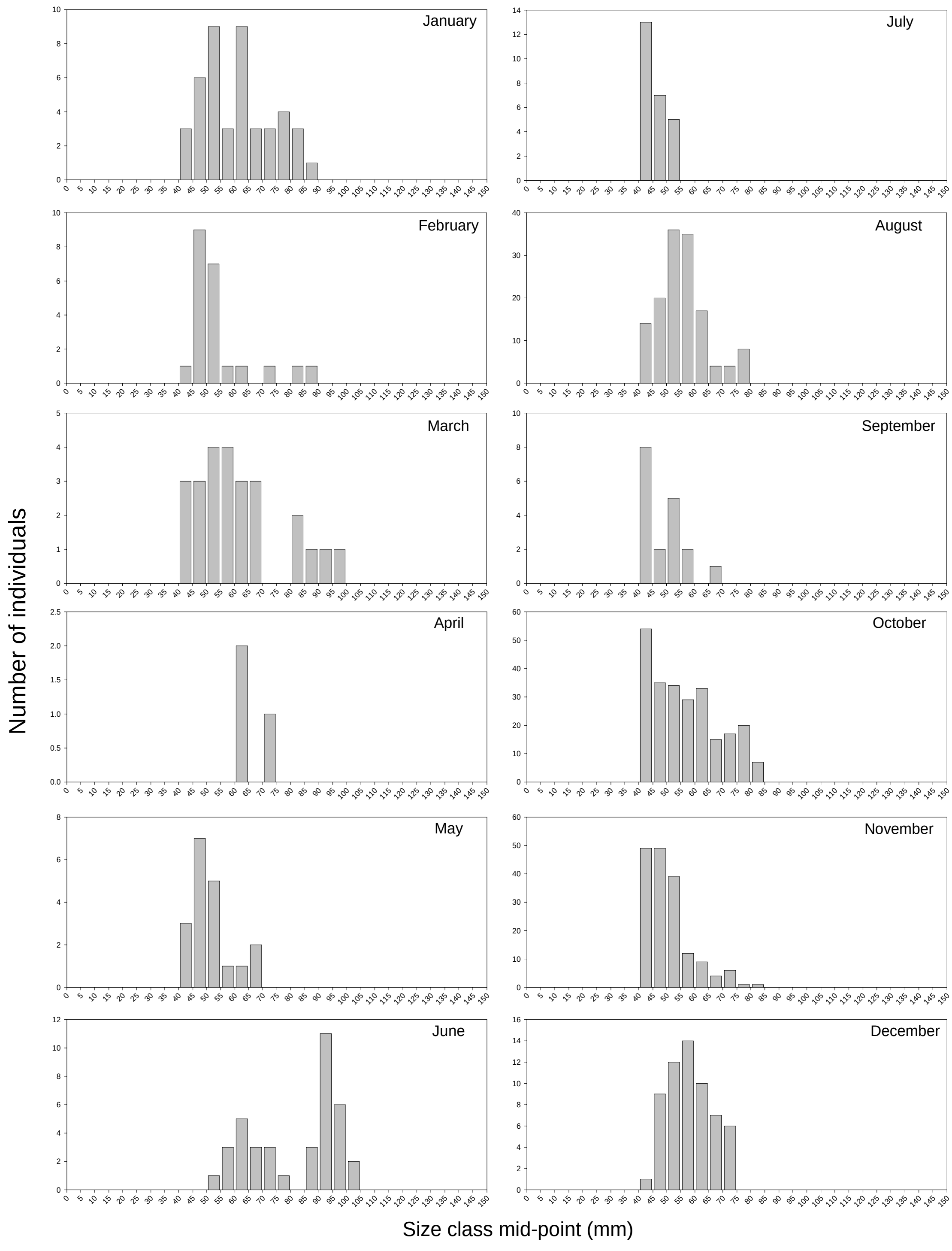


Fig. C22. Monthly length frequencies of silver jenny collected in the Chassahowitzka River estuary.

Eucinostomus harengulus (tidewater mojarra)

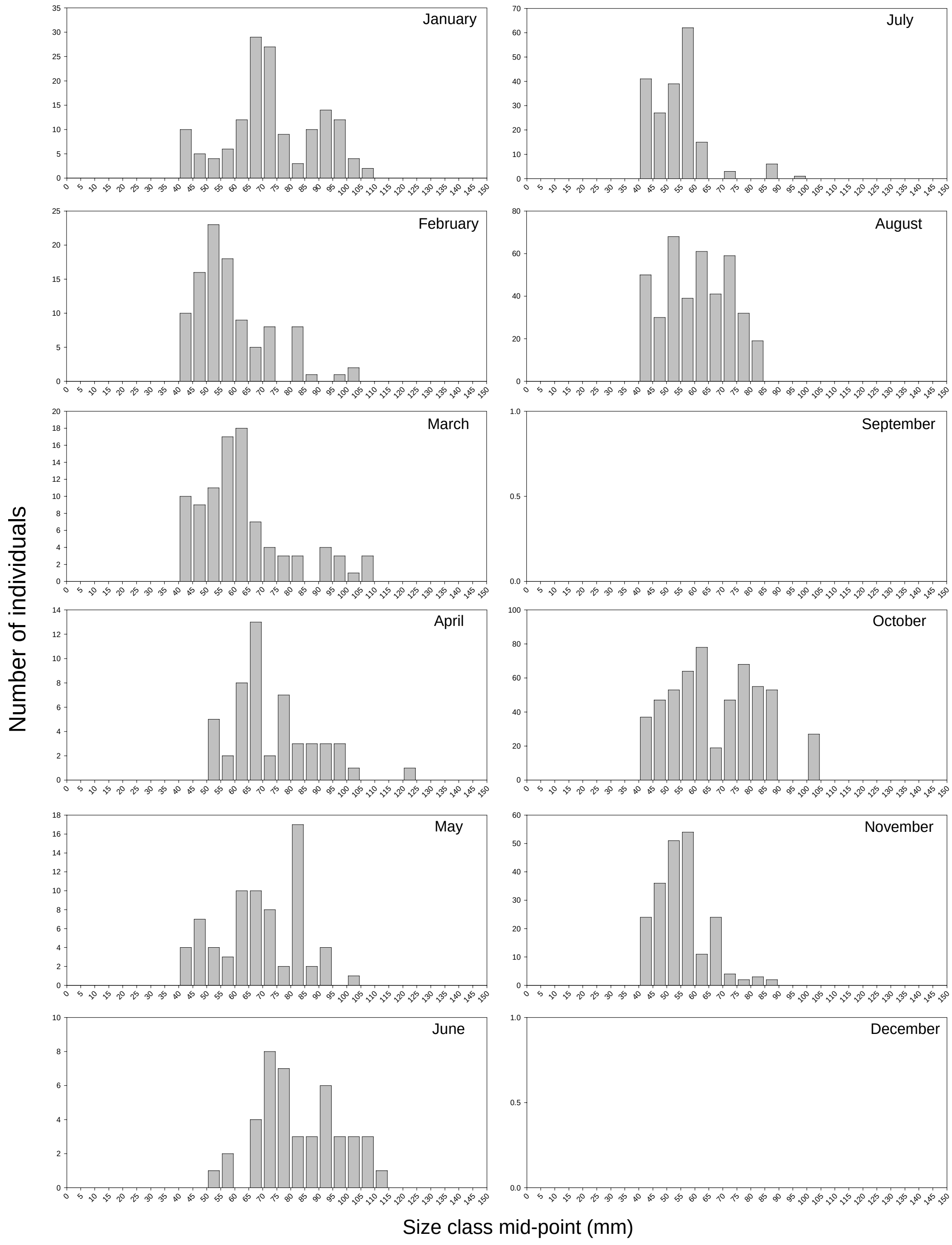


Fig. C23. Monthly length frequencies of tidewater mojarra collected in the Chassahowitzka River estuary.

Lagodon rhomboides (pinfish)

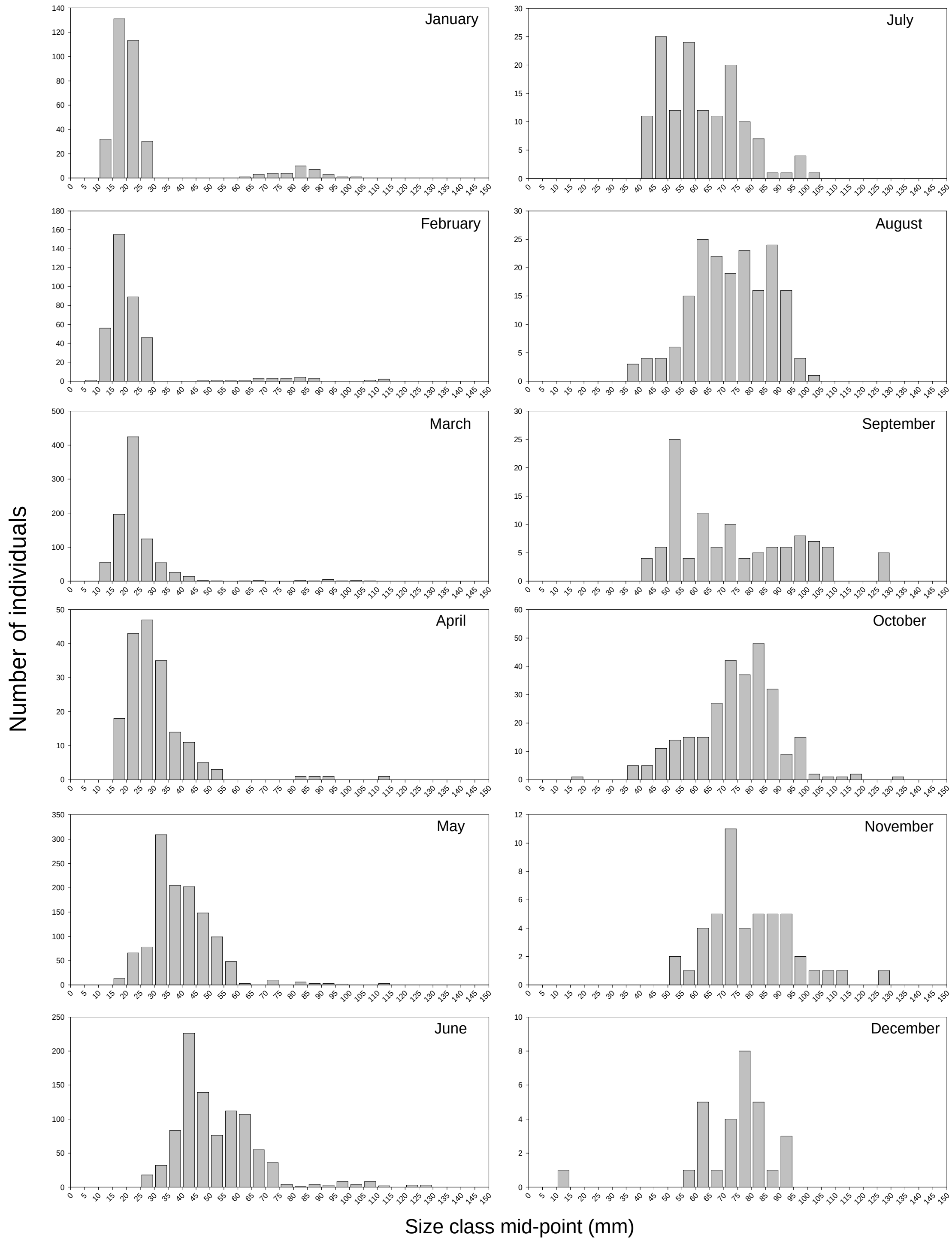


Fig. C24. Monthly length frequencies of pinfish collected in the Chassahowitzka River estuary.

Leiostomus xanthurus (spot)

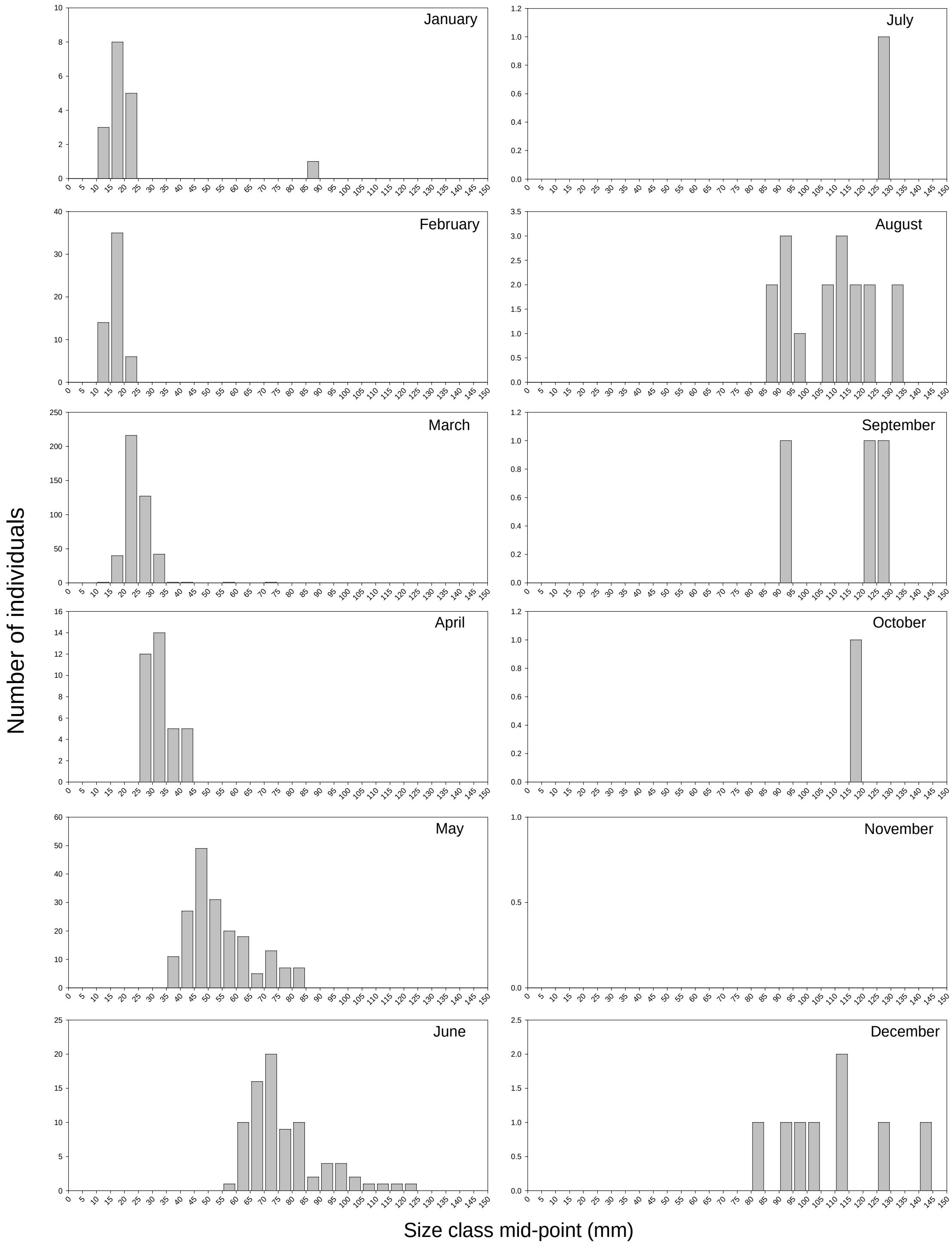


Fig. C25. Monthly length frequencies of spot collected in the Chassahowitzka River estuary.

Mugil cephalus (striped mullet)

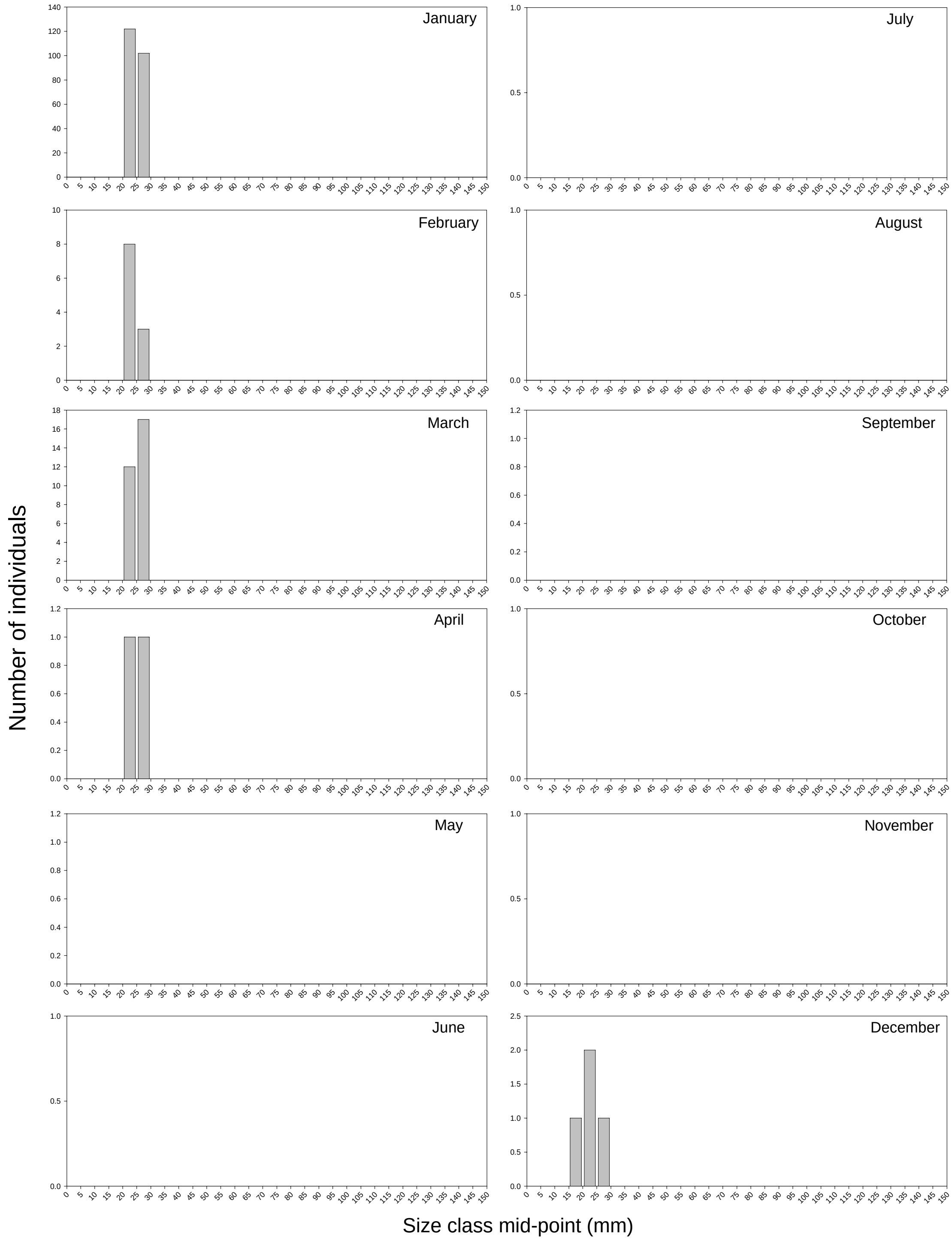


Fig. C26. Monthly length frequencies of striped mullet collected in the Chassahowitzka River estuary.

Gobiosoma spp. (Gobiosoma gobies)

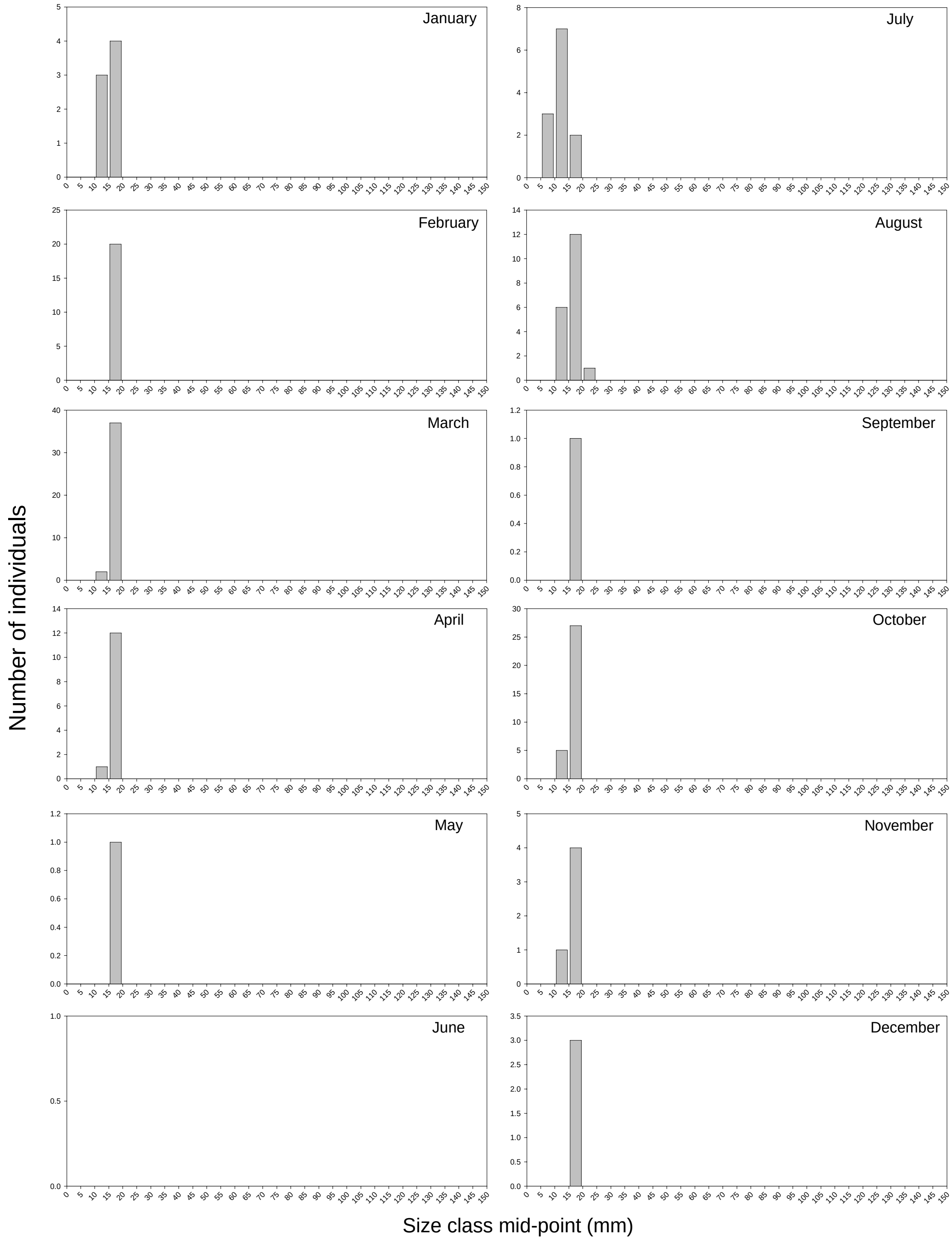


Fig. C27. Monthly length frequencies of Gobiosoma gobies collected in the Chassahowitzka River estuary.

Gobiosoma robustum (code goby)

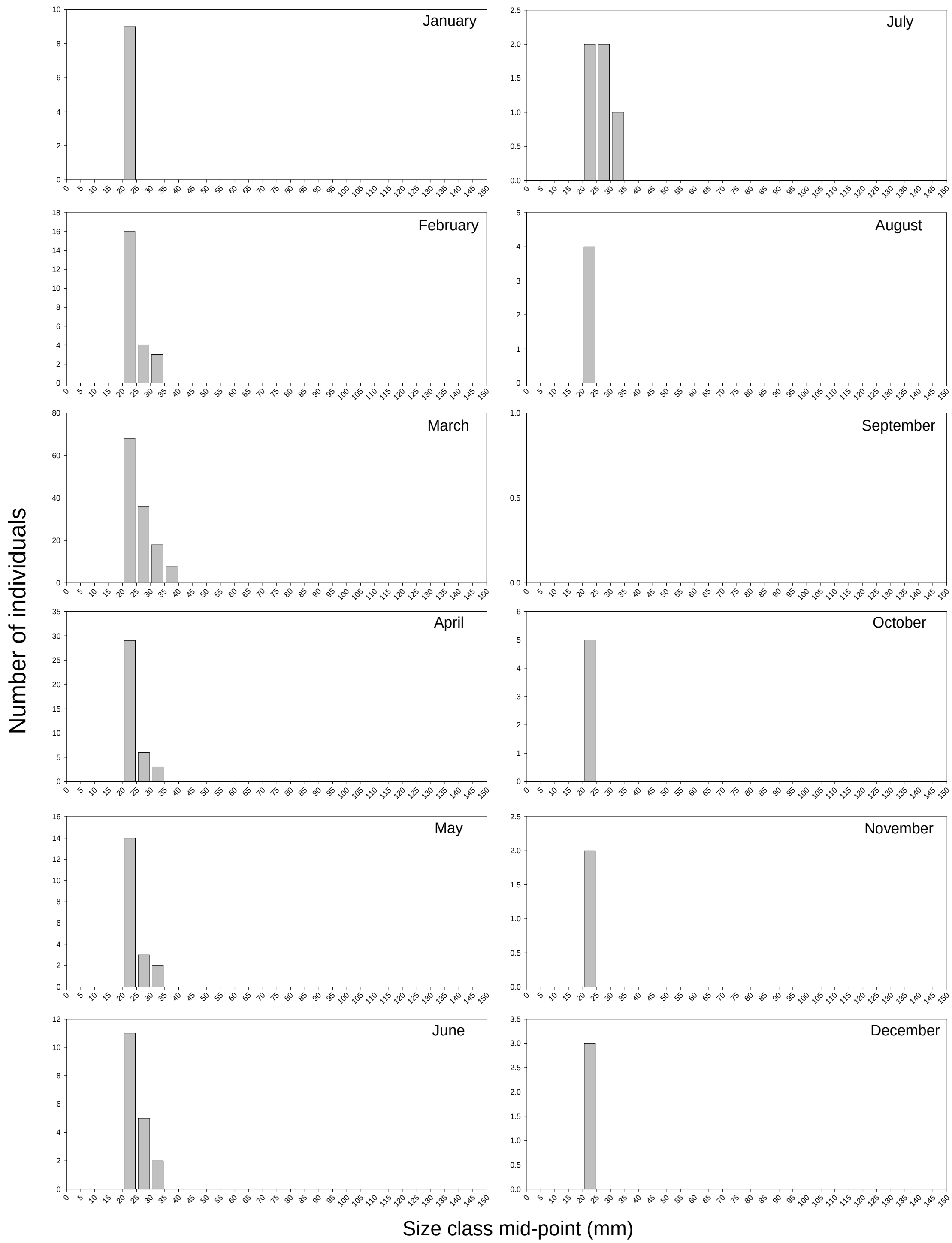


Fig. C28. Monthly length frequencies of code goby collected in the Chassahowitzka River estuary.

Microgobius gulosus (clown goby)

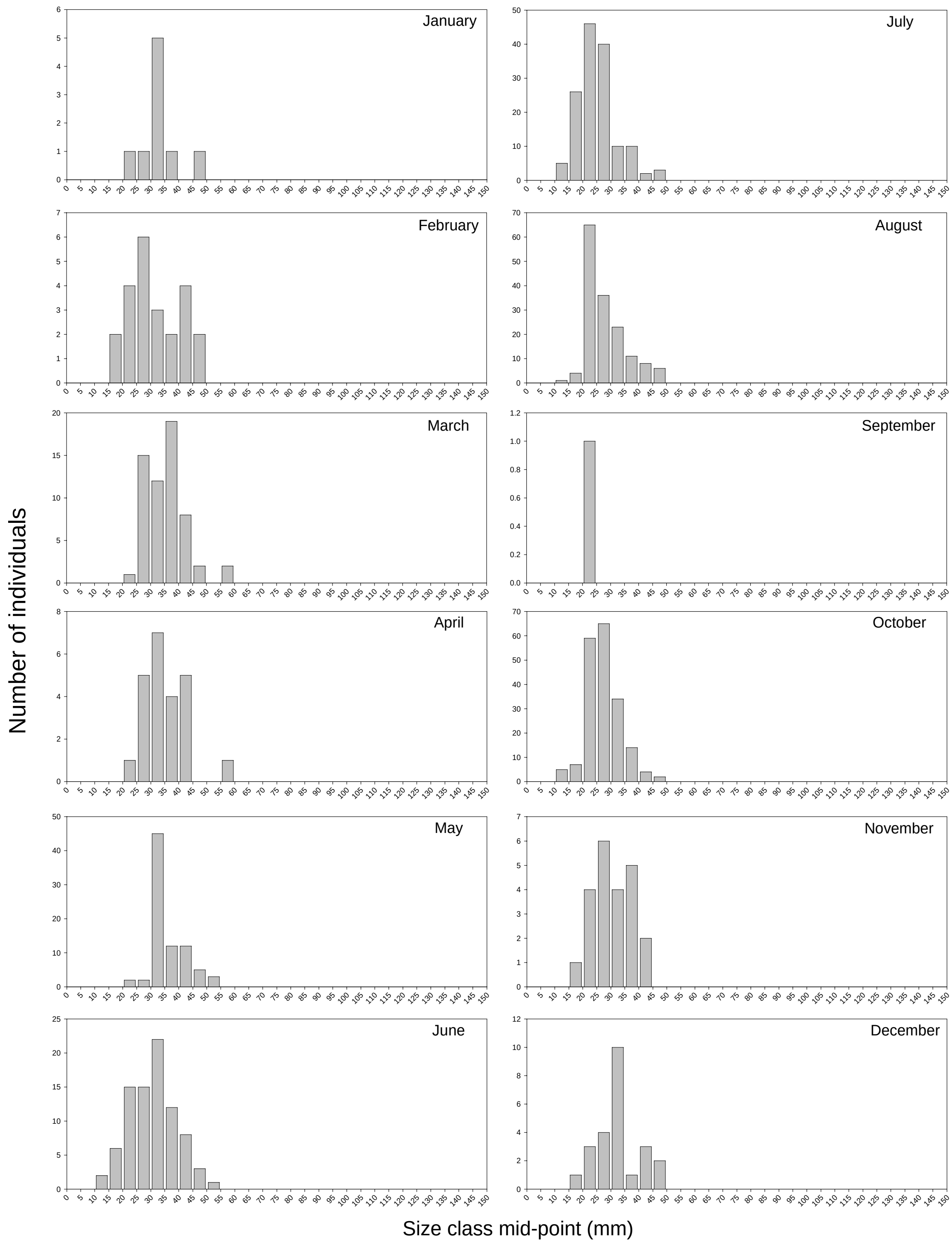


Fig. C29. Monthly length frequencies of clown goby collected in the Chassahowitzka River estuary.

Symphurus plagiusa (blackcheek tonguefish)

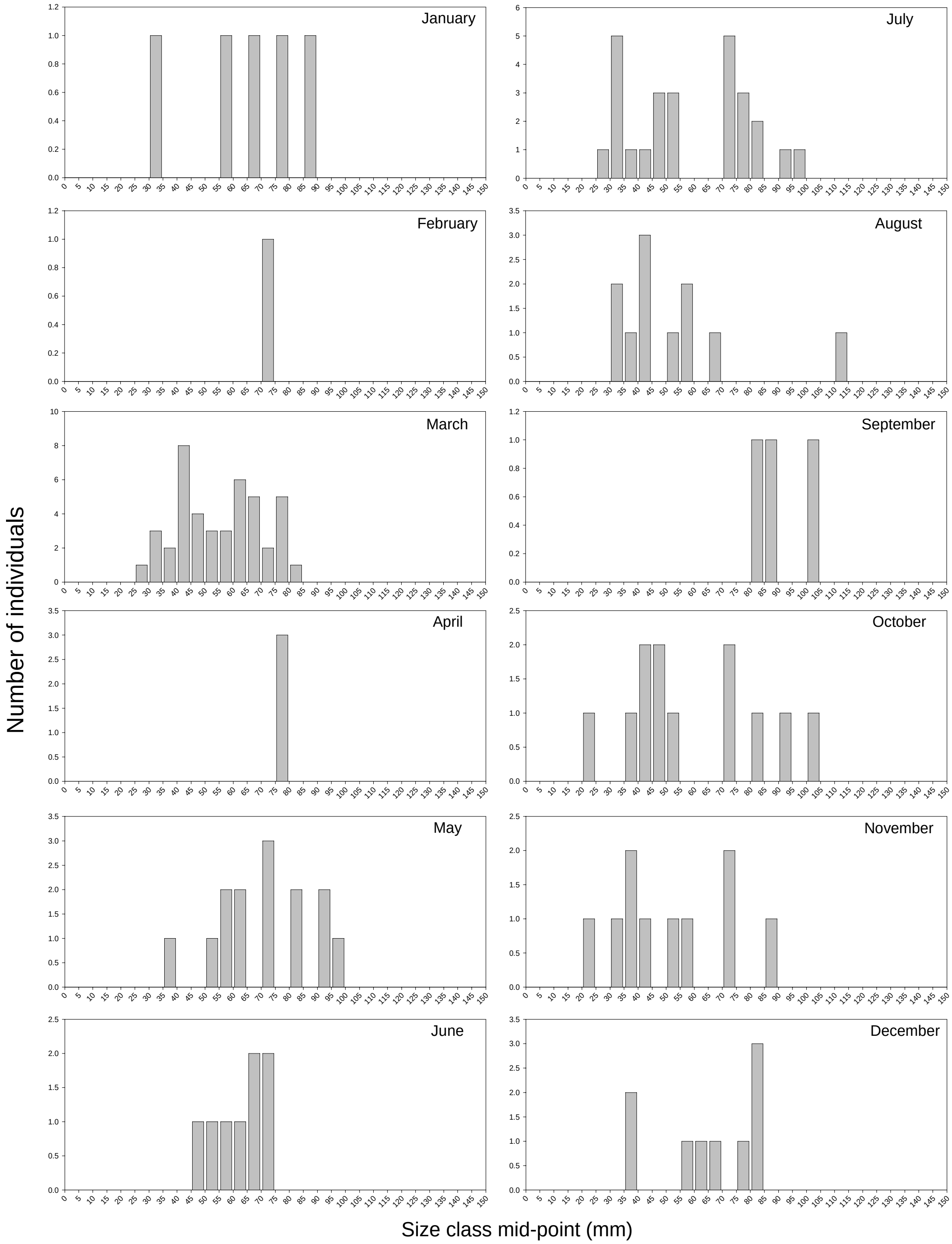


Fig. C30. Monthly length frequencies of blackcheek tonguefish collected in the Chassahowitzka River estuary.

Trinectes maculatus (hogchoker)

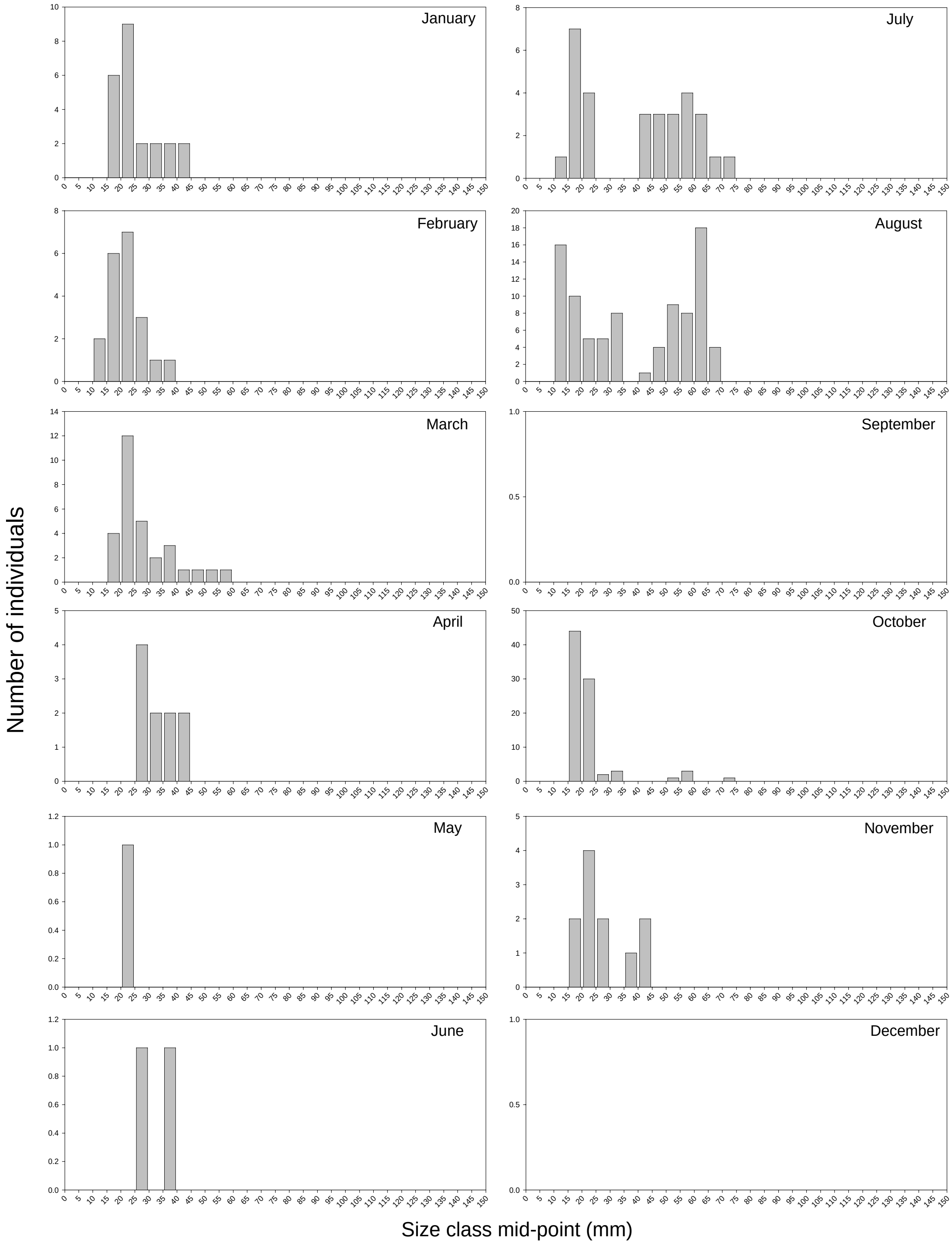


Fig. C31. Monthly length frequencies of hogchoker collected in the Chassahowitzka River estuary.

