SHARK NURSERY GROUNDS AND ESSENTIAL FISH HABITAT STUDIES

GULFSPAN GULF OF MEXICO-FY07
Cooperative Gulf of Mexico States Shark Pupping and Nursery Survey

REPORT TO NOAA FISHERIES, HIGHLY MIGRATORY SPECIES DIVISION

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BACKGROUND

The importance of identifying shark nursery areas has increased in recent decades as some declines in some US shark populations due to overfishing have been documented (NMFS 2006, NMFS 2007), necessitating the implementation of management or conservation measures. In addition, with the mandate to incorporate essential fish habitat (EFH) in all Fishery Management Plans (USDOC 2007), research on shark nursery areas has increased (McCandless et al. 2002, in press). The increased use of EFH in management plans has recognized that all stages in a species life cycle are important, not just those stages vulnerable to exploitation. Thus better understanding of those habitats or regions that serve as nurseries should improve shark conservation and management (USDOC 2007). Beginning in 2003, the cooperative Gulf of Mexico Shark Pupping and Nursery (GULFSPAN) program was developed to examine the distribution and abundance of juvenile sharks in coastal areas, with the ultimate intent of further describing shark EFH. Current participants in this project include the University of Florida, the University of South Alabama, Gulf Coast Research Laboratory, the Louisiana State University, and the NOAA Fisheries Panama City Laboratory, which oversees the program. This report describes results from the GULFSPAN project for 2007.

METHODS

All participating institutions modeled fishery independent surveys after those developed by Carlson and Brusher (1999) to provide a direct comparison of abundance among areas. A gill net consisting of six different mesh size panels was used for sampling in all areas by all participants. Stretched mesh sizes ranged from 7.6 cm (3.0”) to 14.0 cm (5.5”) in steps of 1.3 cm (0.5”). Each panel was 3.0 m (10 ft) deep and 30.5 m (100 ft) long. The sampling gear was randomly set within each area based on depth strata and GPS location.

Captured sharks were measured (precaudal, PCL; fork, FL; total, TL: and stretched total length, STL in cm), sexed, and life history stage assessed and recorded (young-of-the-year, juvenile, or adult). Sharks in poor condition were sacrificed for life history studies and those in good condition were tagged and released. Captured rays were measured in disc width (DW in cm) and sexed. Because of the limited life history information for most ray species, a life history category could not always be assigned.

For each set of the gear, mid-water temperature (^{o}C), salinity (ppt), and dissolved oxygen (mg l^{-1}) were recorded from a YSI-85 environmental meter, average depth (m) was calculated using gear start and end points recorded from the vessel's depth finder, water clarity (depth of the photic zone) was measured by secchi disc (cm), and qualitative habitat type (e.g., mud, sand, oyster, etc.) was determined by personal observation or previously documented literature. Catch-per-unit-effort (CPUE) of each set was defined as the number individuals caught divided by the soak time of the net (the time from the first float entering the water to the time that the last float came out of the water; animals per net hour). Nets were typically fished between 0.5-1.0 hours.

RESULTS AND DISCUSSION

1. Northwest Florida (Panama City Laboratory)

Sampling sites were located in five major areas along the panhandle of Florida: St. Andrew Bay, Crooked Island Sound (Figure 1), St. Joseph Bay, the Gulf of Mexico-side of St. Vincent Island, and Apalachicola Bay, FL (Figure 2). A total of 143 sets were made, capturing nine species of sharks and three species of rays. The majority of individuals encountered were immature.

Abundance trends

Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, a member of the small coastal management group, was the most abundant shark captured (females: 22.5-86.0 cm FL, mean = 43.2 cm FL and males: 25.0-86.0 cm FL, mean = 62.0 cm FL). Blacktip shark, *Carcharhinus limbatus*, was the second-most abundant species captured overall and the most abundant shark captured from the large coastal management group (females: 40.5-150 cm FL, mean = 68.4 cm FL and males: 49-105 cm FL, mean = 66 cm FL). Bonnethead shark, *Sphyrna tiburo*, was the third-most abundant shark species encountered (females: 38.0-91.0 cm FL, 54.5 mean = 61.6 cm FL and males: 36.0-80.0 cm FL, mean = 56.7 cm FL). The remaining species captured in decreasing abundance were scalloped hammerhead shark, *S. lewini* (females: 32.0-61.5 cm FL, mean = 40.9 cm TL and males: 34.0-70.0 cm FL, mean = 43.7 cm TL), spinner shark, *C. brevipinna* (females: 47.0-93.0 cm FL, mean = 58.5 cm FL and males: 43.0-150 cm FL, mean = 61.5 cm FL), finetooth shark, *C. isodon* (females: 41.0-108 cm FL, mean = 85.4 cm FL and males: 45.0-115 cm FL, mean = 83.6 cm FL), blacknose shark, *C. acronotus* (females: 35.0-47.5 cm FL, mean = 40.3 cm FL and males: 37.5-92.0 cm FL, mean = 47.9 cm FL), and sandbar, *C. plumbeus* (females: 47.0-50.0 cm FL, mean = 48.5 cm FL and males: 50.0-71.0 cm FL, mean = 58.2 cm FL). Two bull shark, *C. leucas* (male: 150 cm FL and undetermined sex: 200 cm FL) were encountered.

Cownose ray, *Rhinoptera bonasus*, was the most abundant ray captured (females: 40.0-100 cm DW, mean = 82.9 cm DW and males: 42.5-100 cm DW, mean = 66.0 cm DW). Smooth butterfly ray, *Gymnura micrura* (females: 28.0-36.5 cm DW, mean = 32.3 and males: 26.5-36.0

cm DW, mean = 31.3 cm DW) was the second-most ray species encountered. One southern stingray was encountered, *Dasyatis americana* (female: 50 cm DW).

Catch-per-unit-effort by month and life stage

CPUE trends were examined by month and life stage (areas combined) for the three most abundant shark species captured overall (Atlantic sharpnose, blacktip, and bonnethead shark) and the most abundant batoid captured (cownose ray).

CPUE was lowest for Atlantic sharpnose in April and October (Figure 3a). This is likely due to generally cooler water temperature during these months (on average 7^{o}C cooler). CPUE spiked in May for adult Atlantic sharpnose, in June for juveniles, and in September for young-of-the-year.

Adult blacktip sharks were collected only in April and May. This is the time of year when adults move to inshore areas in the panhandle of Florida to pup and mate (Carlson and Brusher 1999, Carrier et al. 2004). CPUE spiked in May for juveniles and again in September. Young-of-the-year sharks were collected in all months at relatively the same rate (Figure 3b).

Adult bonnetheads were collected in all months, except October, with a spike in CPUE in September. Juveniles were collected at relatively the same rate throughout the sampling season. CPUE for young-of-the-year bonnetheads peaked in June and July and then steadily decreased until the end of the sampling season (Figure 3c).

CPUE spiked in May for adult cownose ray. CPUE was highest in April for juveniles and young-of-the-year (Figure 3d). Cownose ray were absent from all catches in July, September, and October and CPUE was relatively low in August. This may suggest that cownose ray prefer inshore waters during the cooler months.