Sphoeroides nephelus (Southern puffer)

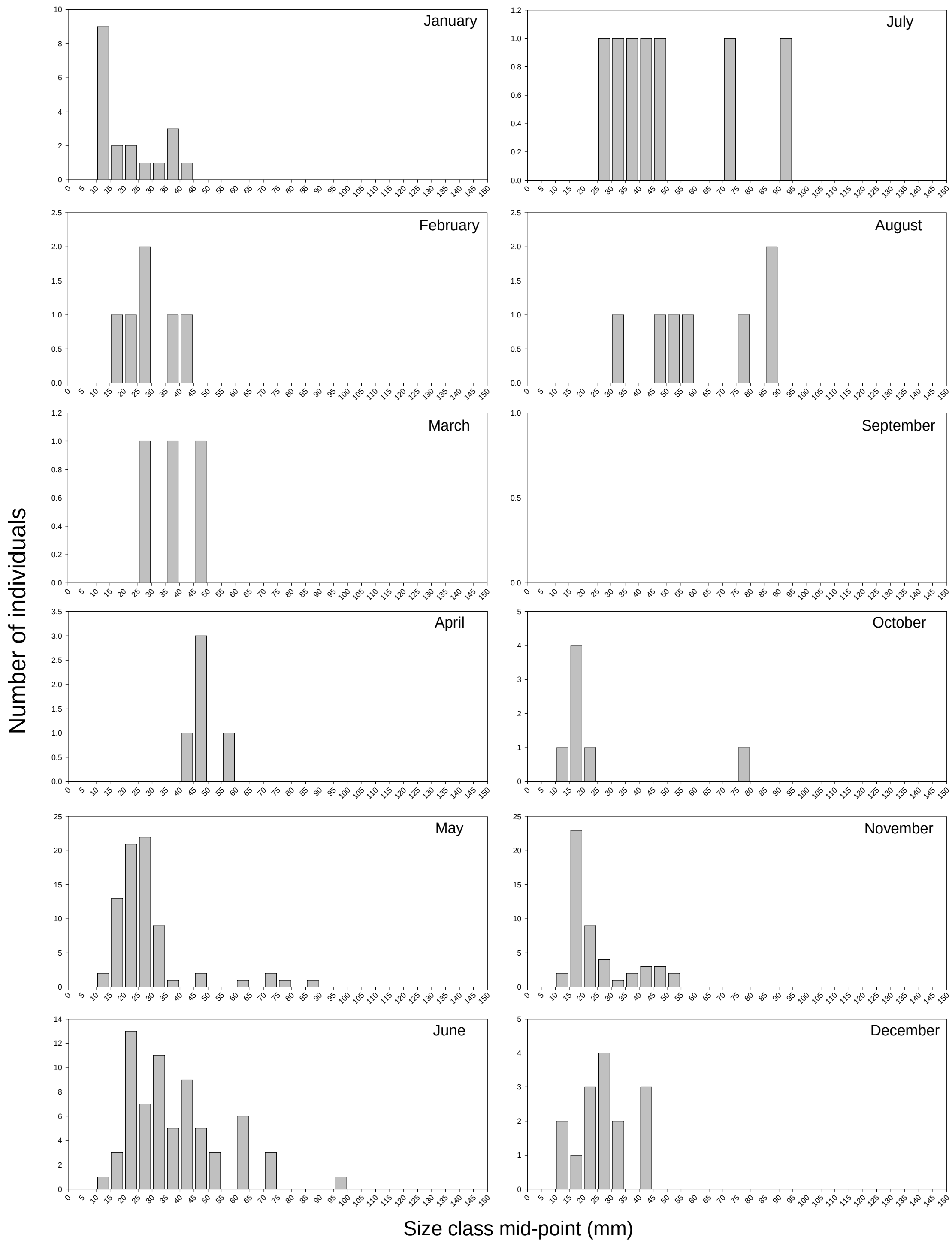


Fig. C32. Monthly length frequencies of Southern puffer collected in the Chassahowitzka River estuary.

Appendix D:

Seine catch overview plots

Farfantepenaeus duorarum **(pink shrimp) in seines**

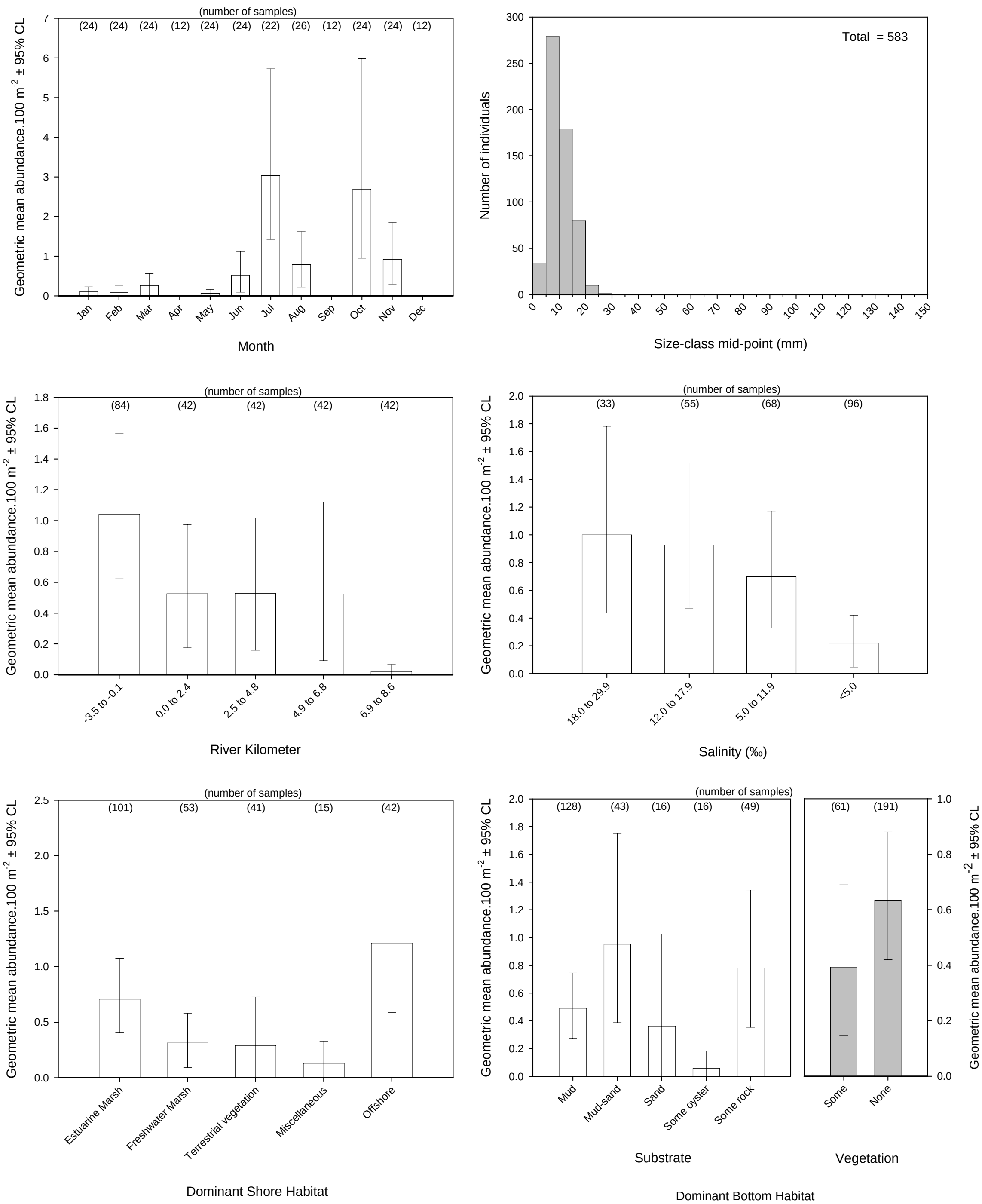


Fig. D1. Relative abundance of pink shrimp collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

***Palaemonetes intermedius* (brackish grass shrimp) in seines**

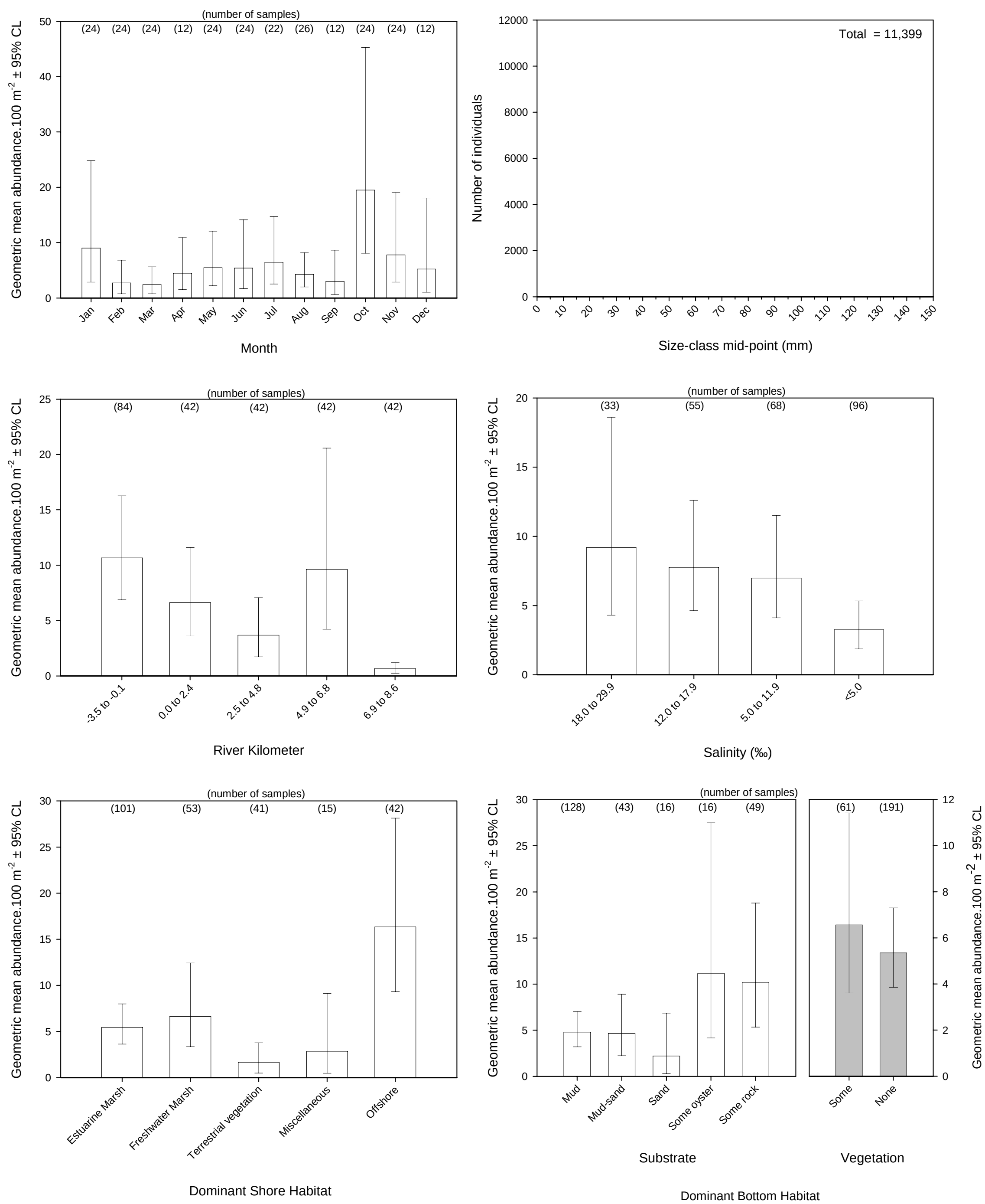


Fig. D2. Relative abundance of brackish grass shrimp collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Callinectes sapidus (blue crab) in seines

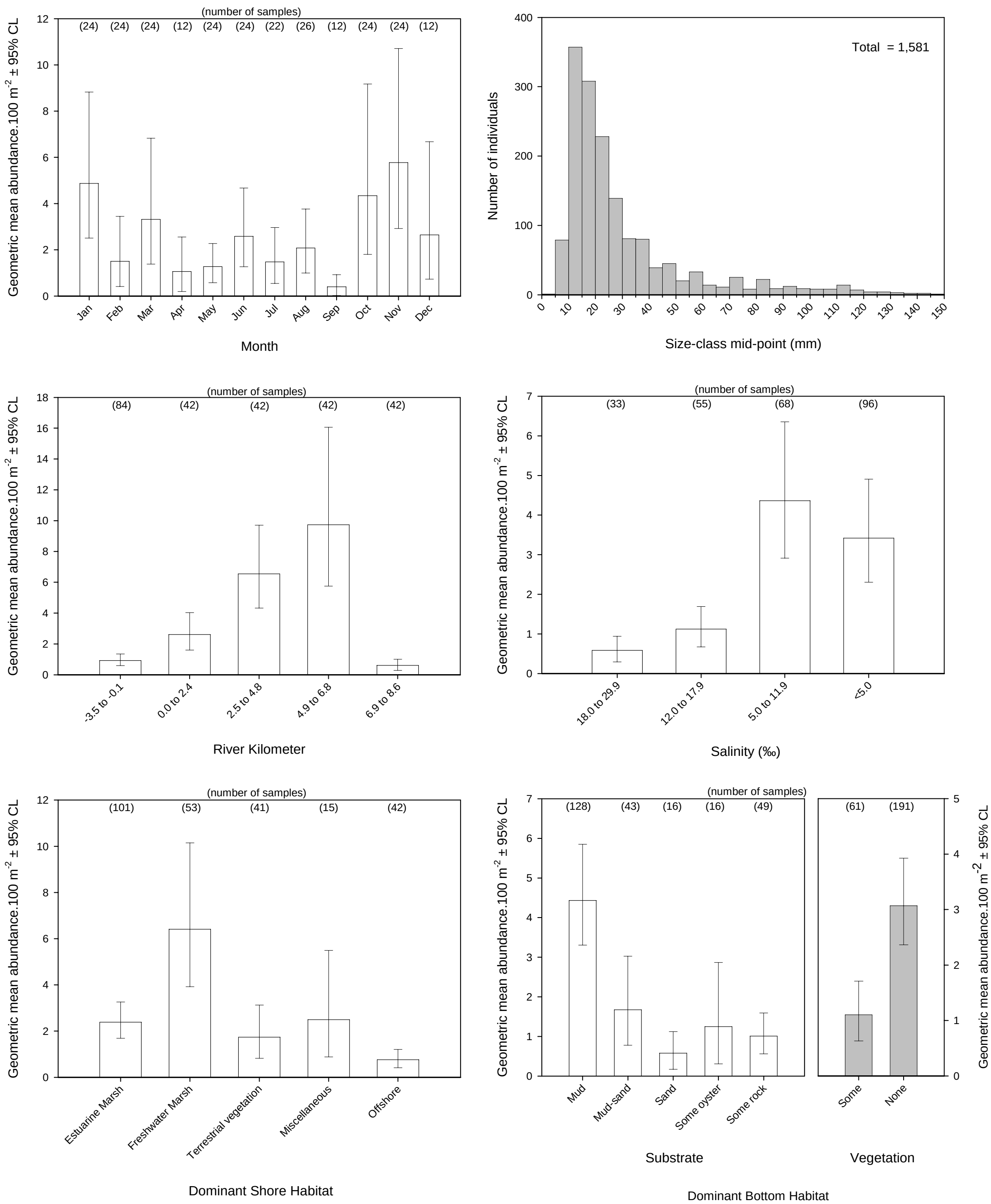


Fig. D3. Relative abundance of blue crab collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Anchoa mitchilli (bay anchovy) in seines

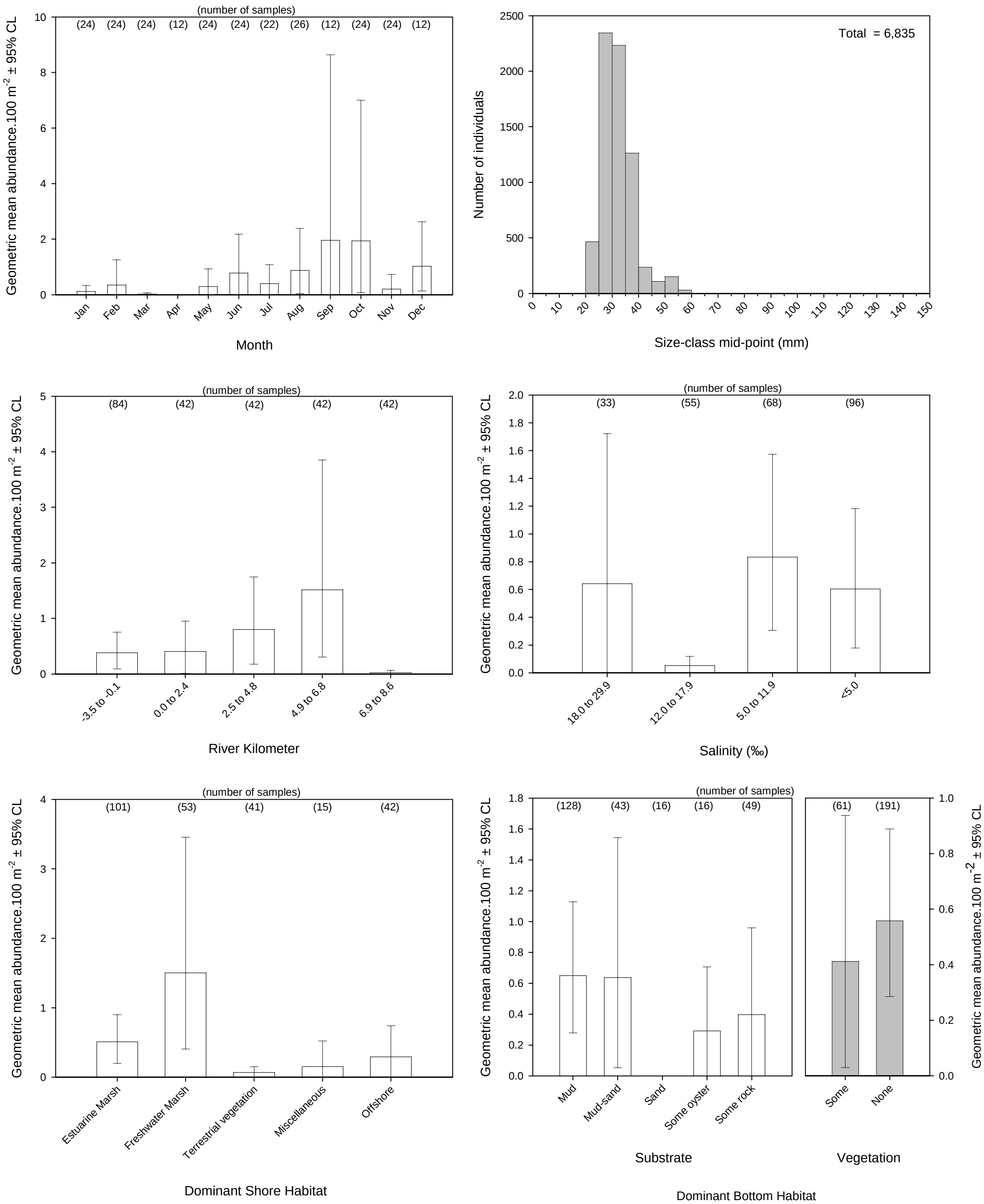


Fig. D4. Relative abundance of bay anchovy collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Synodus foetens (inshore lizardfish) in seines

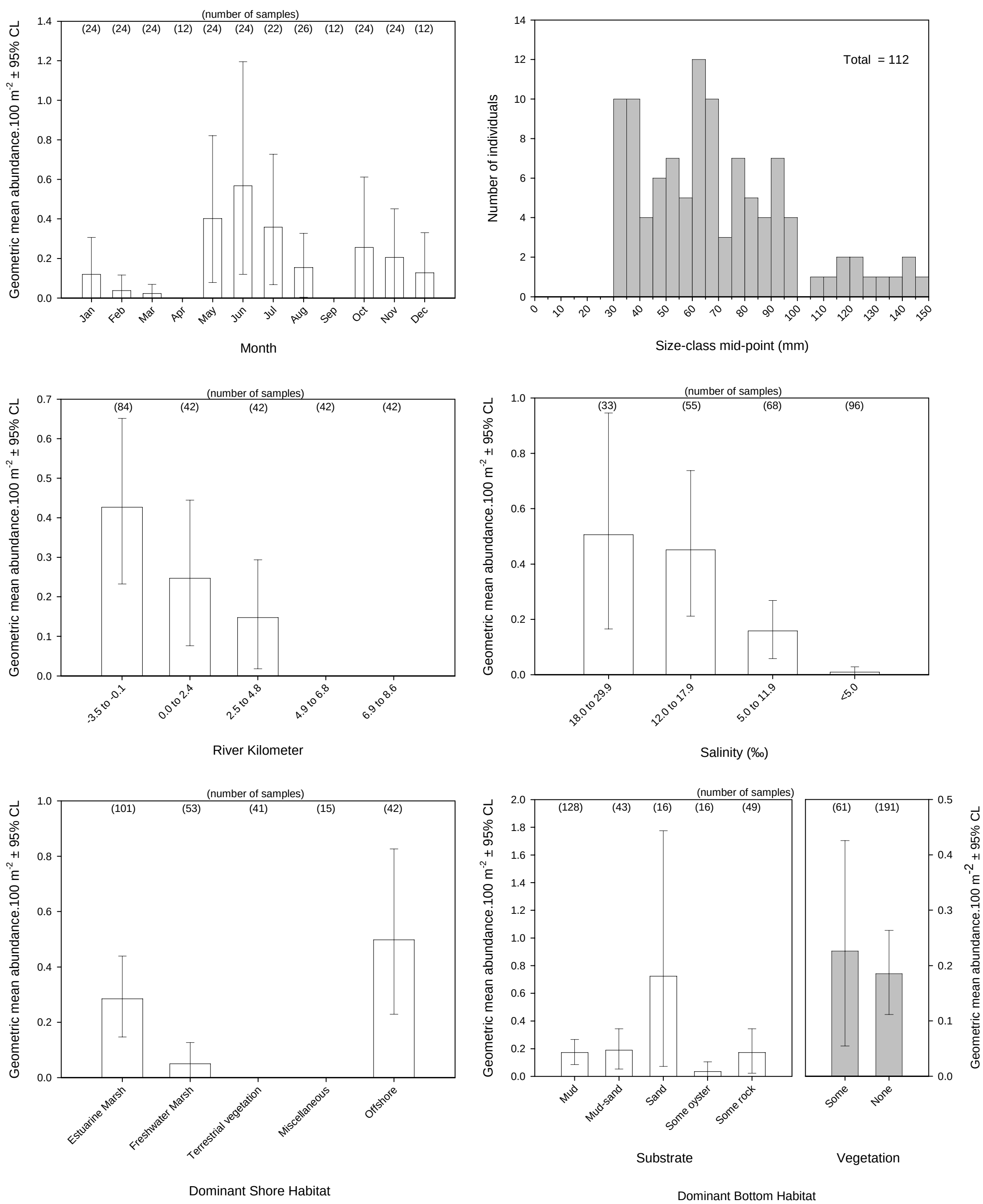


Fig. D5. Relative abundance of inshore lizardfish collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Notropis petersoni (coastal shiner) in seines

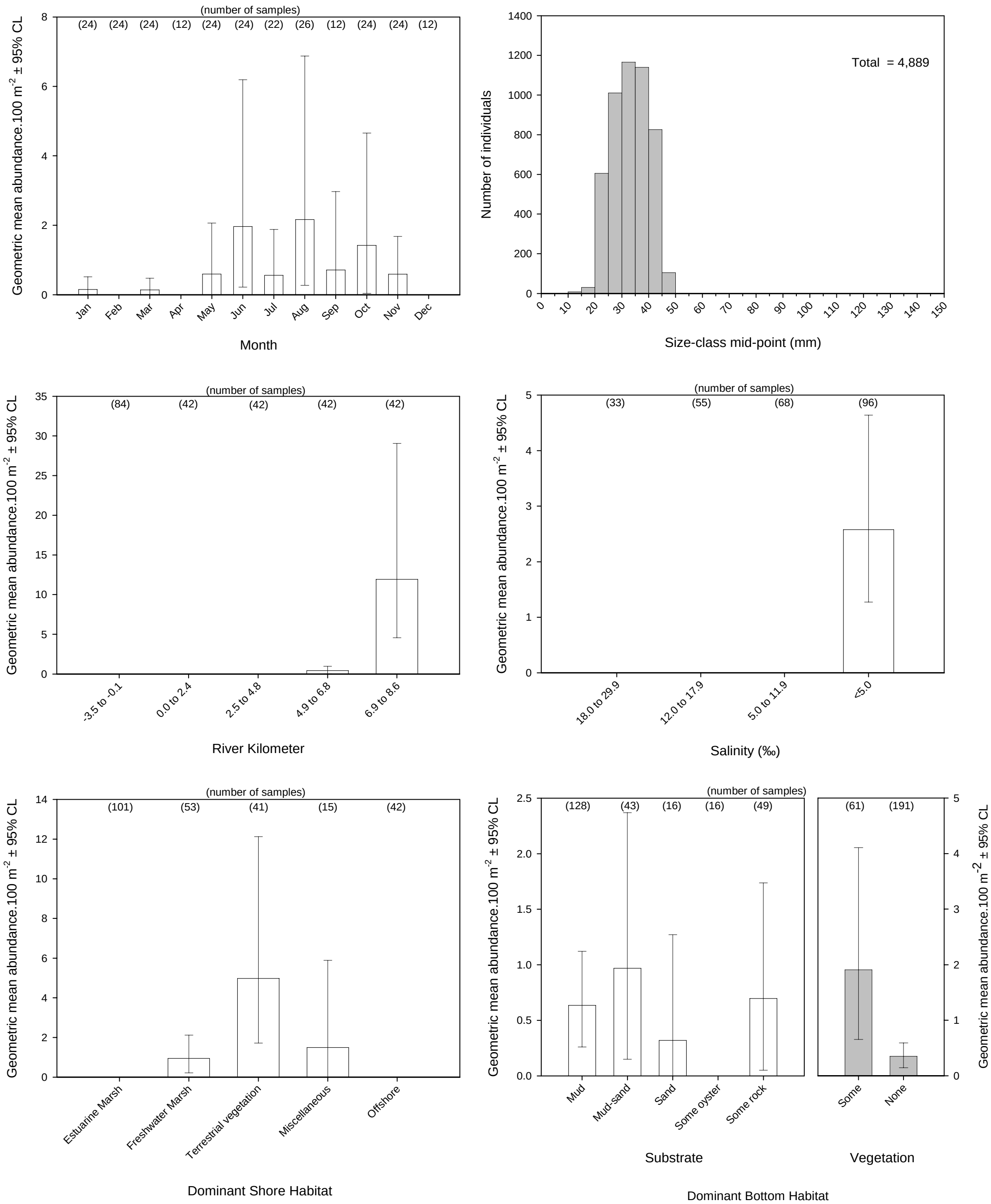


Fig. D6. Relative abundance of coastal shiner collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Strongylura notata (redfin needlefish) in seines

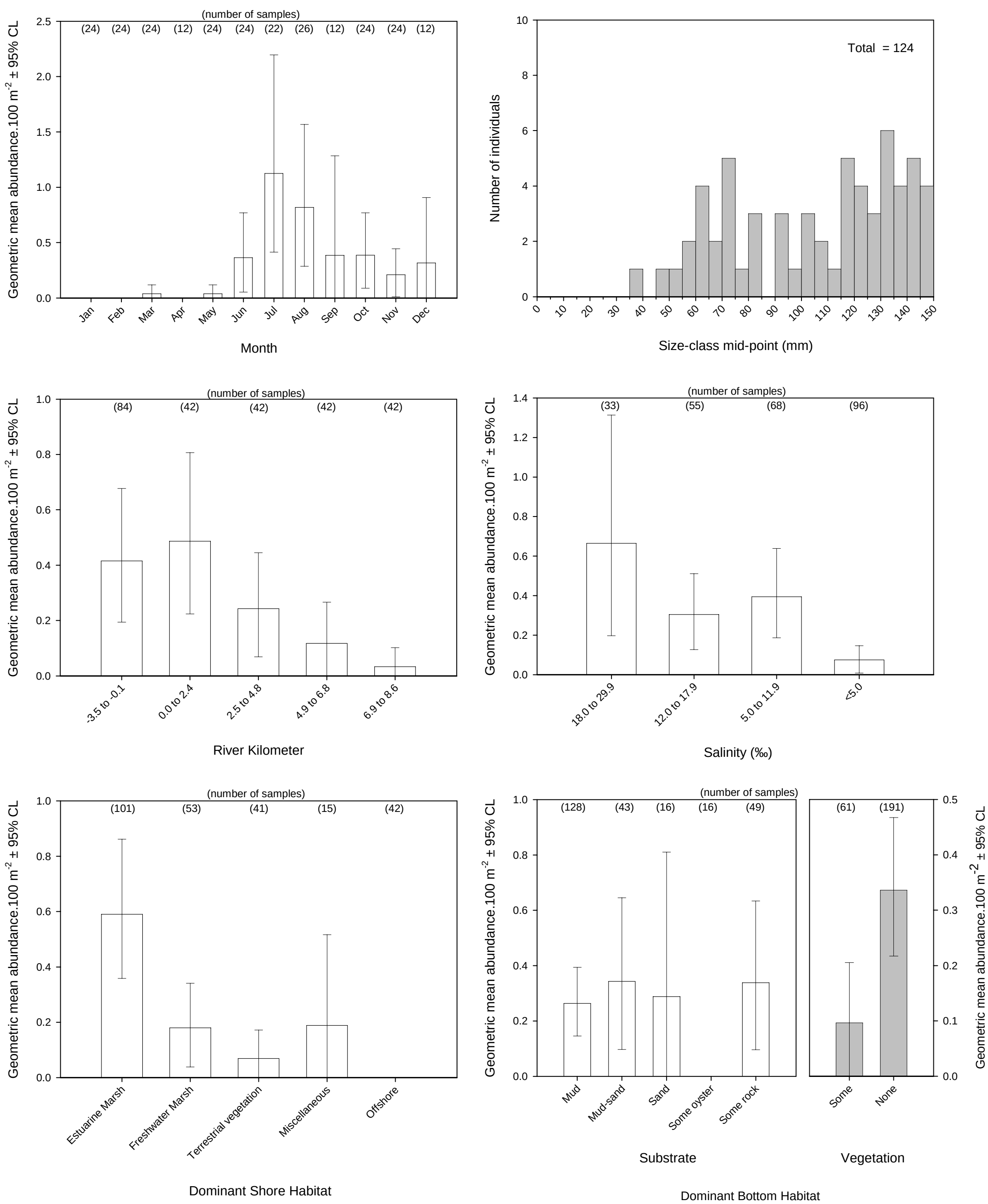


Fig. D7. Relative abundance of redfin needlefish collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Strongylura timucu (timucu) in seines

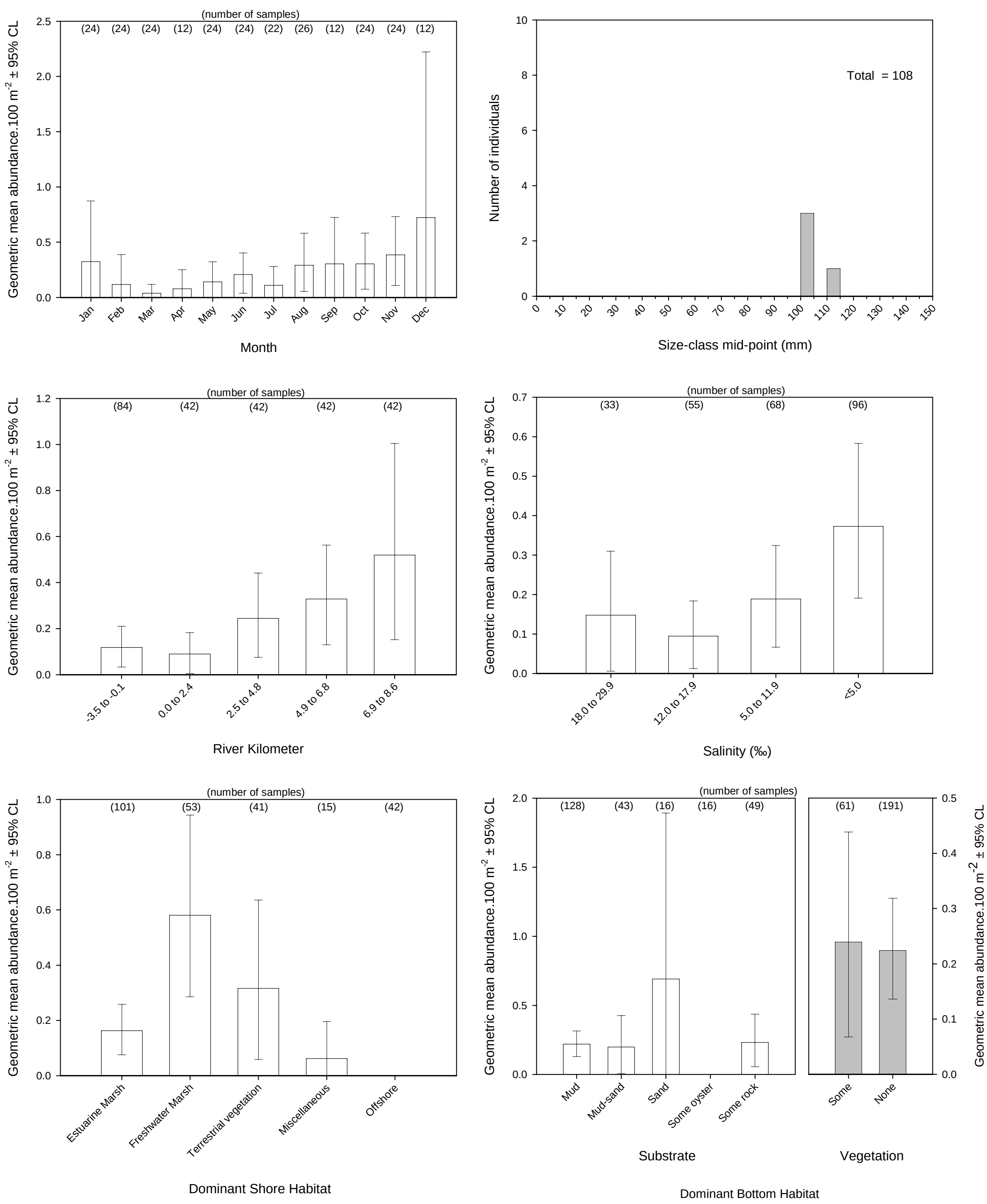


Fig. D8. Relative abundance of timucu collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Cyprinodon variegatus (sheepshead minnow) in seines

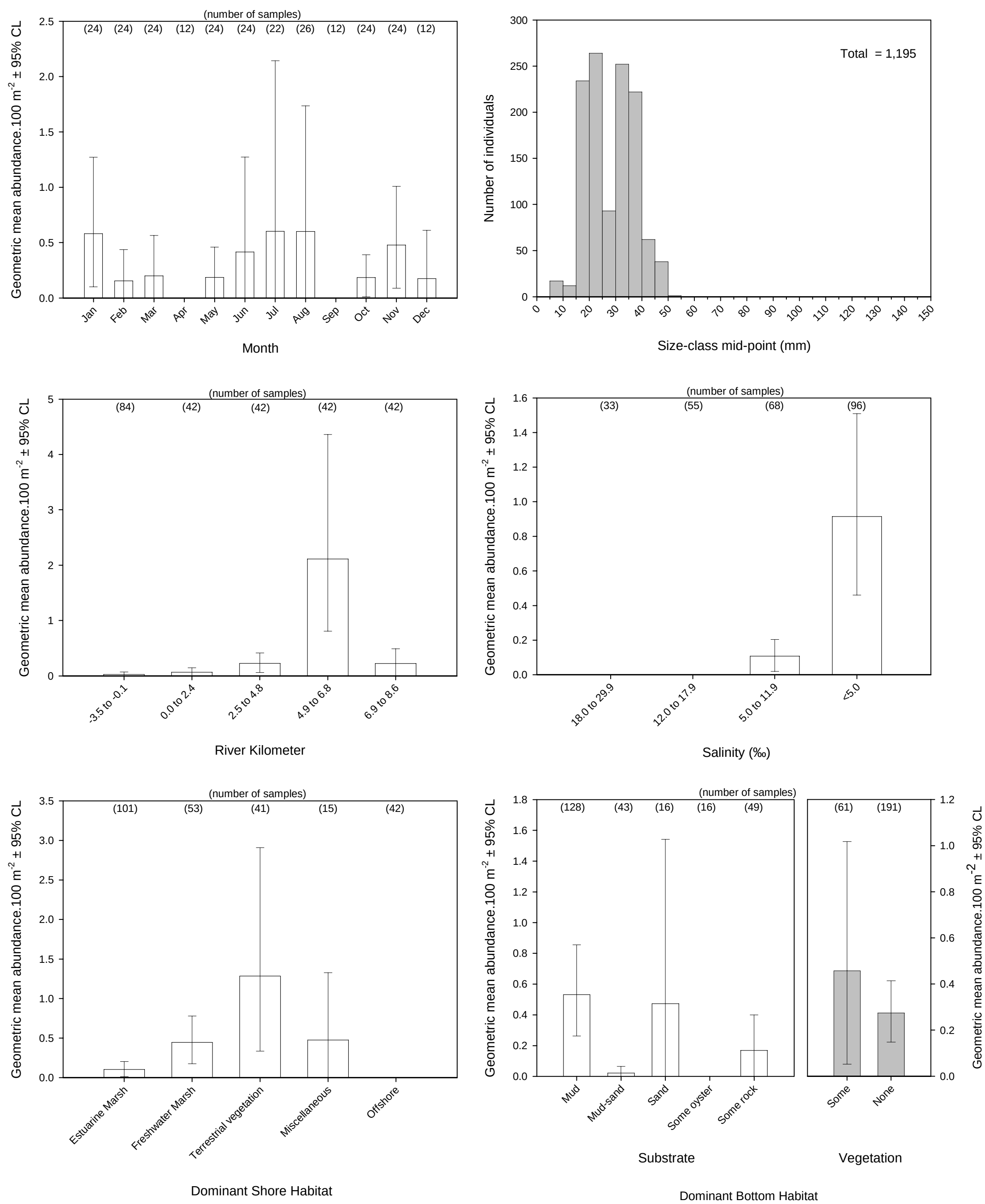


Fig. D9. Relative abundance of sheepshead minnow collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Fundulus grandis (gulf killifish) in seines

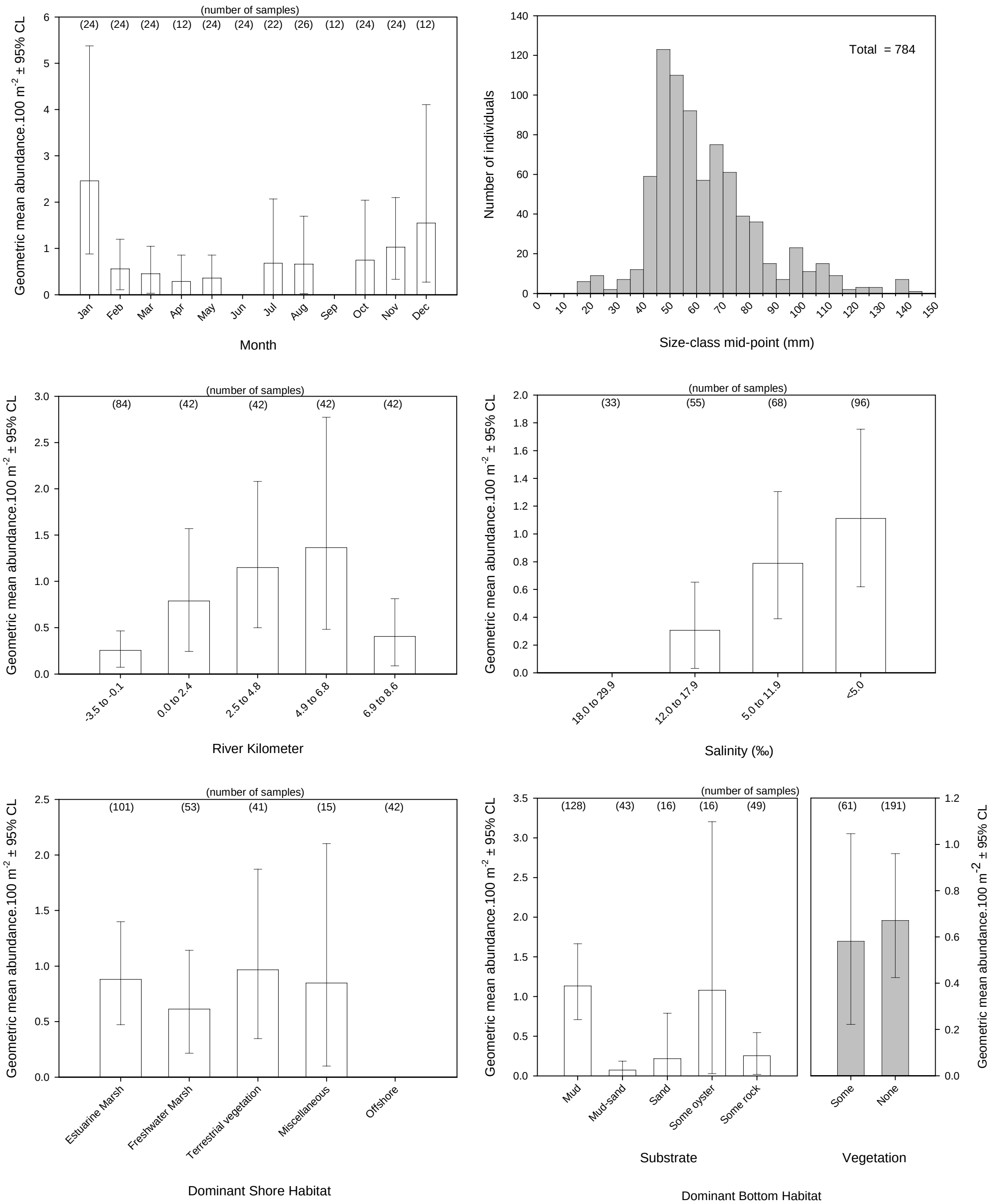


Fig. D10. Relative abundance of gulf killifish collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Fundulus seminolis (Seminole killifish) in seines

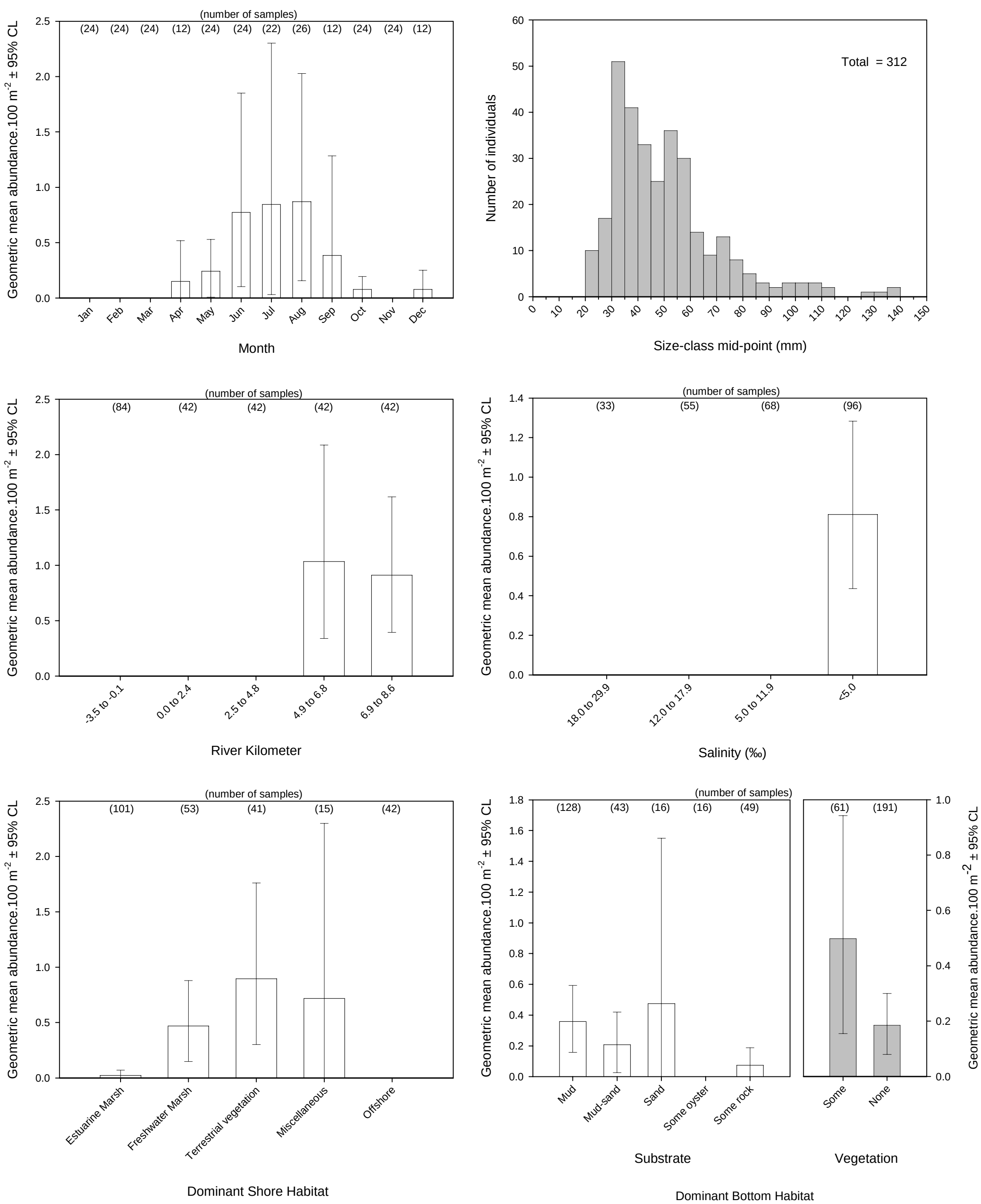


Fig. D11. Relative abundance of Seminole killifish collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Lucania parva (rainwater killifish) in seines

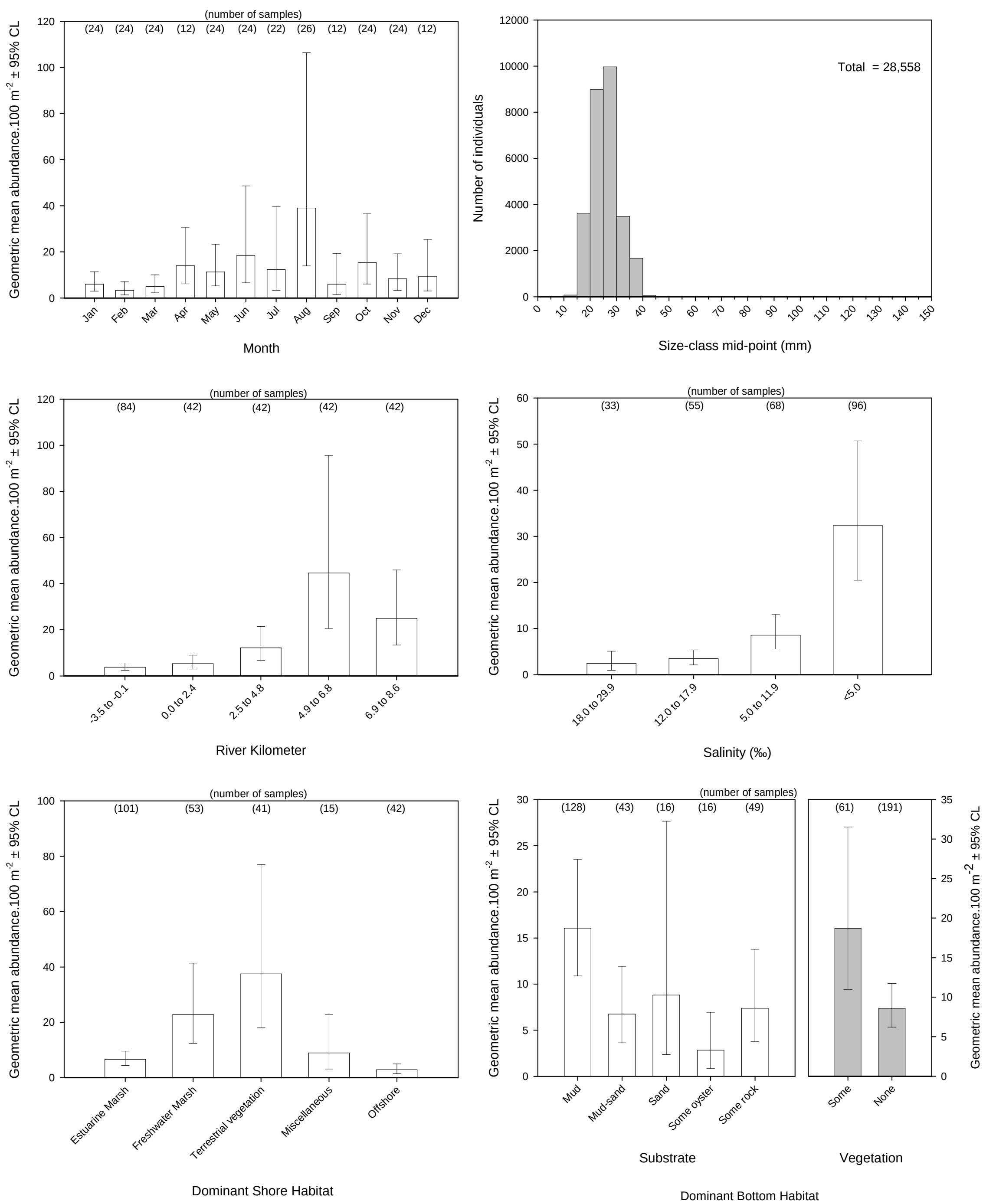


Fig. D12. Relative abundance of rainwater killifish collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Lucania goodei (bluefin killifish) in seines

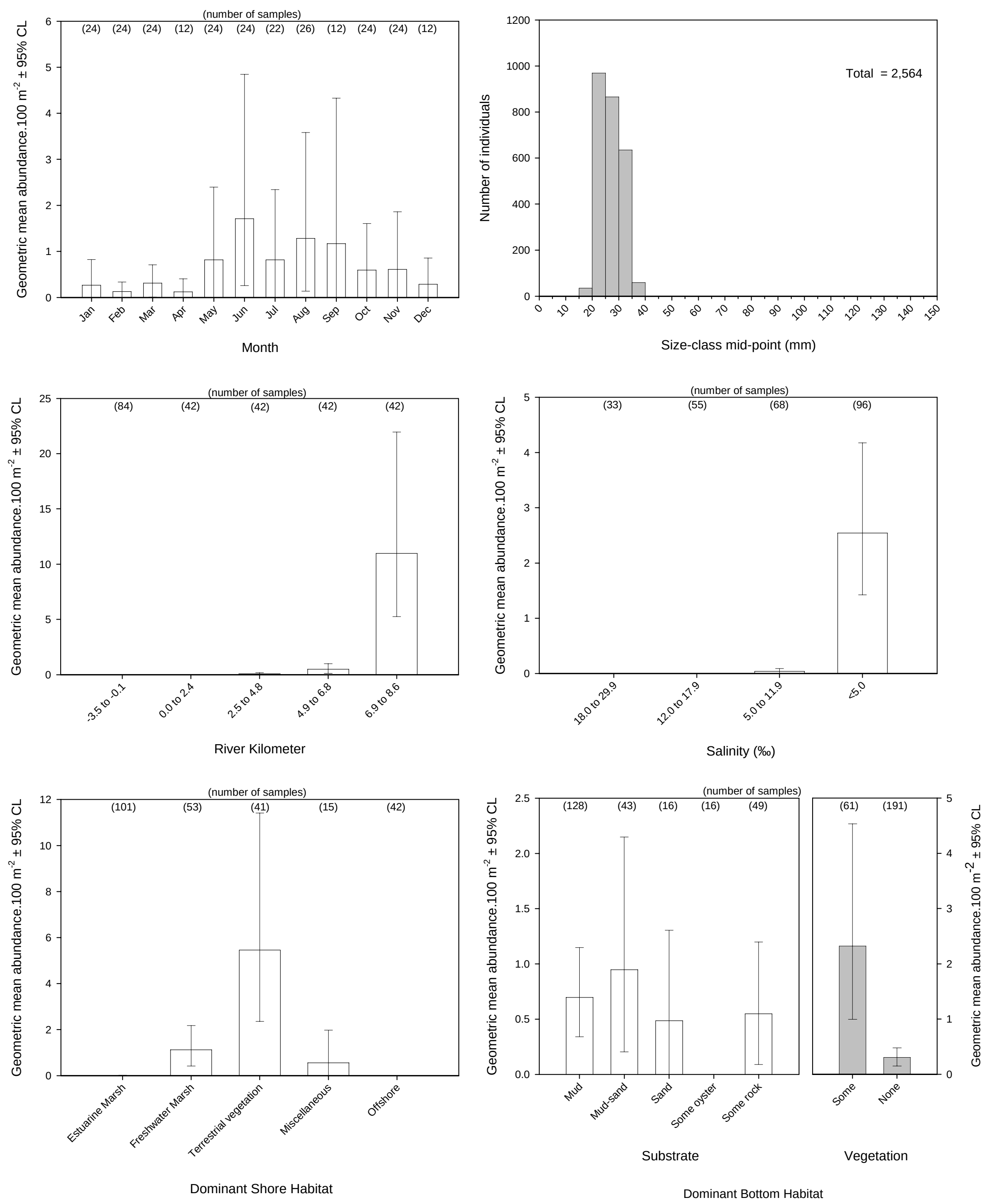


Fig. D13. Relative abundance of bluefin killifish collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Floridichthys carpio (goldspotted killifish) in seines

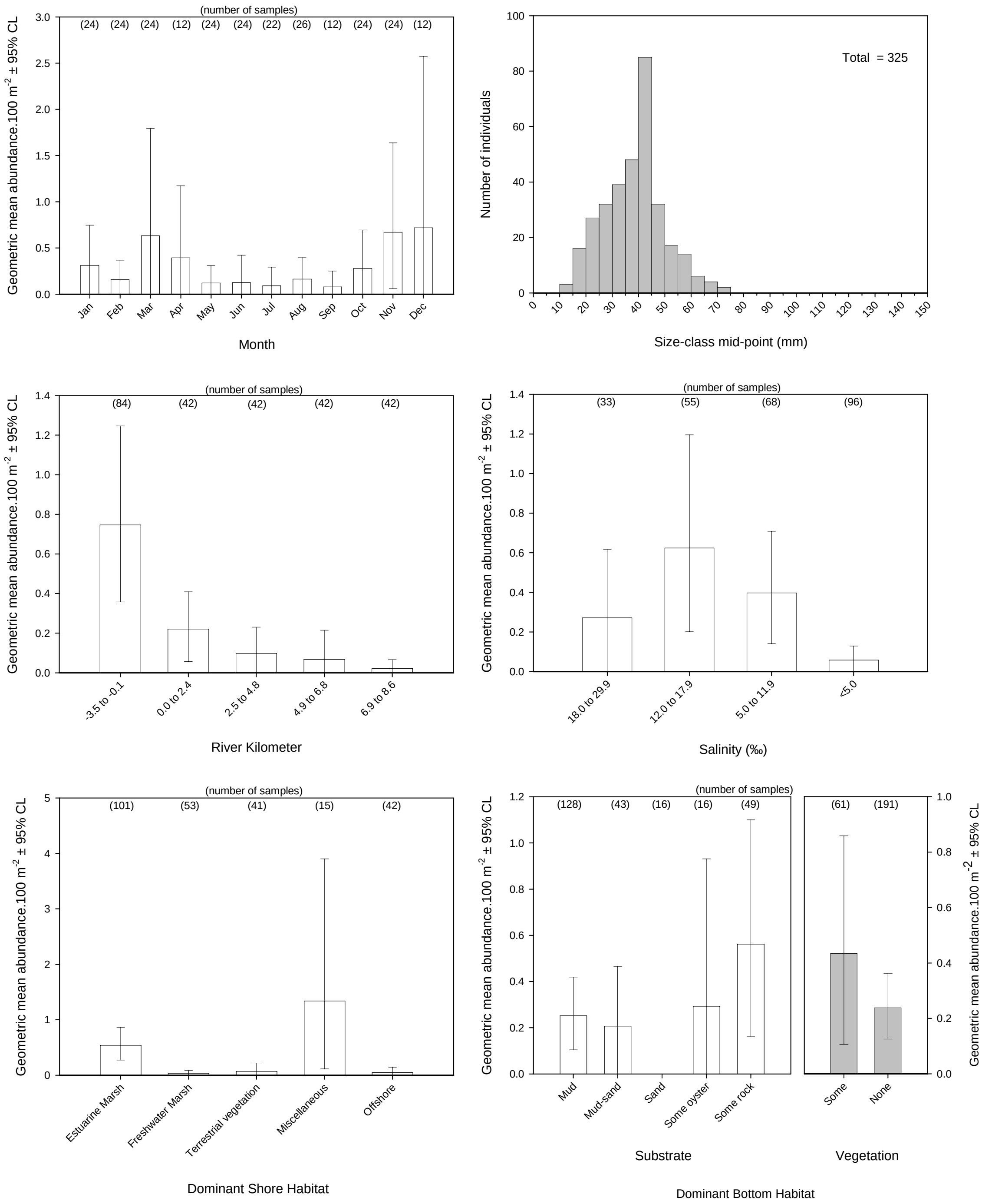


Fig. D14. Relative abundance of goldspotted killifish collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Gambusia holbrooki (Eastern mosquitofish) in seines

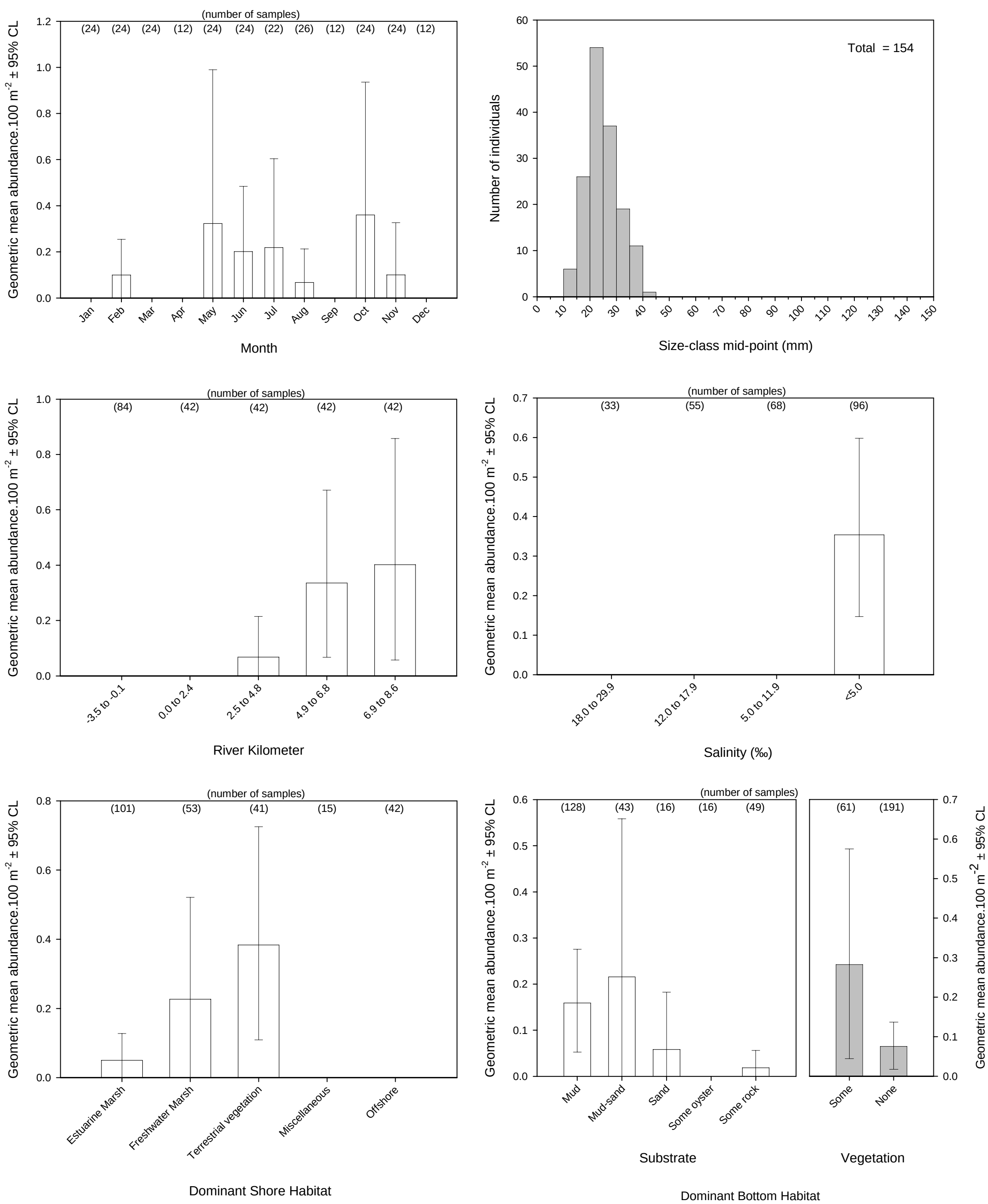


Fig. D15. Relative abundance of Eastern mosquitofish collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Poecilia latipinna (sailfin molly) in seines

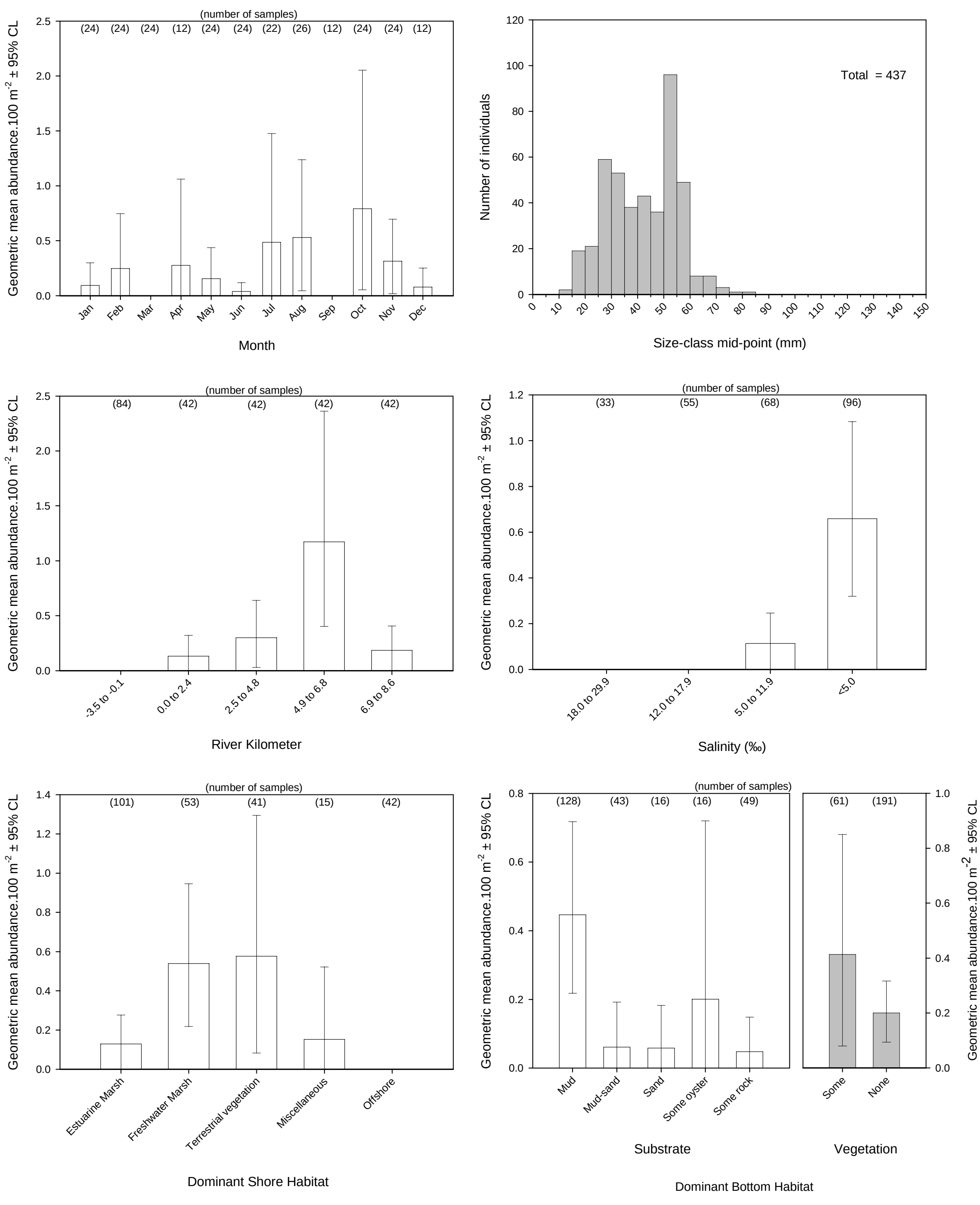


Fig. D16. Relative abundance of sailfin molly collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Menidia spp. (silverside menidia) in seines

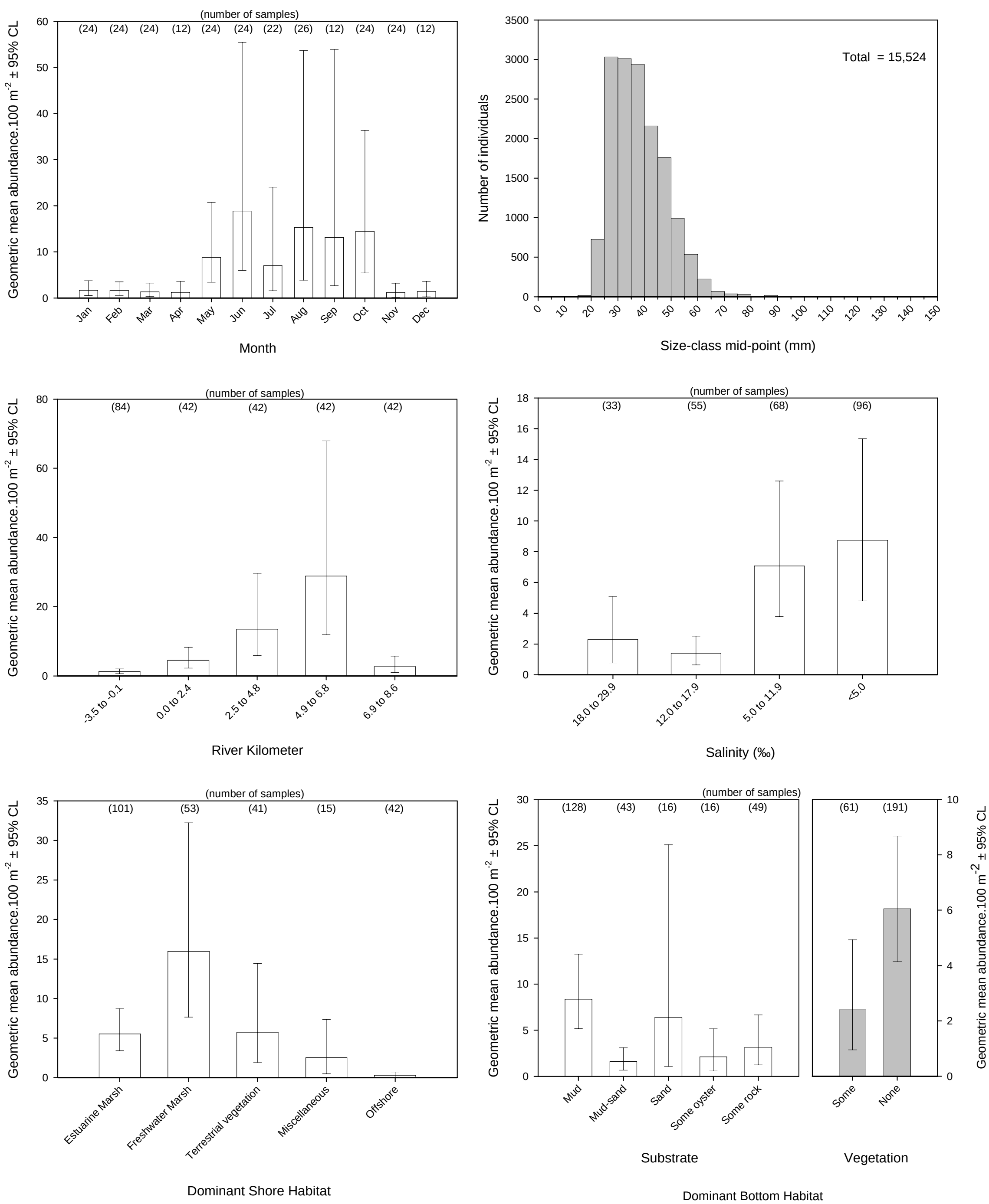


Fig. D17. Relative abundance of silverside menidia collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Syngnathus scovelli (Gulf pipefish) in seines

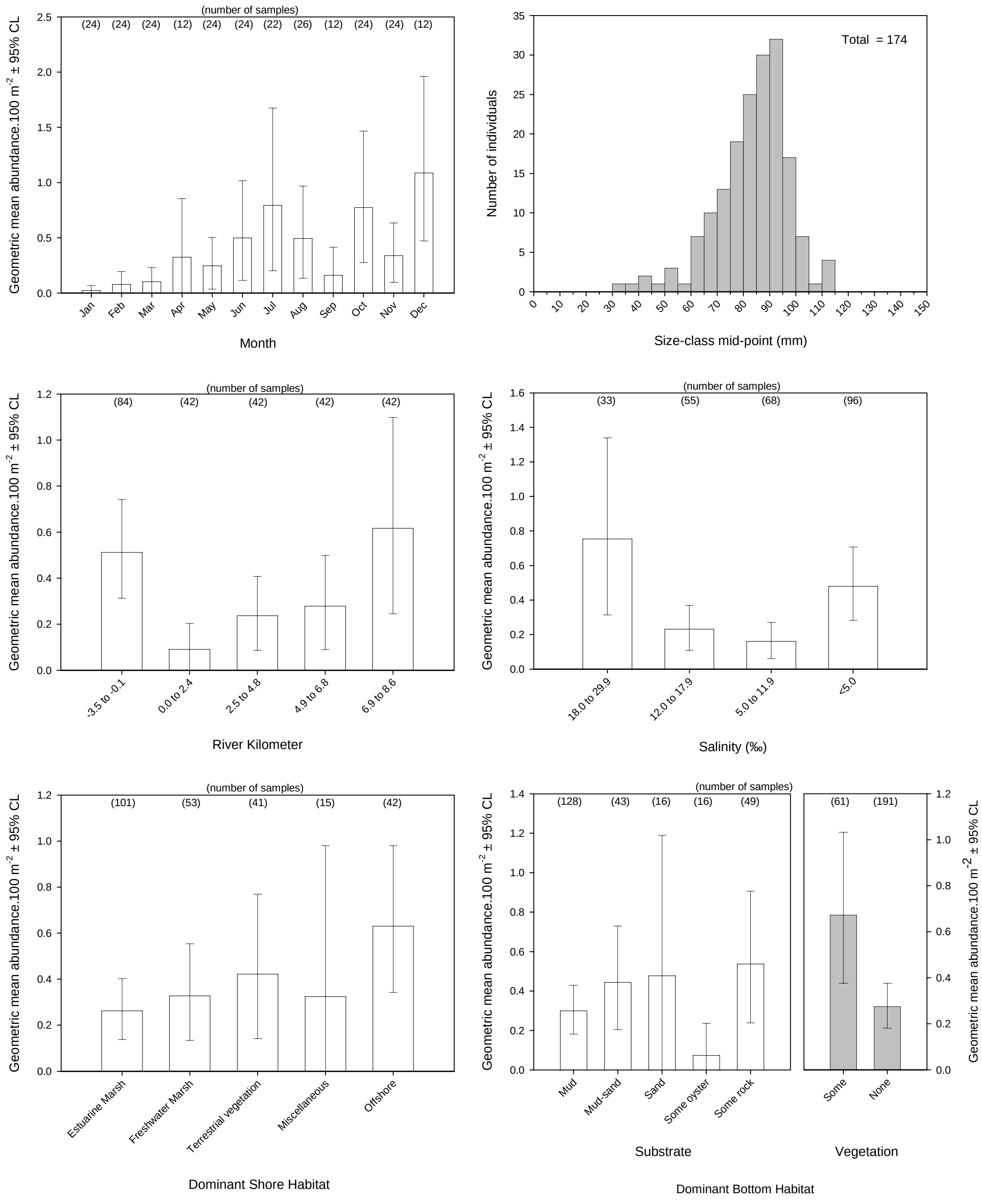


Fig. D18. Relative abundance of Gulf pipefish collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Lepomis punctatus (spotted sunfish) in seines