Catch-per-unit-effort by time period

Beginning this year, sampling times were expanded in Crooked Island Sound. Following Carlson and Bethea (2006), sampling was broken into three periods: dawn (0400-0900), day (0900-1500), and dusk (1500-2100). CPUE trends by time period were examined for all species captured in Crooked Island Sound (life stages combined).

Atlantic sharpnose, finetooth, and spinner sharks showed clear spikes in CPUE for the dusk time period in Crooked Island Sound (Figure 4a, e, and g). Blacknose and blacktip sharks showed increasing CPUE throughout the day (Figure 4b and c). CPUE for bonnethead shark and cownose ray peaked during the day time period (Figure 4d and h) while the opposite was seen for scalloped hammerhead shark. CPUE for scalloped hammerhead shark was highest during dawn and dusk time periods (Figure 4f).

Species essential fish habitat profiles

Essential fish habitat (EFH) profiles for elasmobranchs collected in northwest Florida are summarized in Tables 3-14. As the majority of life stages of sharks collected were young-of-the-year and juveniles, areas in northwest Florida remain important potential nurseries for both large and small coastal shark species (Tables 3-11). In general, young-of-the-year sharks were more often collected in shallower water with higher temperature, lower salinity, and more turbid conditions compared to juveniles and adults. These small, young sharks may be selecting these habitats as a haven from larger, more active predators. Except for cownose ray, EFH requirements for ray species were sparse (Tables 13-14). As in years past, data for cownose ray suggest that adults can tolerate a much wider range of environmental factors than smaller life stages (Table 12).

In an attempt to better refine EFH, the long-term data series available at the NOAA Fisheries Panama City Lab was used to examine the relationship of CPUE with several environmental factors. Following Forney (2000), generalized additive models were used to examine the relationship between temperature, salinity, turbidity/water clarity, and dissolved oxygen and CPUE of most abundant species encountered – Atlantic sharpnose, blacktip and bonnethead shark. In most cases, models demonstrated low correlation between CPUE and environmental factors. Although not significant, CPUE for young-of-the-year Atlantic sharpnose and juvenile blacktip shark correlated with turbidity/water clarity (Figure 5 and 6, respectively) and juvenile bonnethead shark correlated with salinity (Figure 7). Additionally, area could co-vary with environmental factors. Future work will examine this relationships as well as anthropogenic influences such as the level of urban development and land use surrounding a particular area.

Bioenergetics

To better determine how habitat type may affect sharks during early life stages, the bioenergetic condition of juvenile scalloped hammerhead shark, *Sphyrna lewini*, in two contrasting habitats in the northwest Florida was examined. Experiments were conducted to test for differences in growth and daily ration between juveniles in a relatively shallow, protected area (Crooked Island Sound, FL) and river-influenced estuarine environment (Apalachicola Bay system, FL). Archived shark samples collected from May-July, 2000-2004, were examined for hepatosomatic index and diet. Bioenergetic models were also constructed to obtain estimates of daily ration. In both areas, the hepatosomatic index was lowest when water temperature was highest, suggesting sharks may be using liver reserves when stressed by high temperatures.

Based on published metabolic rates (Lowe 2001) and assuming 27 % of consumed energy is lost as waste (Wetherbee and Cortés 2004), scalloped hammerhead shark feeding on fish in Crooked Island Sound would have to eat 3.2% of its body weight per day just to maintain its weight. The same sharks occupying the Apalachicola Bay system and feeding on a diet primarily of shrimp would have to eat 3.1% of its body weight per day to maintain its weight. Thus, preliminary evidence suggests both areas provide a similar "nursery value" (Beck et al. 2001) in terms of fulfilling energetic need.

Predator-prey and trophic relationships

The diet and feeding habits of roundel skate, *Raja texana*, are being examined to evaluate trophic role in offshore waters of the northern Gulf of Mexico. Diet was assessed by life stage (immature and mature) and quantified using the index of relative importance expressed on a percent basis (%IRI, Pinkas 1971) and the percentage index of relative importance based on prey category (%IRI_{PC}, following the 7 prey categories in Bizzarro et al. 2007). Preliminary results of this study were presented at the skate symposium at the 2006 Joint Meeting of the American Society of Ichthyologists and Herpetologists and the American Elasmobranch Society in New Orleans, LA. Analysis of stomachs from 198 immature individuals (173 non-empty; mean DW = 23.5 cm) and 158 mature individuals (136 non-empty; mean DW = 32.2 cm) indicate shrimp make up 74.6 %IRI_{PC} of immature skate diet, with Family Solenoceridae as the most important identifiable shrimp present. Other crustaceans (largely amphipods) were also a relatively important prey category in the diet of immature skates (55.0 %IRI_{PC}, 31.8 %IRI amphipods only). Crabs and fishes were found in the diet of immature skates although in small amounts (1.1 and 0.9 %IRI_{PC}, respectively). Mature skate diet was also predominantly shrimp (57.3

$\%IRI_{PC}$); however, fishes made up a much larger percentage by prey category (37.1 $\%IRI_{PC}$). Crabs were also relatively important in the diet of mature animals (4.9 $\%IRI_{PC}$) while other crustaceans (largely amphipods) were much less important (0.01 $\%IRI_{PC}$). This suggests that roundel skate exhibit ontogenetic changes in diet with size and maturity. This skate may also show differences in diet with maturity and sex as sexual dimorphism regarding dentition is common in skates (Feduccia and Slaughter 1973). Specimen collection for this study ended November 2007, and a manuscript is being prepared for submission to the journal Environmental Biology of Fishes (Bethea and Hale, in prep).

Coastal habitat use and residency of juvenile Atlantic sharpnose sharks

A study on habitat use and residency of a coastal northwest Florida bay by juvenile Atlantic sharpnose shark was completed in 2007. Acoustic monitoring data were used to define the residency and movement patterns of sharks within Crooked Island Sound, FL. Over three years, sharks were monitored for periods of 1–37 days, with individuals regularly moving in and out of the study site. Individual sharks were continuously present within the study site for periods of 1-35 days. Patterns of movement could not be correlated with time of day. Home range sizes were typically small (average = 1.29 km^2) and did not vary on a yearly basis. Gillnet sampling revealed that juvenile Atlantic sharpnose sharks were present in all habitat types found within Crooked Island Sound, and peaks in abundance varied depending on month within a year. Although telemetry data showed that most individuals remained within the study site for short periods of time before emigrating, conventional tag-recapture data indicated some individuals return to Crooked Island Sound after extended absences (maximum length = 1352 days). Although conventional shark nursery theory suggests small sharks remain in shallow coastal waters to avoid predation, juvenile Atlantic sharpnose sharks frequently exited from shallow, protected areas and appeared to move through deeper waters to adjacent coastal bays and estuaries. The benefit gained through using a nursery that reduces predation may be limited for this species.

2. Cedar Key Region, Florida (University of Florida)

Funds were provided to sample in Cedar Key, FL, and areas north to Apalachee Bay, FL. Within this region, sampling sites were randomly chosen from three areas: Suwannee Sound, Cedar Key, and Waccasassa Bay (Figure 8). Each area was bounded on the eastern side by the coastline and on the western side by the three nautical mile limit. There are no natural boundaries between these areas, and each was arbitrarily chosen to be approximately 20 km in length. During the spring and summer of 2007, a total of 24 gillnet sets were made, capturing four species of sharks and five species of rays.