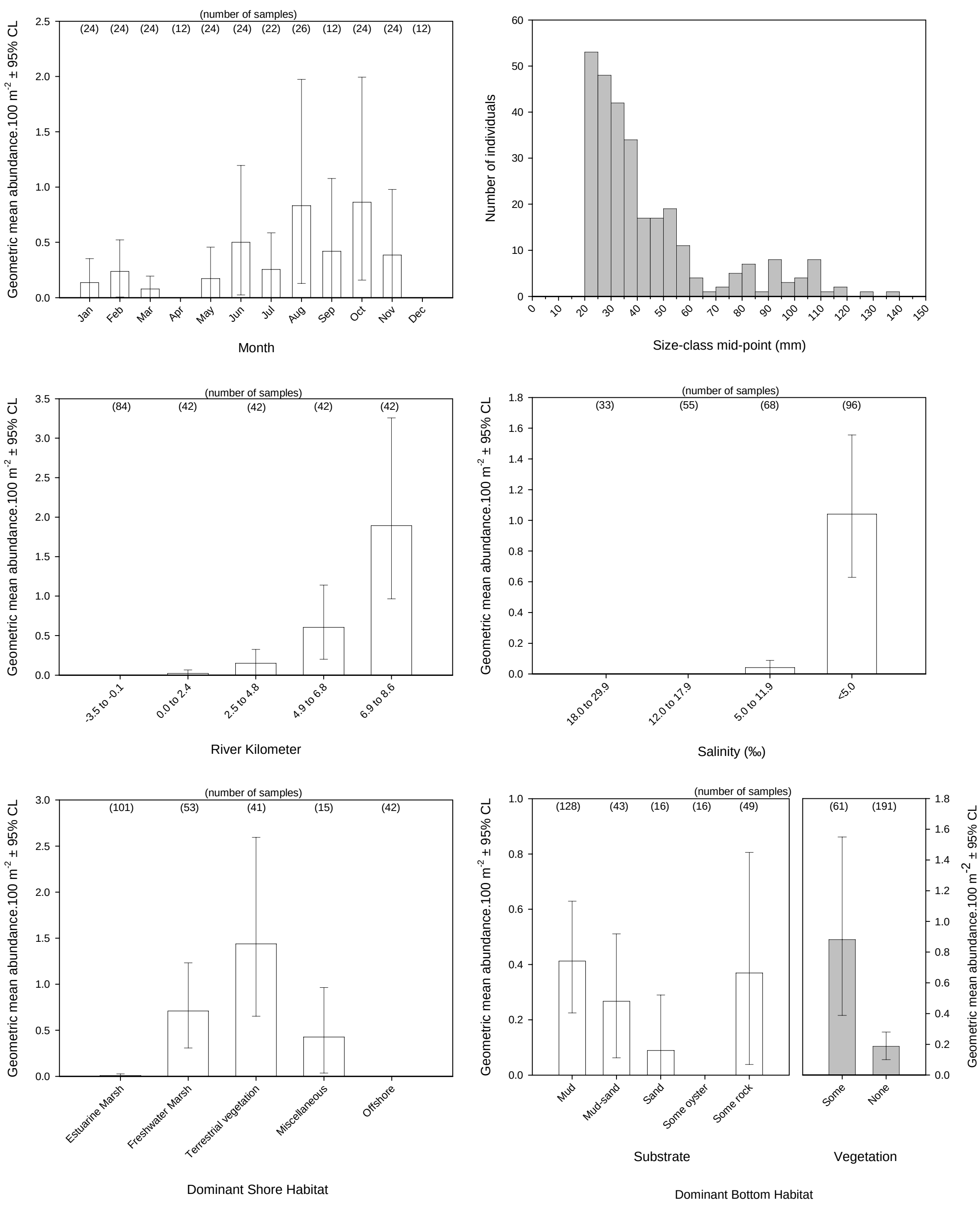


Fig. D19. Relative abundance of spotted sunfish collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Micropterus salmoides (largemouth bass) in seines

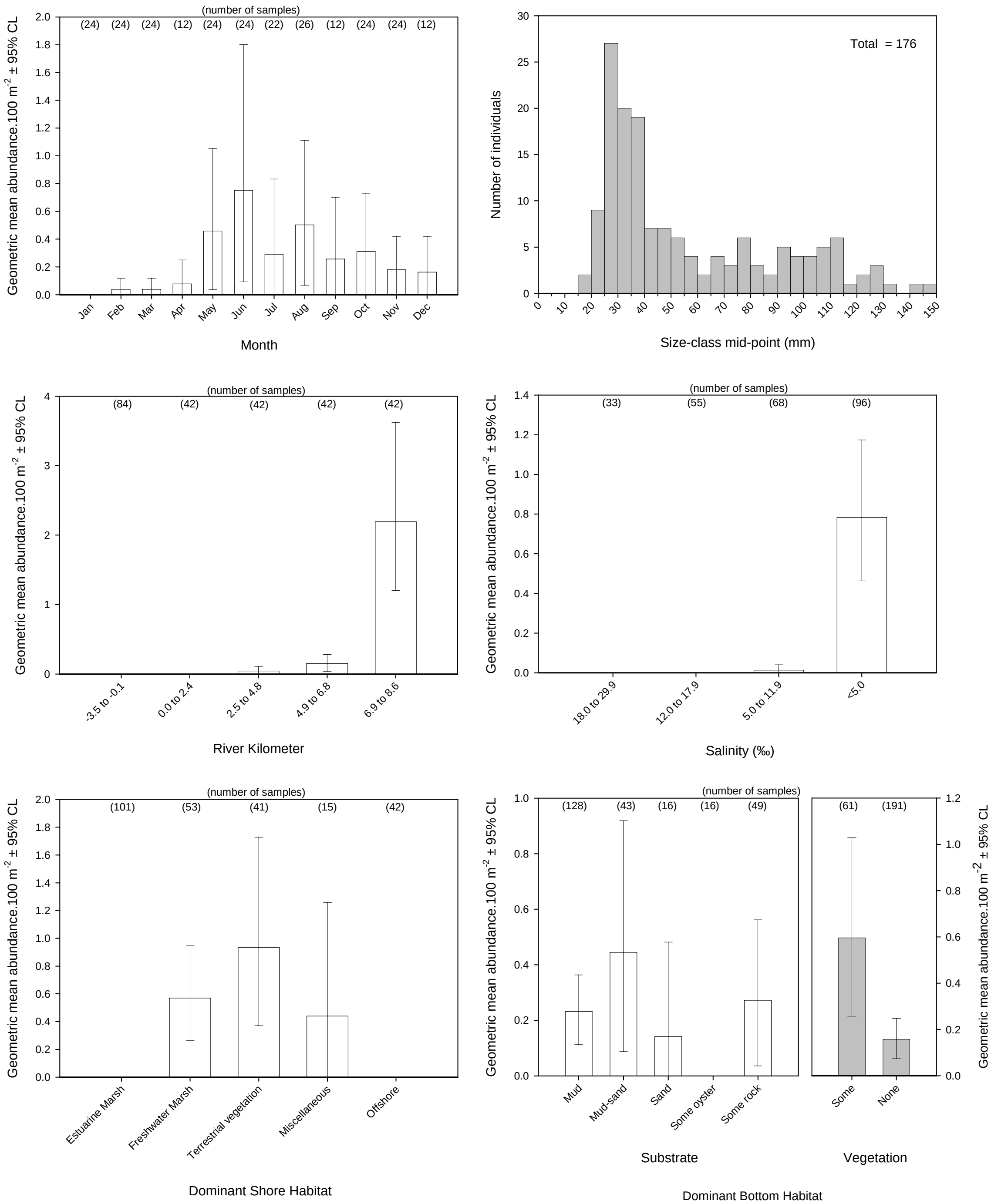


Fig. D20. Relative abundance of largemouth bass collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Eucinostomus spp. (Eucinostomus mojarras) in seines

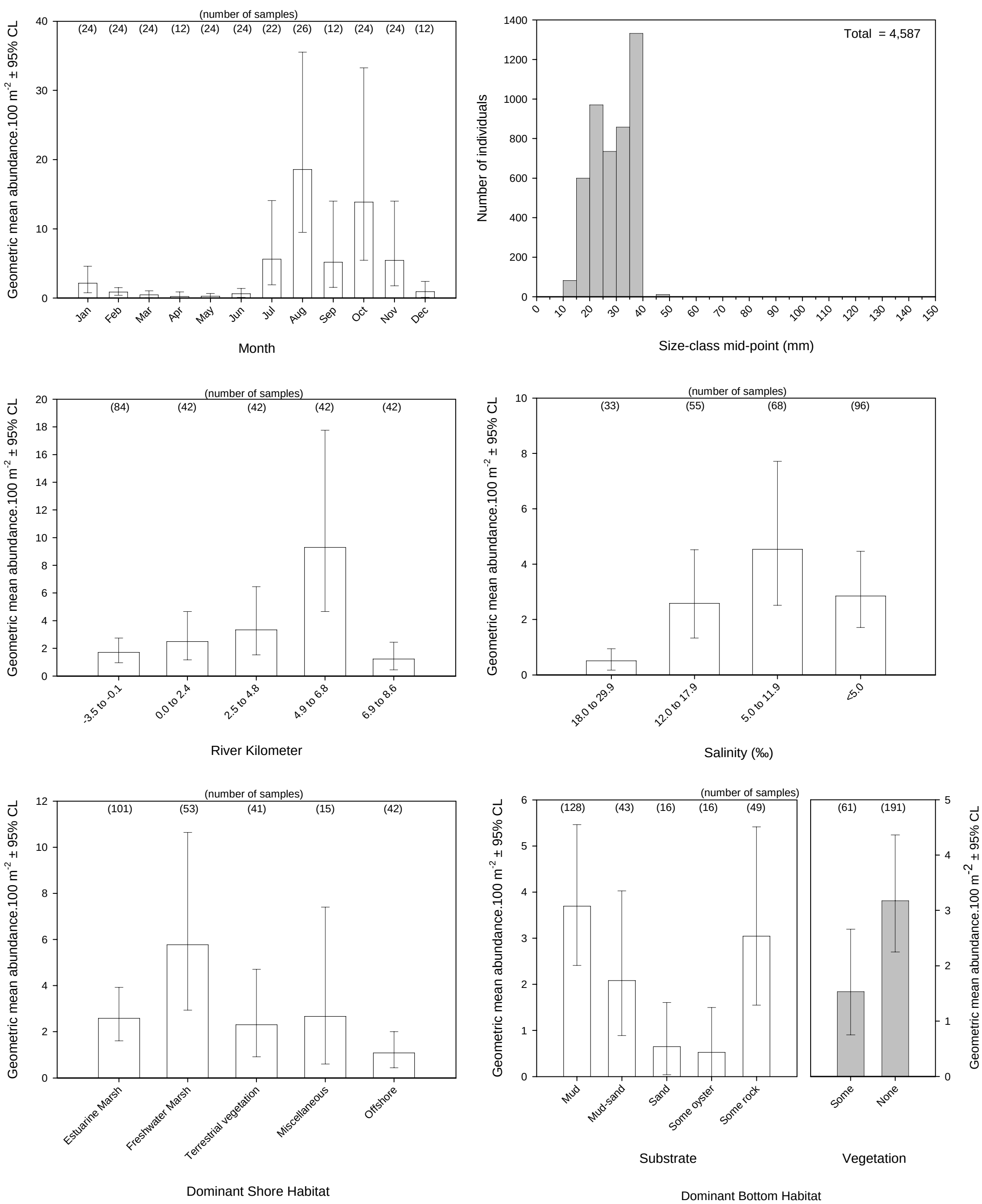


Fig. D21. Relative abundance of Eucinostomus mojarras collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Eucinostomus gula (silver jenny) in seines

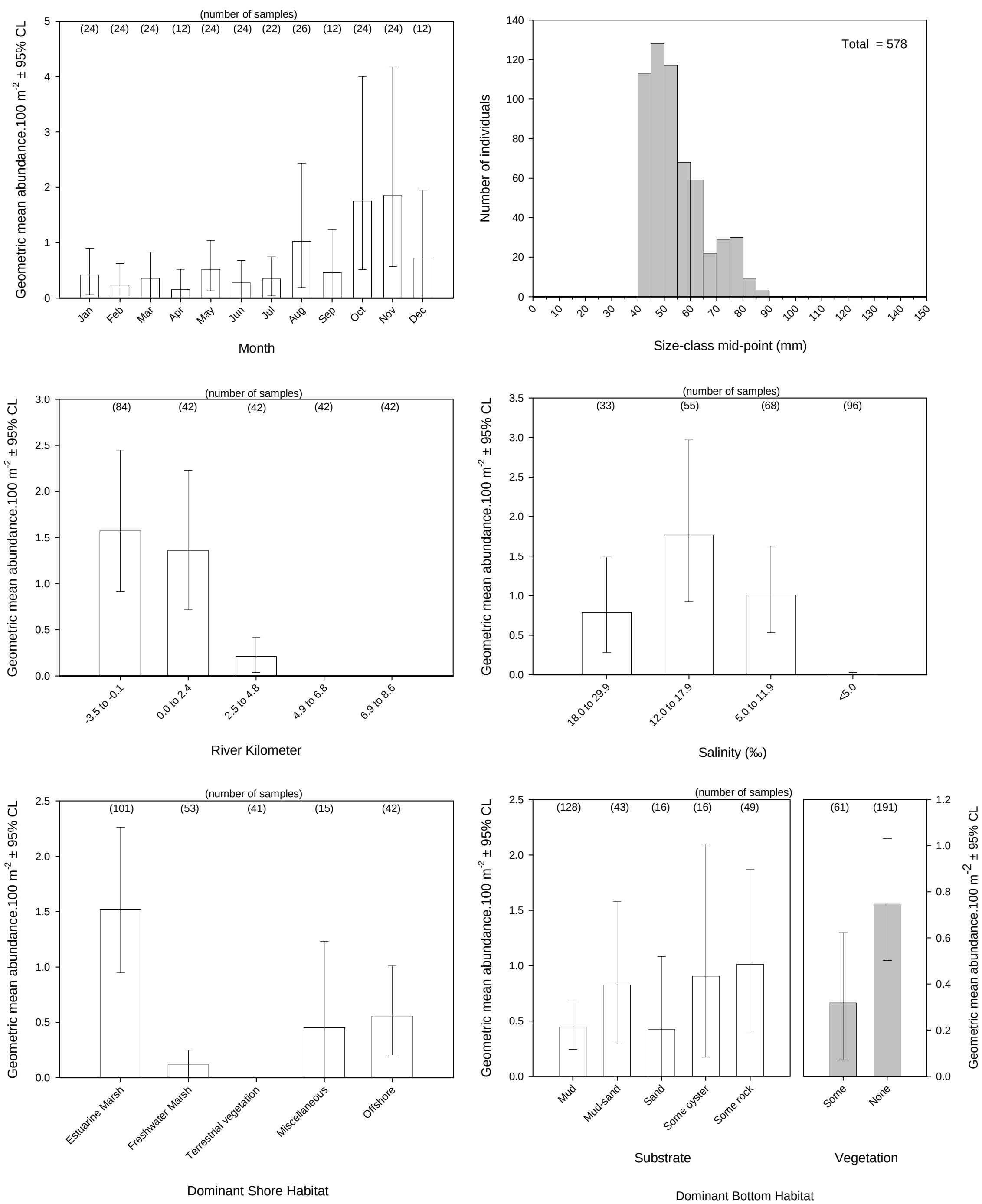


Fig. D22. Relative abundance of silver jenny collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Eucinostomus harengulus (tidewater mojarra) in seines

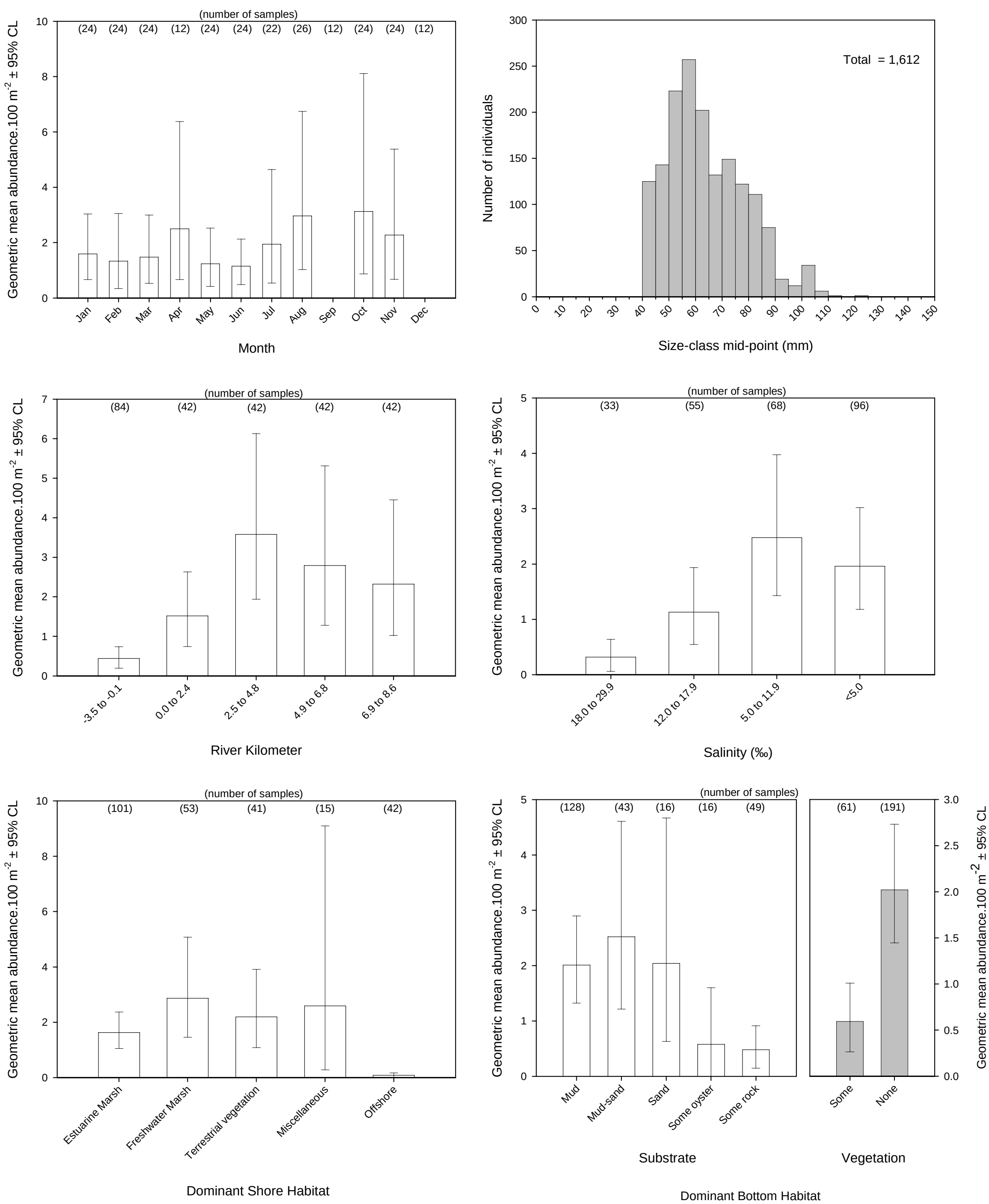


Fig. D23. Relative abundance of tidewater mojarra collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Lagodon rhomboides (pinfish) in seines

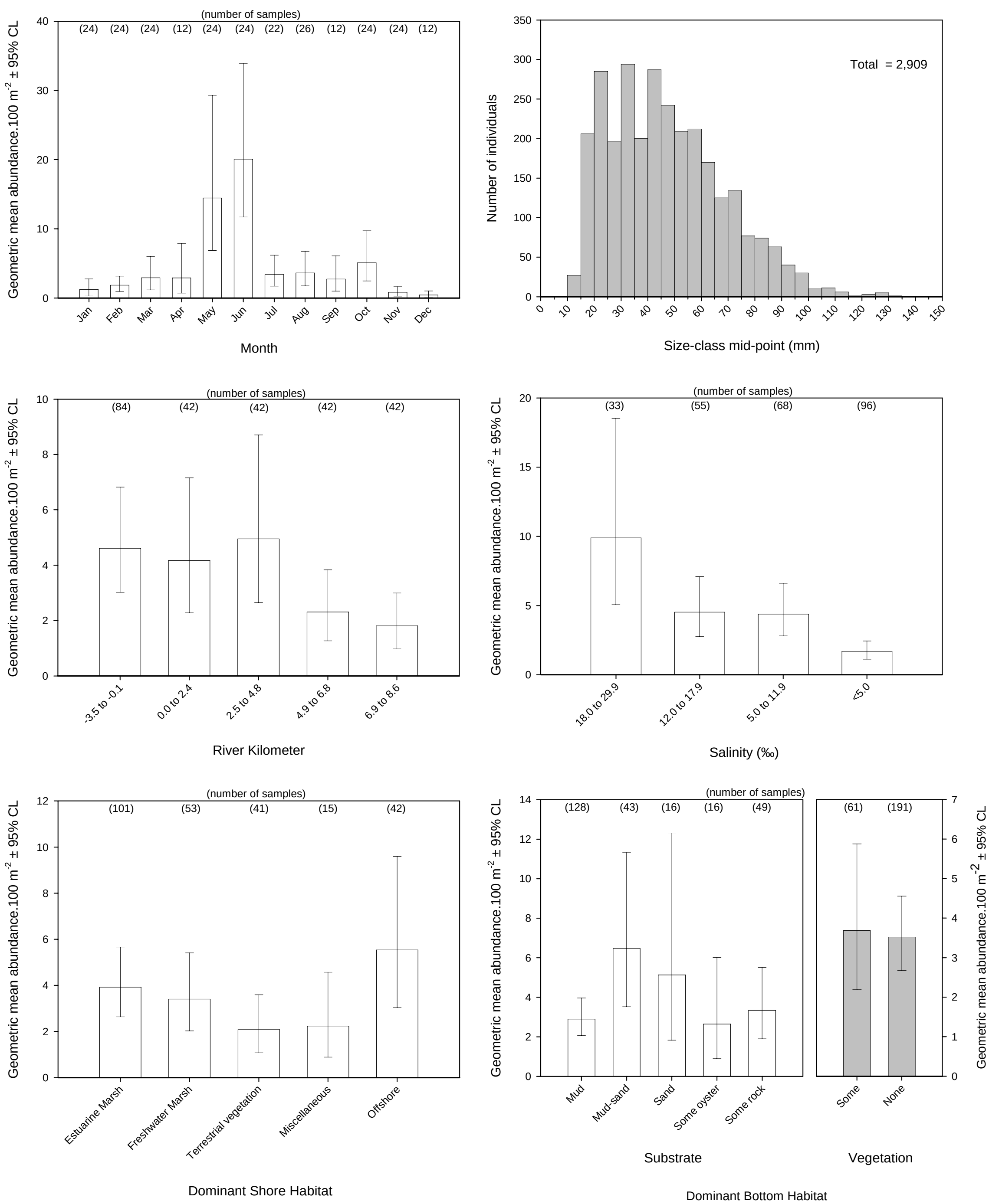


Fig. D24. Relative abundance of pinfish collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Leiostomus xanthurus (spot) in seines

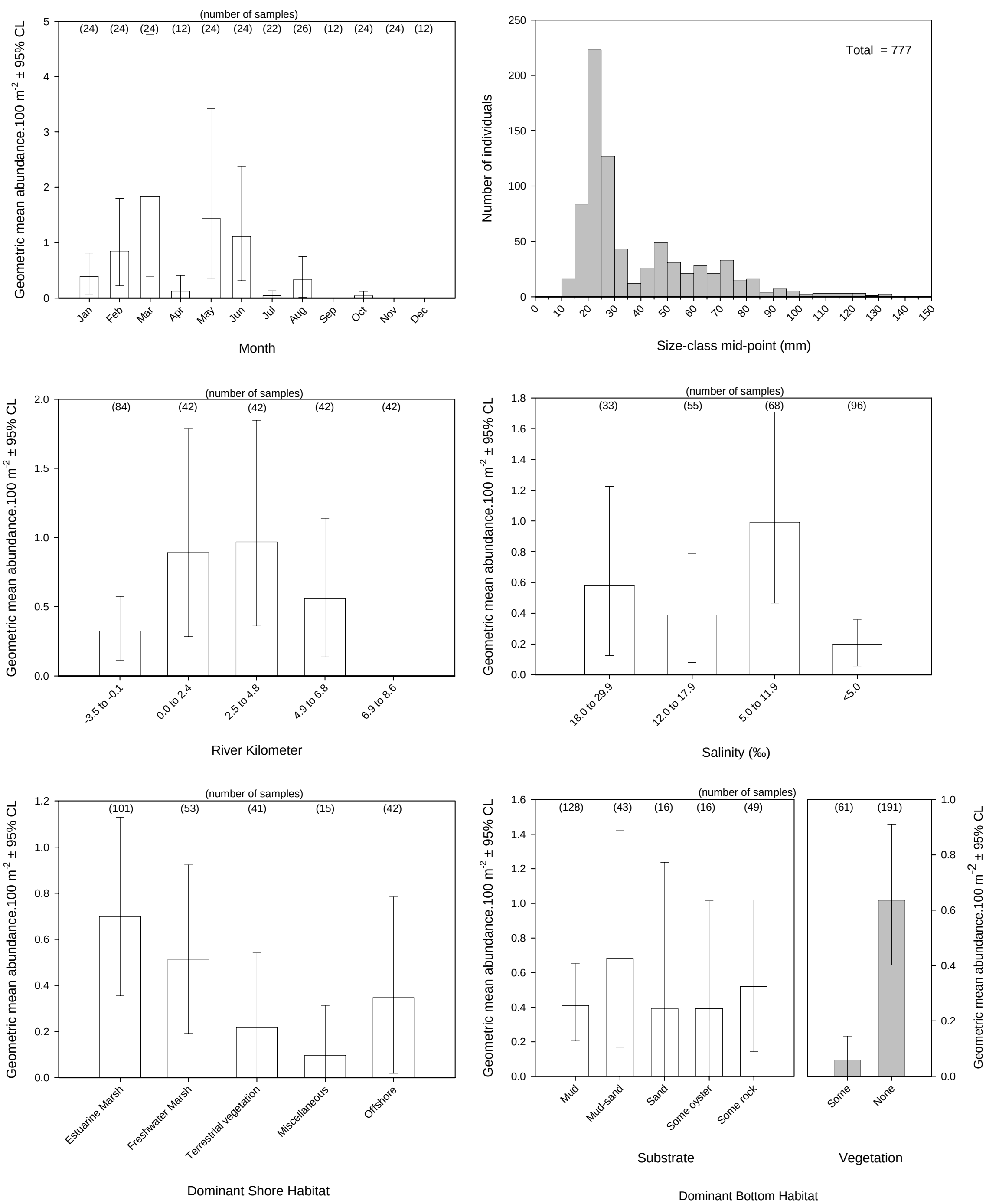


Fig. D25. Relative abundance of spot collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Mugil cephalus (striped mullet) in seines

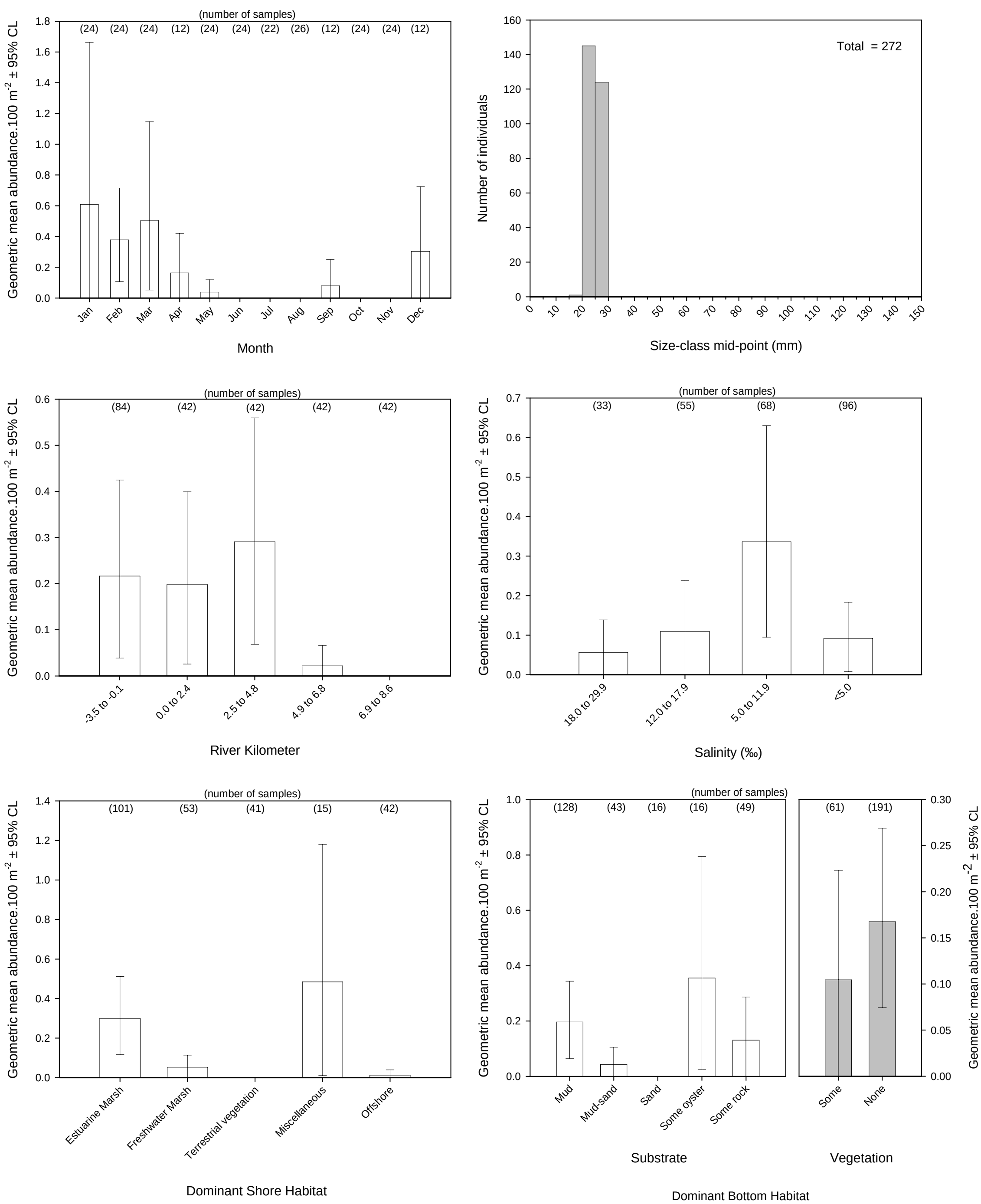


Fig. D26. Relative abundance of striped mullet collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Microgobius gulosus (clown goby) in seines

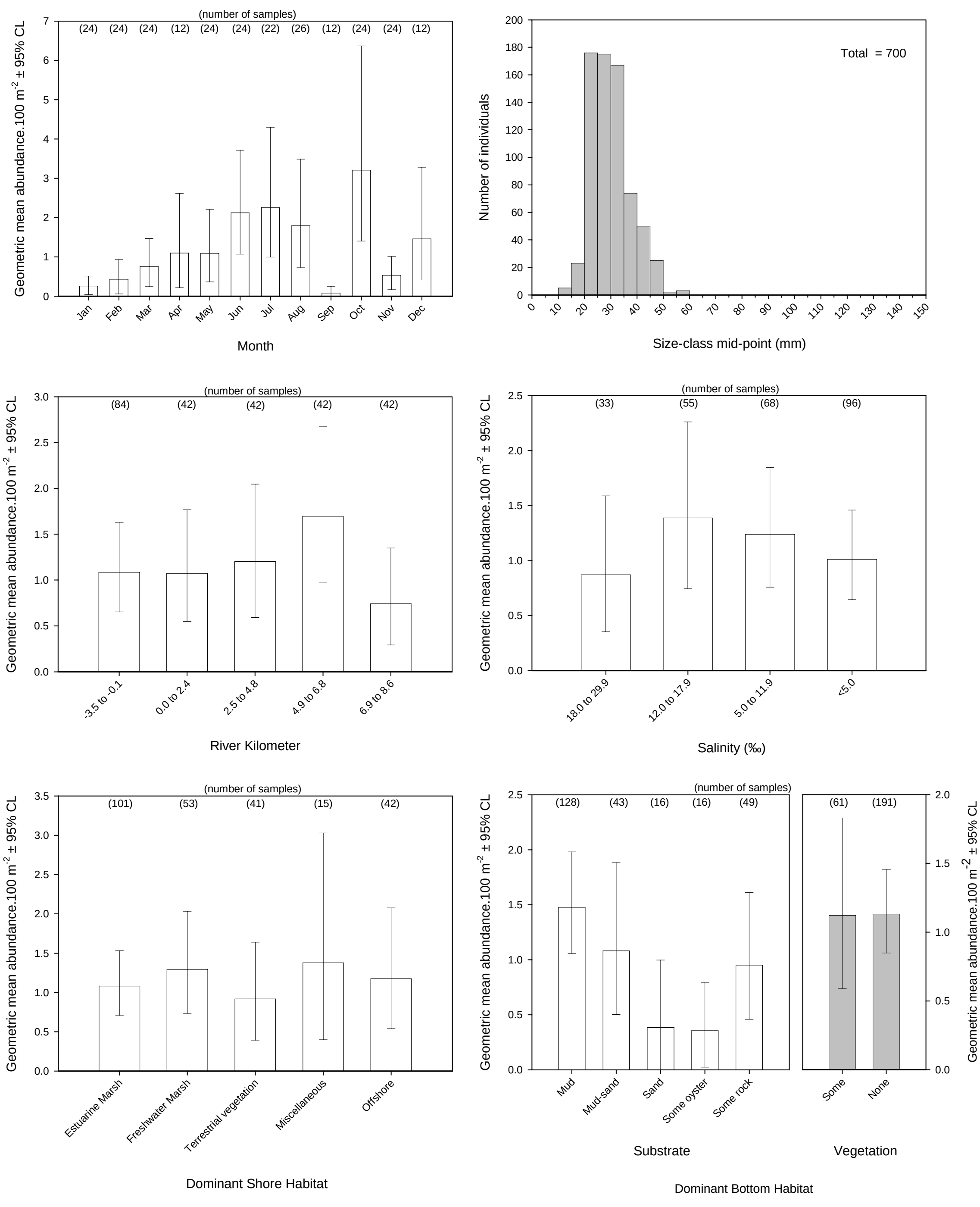


Fig. D27. Relative abundance of clown goby collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

CI.

Trinectes maculatus (hogchoker) in seines

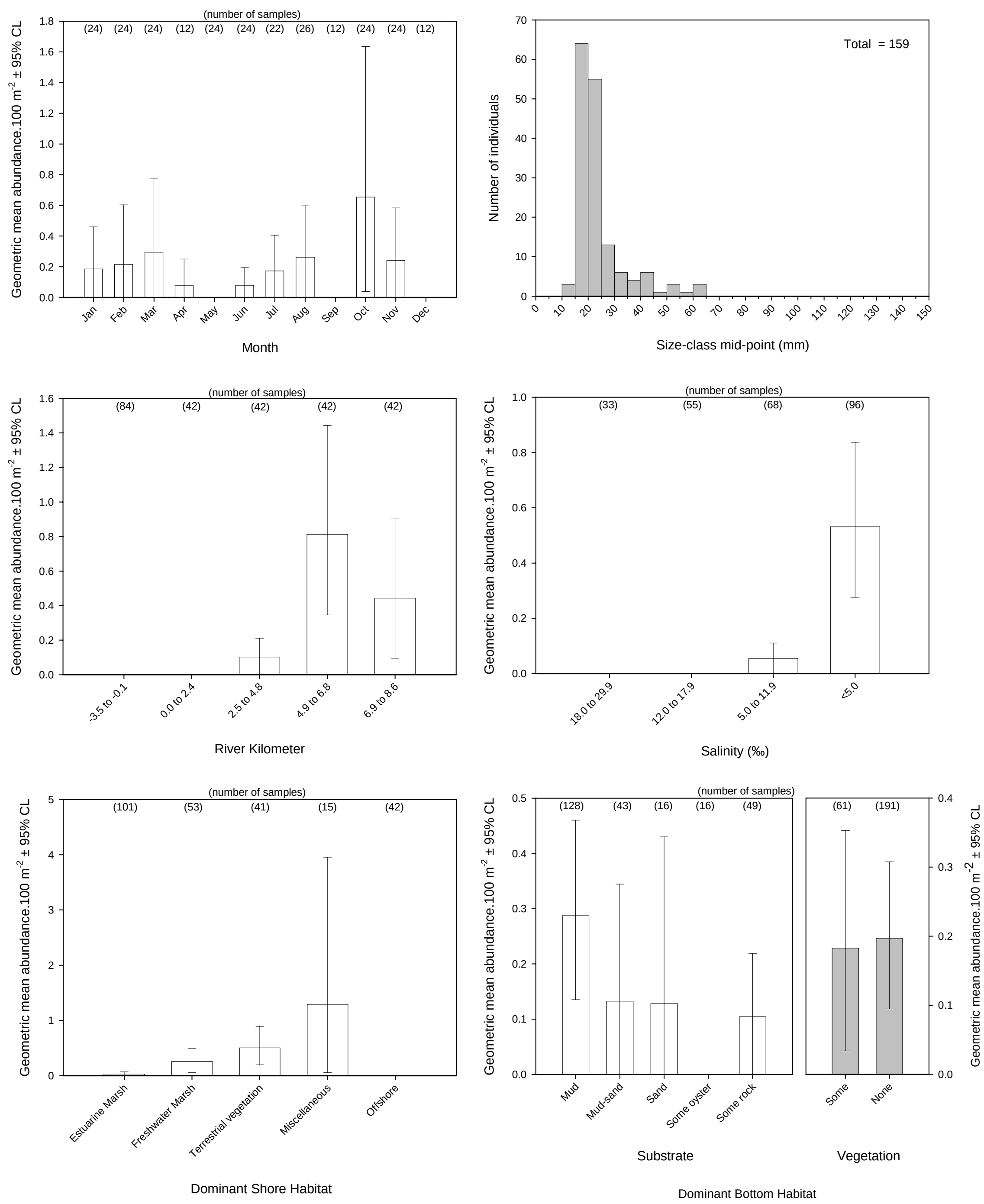


Fig. D28. Relative abundance of hogchoker collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Sphoeroides nephelus (Southern puffer) in seines

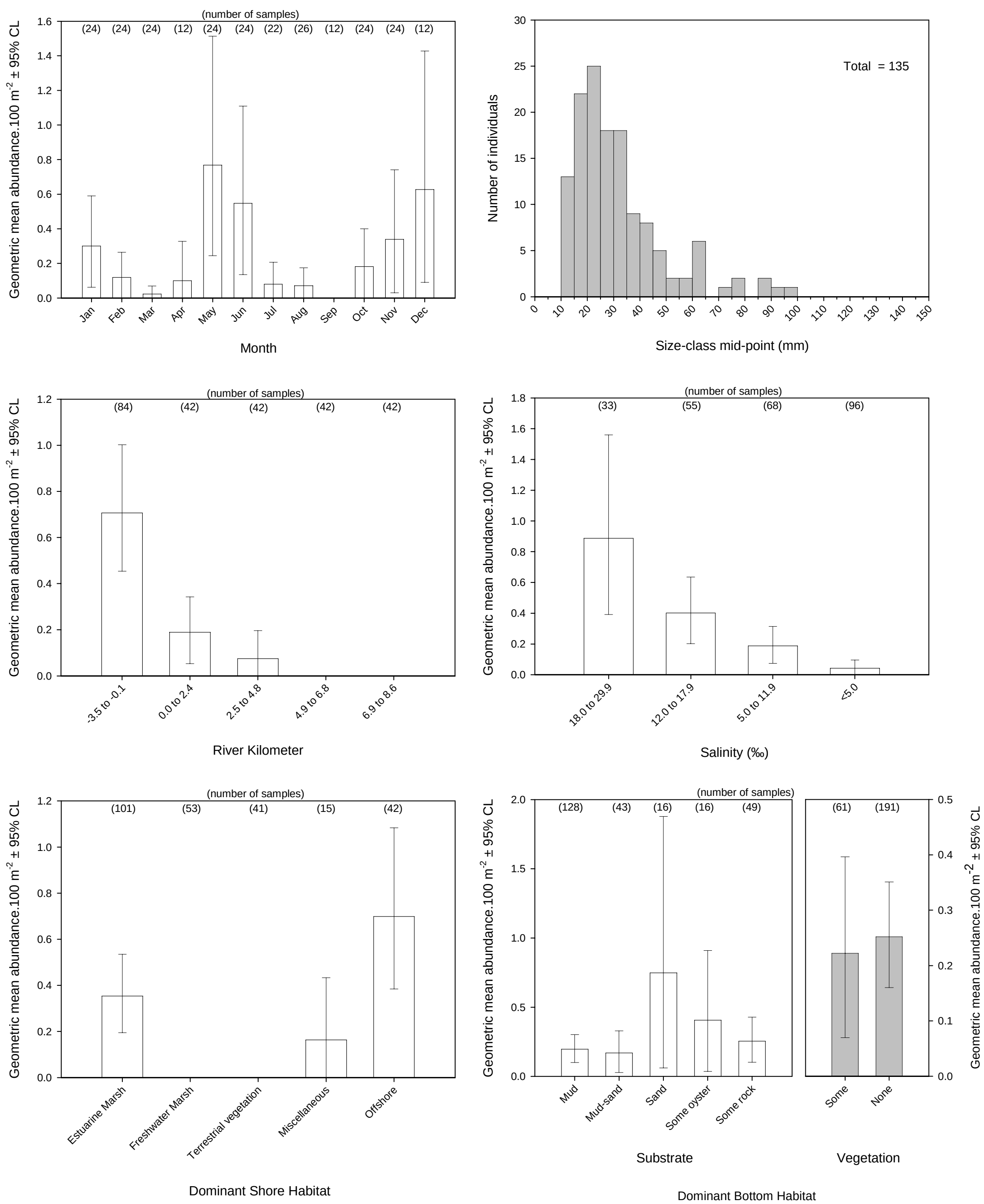


Fig. D29. Relative abundance of Southern puffer collected with seines (water depths <= 1.8-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Appendix E:

Trawl catch overview plots

Farfantepenaeus duorarum (pink shrimp), trawls

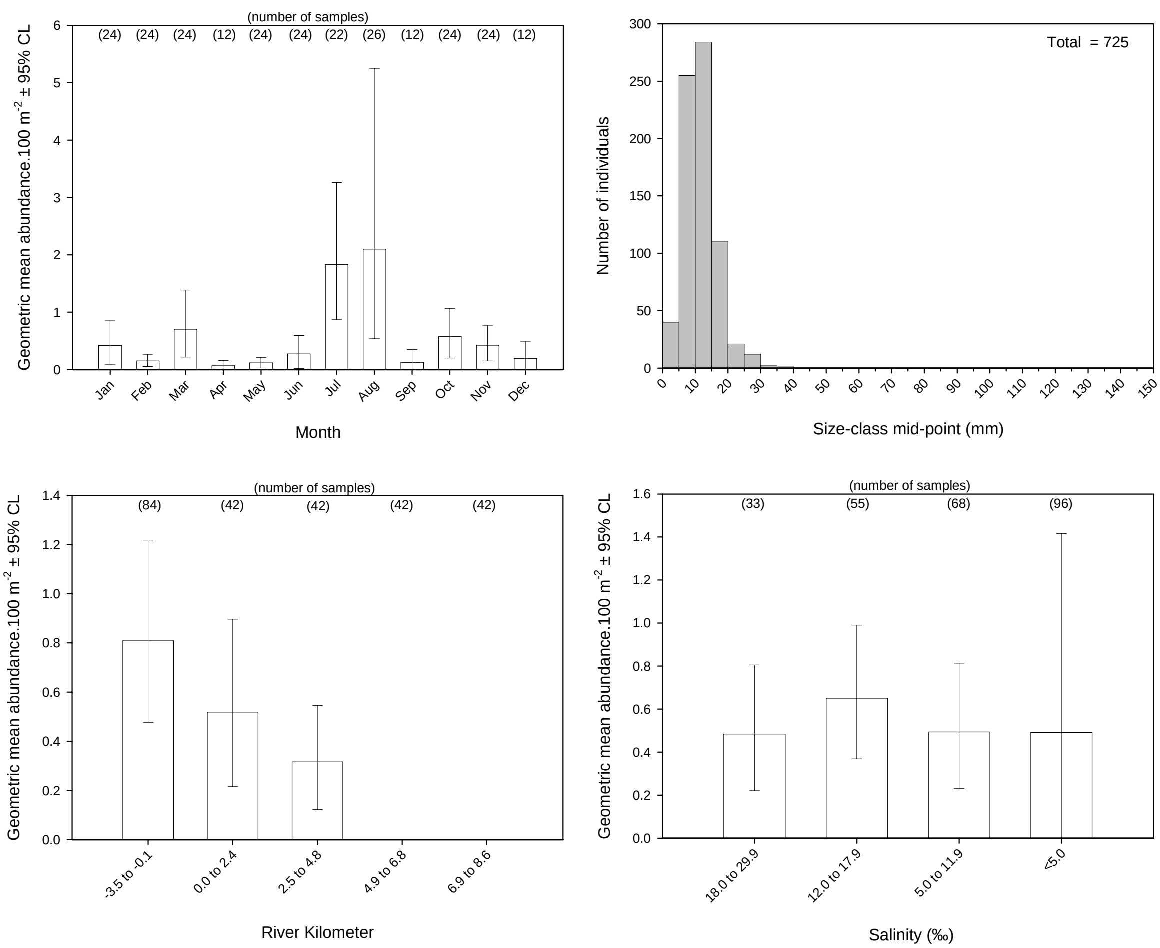


Fig. E1. Relative abundance of pink shrimp collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI. Length data were not recorded for grass shrimp.

Palaemonetes intermedius (brackish grass shrimp), trawls

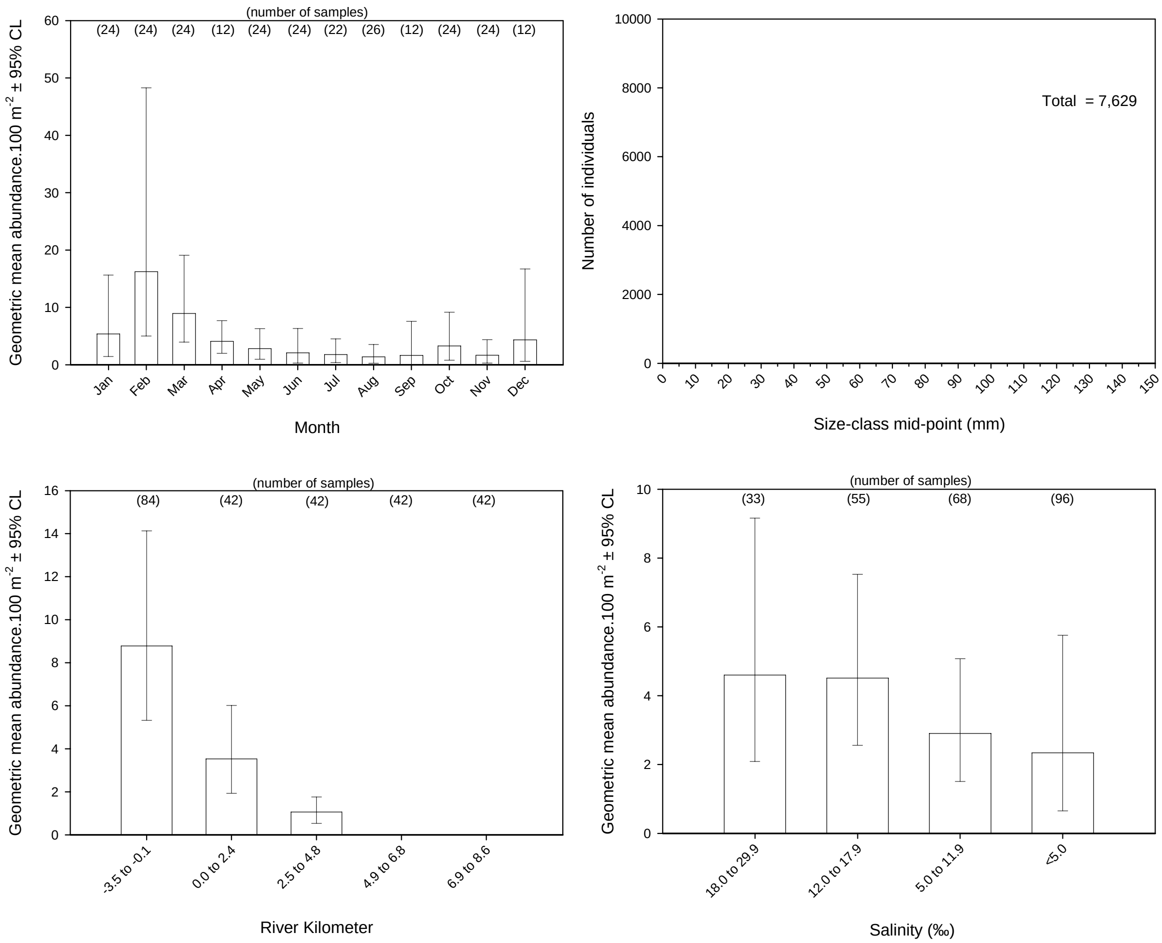


Fig. E2. Relative abundance of brackish grass shrimp collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI. Length data were not recorded for grass shrimp.

Alpheidae spp. (snapping shrimp), trawls

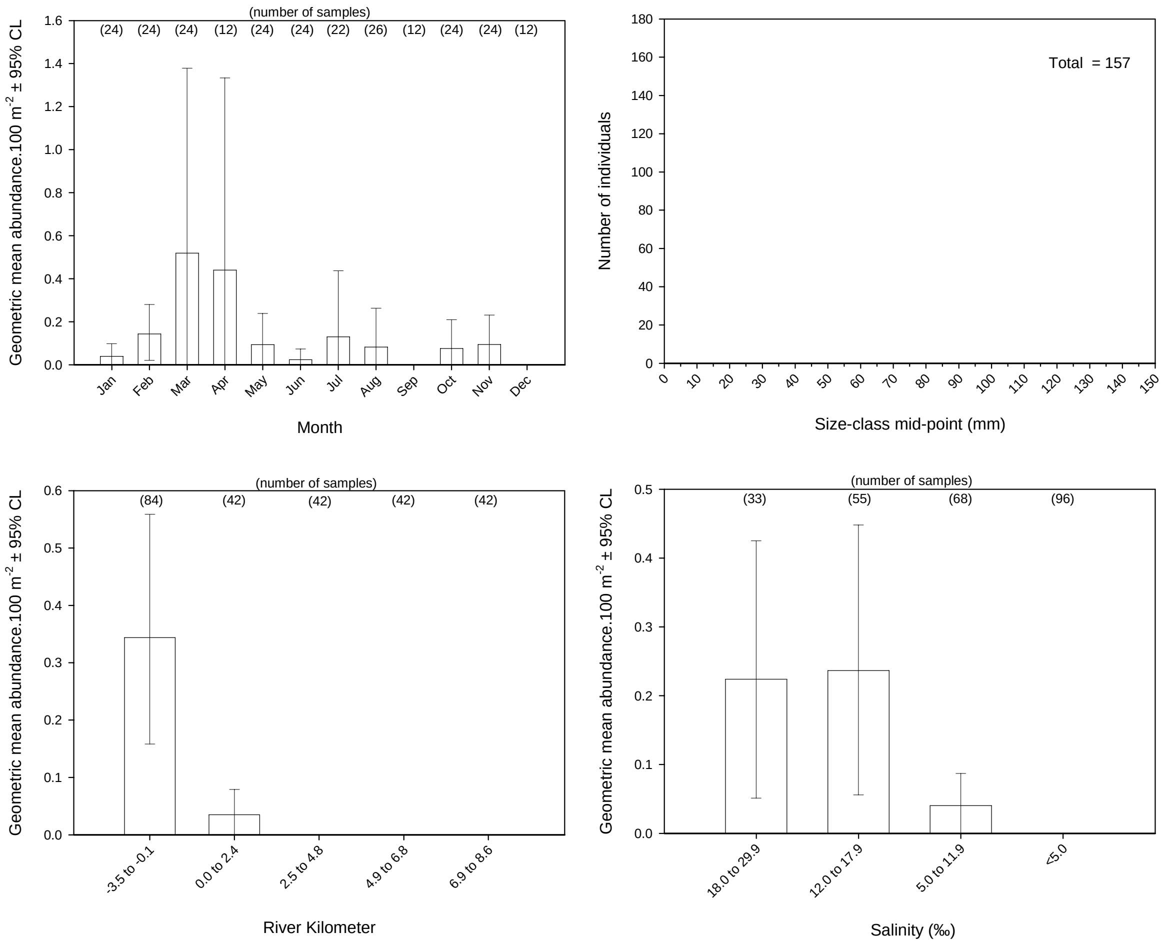


Fig. E3. Relative abundance of snapping shrimp collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI. Length data were not recorded for snapping shrimp.

Callinectes sapidus (blue crab), trawls

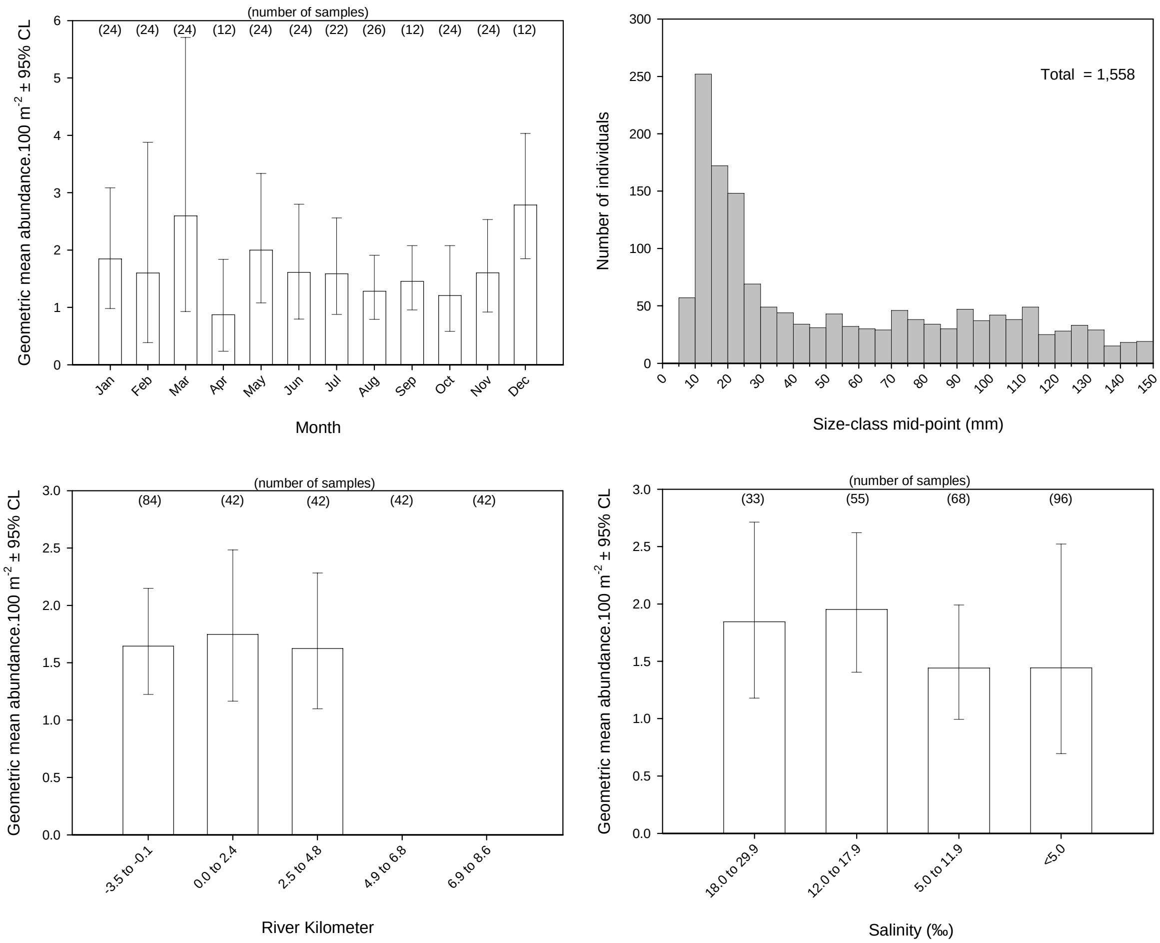


Fig. E4. Relative abundance of blue crab collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

***Anchoa mitchilli* (bay anchovy), trawls**

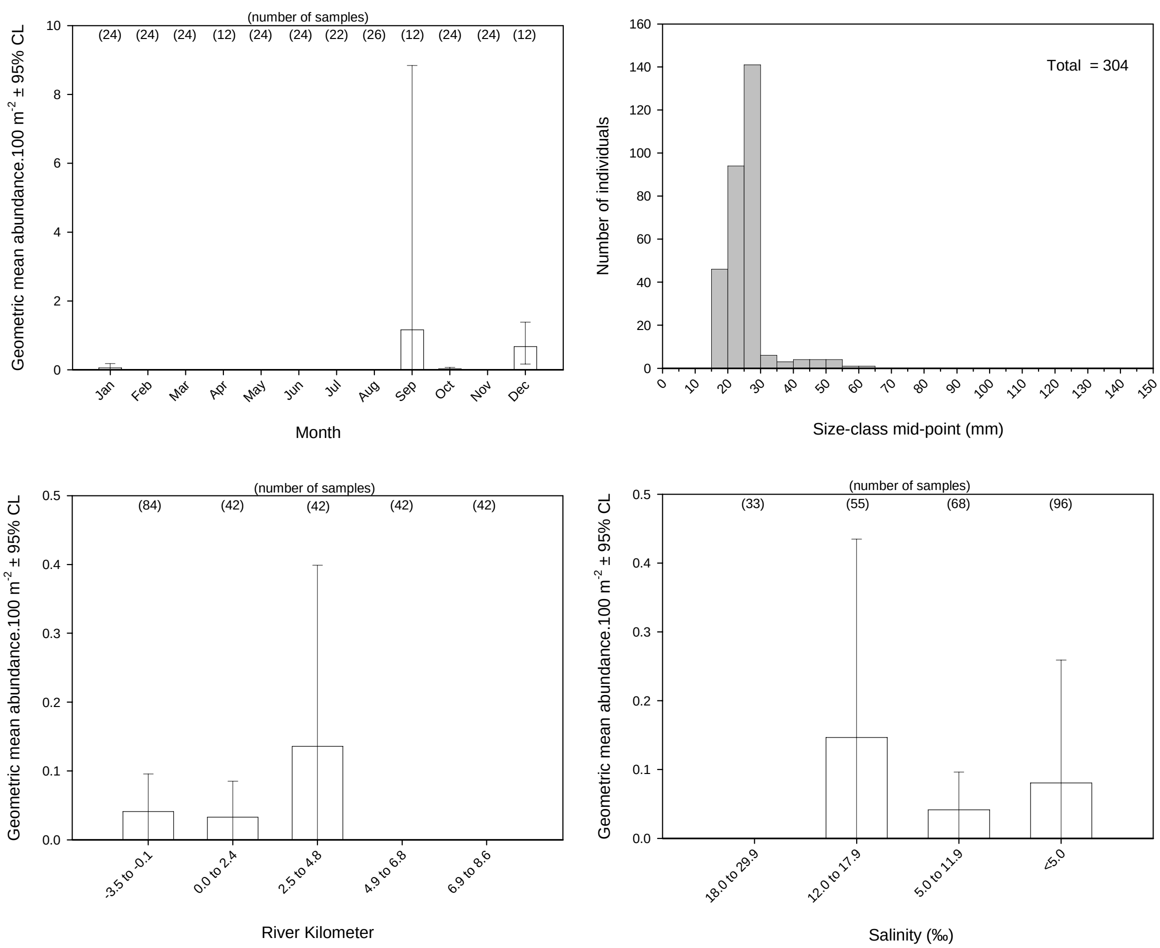


Fig. E5. Relative abundance of bay anchovy collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Synodus foetens (inshore lizardfish), trawls

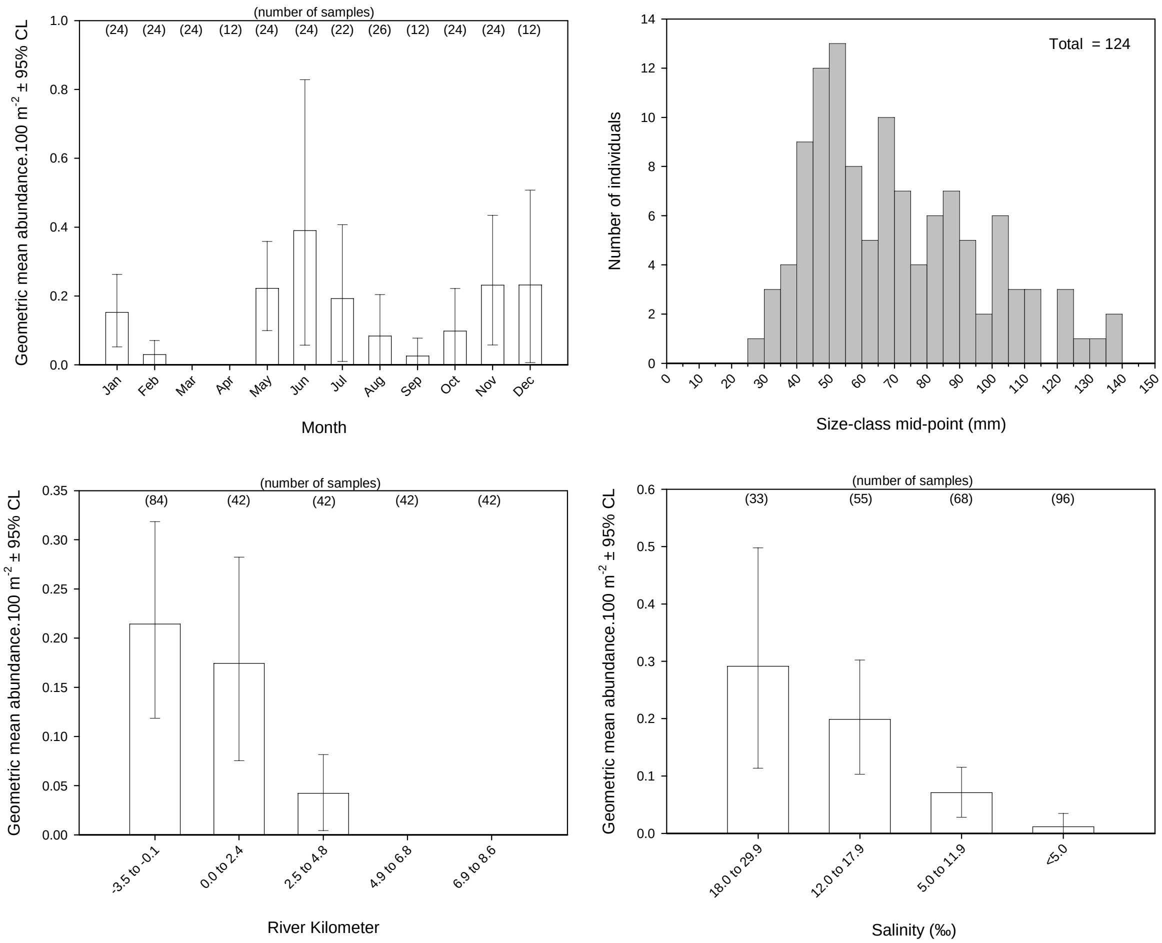


Fig. E6. Relative abundance of inshore lizardfish collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Opsanus beta (gulf toadfish), trawls

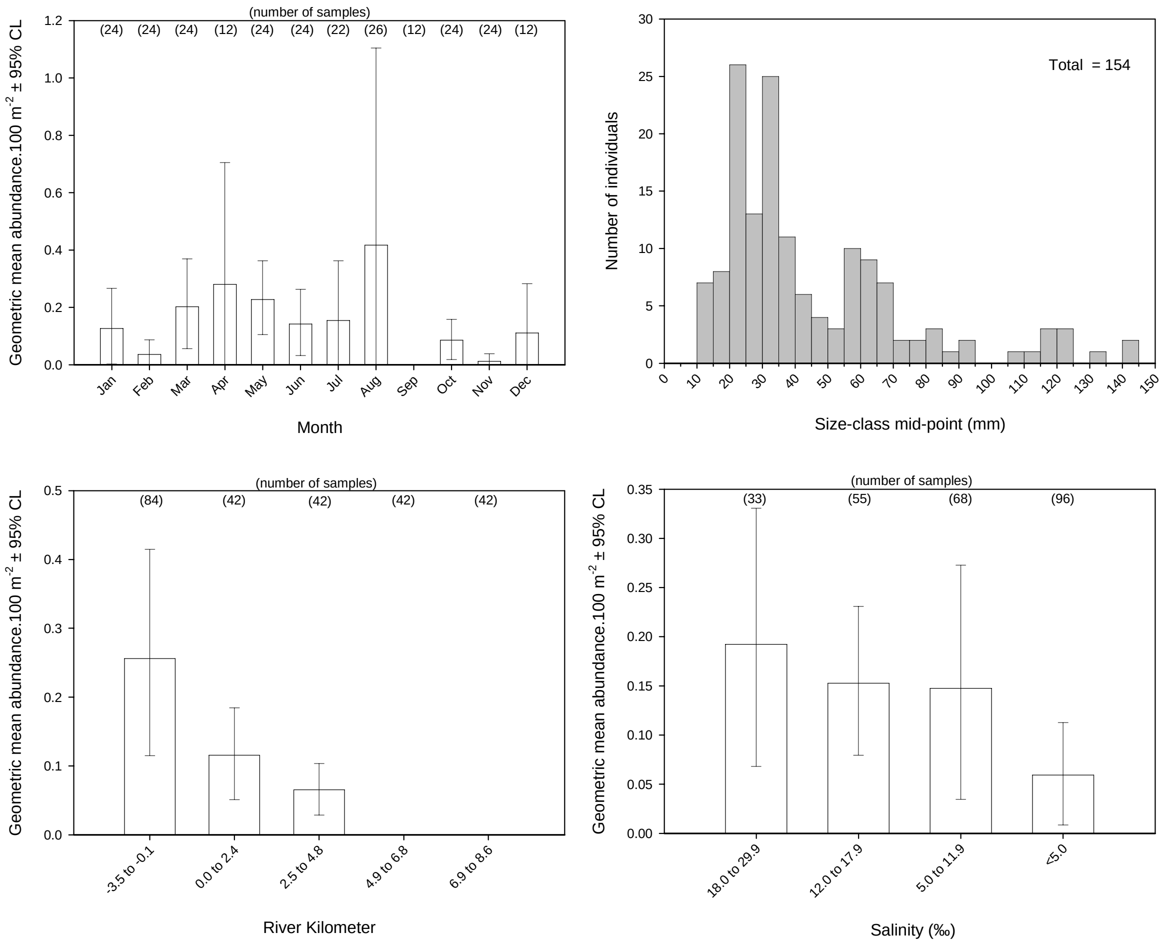


Fig. E7. Relative abundance of gulf toadfish collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Lucania parva (rainwater killifish), trawls

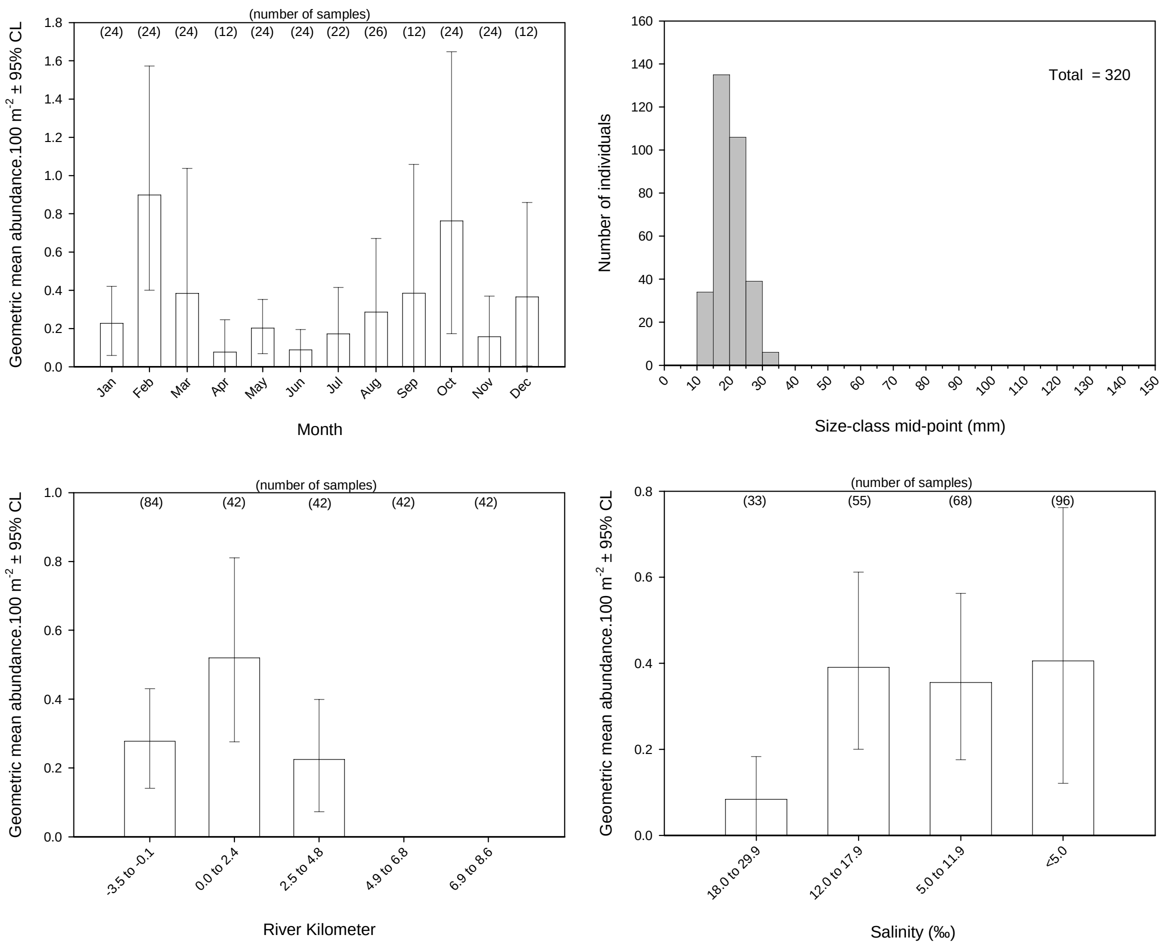


Fig. E8. Relative abundance of rainwater killifish collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Syngnathus scovelli (gulf pipefish), trawls