Abundance trends

The most abundant shark captured within this region was bonnethead shark (33.4 – 87.6 cm FL, mean = 64.2 cm FL). Bonnethead shark was more prevalent in the Suwannee Sound than the other two areas (Table 15c). Blacktip shark was the second most abundant shark captured and the most abundant large coastal shark captured (42.5 – 103.4 cm FL, mean = 64.3 cm FL). Blacktip shark abundance was highest in the two southern areas (Table 15b). The third most abundant shark captured was the Atlantic sharpnose shark (27.8 – 88.0 cm FL, mean = 66.4 cm FL). Atlantic sharpnose shark abundance was similar throughout all sampling areas (Table 15a). The only other shark captured by the survey was the scalloped hammerhead shark (n=4, 85.0 –

147.6 cm FL, mean = 113.4 cm FL). Three of four of the scalloped hammerhead sharks captured were caught within the Waccasassa Bay region (Table 15d).

Five species of ray were captured during sampling activities in this region. The most abundant ray was cownose ray (n=5; 50.0 - 93.9 cm DW, mean = 70.0 cm DW), and Atlantic stingray, *D. sabina* (n=5; 22.8 – 27.8 cm DW, mean = 25.3 cm DW). The next most abundant ray species captured was southern stingray (n=3; 61.3 – 75.0 cm DW, mean = 70.0 cm DW) and smooth butterfly ray (n=3; 29.1 – 34.4 cm DW, mean = 31.9 cm DW). One bluntnose stingray, *D. sayi* was also captured (DW = 17.6 cm). Rays were captured throughout all sampling areas, but were not abundant in any locality (Table 16).

Species essential fish habitat profiles

The essential fish habitat profiles for sharks in this area are summarized in Tables 17-21. About half the catch of elasmobranchs within this region consisted of adult animals and about half the catch consisted of neonate and juvenile animals. Young-of-the-year sharks tended to be captured in shallower waters than larger immature or mature sharks. In addition, these sharks tended to be captured in warmer, more saline waters but this maybe a reflection of a lack of young-of-the-year animals within the catch of the earlier and cooler months of the sampling season. There is some indication that ray species may be able to tolerate a wider range of salinities, but more data are needed to confirm this finding.

3. Alabama (University of South Alabama)

As part of an on-going project off Dauphin Island, AL, GULFSPAN now includes the University of South Alabama as collaborators in this project. Areas sampled in this region included waters off Point Aux Pins and the west end of Dauphin Island (Mississippi Sound), Little Dauphin Island (Mobile Bay), Pelican Bay, and Bon Secour Bay (Figure 9). Due to the resources being allocated in August 2007, only 19 sets were made with most areas lacking replication.

Abundance trends

A total of 28 sharks were collected, representing four species, 82% of which were immature. Finetooth shark was the most abundant species caught (53-89 cm FL, mean = 75 cm FL; Table 22d), followed by Atlantic sharpnose shark (59-75 cm FL, mean = 69 cm FL, Table 22a) and blacktip shark (60-110 cm FL, mean = 84 cm FL, Table 22b). In addition, one immature male bonnethead shark was caught (FL = 51 cm, Table 22c). The only ray species caught was the Atlantic stingray (mean=124 cm DW, Table 23).

The highest CPUE was recorded at Little Dauphin Island (10.1 sharks per net hr) and was primarily comprised of juvenile finetooth sharks. However, this high CPUE was based on a single collection. The second highest CPUE was observed at West End of Dauphin Island (3.1 ± 2.1 sharks per net hr), again largely due to a high catch of juvenile finetooth sharks. Though further replication in this region is still necessary, it appears that the north-facing shoreline of Dauphin Island may represent a potential nursery ground for this species. Lower catch rates of sharks were observed for Pelican Island (1.4 ± 1.0 sharks per net hr) and Point Aux Pins (0.84 sharks net hr), and no sharks were caught in Bon Secour Bay during the sampling period (August-October). It should also be noted that although cownose ray and bull shark were never caught using normal sampling procedure, both species were caught in a separate net at Pelican Bay and Bon Secour Bay, respectively. This net (300 m alternating 4-inch and 6-inch panels) was simultaneously set in-line with the normal sampling gear, and generally produced greater catches and larger individuals across the sampling area (M. Ajemian, unpublished data).

Species essential fish habitat profiles

Small sample sizes and a limited field season restrict results on essential fish habitat (EFH) profiles; although, a few interesting trends emerge from the data (Tables 24-28). Despite having sampled in waters 17.2-30.4 ºC, all sharks were caught within a relatively narrow temperature range (26.6-30.0 ºC). Whether or not this small range reflects limited thermal tolerance of these sharks is not presently clear. Bon Secour Bay was characterized by the lowest recorded salinities in the coverage area (23.3-25.9 ppt, mean = 24.3 ppt). Bull sharks, which have high preference for low salinity waters at juvenile stages, were the only elasmobranchs caught in this region. Dissolved oxygen concentrations were also the lowest in Bon Secour Bay, and may have also limited overall catch rates in this area.

4. Mississippi (University of Southern Mississippi)

A total of 44 sets at nine sampling stations were performed in Mississippi coastal waters from June to October 2007 (Figure 10).

Catch rates

A total of 79 sharks were collected in Mississippi coastal waters, representing five species, 85% of which were immature. Blacktip shark (females: 48.1-99.5 cm FL, mean = 69.3 cm FL and males: 45.0-97.1 cm FL, mean = 70.1 cm FL) were the most abundant species caught, followed by Atlantic sharpnose shark (females: 36.7-37.0 cm FL, mean = 36.9 cm FL and males:

63.0-77.3 cm FL, mean = 71.9 cm FL), bull shark (females: 69.1-114.7 cm FL, mean = 91.5 cm FL and males: 70.0-114.5 cm FL, mean = 94.9 cm FL), scalloped hammerhead shark (females: 43.8-44.2 cm FL, mean = 44.0 cm FL and males: 39.6-41.0 cm FL, mean = 40.3 cm FL), and finetooth shark (49.1 cm FL) (Table 29). Nine rays were collected representing two species, cownose ray (females: 39.9-86.0 cm DW, mean = 57.5 cm DW) and Atlantic stingray (females: 24.5 cm DW and males: 26.4-28.0, mean = 27.1 cm DW) (Table 30).

Similar to previous years, Round Island was the most productive location (4.6 ± 1.4 sharks per net hr), followed by Cat Island (3.7 ± 1.5 sharks per net hr), Horn Island (1.7 ± 0.4 sharks per net hr), Davis Bayou (0.4 ± 0.2 sharks per net hr), and Deer Island (0.2 ± 0.20 sharks per net hr; Table 29). Monthly nominal catch rates typically peak during the summer and decline during the fall months. During 2007, catch rates were highest during June (2.2 ± 0.8 sharks per net hr), July (3.2 ± 0.9 sharks per net hr), and August (3.8 ± 1.5 sharks per net hr), and declined during September (0.1 ± 0.1 sharks per net hr) and October (1.1 ± 0.6 sharks per net hr).

For all combined life stages, blacktip and scalloped hammerhead sharks were most abundant in waters off Round Island, while bull shark, Atlantic stingray, and cownose ray were most abundant in waters off Cat Island. Atlantic sharpnose shark were most abundant in waters off Horn Island, and finetooth shark were only encountered in waters off Deer Island. Bull shark was the only species collected from Davis Bayou (Table 29c).

Species essential fish habitat profiles

Information on essential fish habitat profiles for the five shark and two ray species were relatively similar (Tables 31-36); however, there were a few interesting observations. The majority of sharks collected in this study were immature, indicating that Mississippi Sound may be a potential nursery area for several shark species. Juvenile and young-of-the-year sharks appeared to prefer shallow, warmer, lower salinity, and more turbid waters compared to adult sharks (Tables 31-35).

The bull shark was the only species encountered at Davis Bayou, which isn't surprising given the preference for low salinity by immature life stages (Table 33). Only one finetooth shark was collected during 2007, which occurred at Deer Island (Table 34). The lack of significant rainfall and unusually high salinities around the Mississippi Sound barrier island system may have forced young finetooth sharks further inshore and out of our sampling range. Atlantic stingray and cownose ray are common within the waters of Mississippi Sound. All rays were collected at the barrier islands (Horn Island and Cat Island) in waters with relatively high salinity (26.4-32.0 ‰), relatively warm water temperature (21.4-31.2˚C), and similar bottom type (sand/silt/clay; Table 36).

5. Louisiana (Louisiana State University)

Louisiana was hit by Hurricanes Katrina and Rita in 2005, causing severe damage to the coastal zone surrounding the Mississippi River. For the first time since late 2005, sampling was accomplished in Louisiana waters. A total of nine sets were made at nine different sampling locations in the coastal waters of Terrebonne Bay, LA, in 2007 (Figure 11).

Catch rates

A total of 64 sharks were collected in Terrebonne Bay, representing four species, 95 % of which were immature. Blacktip shark (45.5-114.0 cm FL) was the most abundant species caught followed by Atlantic sharpnose shark (31.0-40.0 cm FL), finetooth shark (47.0-99.0 cm

FL), and bull shark (90.0-96.0 cm FL). Three cownose ray (49.5-51.0 cm, DW) were also collected in one set, tagged, and released. The CPUE for sharks by species and life history stage is summarized in Table 37.

Species essential fish habitat profiles

Fish habitat characteristics necessary to assess essential fish habitat profiles for all elasmobranchs were collected in Terrebonne Bay and were relatively similar (Tables 38-42). Since the overwhelming majority of life stages of sharks collected were young-of-the-year and juveniles (95%), the areas sampled in Terrebonne Bay appear to be potential nursery habitats for both large and small coastal shark species (Table 38-42). Thompson et al. (2002) found similar results in a previous 3-year study of sharks in coastal Louisiana, with immature stages making up 80-90% of sharks captured. Only three adults (1 female blacktip shark and 2 male finetooth shark) were captured during this study; however, the gear is less effective at capturing adults. No sampling was done before July of this season, so no inferences can be made about the importance of this area as adult or pupping habitat. EFH profiles for ray species are sparse as only three cownose ray were collected in this study and all from one set in August (Table 42).

TAG RECAPTURE DATA

In 2007, 672 elasmobranchs were tagged by GULFSPAN survey participants. Tag recapture data were collected for 22 sharks (Table 43). Of those, 14 were Atlantic sharpnose shark, three were blacktip shark, three were spinner shark, and two were bonnethead shark. Data on these sharks were returned by recreational anglers using hook and line, GULFSPAN surveys using gillnet, and commercial fishermen. The shark at liberty the longest was a male Atlantic sharpnose shark. It was tagged on August 23, 2003, on the Gulf of Mexico-side of St. Joseph Bay, FL, and recaptured 1385 days later on the Gulf of Mexico-side of St. Vincent Island, FL, approximately 20 km to the east. The shark that traveled the longest distance was also a male Atlantic sharpnose shark which was tagged in Crooked Island Sound, FL, and recaptured 40 days later approximately 129.0 km southeast at the mouth of the St. Marks River in Apalachee Bay, FL.

Efforts are underway to develop a US Gulf of Mexico and southeast Atlantic Ocean centralized elasmobranch tag and recapture database for the NOAA Fisheries Panama City Laboratory, NOAA Fisheries Mississippi Labs, and GULFSPAN participants. The ultimate goal is to have all colleagues gain access to an online database with fully searchable records for all tagged and recaptured specimens.

CONCLUSIONS

The GULFSPAN project now has 4 institutions collaborating on determining essential fish habitat for elasmobranchs in the Gulf of Mexico. In addition, data collected as part of this program are being incorporated as abundance trends into stock assessment models (NMFS 2006, NMFS 2007). Continued funding of this program is vital to obtaining these time series data. Moreover, future collaborations with the Florida State University and Texas Parks and Wildlife Department have already been initiated and sampling by these agencies may occur in 2008, as funds permit.

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LITERATURE CITED

Beck MW, Heck KL, Able KW, Childers DL, Eggleston DB, Gillanders BM, Halpern B, Hays CG, Hoshino K, Minello TJ, Orth RJ, Sheridan PF, Weinstein MP (2001) The identification, conservation, and management of estuarine and marine nurseries for fish and invertebrates. Bioscience 51(8): 633-641

Bethea DM, Hale L (In prep) Diet of the roundel skate *Raja texana* from the northern Gulf of Mexico. Env. Biol. Fish.

Bizarro JJ, Robinson HJ, Rinewalt CS, Ebert DA (2007) Comparative feeding ecology of four sympatric skate species off central California, USA. Env. Biol. Fish. 80: 197-220

Carlson JK, Brusher JH (1999) An index of abundance for juvenile coastal species of sharks from the northeast Gulf of Mexico. Mar. Fish. Rev. 61(3): 37-45

Carlson JK, Bethea DM (2006) SEDAR 13-DW-06: Standardized catch rates of small coastal sharks from a fishery-independent gillnet survey in northwest Florida (http://www.sefsc.noaa.gov/sedar/Sedar_Documents.jsp?WorkshopNum=13&FolderType=Data)

Carrier JC, Pratt Jr. HL, Castro JI (2004) "Reproductive Biology of Elasmobranchs" *In*: Biology of Sharks and Their Relatives. JC Carrier, JA Musick, MR Heithaus (Eds.) CRC Press, Boca Raton, FL. p269-286

Feduccia A, Slaughter BH (1974) Sexual dimorphism in skates (Rajidae) and its possible role in differential niche utilization. Evolution 28(1): 164-168

Forney KA (2000) Environmental models of cetacean abundance: reducing uncertainty in population trends. Cons. Biol. 14(5): 1271-1286

Lowe CG (2001) Metabolic rates of juvenile scalloped hammerhead sharks (*Sphyrna lewini*). Mar Biol 139: 447-453

NMFS National Marine Fisheries Service (2006) SEDAR 11: Stock assessment report large coastal complex, blacktip, and sandbar shark. US Department of Commerce, National Oceanic and Atmospheric Administration, Highly Migratory Species Division, Silver Spring, MD