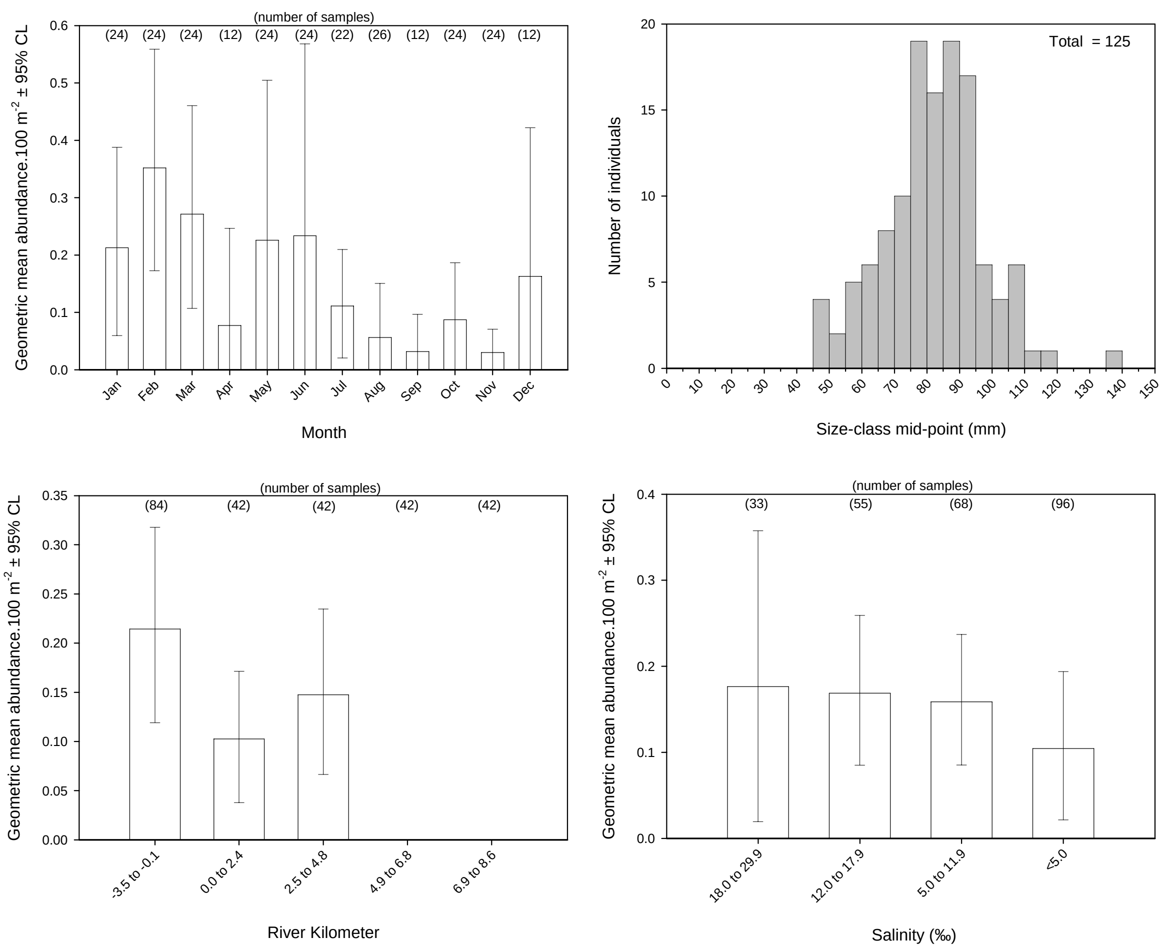


Fig. E9. Relative abundance of gulf pipefish collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Eucinostomus gula (silver jenny), trawls

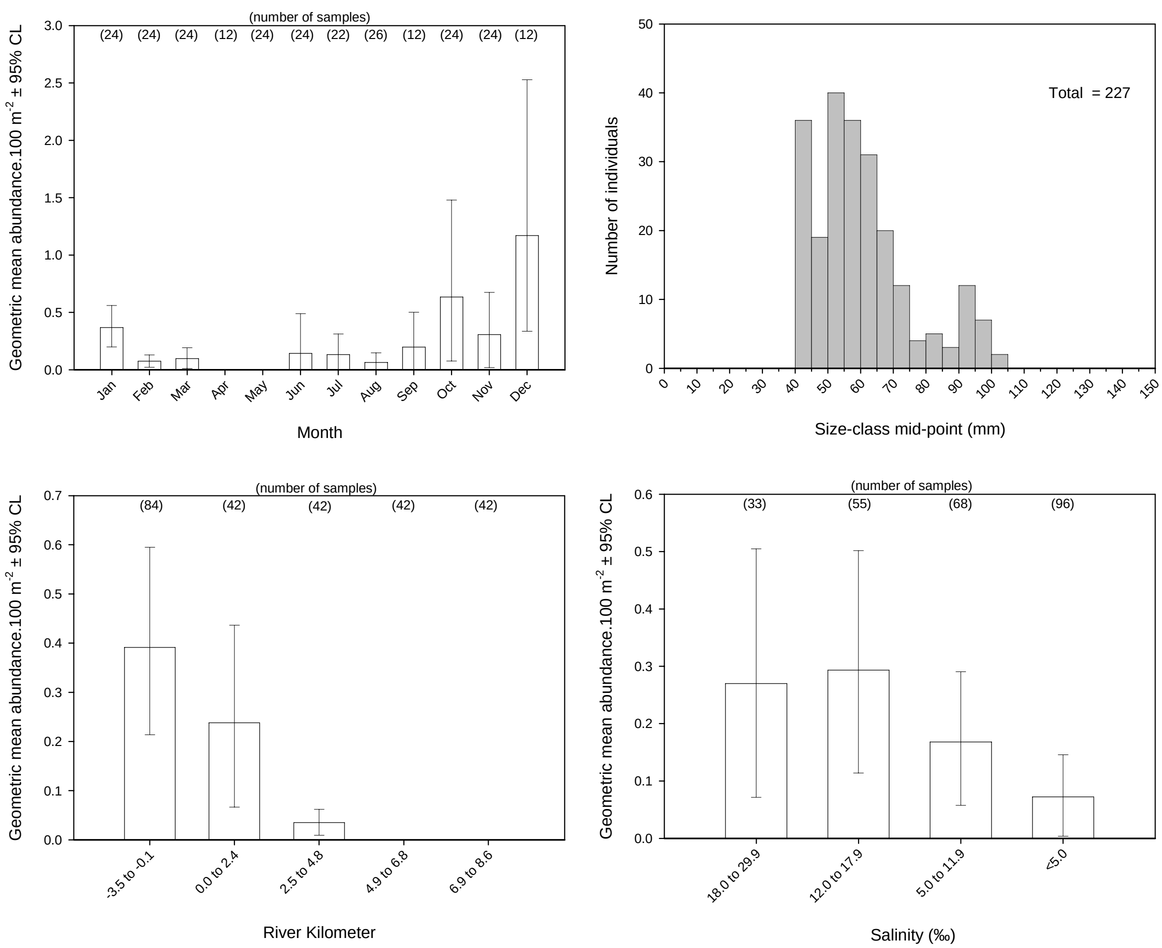


Fig. E10. Relative abundance of silver jenny collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Eucinostomus harengulus (tidewater mojarra), trawls

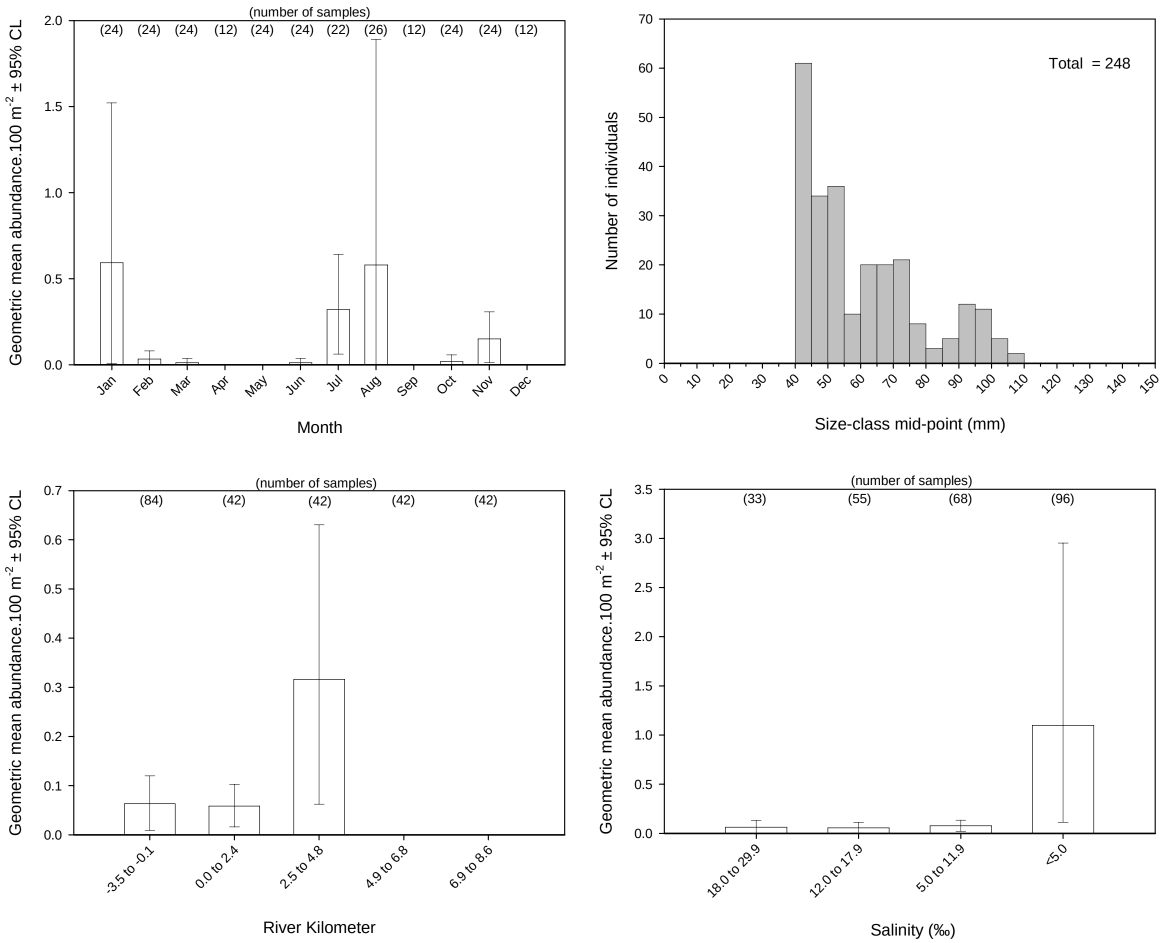


Fig. E11. Relative abundance of tidewater mojarra collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Lagodon rhomboides (pinfish), trawls

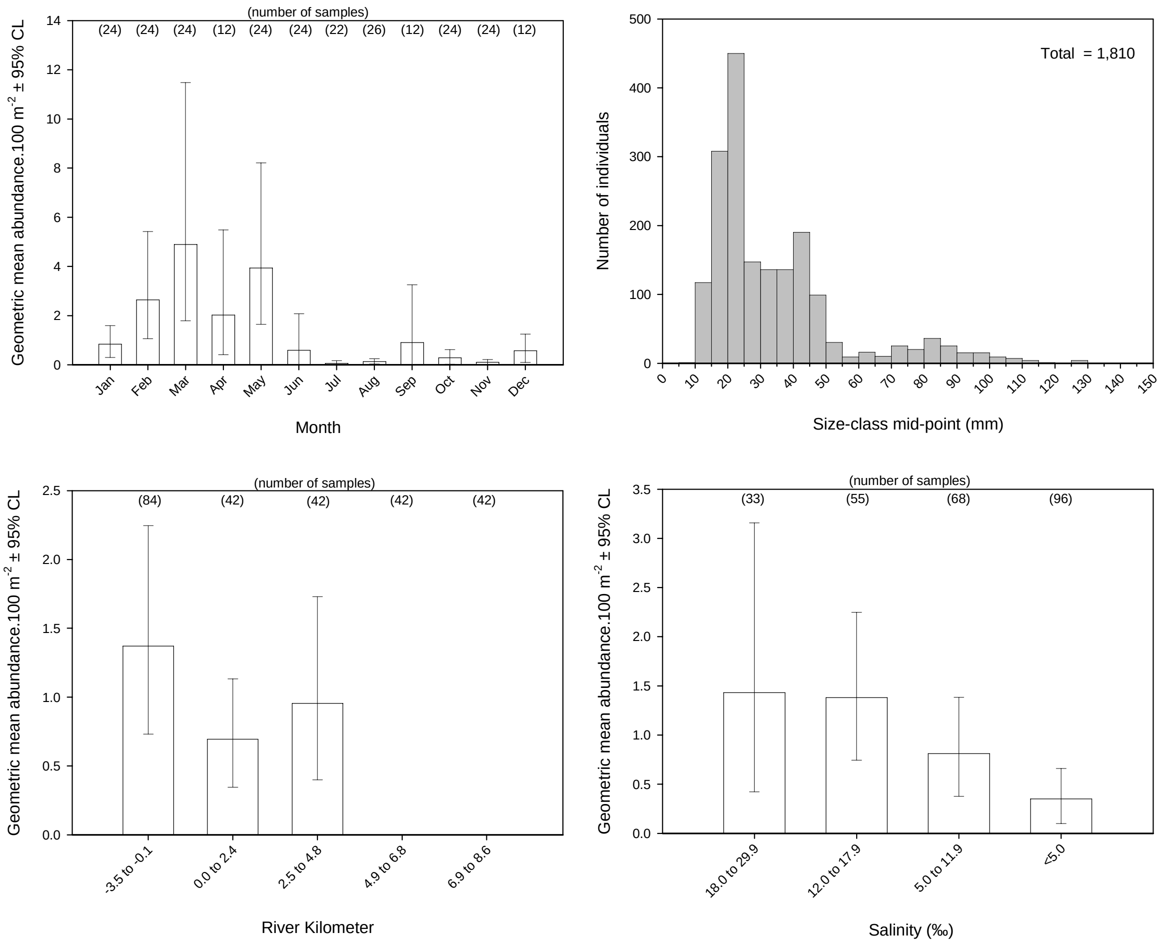


Fig. E12. Relative abundance of pinfish collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Gobiosoma spp. (Gobiosoma gobies), trawls

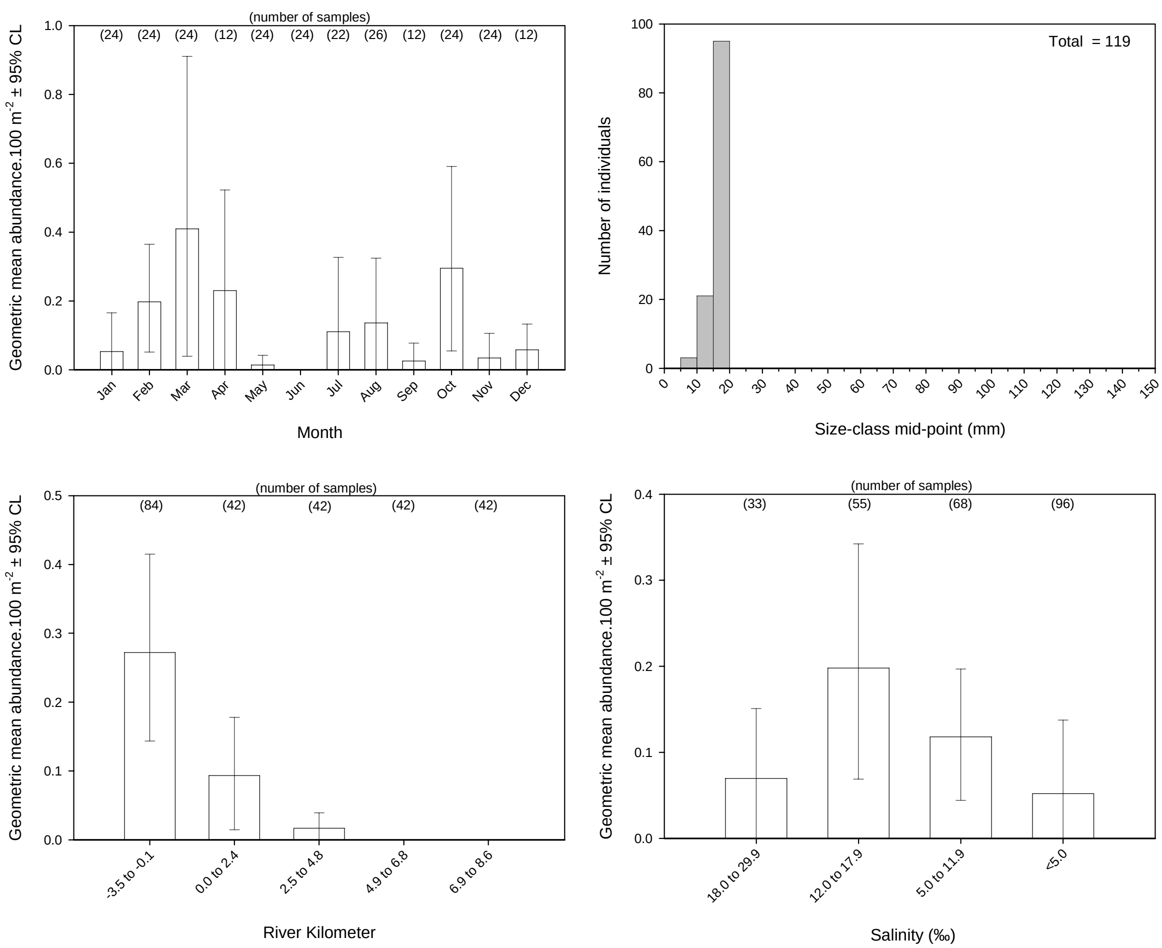


Fig. E13. Relative abundance of Gobiosoma gobies collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Gobiosoma robustum (code goby), trawls

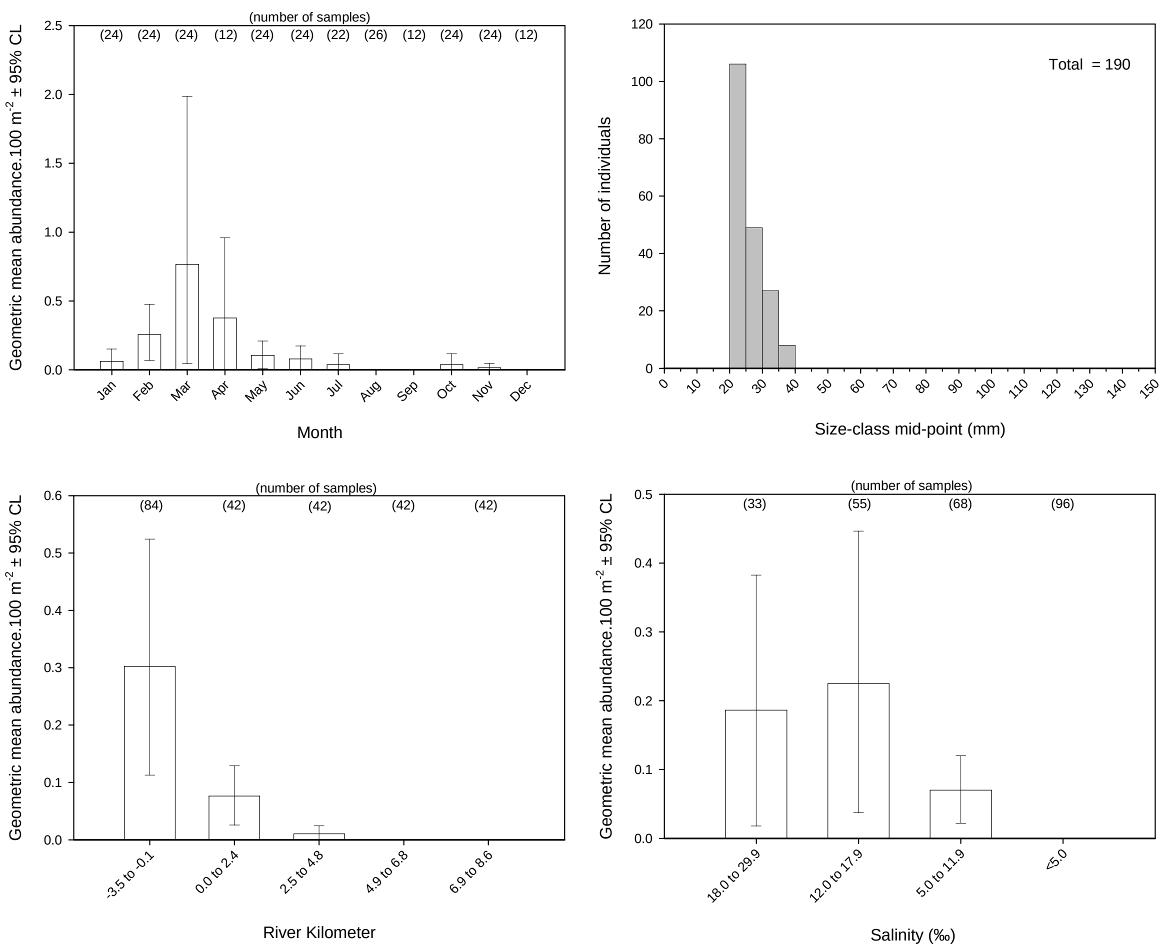


Fig. E14. Relative abundance of code goby collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Microgobius gulosus (clown goby), trawls

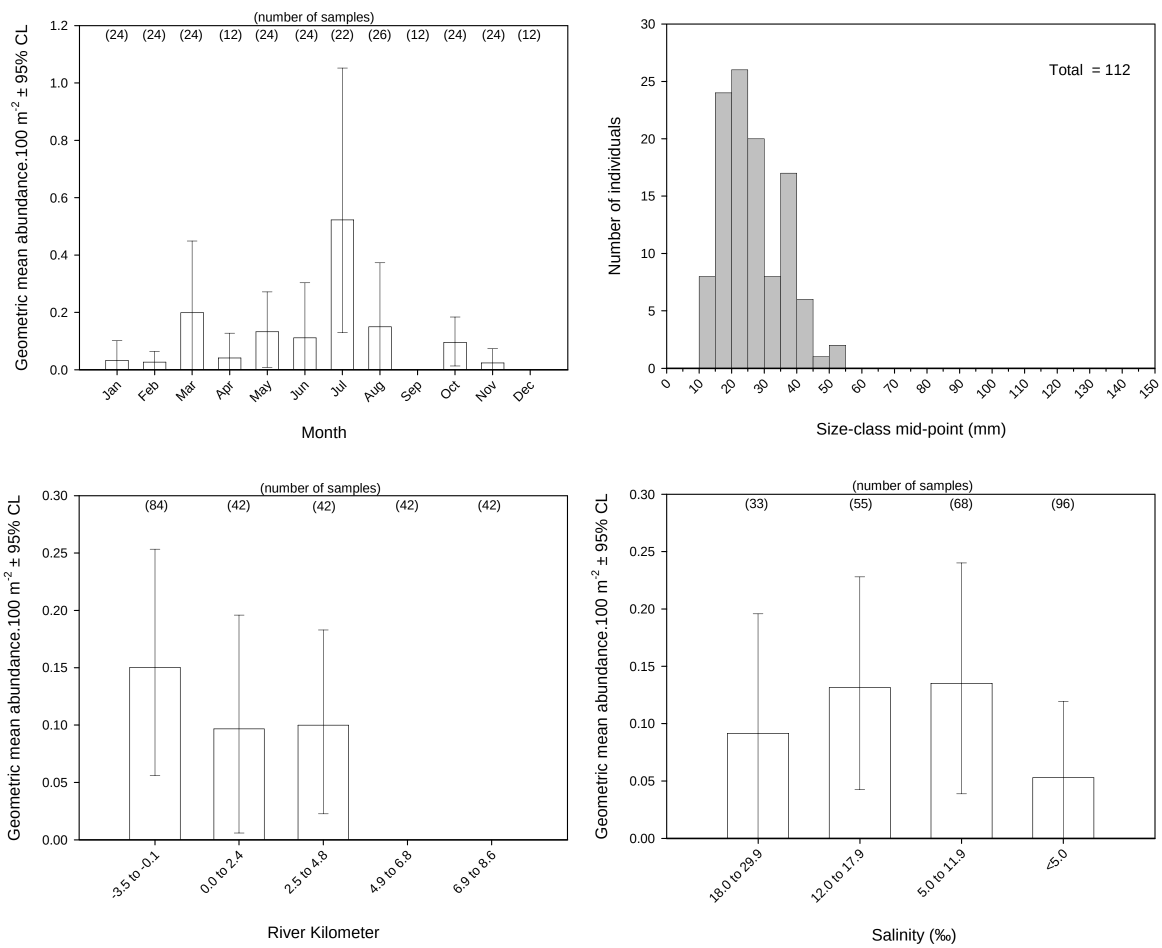


Fig. E15. Relative abundance of clown goby collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Symphurus plagiusa (blackcheek tonguefish), trawls

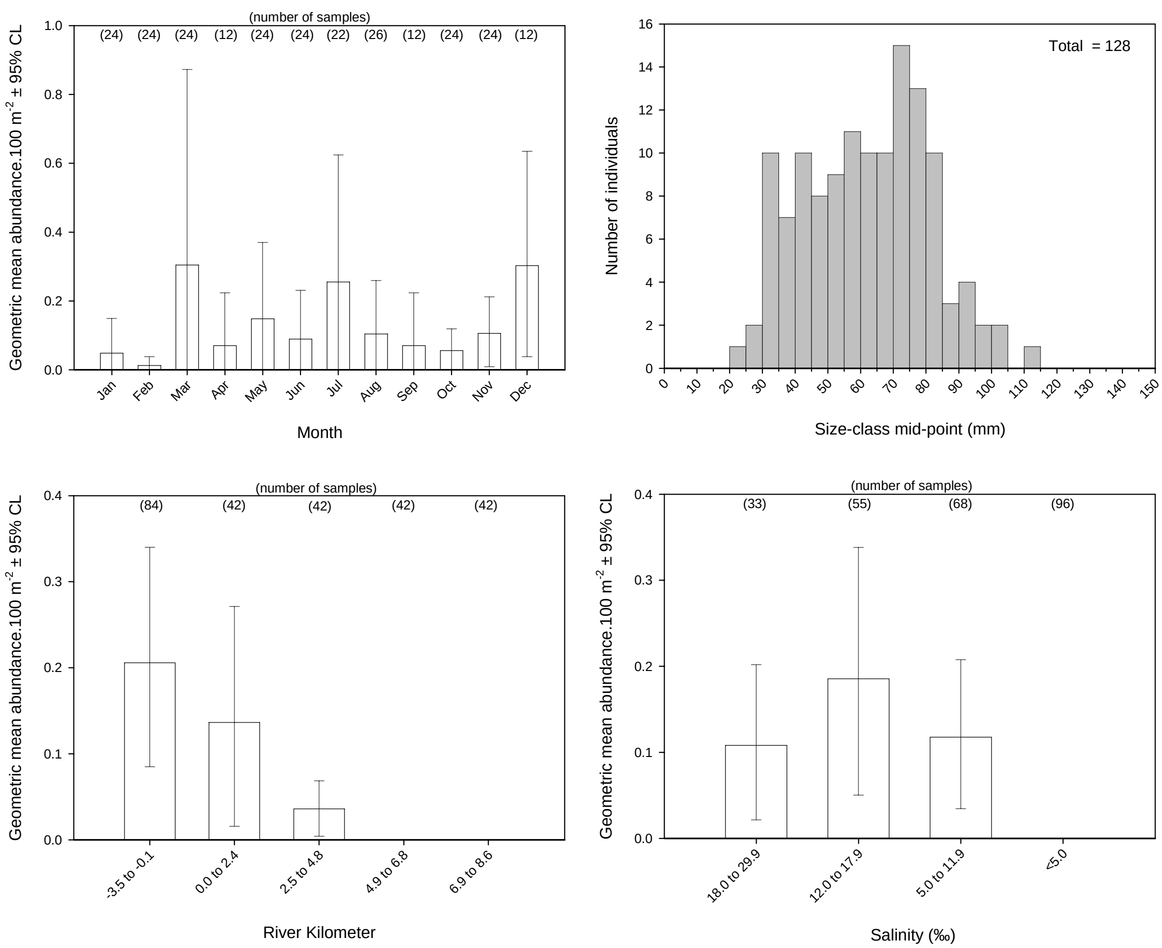


Fig. E16. Relative abundance of blackcheek tonguefish collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Trinectes maculatus (hogchoker), trawls

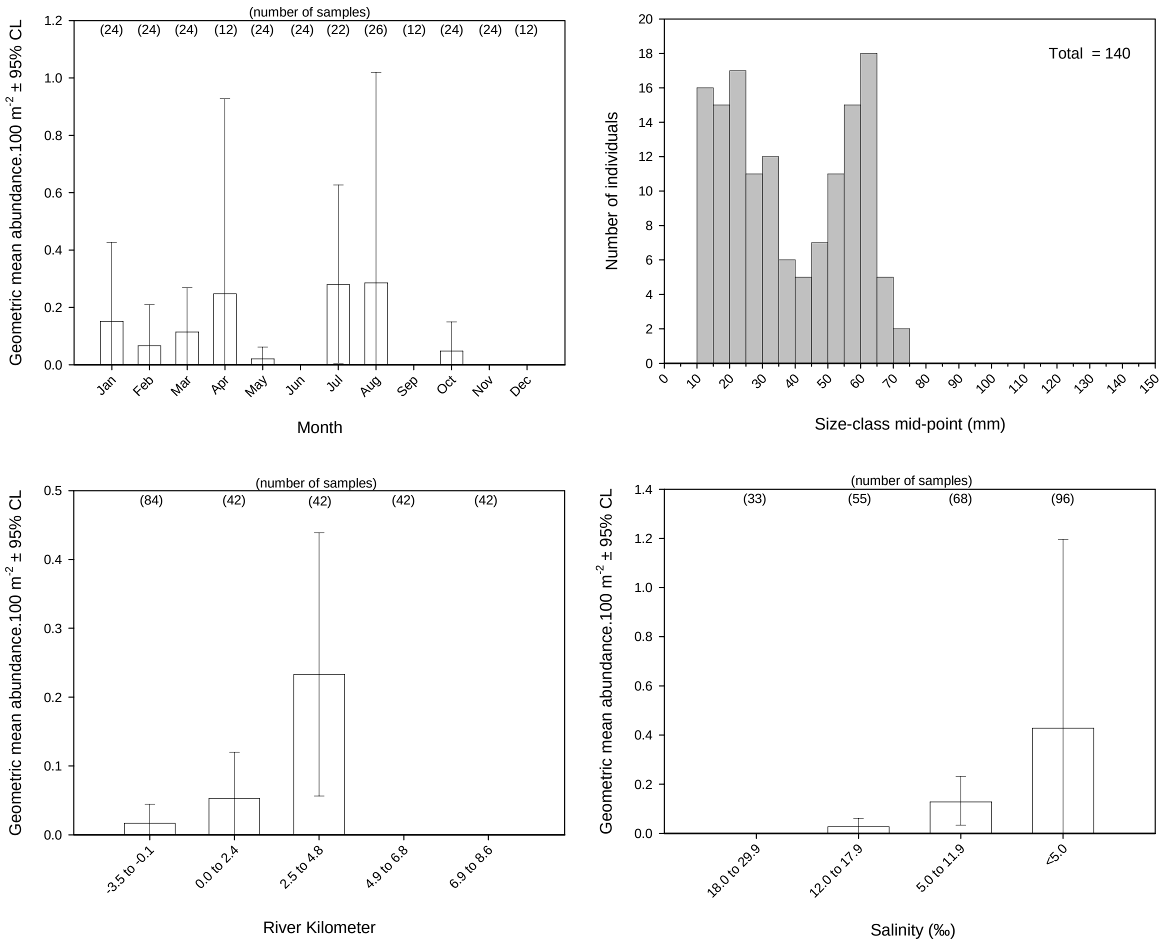


Fig. E17. Relative abundance of hogchoker collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

Sphoeroides nephelus (Southern puffer), trawls

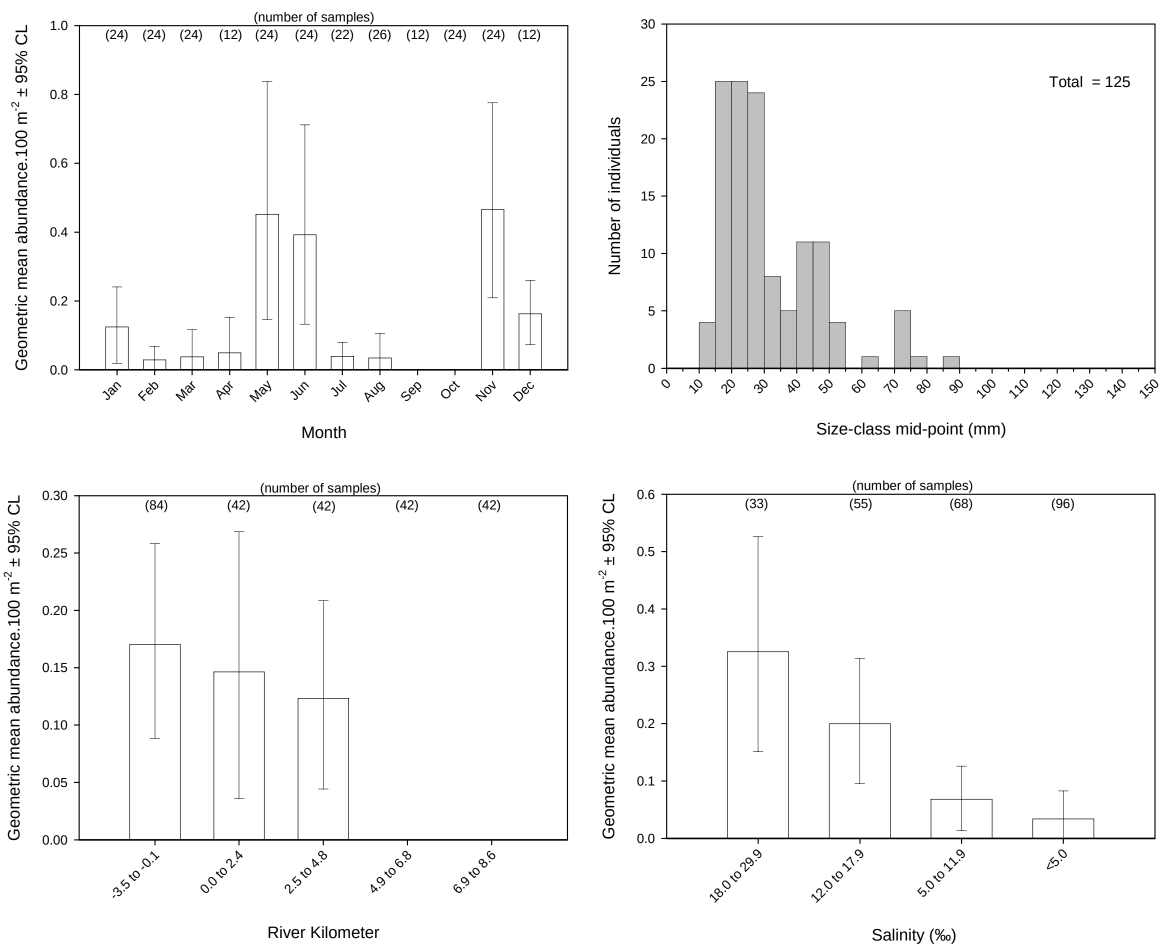
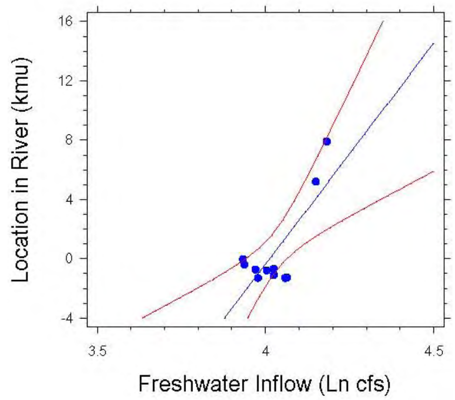


Fig. E18. Relative abundance of Southern puffer collected with trawls (water depths <= 2.0-m) in the Chassahowitzka River estuary. Box: average relative abundance; error bars: 95% CI.