NMFS National Marine Fisheries Service (2007) SEDAR 13: Stock assessment report small coastal shark complex, Atlantic sharpnose, blacknose, bonnethead, and finetooth shark. US Department of Commerce, National Oceanic and Atmospheric Administration, Highly Migratory Species Division, Silver Spring, MD

McCandless CT, Pratt Jr. HL, Kohler NE (2002) (eds) Shark nursery grounds of the Gulf of Mexico and East Coast waters of the United States: an overview. An internal report to NOAA's Highly migratory Species Office. NOAA Fisheries Narragansett Lab, 28 Tarzwell Drive, Narragansett, RI 02882

McCandless CT, Pratt Jr. HL, Kohler NE (eds) (in press) Shark nursery grounds of the Gulf of Mexico and East Coast waters of the United States. American Fisheries Society Publication

Pinkas LM, Oliphant S, Iverson ILK (1971) Food habits of albacore, bluefin tuna, and bonito in Californian waters. Calif Fish Game 152: 1-105

Thompson B, Condrey RE, Neer JA, Barry KP, Blackburn JK, deSilva JA, Peterson GW (2002) Essential shark conservation needs: A timely assessment of the role Louisiana's waters play as critical pupping and nursery grounds. Third-year Annual Report and Project Summary to the Coypu Foundation Trust. 26p + 3 Appendices

USDOC US Department of Commerce, NOAA National Oceanic and Atmospheric Administration, NMFS National Marine Fisheries Service (2007) Magnusen-Stevens Fishery Conservation and Management Act, as amended through Jan. 12, 2007. NMFS, Silver Spring, MD. 170p

Wetherbee B, Cortés E (2004) “Food Consumption and Feeding Habits” *In*: JC Carrier, JA Musick, MR Heithaus (eds.) Biology of Sharks and Their Relatives. CRC Press, Boca Raton, FL. p225-246

Table 1. Summary of CPUE (number of sharks per net hr) for sharks by life history stage and major area sampled in northwest Florida for FY-07. Means (standard deviations) are presented. Young-of-the-year includes neonate life stage. Sexes are combined. Specimens with an undetermined life stage are included in total CPUE calculation. Species are listed alphabetically by common name.

(a) Atlantic sharpnose shark, *Rhizoprionodon terraenovae*

Life stage	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	0.80 (2.65)	1.67 (4.53)	0.42 (1.65)	0.07 (0.20)	1.15 (2.15)
Juveniles	0.02 (0.10)	3.35 (5.58)	0.72 (1.37)	0.05 (0.19)	0.20 (0.56)
Adults	2.17 (3.46)	2.59 (4.19)	0.07 (0.25)	0.57 (1.81)	1.34 (3.00)
All	3.69 (5.86)	7.61 (9.05)	0.51 (1.65)	0.69 (1.90)	2.68 (3.97)

(b) Blacknose shark, *Carcharhinus acronotus*

Life stage	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	--	0.39 (0.88)	0.05 (0.21)	--	--
Juveniles	--	--	--	--	--
Adults	--	--	0.02 (0.10)	--	0.03 (0.15)
All	--	0.39 (0.88)	0.07 (0.23)	--	0.03 (0.15)

(c) Blacktip shark, *Carcharhinus limbatus*

Life stage	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	--	0.15 (0.39)	0.04 (0.24)	0.32 (0.58)	0.61 (0.97)
Juveniles	0.03 (0.17)	1.10 (2.66)	0.25 (1.20)	0.10 (0.42)	3.08 (3.65)
Adults	--	0.07 (0.34)	--	--	0.08 (0.19)
All	0.03 (0.17)	1.32 (2.99)	0.29 (1.44)	0.42 (0.67)	3.76 (4.15)

(d) Bonnethead shark, *Sphyrna tiburo*

Life stage	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	--	1.12 (1.17)	0.17 (0.49)	0.35 (1.00)	--
Juveniles	0.05 (0.20)	0.29 (0.53)	0.12 (0.33)	0.07 (0.21)	0.13 (0.29)
Adults	--	0.27 (0.55)	0.65 (3.46)	0.08 (0.23)	0.35 (0.71)
All	0.05 (0.20)	1.68 (1.43)	0.94 (3.60)	0.50 (1.32)	0.48 (0.75)

(e) Bull shark, *Carcharhinus leucas*

Life stage	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	--	--	--	--	--
Juveniles	--	--	--	0.04 (0.17)	--
Adults	--	--	--	--	0.02 (0.10)
All	--	--	--	0.04 (0.17)	0.02 (0.10)

(f) Finetooth shark, *Carcharhinus isodon*

Life stage	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	--	--	0.03 (0.17)	0.25 (0.74)	0.02 (0.11)
Juveniles	--	--	--	0.04 (0.17)	0.31 (0.60)
Adults	0.06 (0.31)	0.06 (0.32)	--	--	0.09 (0.24)
All	0.06 (0.31)	0.06 (0.32)	0.03 (0.17)	0.29 (0.74)	0.42 (0.79)

(g) Sandbar, *Carcharhinus plumbeus*

	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	--	--	--	0.19 (0.56)	--
Juveniles	--	--	--	0.05 (0.19)	--
Adults	--	--	--	--	--
All	--	--	--	0.24 (0.57)	--

(h) Scalloped hammerhead shark, *Sphyrna lewini*

Life stage	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	--	0.77 (1.61)	0.07 (0.31)	--	1.33 (2.85)
Juveniles	--	--	--	--	0.23 (0.73)
Adults	--	--	--	--	--
All	--	0.77 (1.61)	0.07 (0.31)	--	1.56 (3.32)

(i) Spinner shark, *Carcharhinus brevipinna*

Life stage	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	--	0.06 (0.21)	0.53 (2.86)	0.03 (0.14)	0.52 (1.14)
Juveniles	--	--	0.05 (0.21)	--	0.40 (1.11)
Adults	--	--	--	--	0.04 (0.20)
All	--	0.06 (0.21)	0.58 (2.94)	0.03 (0.14)	0.96 (1.50)

Table 2. Summary of CPUE (number of rays per net hr) for rays by major area sampled in northwest Florida for FY-07. Means (standard deviations) are presented. Sexes are combined. Young-of-the-year includes neonate life stage. Specimens with an undetermined life stage are included in total CPUE calculation. Species are listed alphabetically by common name.