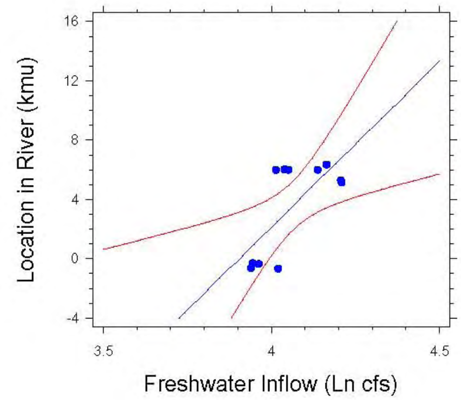
Appendix F:

Plots of the plankton-net distribution responses in *Table 3.7.1.1*
with 95% confidence limits for predicted means

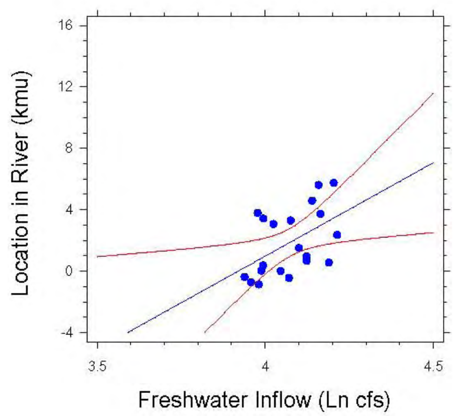
Parasterope pollex



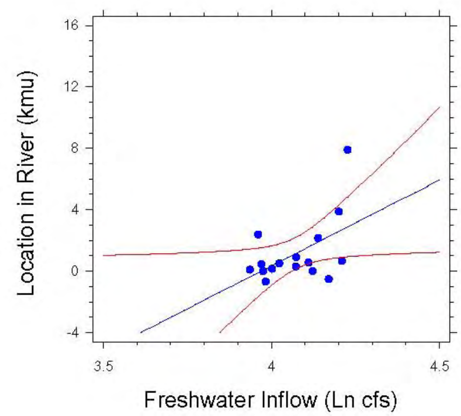
Cyathura polita



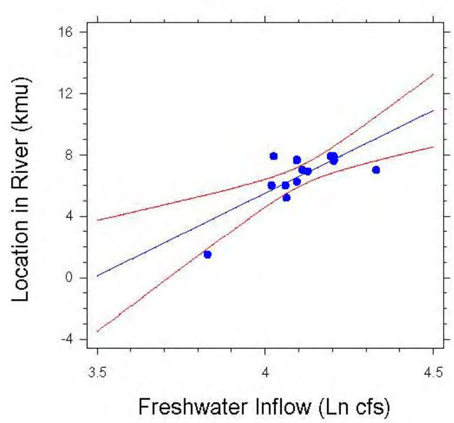
polychaetes



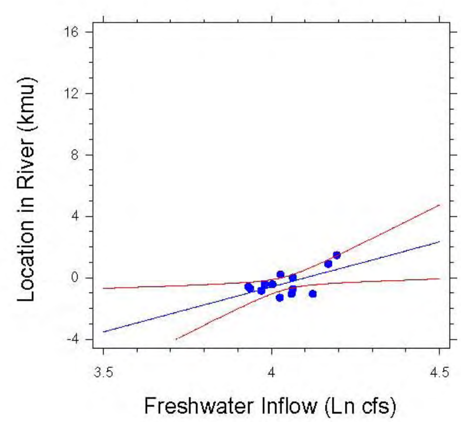
pelecypods

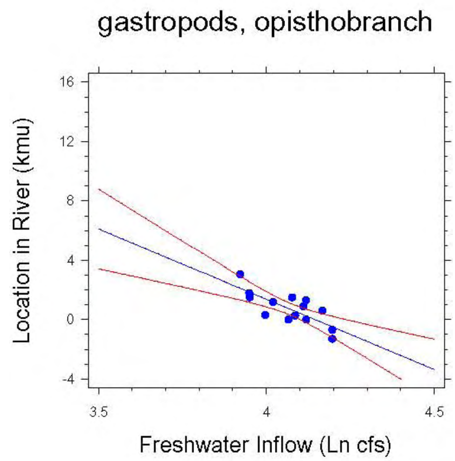


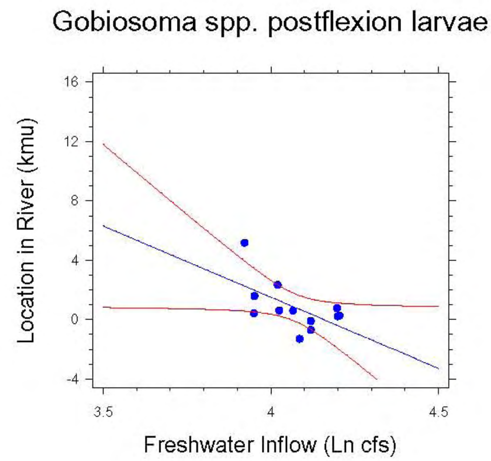
trichopteran larvae

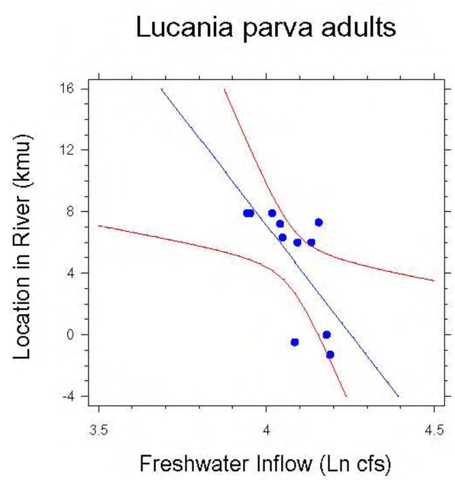


Sarsiella zostericola




gastropods, opisthobranch
Location in River (kmu)
Freshwater Inflow (Ln cfs)


Gobiosoma spp. postflexion larvae
Location in River (kmu)
Freshwater Inflow (Ln cfs)


Lucania parva adults
Location in River (kmu)
Freshwater Inflow (Ln cfs)

Appendix G:

Plots of the seine and trawl distribution responses in *Table 3.7.2.1*

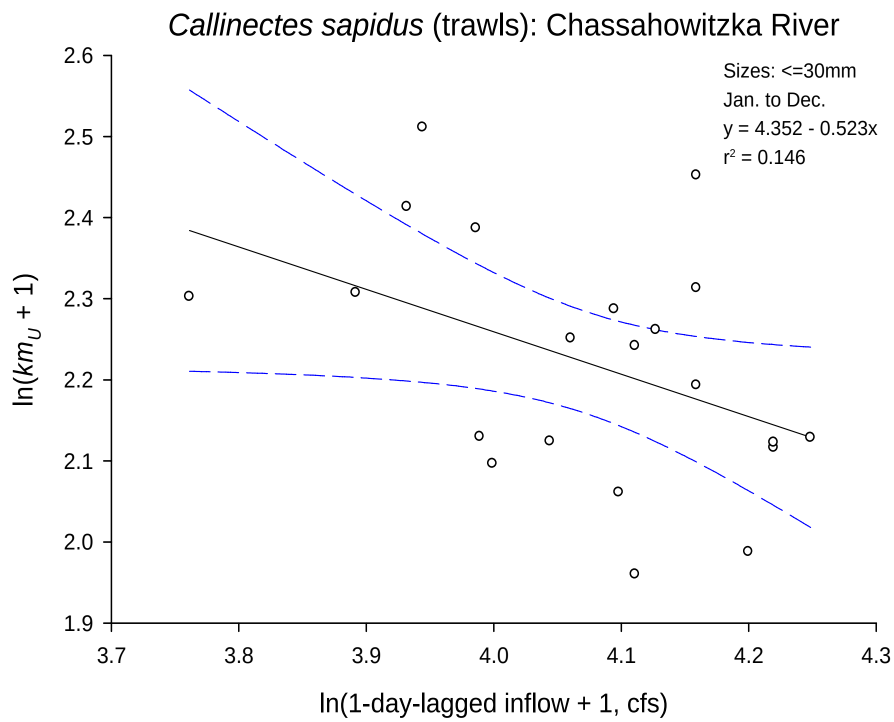


Fig. G1. Distribution response of blue crab (<=30 mm) in the Chassahowitzka River estuary to 1-day-lagged inflow. Solid lines: predicted values; dashed lines: 95% CI.

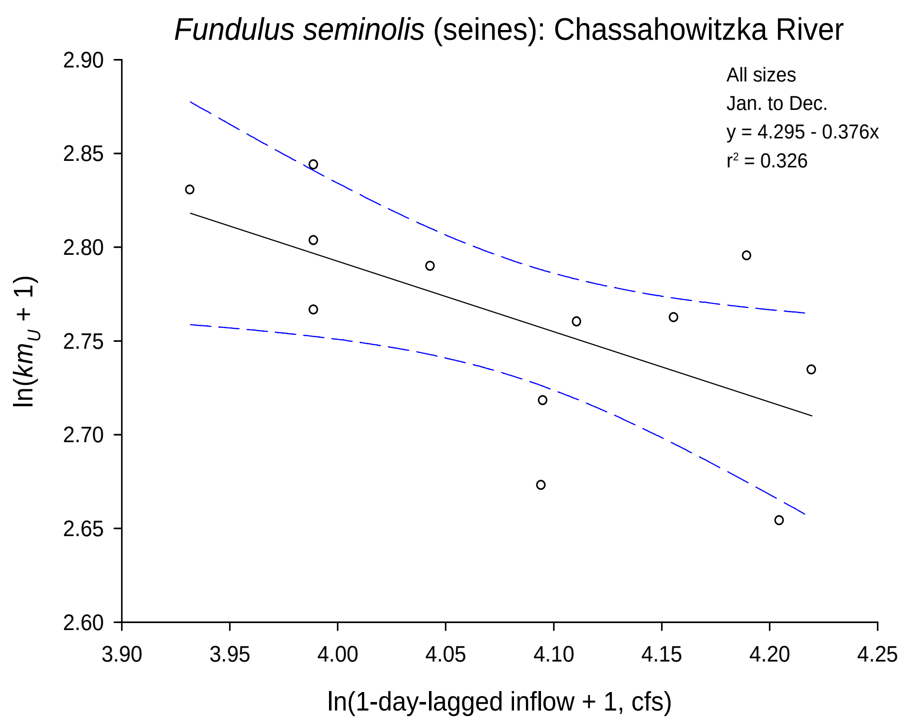


Fig. G2. Distribution response of seminole killifish (all sizes) in the Chassahowitzka River estuary to 1-day-lagged inflow. Solid lines: predicted values; dashed lines: 95% CI.

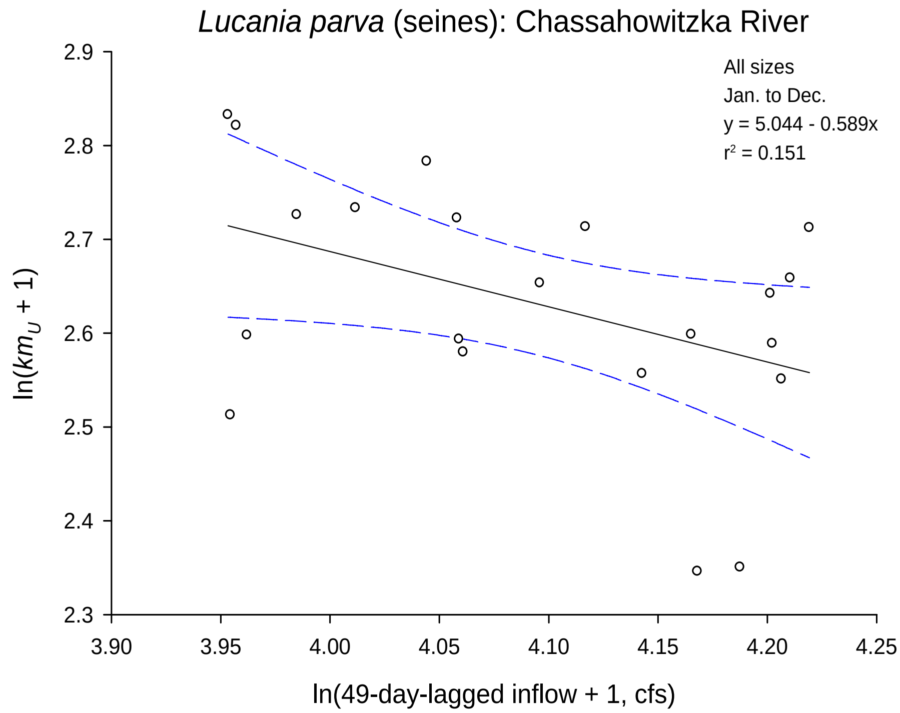


Fig. G3. Distribution response of rainwater killifish (all sizes) in the Chassahowitzka River estuary to 49-day-lagged inflow. Solid lines: predicted values; dashed lines: 95% CI.

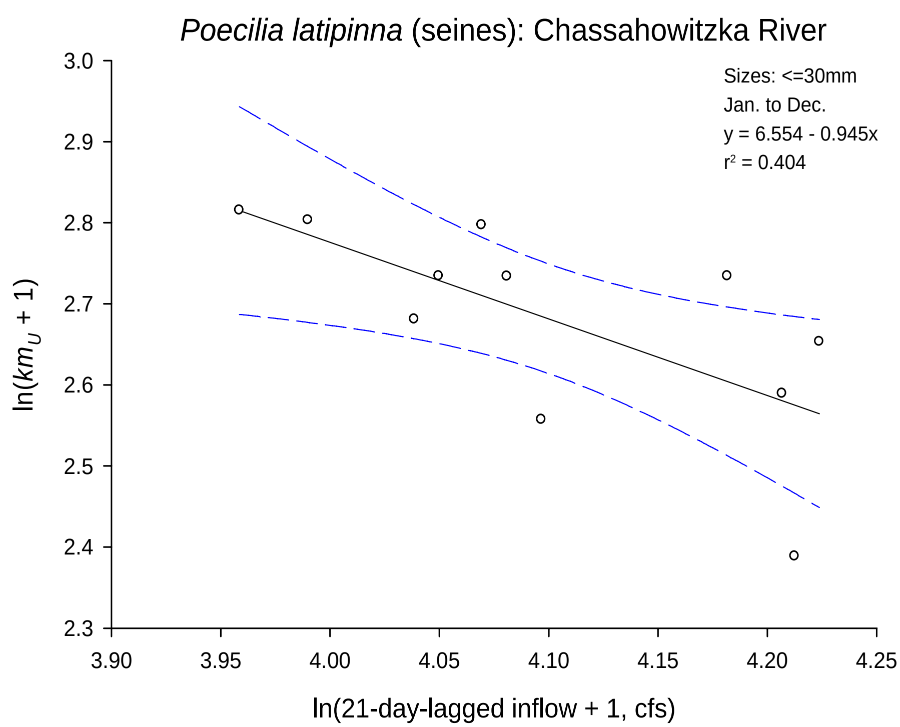


Fig. G4. Distribution response of sailfin molly (<=30 mm) in the Chassahowitzka River estuary to 21-day-lagged inflow. Solid lines: predicted values; dashed lines: 95% CI.

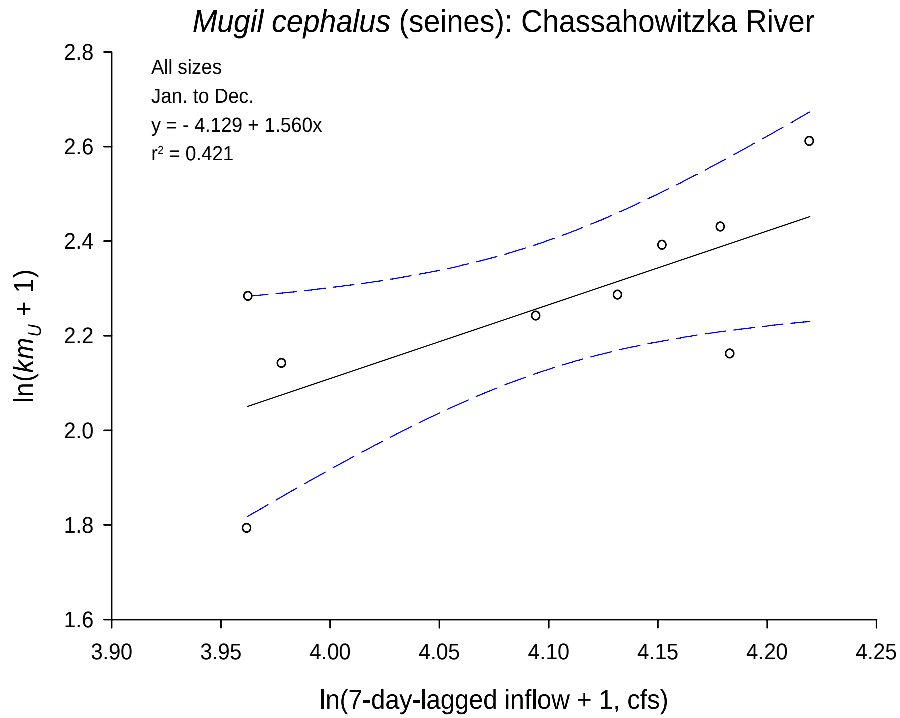
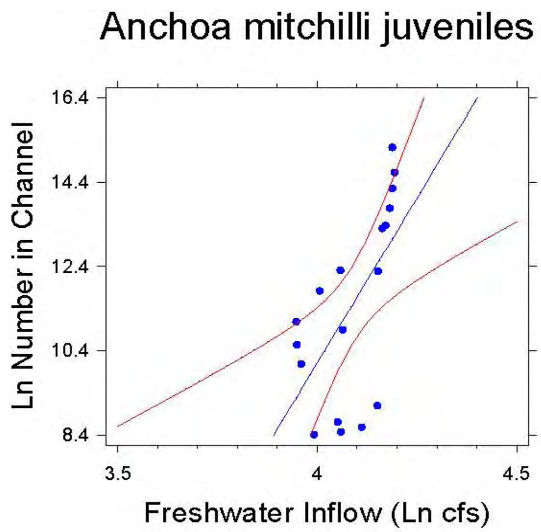
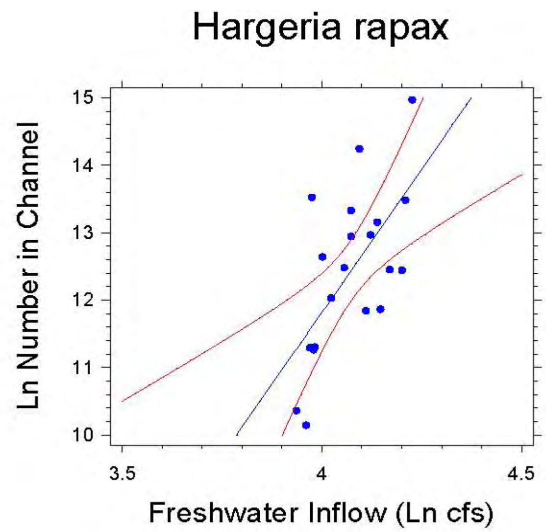


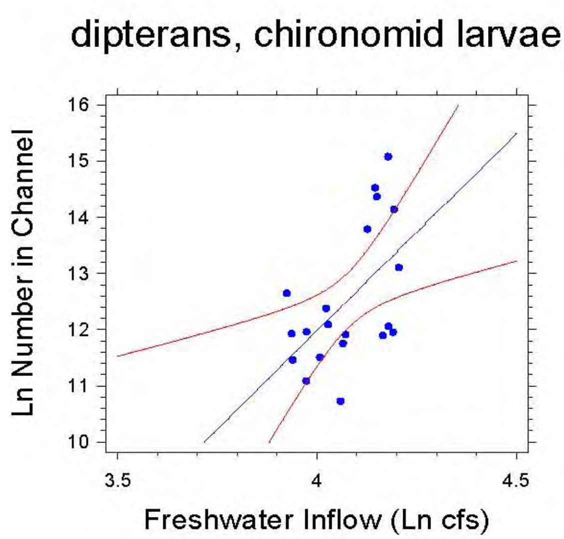
Fig. G5. Distribution response of striped mullet (all sizes) in the Chassahowitzka River estuary to 7-day-lagged inflow. Solid lines: predicted values; dashed lines: 95% CI.

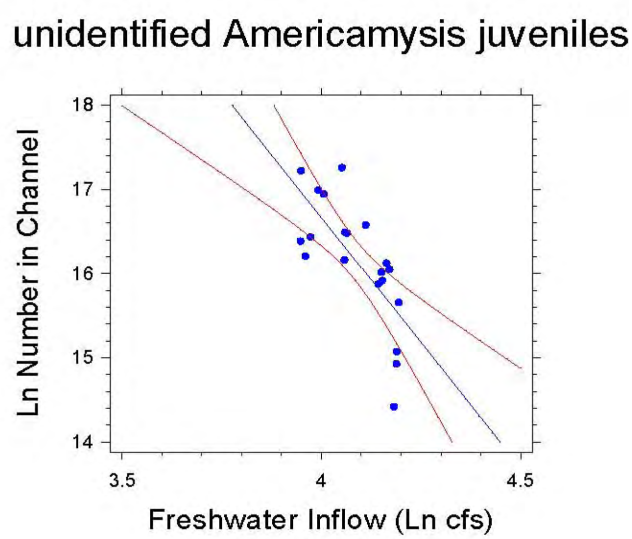
Appendix H:

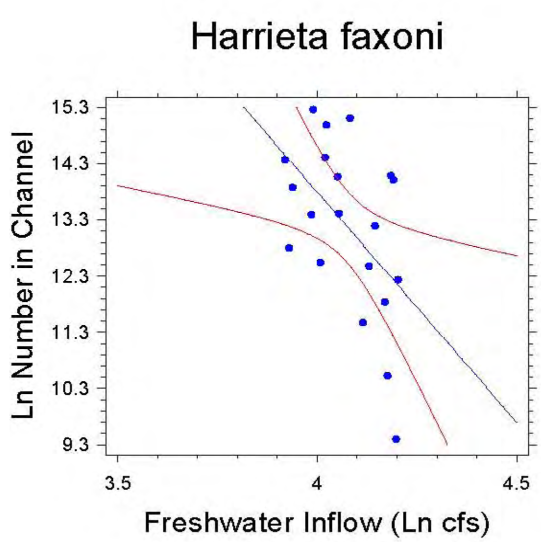
Plots of the plankton-net abundance responses in *Table 3.8.1.1*
with 95% confidence limits for predicted means

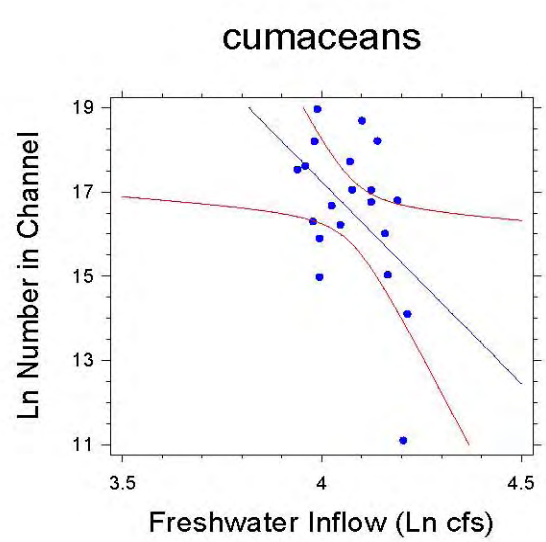

Anchoa mitchilli juveniles
Ln Number in Channel
16.4
14.4
12.4
10.4
8.4
3.5
4
4.5
Freshwater Inflow (Ln cfs)


Hargeria rapax
Ln Number in Channel
15
14
13
12
11
10
3.5
4
4.5
Freshwater Inflow (Ln cfs)

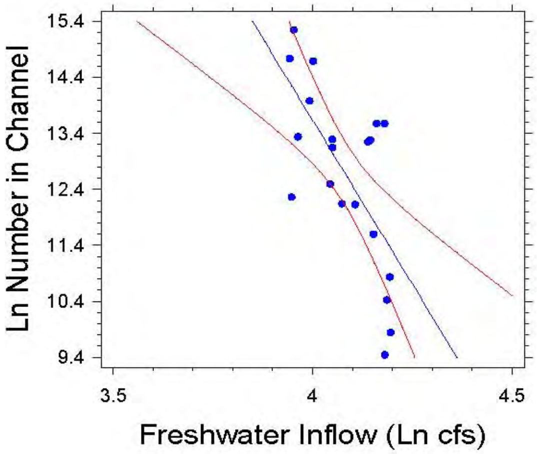

dipterans, chironomid larvae
Ln Number in Channel
16
15
14
13
12
11
10
3.5
4
4.5
Freshwater Inflow (Ln cfs)


unidentified Americamysis juveniles
Ln Number in Channel
18
17
16
15
14
3.5
4
4.5
Freshwater Inflow (Ln cfs)

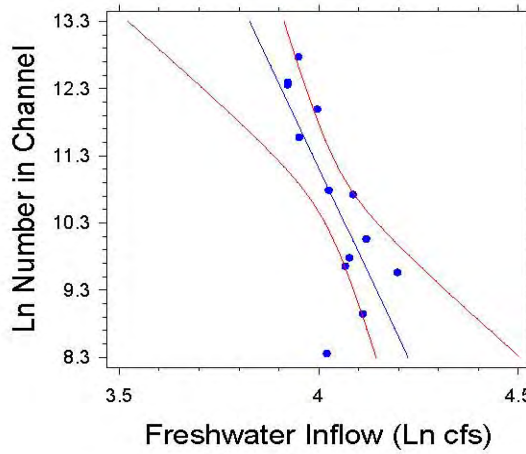

Harrieta faxoni
Ln Number in Channel
15.3
14.3
13.3
12.3
11.3
10.3
9.3
3.5
4
4.5
Freshwater Inflow (Ln cfs)


cumaceans
Ln Number in Channel
19
17
15
13
11
3.5
4
4.5
Freshwater Inflow (Ln cfs)

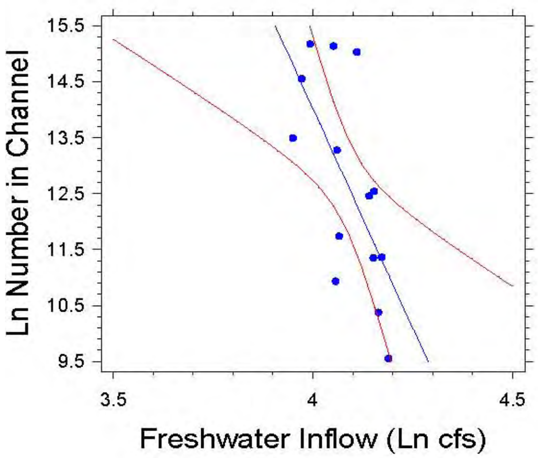
polychaetes



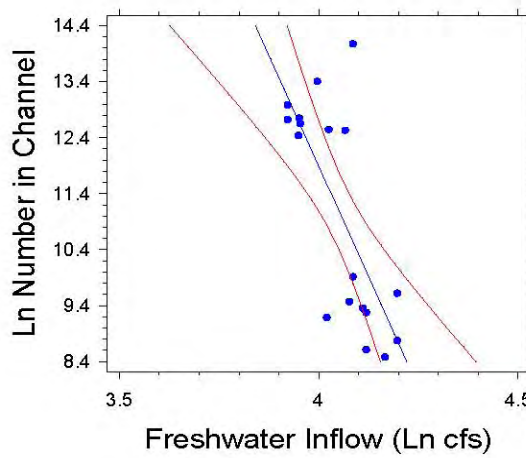
Sarsiella zostericola



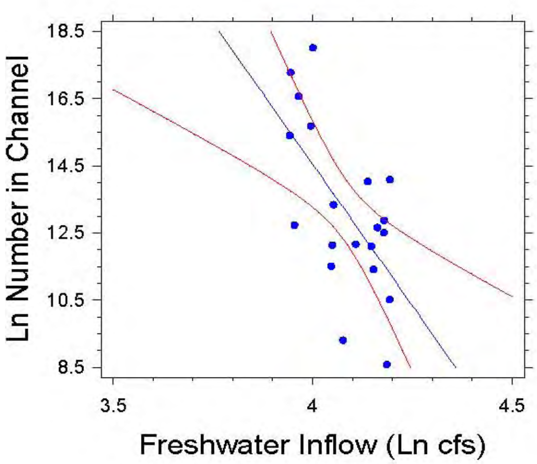
gobiid flexion larvae



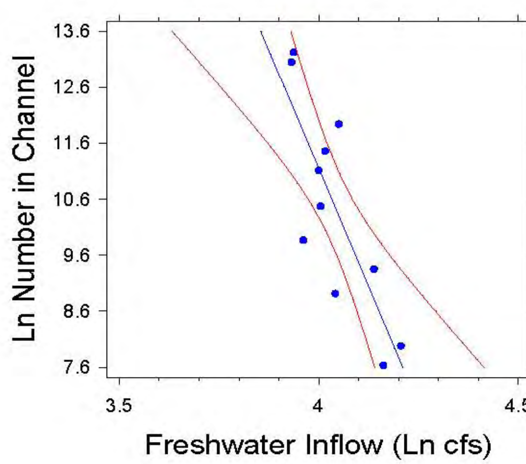
Pseudodiaptomus coronatus



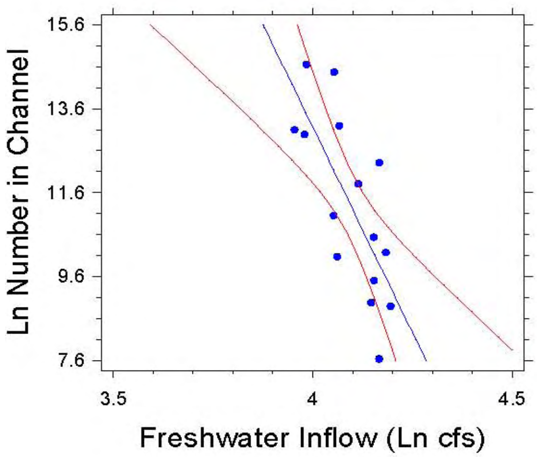
Acartia tonsa



Parasterope pollex



Microgobius spp. postflexion larvae



Appendix I:

Plots of the seine and trawl abundance responses in *Table 3.8.2.1*

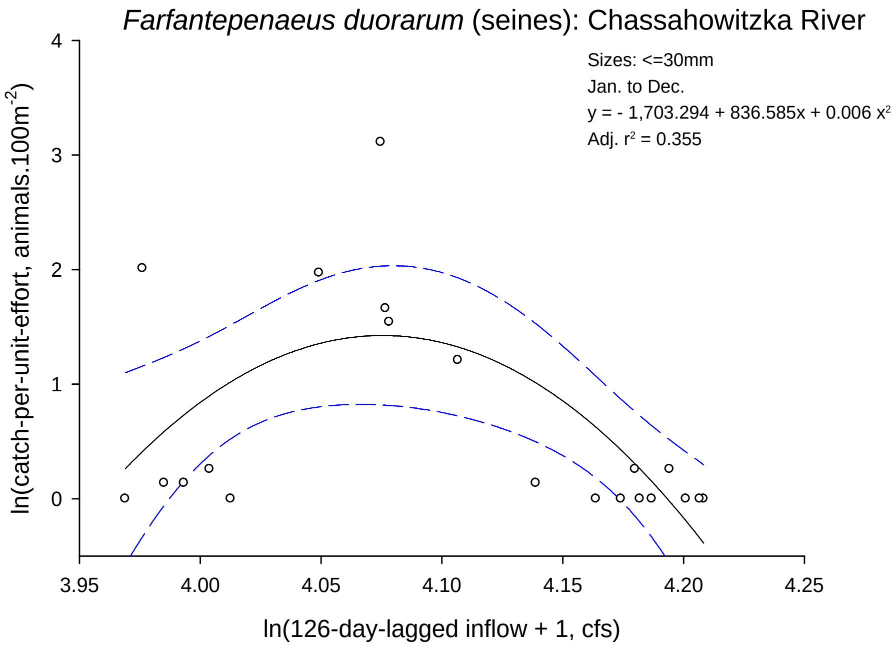


Fig. I1. Abundance response of pink shrimp (<=30mm) in the shoreline habitat of the Chassahowitzka River estuary to 126-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

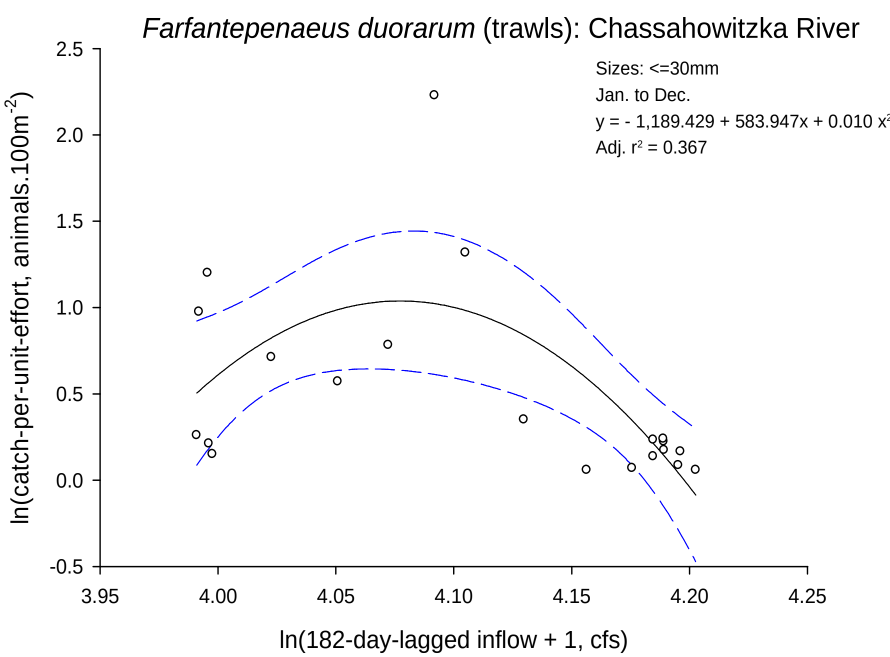


Fig. I2. Abundance response of pink shrimp (<=30mm) in the channel habitat of the Chassahowitzka River estuary to 182-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

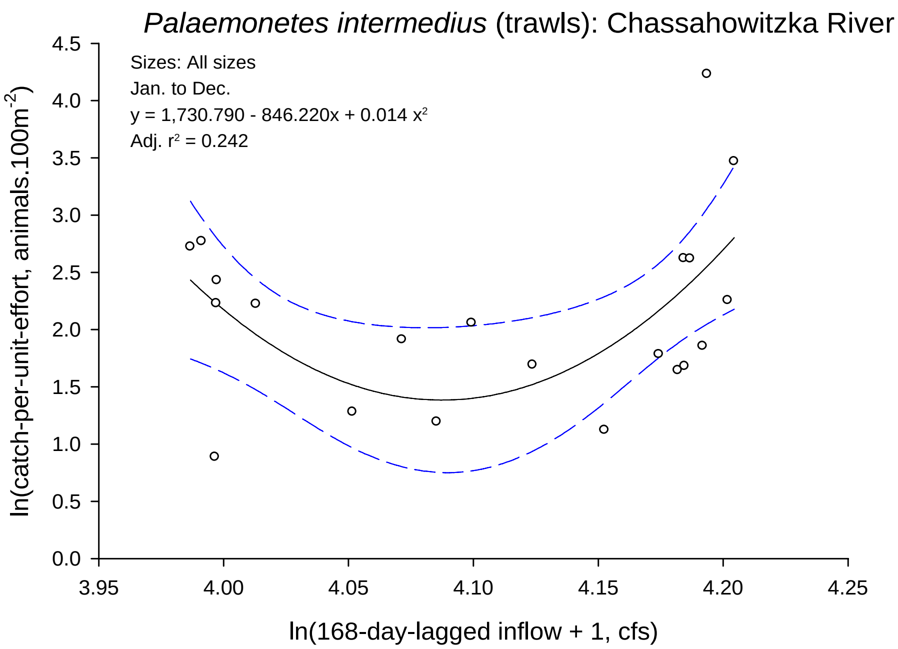


Fig. I3. Abundance response of brackish grass shrimp (all sizes) in the channel habitat of the Chassahowitzka River estuary to 168-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

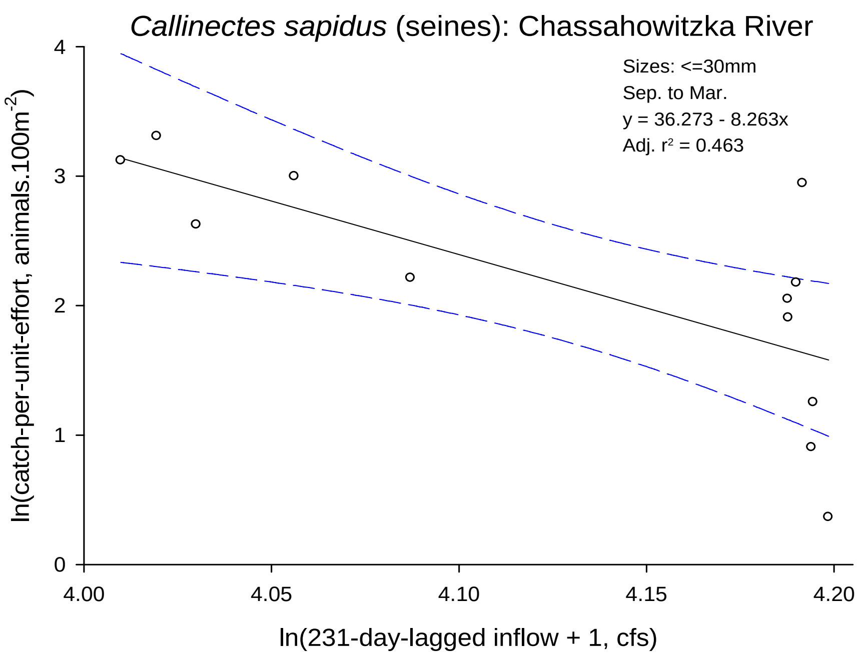


Fig. I4. Abundance response of blue crab (<=30mm) in the shoreline habitat of the Chassahowitzka River estuary to 231-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

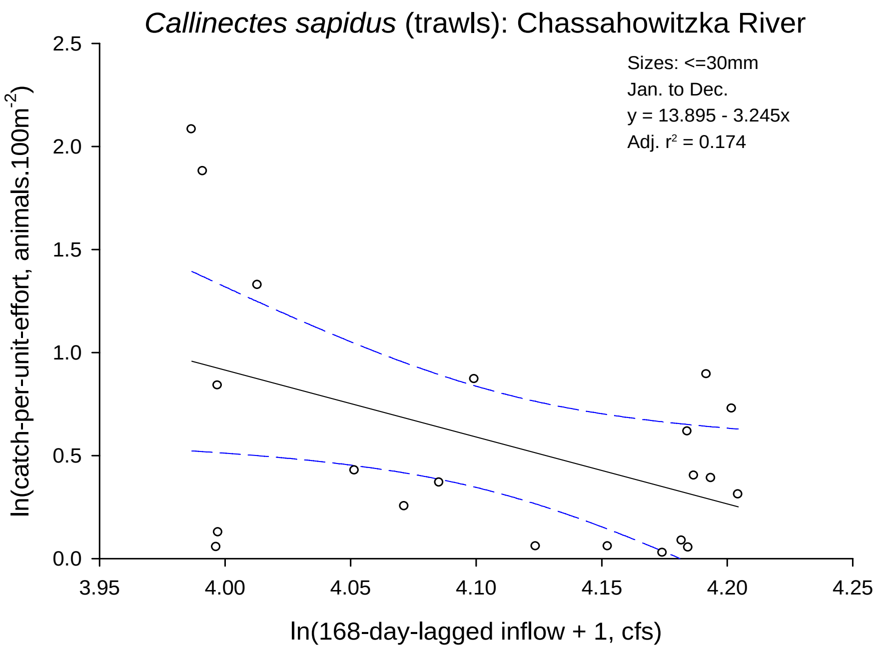


Fig. I5. Abundance response of blue crab (<=30mm) in the channel habitat of the Chassahowitzka River estuary to 168-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