(a) Cownose ray, *Rhinoptera bonasus*

Life stage	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	--	0.04 (0.19)	0.07 (0.34)	0.05 (0.20)	0.05 (0.17)
Juveniles	--	0.02 (0.12)	--	0.09 (0.27)	0.05 (0.21)
Adults	0.07 (0.38)	0.03 (0.17)	0.09 (0.36)	--	0.33 (0.73)
All	0.07 (0.38)	0.09 (0.43)	0.17 (0.51)	0.14 (0.43)	0.43 (0.89)

(b) Smooth butterfly ray, *Gymnura micrura*

Life stage	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	--	--	--	--	--
Juveniles	--	--	--	--	--
Adults	--	--	--	--	--
All	--	0.08 (0.25)	--	--	--

(c) Southern stingray, *Dasyatis americana*

Life stage	St. Andrew Bay	Crooked Island Sound	St. Joseph Bay	Apalachicola Bay	Gulf-side of St. Vincent Island
Young-of-the-year	--	--	--	--	--
Juveniles	--	0.04 (0.26)	--	--	--
Adults	--	--	--	--	--
All	--	0.04 (0.26)	--	--	--

Table 3. Summary of the habitat associations for Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, by life stage in northwest Florida for FY-07. Sexes are combined. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (^oC)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	29.2 (18.7-32.4)	34.2 (26.7-36.3)	4.9 (1.3-9.1)	178 (50-350)	4.7 (3.0-5.8)	Mud/Sand
Juveniles	30.0 (21.4-32.3)	34.1 (30.0-36.5)	3.7 (1.5-9.0)	206 (50-305)	4.9 (3.8-5.8)	Sand/Mud/ Seagrass
Adults	28.6 (18.7-32.7)	34.0 (30.0-36.5)	4.5 (1.7-9.1)	186 (50-450)	4.8 (3.3-6.0)	Mud/Sand/ Seagrass

Table 4. Summary of the habitat associations for blacknose shark, *Carcharhinus acronotus*, by life stage in northwest Florida for FY-07. Sexes are combined. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	30.6 (28.1-32.7)	34.5 (31.0-35.4)	3.3 (1.7-5.2)	206 (100-275)	4.6 (3.9-5.2)	Mud/Sand
Juveniles	- -	- -	- -	- -	- -	-
Adults	25.9 (21.4-30.3)	34.8 (34.7-34.8)	5.9 (4.5-7.4)	193 (175-210)	5.1 -	Mud and Sand

Table 5. Summary of the habitat associations for blacktip shark, *Carcharhinus limbatus*, by life stage in northwest Florida for FY-07. Sexes are combined. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	28.2 (21.9-32.3)	31.6 (24.1-35.0)	3.6 (1.7-7.9)	130 (40-275)	4.8 (4.0-5.5)	Mud/Sand/ Seagrass/Oyster
Juveniles	27.5 (21.4-32.3)	34.2 (31.0-35.3)	4.5 (2.3-7.9)	160 (50-305)	4.7 (4.0-5.5)	Mud/Sand/ Seagrass
Adults	26.6 (25.0-30.3)	34.5 (33.0-35.0)	3.7 (2.5-7.4)	158 (100-200)	5.1 -	Mud/Sand

Table 6. Summary of the habitat associations for bonnethead shark, *Sphyrna tiburo*, by life stage in northwest Florida for FY-07. Sexes are combined. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	26.7 (23.7-32.7)	33.9 (25.7-36.0)	3.7 (1.2-8.4)	177 (50-350)	4.9 (4.3-6.2)	Mud/Sand Seagrass
Juveniles	28.5 (21.4-32.2)	33.7 (25.7-35.4)	4.0 (1.2-7.4)	177 (50-330)	4.8 (3.9-6.2)	Mud/Sand
Adults	29.3 (21.4-30.8)	34.3 (27.0-36.5)	4.6 (1.2-7.9)	179 (60-270)	4.3 (3.9-6.2)	Sand/Mud

Table 7. Summary of the habitat associations for bull shark, *Carcharhinus leucas*, by life stage in northwest Florida for FY-07. Means (ranges) are presented for juveniles. Raw data are presented for adults. NA indicated data not available.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	- -	- -	- -	- -	- -	-
Juveniles	21.3 -	26.7 -	3.8 -	160 -	NA	Mud
Adults	26.5 -	31.0 -	3.5 -	125 -	NA	Mud

Table 8. Summary of the habitat associations for finetooth shark, *Carcharhinus isodon*, by life stage in northwest Florida for FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	29.4 (27.1-31.9)	30.6 (26.0-34.4)	2.6 (1.4-4.2)	121 (50-275)	4.9 (4.5-5.5)	Mud/Oyster
Juveniles	27.0 (21.3-29.7)	32.3 (26.7-34.6)	3.5 (3.3-4.3)	113 (75-200)	4.8 (4.0-5.0)	Mud/Oyster/ Sand
Adults	28.3 (23.8-31.2)	34.0 (33.0-34.4)	3.1 (2.2-4.2)	147 (75-305)	4.5 (4.1-5.0)	Mud/Sand

Table 9. Summary of the habitat associations for sandbar, *Carcharhinus plumbeus*, by life stage in northwest Florida for FY-07. Sexes are combined. Young-of-the-year includes neonate life stage. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	31.1 (31.0-31.1)	31.9 (31.8-31.9)	3.4 (3.2-3.6)	50 -	4.5 (4.2-4.9)	Mud/Oyster
Juveniles	27.1 -	26 -	1.8 -	50 -	5.5 -	Mud
Adults	- -	- -	- -	- -	- -	-

Table 10. Summary of the habitat associations for scalloped hammerhead shark, *Sphyrna lewini*, by life stage in northwest Florida for FY-07. Young-of-the-year includes neonate life. Means (ranges) are presented. Values without ranges are raw data. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	29.5 (25.0-32.3)	34.2 (31.0-36.5)	4.1 (2.5-9.0)	169 (60-375)	4.7 (4.0-5.8)	Mud/Sand/ Seagrass
Juveniles	28.6 (25.0-29.8)	34.3 (33.0-34.6)	4.2 (3.3-7.0)	100 (60-200)	4.4 (4.3-4.7)	Mud
Adults	- -	- -	- -	- -	-	-

Table 11. Summary of the habitat associations for spinner shark, *Carcharhinus brevipinna*, by life stage northwest Florida for FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	29.1 (18.4-32.2)	33.4 (25.7-35.2)	4.5 (2.9-9.1)	140 (50.0-275)	4.7 (4.3-5.1)	Sand/Seagrass Mud
Juveniles	27.0 (21.4-32.3)	32.8 (31.0-34.7)	5.2 (2.9-7.9)	120 (100-210)	4.8 (4.5-4.9)	Mud/Sand
Adults	30.9 (29.5-32.3)	34.9 (34.7-35.0)	5.1 (2.9-7.4)	175 (150-200)	4.8 (4.5-5.0)	Mud

Table 12. Summary of the habitat associations for cownose ray, *Rhinoptera bonasus*, by life stage in northwest Florida for FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated. NA indicated data not available.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	28.9 (22.7-32.4)	30.5 (12.6-35.6)	3.4 (1.9-4.8)	145 (60.0-275)	4.7 (4.3-5.1)	Mud/Sand
Juveniles	26.3 (22.7-27.7)	23.3 (12.6-34.0)	3.0 (1.5-4.1)	127 (50-175)	NA	Mud
Adults	25.1 (18.4-29.0)	33.5 (31.0-36.0)	3.9 (3.3-6.8)	148 (50-325)	5.0 -	Mud/Sand

Table 13. Summary of the habitat associations for smooth butterfly ray, *Gymnura micrura*, by life stage northwest Florida for FY-07. Sexes are combined. Young-of-the-year includes neonate life stage. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	30.7 (28.5-32.7)	34.9 (34.2-35.4)	3.3 (2.1-3.9)	200 (190-210)	4.8 (4.4-5.2)	Mud/Sand
Juveniles	- -	- -	- -	- -	- -	-
Adults	- -	- -	- -	- -	- -	-

Table 14. Summary of the habitat associations for southern stingray, *Dasyatis americana*, by life stage in northwest Florida for FY-07. Raw data are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	- -	- -	- -	- -	- -	-
Juveniles	23.5 -	25.8 -	2.4 -	240 -	5.5 -	Sand/Seagrass/ Mud
Adults	- -	- -	- -	- -	- -	-

Table 15. Summary of CPUE (number of sharks per net hr) for sharks by major area sampled in the Cedar Key region of Florida FY-07. Means (standard deviations) are presented. Young of the year includes neonate life stage. Species are listed alphabetically by common name.

(a) Atlantic sharpnose shark, *Rhizoprionodon terraenovae*

Life stage	Suwannee Sound	Cedar Key	Waccasassa Bay
Young-of-the-year	-	0.37 (0.69)	0.13 (0.23)
Juveniles	0.19 (0.37)	0.08 (0.16)	0.56 (1.40)
Adults	1.09 (1.75)	0.84 (1.17)	1.08 (1.12)
All	1.27 (0.46)	1.29 (1.13)	1.77 (1.48)

(b) Blacktip shark, *Carcharhinus limbatus*

Life stage	Suwannee Sound	Cedar Key	Waccasassa Bay
Young-of-the-year	0.21 (0.43)	0.07 (0.19)	1.26 (2.49)
Juveniles	0.17 (0.33)	1.08 (1.37)	1.08 (1.34)
Adults	-	-	-
All	0.38 (0.46)	1.15 (1.35)	2.34 (3.52)

(c) Bonnethead shark, *Sphyrna tiburo*

Life stage	Suwannee Sound	Cedar Key	Waccasassa Bay
Young-of-the-year	0.10 (0.19)	0.05 (0.15)	0.29 (0.66)
Juveniles	0.04 (0.10)	0.11 (0.22)	0.11 (0.21)
Adults	2.47 (2.54)	0.75 (0.61)	0.60 (0.84)
All	3.54 (4.75)	0.92 (0.71)	1.00 (1.06)

(d) Scalloped hammerhead shark, *Sphyrna lewini*

Life stage	Suwannee Sound	Cedar Key	Waccasassa Bay
Young-of-the-year	-	-	-
Juveniles	-	0.06 (0.16)	0.18 (0.25)
Adults	-	-	-
All	-	0.06 (0.16)	0.18 (0.25)

Table 16. Summary of CPUE (number of rays per net hr) for rays by major area sampled in the Cedar Key region of Florida FY-07. Means (standard deviations) are presented. Young-of-the-year includes neonate life stage. Species are listed alphabetically by common name.

(a) Atlantic stingray, *Dasyatis sabina*

Life stage	Suwannee Sound	Cedar Key	Waccasassa Bay
Young-of-the-year	-	-	-
Juveniles	-	-	0.05 (0.13)
Adults	0.06 (0.18)	-	0.16 (0.30)
All	0.06 (0.18)	-	0.20 (0.41)

(b) Bluntnose ray, *Dasyatis sayi*

Life stage	Suwannee Sound	Cedar Key	Waccasassa Bay
Young-of-the-year	-	-	-
Juveniles	-	0.05 (0.15)	-
Adults	-	-	-
All	-	0.05 (0.15)	-

(c) Cownose ray, *Rhinoptera bonasus*

Life stage	Suwannee Sound	Cedar Key	Waccasassa Bay
Young-of-the-year	-	-	-
Juveniles	0.13 (0.37)	-	-
Adults	0.06 (0.18)	0.10 (0.29)	-
All	0.19 (0.39)	0.10 (0.29)	-

(d) Smooth butterfly ray, *Gymnura micrura*

Life stage	Suwannee Sound	Cedar Key	Waccasassa Bay
Young-of-the-year	-	-	-
Juveniles	-	-	0.06 (0.17)
Adults	-	-	0.13 (0.23)
All	-	-	0.19 (0.37)

(e) Southern stingray, *Dasyatis americana*

Life stage	Suwannee Sound	Cedar Key	Waccasassa Bay
Young-of-the-year	-	-	-
Juveniles	-	-	0.14 (0.40)
Adults	-	-	-
All	-	-	0.14 (0.40)

Table 17. Summary of the habitat associations for Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, by life stage in the Cedar Key region of Florida for FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (ºC)	Salinity (ppt)	Depth (m)	Dissolved oxygen (mg/L)	Bottom type
Young-of the-year	30.9 (29.8-31.8)	30.9 (24.9-32.7)	1.9 (1.4-3.5)	4.8 (4.3-6.3)	Mud/ Seagrass/ Sand
Juveniles	30.6 (24.7-31.9)	30.1 (27.2-32.9)	2.5 (1.3-4.7)	5.2 (4.5-6.2)	Mud/ Seagrass/ Sand
Adults	28.3 (24.7-31.9)	30.4 (27.2-32.9)	3.9 (1.4-6.0)	5.4 (4.3-6.3)	Mud/Sand/ Seagrass

Table 18. Summary of the habitat associations for blacktip shark, *Carcharhinus limbatus*, by life stage in the Cedar Key region of Florida for FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (ºC)	Salinity (ppt)	Depth (m)	Dissolved oxygen (mg/L)	Bottom type
Young-of the-year	28.9 (26.8-30.0)	29.3 (17.7-31.6)	1.9 (1.4-6.2)	4.9 (4.3-7.2)	Mud/ Oyster
Juveniles	27.7 (24.7-31.8)	30.7 (24.9-32.9)	3.5 (1.4-6.2)	5.5 (4.3-6.3)	Mud/Sand/ Seagrass
Adults	- -	- -	- -	- -	-

Table 19. Summary of the habitat associations for bonnethead shark, *Sphyrna tiburo*, by life stage in the Cedar Key region of Florida for FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (ºC)	Salinity (ppt)	Depth (m)	Dissolved oxygen (mg/L)	Bottom type
Young-of the-year	28.0 (26.8-31.9)	29.8 (24.6-31.6)	2.4 (1.5-4.0)	5.4 (4.9-5.8)	Mud/Sand/ Oyster
Juveniles	31.3 (26.8-31.9)	29.6 (24.6-32.5)	2.2 (1.5-4.0)	4.9 (4.5-5.6)	Sand/Mud/ Oyster/Seagrass
Adults	29.7 (24.7-31.9)	27.8 (21.9-32.9)	2.5 (1.3-6.0)	5.3 (4.5-7.8)	Mud/Sand/ Oyster/Seagrass

Table 20. Summary of the habitat associations for the scalloped hammerhead shark, *Sphyrna lewini*, by life stage in the Cedar Key region of Florida for FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (ºC)	Salinity (ppt)	Depth (m)	Dissolved oxygen (mg/L)	Bottom type
Young-of the-year	- -	- -	- -	- -	-
Juveniles	30.6 (27.5-31.8)	32.4 (31.6-32.9)	3.5 (2.5-4.2)	5.3 (5.0-5.8)	Mud/Sand/ Seagrass
Adults	- -	- -	- -	- -	-

Table 21. Summary of the habitat associations for the ray species captured in the Cedar Key region of Florida for FY-07. Due to the small number of rays captured, life history stages are combined. Species are presented alphabetically by common name. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Species	Temperature (ºC)	Salinity (ppt)	Depth (m)	Dissolved oxygen (mg/L)	Bottom type
Atlantic stingray	27.9 (26.8-29.8)	28.0 (17.7-31.0)	2.2 (1.4-3.8)	6.2 (4.3-7.2)	Mud
Bluntnose stingray**	28.9 -	30.2 -	4.0 -	5.6 -	Mud
Cownose ray	28.9 (28.5-29.2)	23.5 (17.7-30.2)	3.6 (2.5-4.0)	6.2 (5.2-7.2)	Mud/Sand
Smooth butterfly ray	31.5 (31.2-31.7)	32.6 (32.5-32.9)	3.1 (2.5-4.2)	5.0 (5.0-5.1)	Mud/ Seagrass
Southern stingray*	29.8 -	31.0 -	1.4 -	4.3 -	Mud

* All three southern stingrays were captured in the same set.
** n=1

Table 22. Summary of CPUE (number of sharks per net hr) for shark by major area sampled in Alabama coastal waters FY-07. Young-of-the-year includes neonate life stage. Species are listed alphabetically by common name.