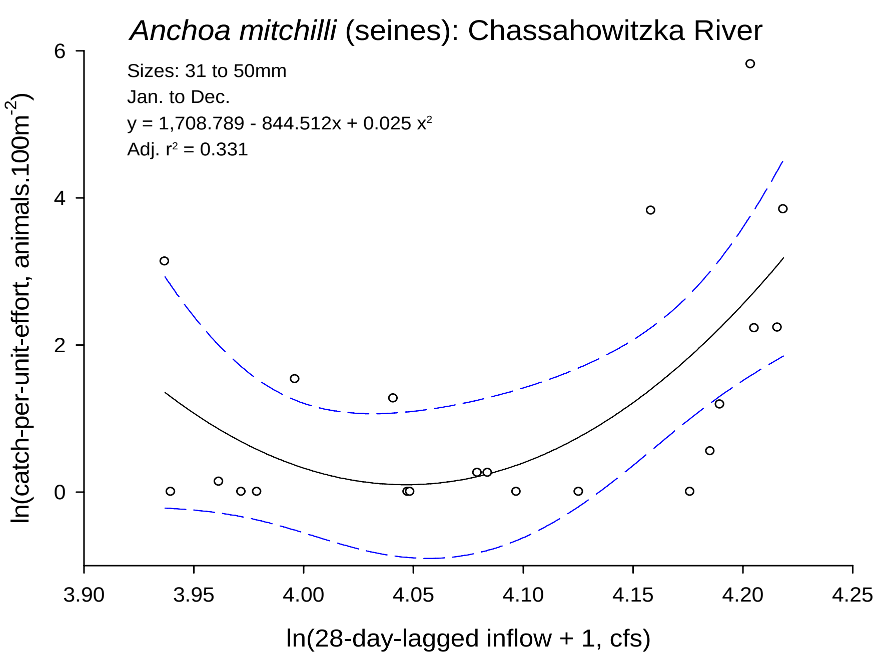


Fig. I6. Abundance response of bay anchovy (31 to 50mm) in the shoreline habitat of the Chassahowitzka River estuary to 28-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

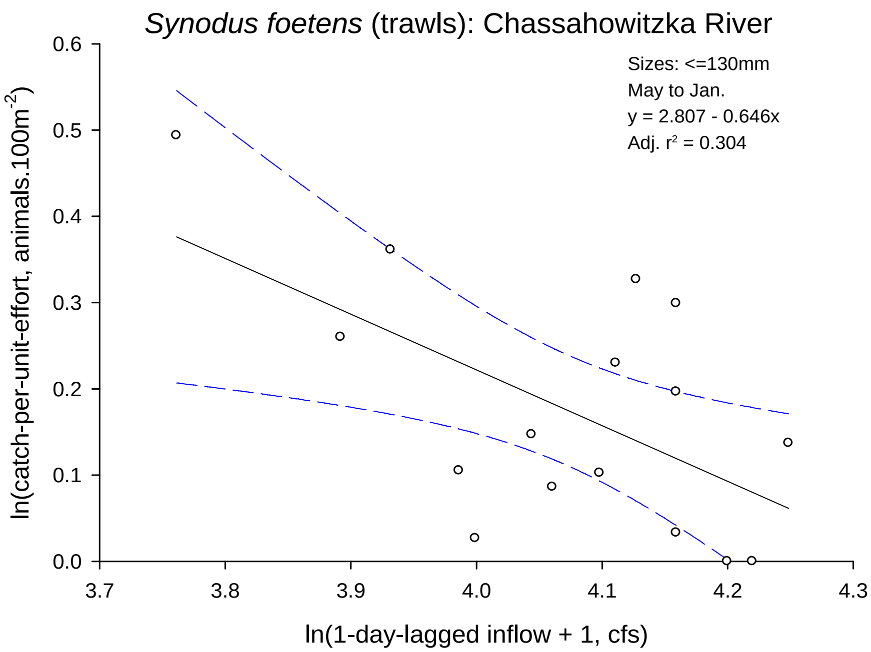


Fig. I7. Abundance response of inshore lizardfish (<=130mm) in the channel habitat of the Chassahowitzka River estuary to 1-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

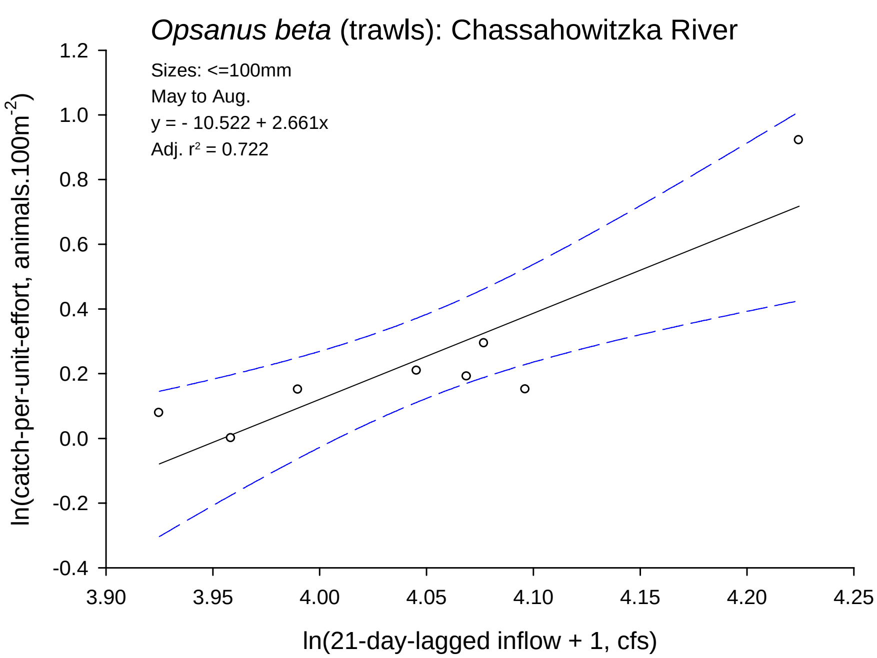


Fig. I8. Abundance response of gulf toadfish (<=100mm) in the channel habitat of the Chassahowitzka River estuary to 21-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

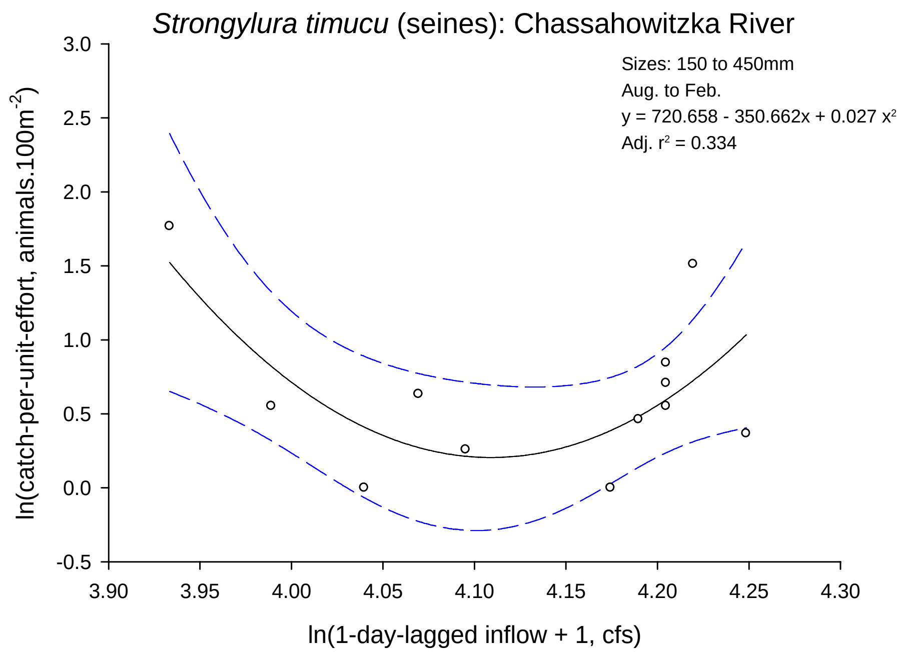


Fig. I9. Abundance response of timucu (150 to 450mm) in the shoreline habitat of the Chassahowitzka River estuary to 1-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

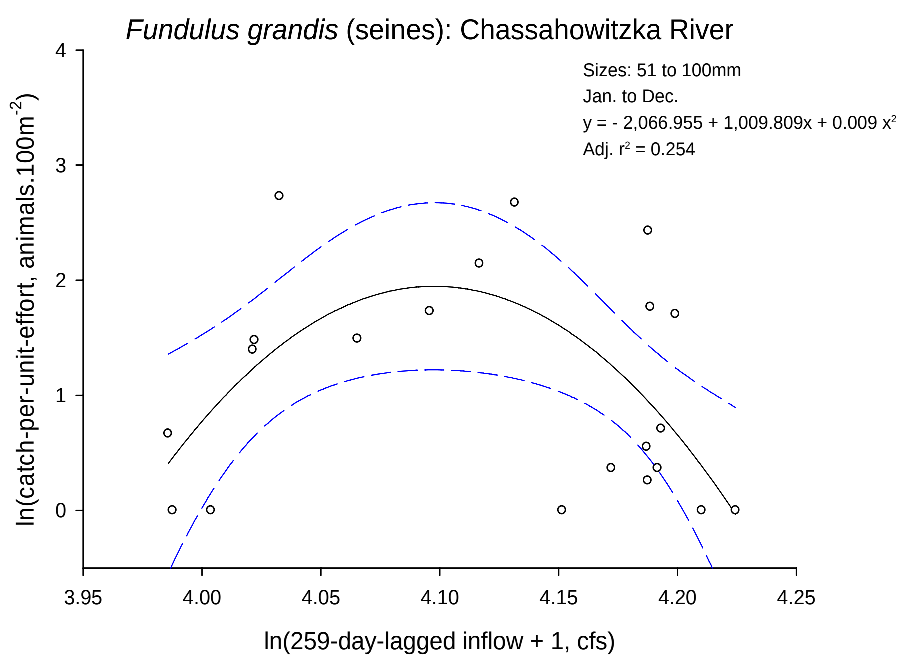


Fig. I10. Abundance response of gulf killifish (51 to 100mm) in the shoreline habitat of the Chassahowitzka River estuary to 259-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

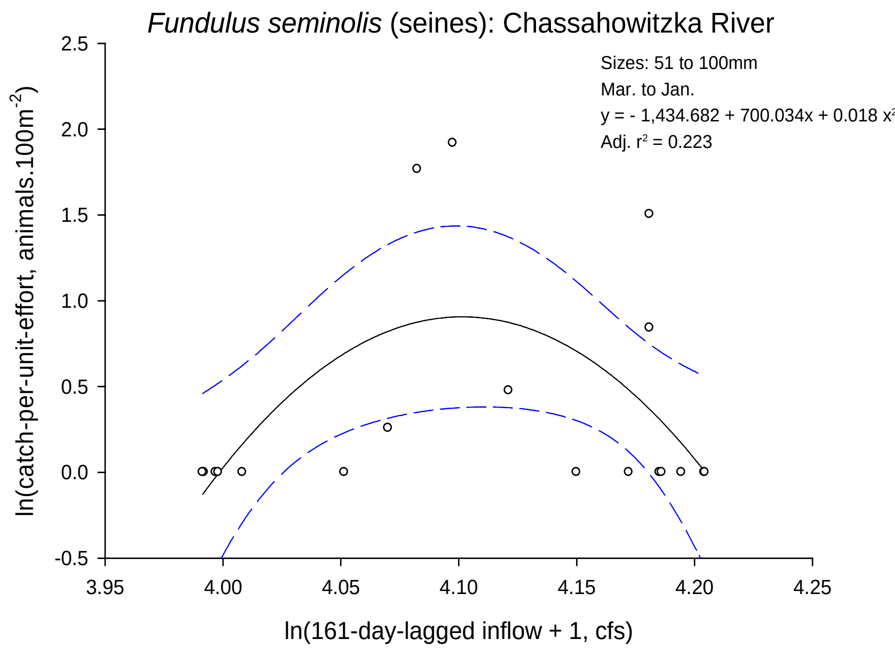


Fig. I11. Abundance response of seminole killifish (51 to 100mm) in the shoreline habitat of the Chassahowitzka River estuary to 161-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

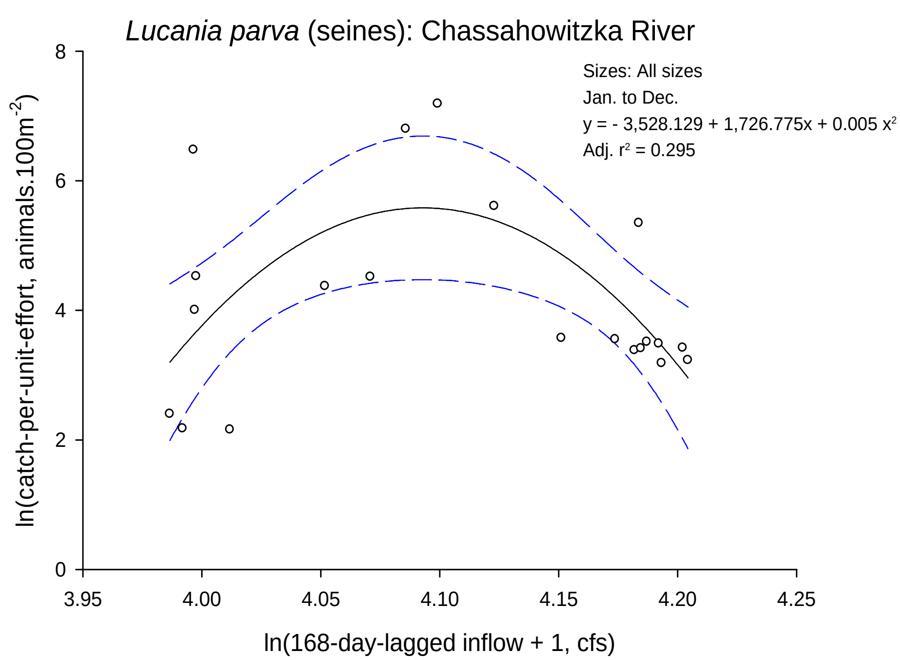


Fig. I12. Abundance response of rainwater killifish (all sizes) in the shoreline habitat of the Chassahowitzka River estuary to 168-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

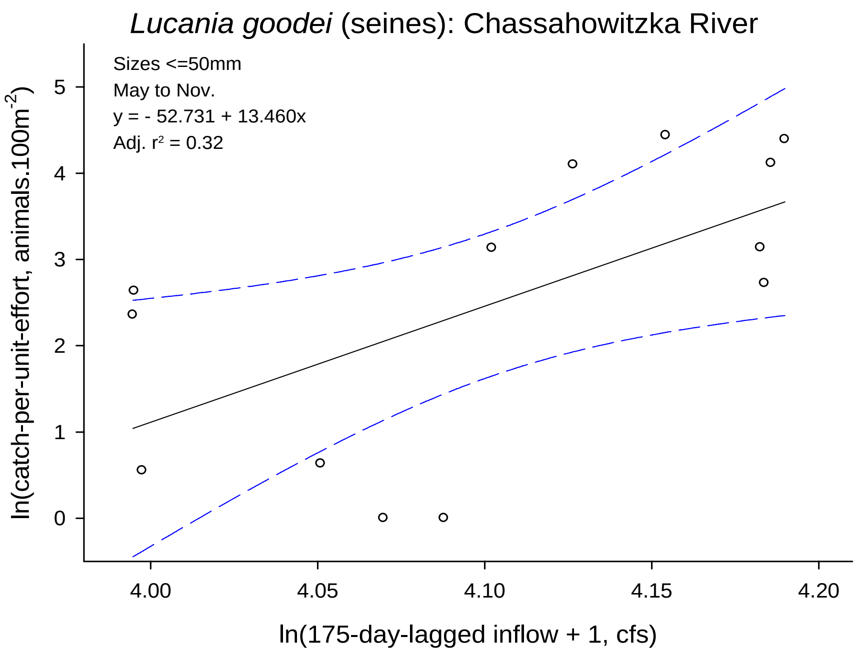


Fig. I13. Abundance response of bluefin killifish (<=50mm) in the shoreline habitat of the Chassahowitzka River estuary to 175-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

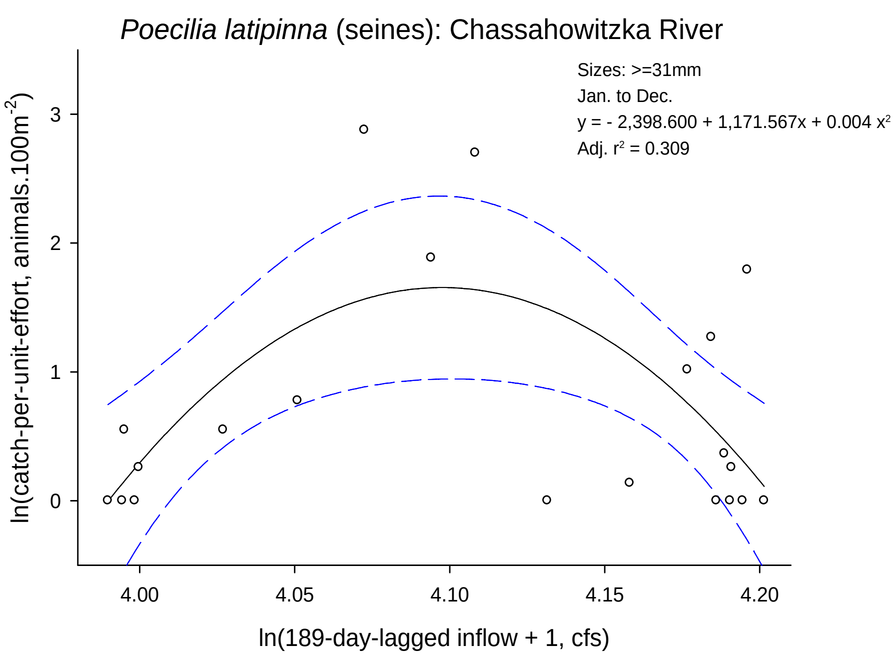


Fig. I14. Abundance response of sailfin molly (>=31mm) in the shoreline habitat of the Chassahowitzka River estuary to 189-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

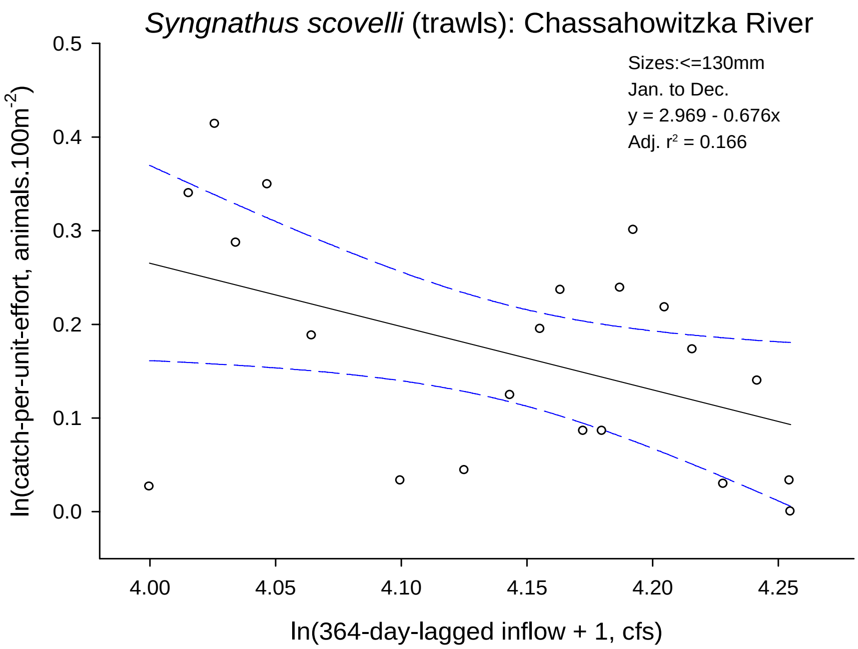


Fig. I15. Abundance response of gulf pipefish (<=130mm) in the channel habitat of the Chassahowitzka River estuary to 364-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

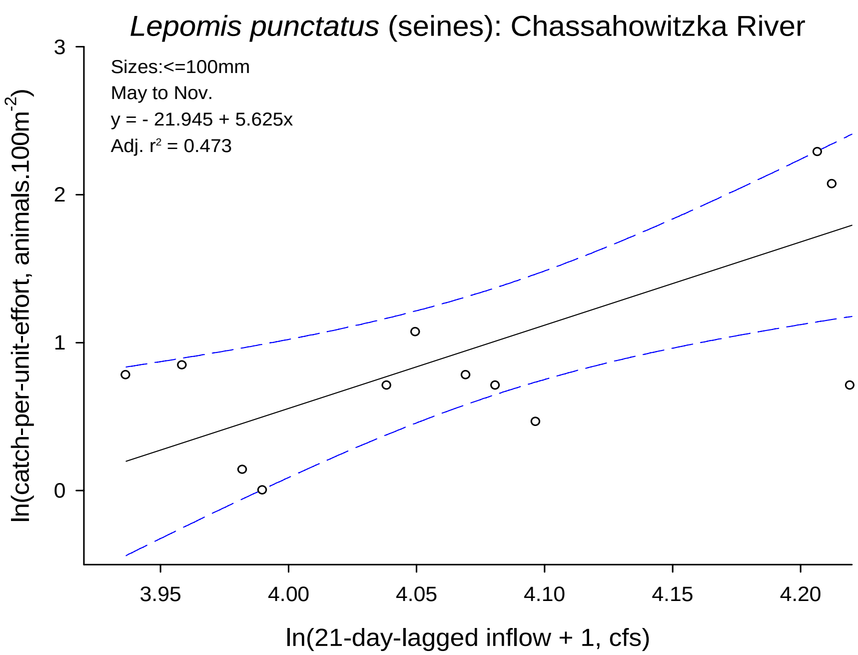


Fig. I16. Abundance response of spotted sunfish (<=100mm) in the shoreline habitat of the Chassahowitzka River estuary to 21-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

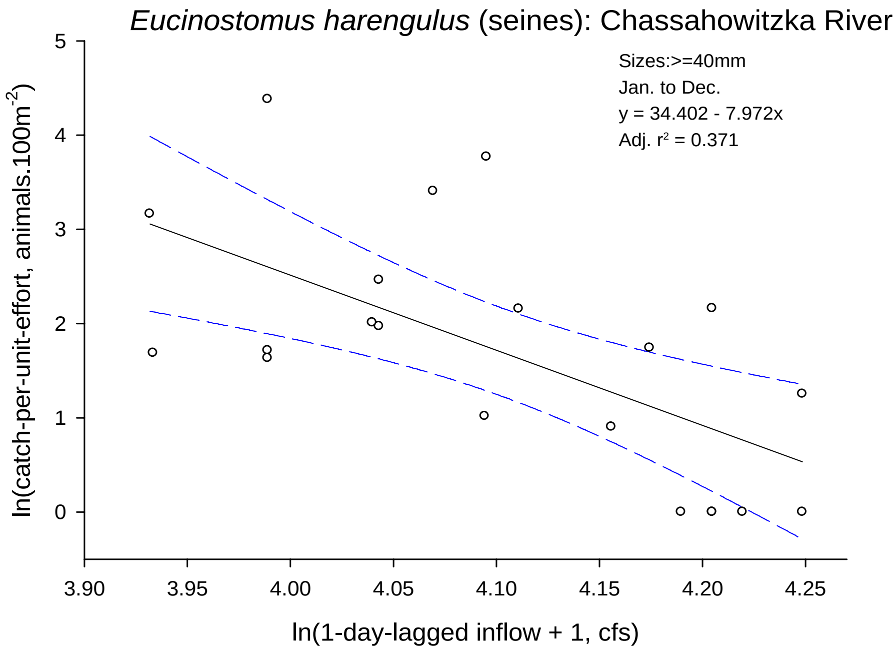


Fig. I17. Abundance response of tidewater mojarra (>=40mm) in the shoreline habitat of the Chassahowitzka River estuary to 1-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

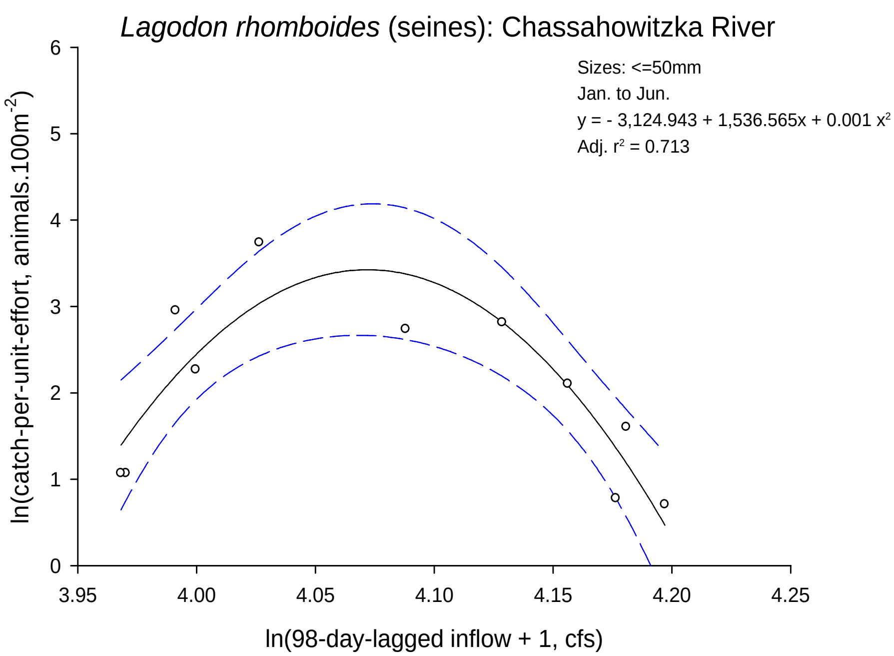


Fig. I18. Abundance response of pinfish (<=50mm) in the shoreline habitat of the Chassahowitzka River estuary to 98-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

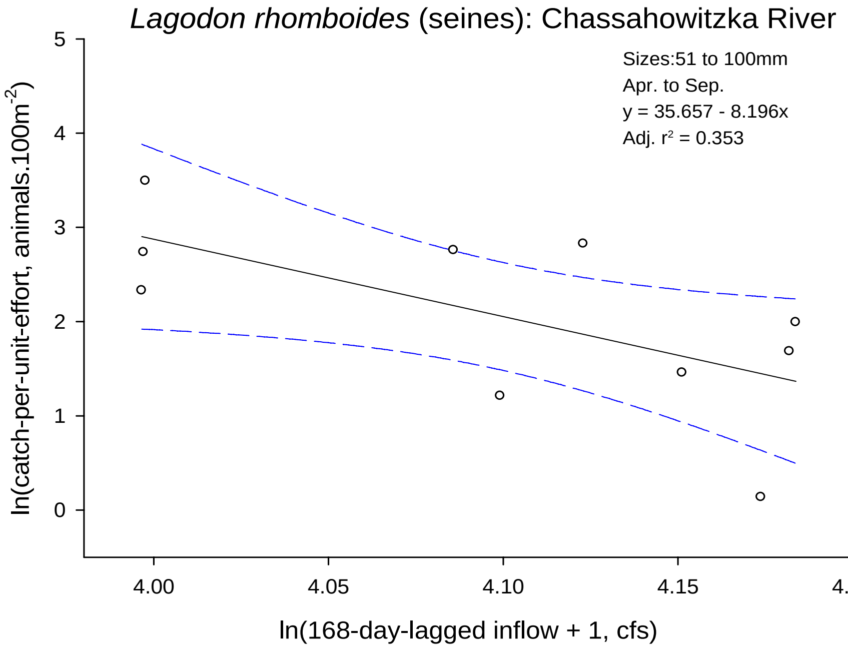


Fig. I19. Abundance response of pinfish (51 to 100mm) in the shoreline habitat of the Chassahowitzka River estuary to 168-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

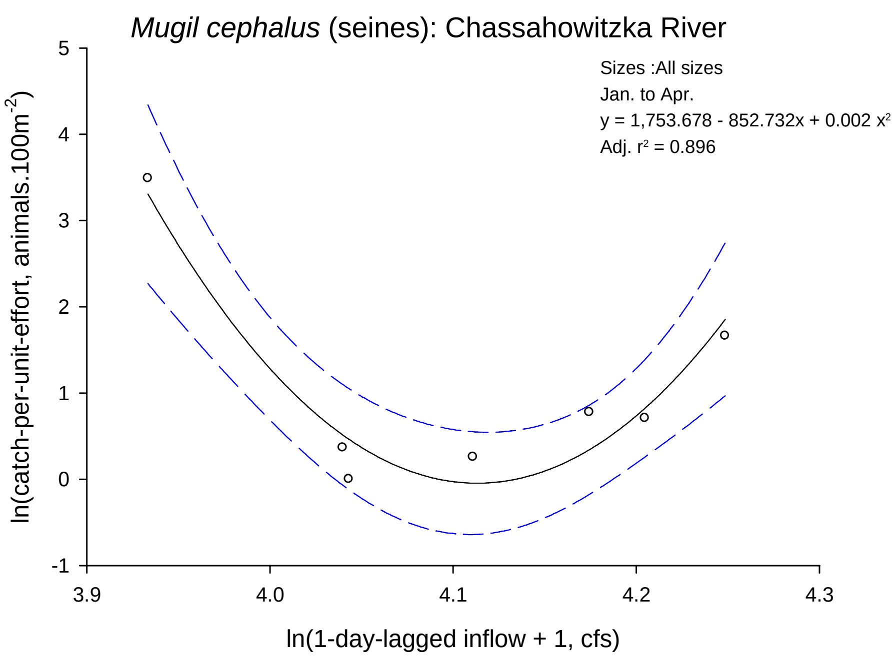


Fig. I20. Abundance response of striped mullet (all sizes) in the shoreline habitat of the Chassahowitzka River estuary to 1-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

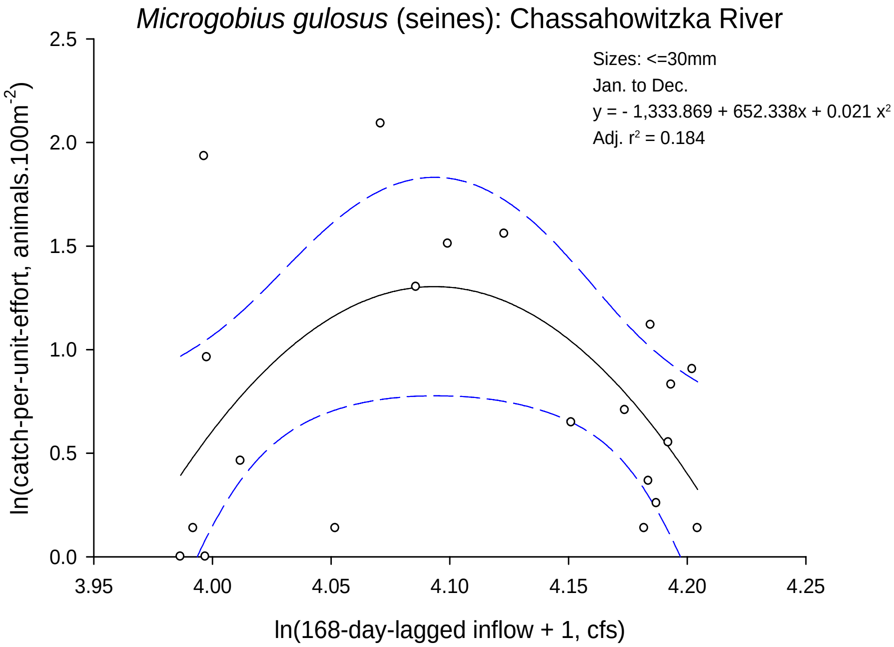


Fig. I21. Abundance response of clown goby (<=30mm) in the shoreline habitat of the Chassahowitzka River estuary to 168-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

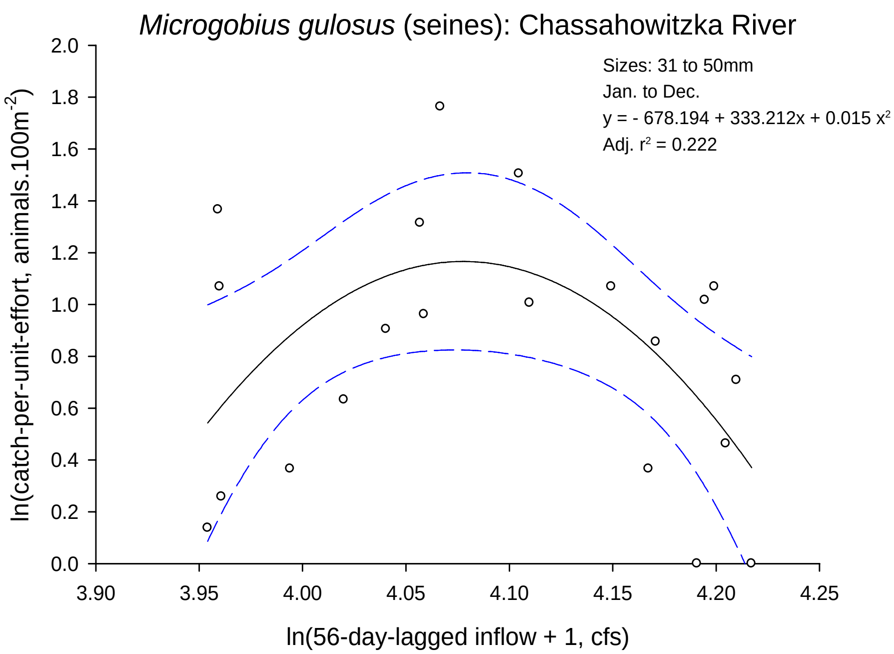


Fig. I22. Abundance response of clown goby (31 to 50mm) in the shoreline habitat of the Chassahowitzka River estuary to 56-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.

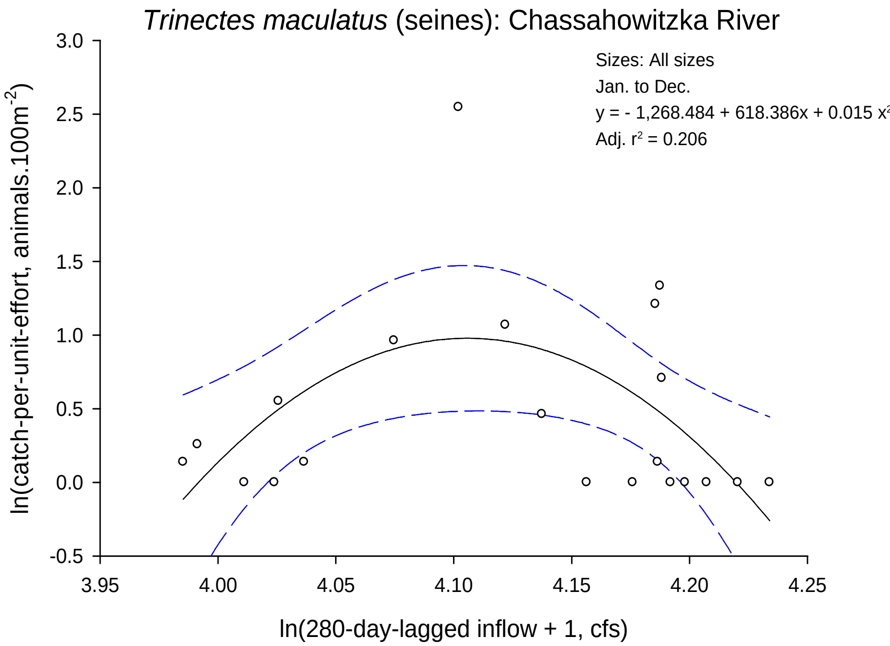


Fig. I23. Abundance response of hogchoker (all sizes) in the shoreline habitat of the Chassahowitzka River estuary to 280-day-lagged inflow. Solid Lines: predicted values; dashed Lines: 95% CI.