(a) Atlantic sharpnose shark, *Rhizoprionodon terraenovae*

Life stage	West End Dauphin Island	Bon Secour Bay	Little Dauphin Island	Pelican Island	Point Aux Pins
Young-of-the-year	-	-	-	-	-
Juveniles	-	-	-	-	1.54
Adults	3.37	-	-	-	-
All	3.37	-	-	-	1.54

(b) Blacktip shark, *Carcharhinus limbatus*

Life stage	West End Dauphin Island	Bon Secour Bay	Little Dauphin Island	Pelican Island	Point Aux Pins
Young-of-the-year	-	-	-	-	-
Juveniles	-	-	1.44	-	-
Adults	-	-	-	2.59 (1.12)	-
All	-	-	1.44	2.59 (1.12)	-

(c) Bonnethead shark, *Sphyrna tiburo*

Life stage	West End Dauphin Island	Bon Secour Bay	Little Dauphin Island	Pelican Island	Point Aux Pins
Young-of-the-year	-	-	-	-	-
Juveniles	0.84	-	-	-	-
Adults	-	-	-	-	-
All	0.84	-	-	-	-

(d) Finetooth shark, *Carcharhinus isodon*

Life stage	West End Dauphin Island	Bon Secour Bay	Little Dauphin Island	Pelican Island	Point Aux Pins
Young-of-the-year	-	-	-	-	-
Juveniles	5.06	-	15.84	-	-
Adults	-	-	-	-	-
All	5.06	-	15.84	-	-

Table 23. Summary of CPUE (number of rays per net hr) for Atlantic stingray, *Dasyatis sabina*, by major area sampled in Alabama coastal waters FY-07. Young-of-the-year includes neonate life stage.

Life stage	West End Dauphin Island	Bon Secour Bay	Little Dauphin Island	Pelican Island	Point Aux Pins
Young-of-the-year	-	-	-	-	-
Juveniles	-	-	-	-	-
Adults	-	-	-	-	-
All	-	-	-	1.94	1.54

Table 24. Summary of the habitat associations for the Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, by life stage in Alabama coastal waters for FY-07. Young-of-the-year includes neonate life stage. Raw data are presented.

Life stage	Temperature (ºC)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved Oxygen (mg l^{-1})	Bottom type
Young-of-the-year	-	-	-	-	-	-
	-	-	-	-	-	
Juveniles	28.3	26.4	1.2	120	6.4	Mud
	-	-	-	-	-	
Adults	25.9	28.1	4.0	230	6.4	Sand
	-	-	-	-	-	

Table 25. Summary of the habitat associations for the blacktip shark, *Carcharhinus limbatus*, by life stage in Alabama coastal waters for FY-07. Means (ranges) or raw data are presented. Young-of-the-year includes neonate life stage.

Life stage	Temperature (ºC)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved Oxygen (mg l^{-1})	Bottom type
Young-of-the-year	-	-	-	-	-	-
	-	-	-	-	-	
Juveniles	28.5	26.8	3.9	157	6.5	Sand
	(27.7-30.0)	(26.0-28.0)	(3.2-4.9)	(50-210)	(6.4-6.6)	
Adults	27.3	29	3.4	220	7.4	Sand
	-	-	-	-	-	

Table 26. Summary of the habitat associations for the bonnethead shark, *Sphyrna tiburo*, by life stage in Alabama coastal waters for FY-07. Young-of-the-year includes neonate life stage. Raw data are presented.

Life stage	Temperature (ºC)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved Oxygen (mg l^{-1})	Bottom type
Young-of-the-year	-	-	-	-	-	-
	-	-	-	-	-	
Juveniles	-	-	-	-	-	-
	-	-	-	-	-	
Adults	28.9	31.0	1.0	100	6.1	Sand/Mud
	-	-	-	-	-	

Table 27. Summary of the habitat associations for the finetooth shark, *Carcharhinus isodon*, by life stage in Alabama coastal waters for FY-07. Means (ranges) are presented. Young-of-the-year includes neonate life stage.

Life stage	Temperature (ºC)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved Oxygen (mg l^{-1})	Bottom type
Young-of-the-year	-	-	-	-	-	-
	-	-	-	-	-	
Juveniles	28.3	27.2	3.3	125	7.1	Sand
	(26.6-30.0)	(26.5-27.8)	(3.0-3.6)	(50-200)	(6.4-7.7)	
Adults	-	-	-	-	-	-
	-	-	-	-	-	

Table 28. Summary of the habitat associations for the Atlantic stingray, *Dasyatis sabina*, by life stage in Alabama coastal waters for FY-07. Means (ranges) are presented. Young-of-the-year includes neonate life stage.

Life stage	Temperature (ºC)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved Oxygen (mg l^{-1})	Bottom type
Young-of-the-year	-	-	-	-	-	-
	-	-	-	-	-	
Juveniles	28.4	27.1	2.8	165	6.6	Mud/Sand
	(27.7-29.1)	(26.2-28.0)	(2.4-3.2)	(120-210)	(6.6-6.6)	
Adults	-	-	-	-	-	-
	-	-	-	-	-	

Table 29. Summary of CPUE (number of sharks per net hr) for sharks by life history stage and major area sampled in Mississippi coastal waters FY-07. Means (standard deviations) are presented. Young-of-the-year includes neonates. Species are listed alphabetically by common name.

(a) Atlantic sharpnose shark, *Rhizoprionodon terraenovae*

Life stage	Round Island	Horn Island	Cat Island	Deer Island	Davis Bayou
Young-of-the-year	0.19 (0.50)	0.20 (0.45)	-	-	-
Juveniles	-	0.13 (0.45)	-	-	-
Adults	0.19 (0.50)	0.40 (0.51)	0.11 (0.16)	-	-
All	0.38 (1.00)	0.74 (0.71)	0.11 (0.16)	-	-

(b) Blacktip shark, *Carcharhinus limbatus*

Life stage	Round Island	Horn Island	Cat Island	Deer Island	Davis Bayou
Young-of-the-year	0.76 (1.51)	-	1.22 (1.92)	-	-
Juveniles	2.28 (2.27)	0.47 (1.13)	0.89 (1.27)	-	-
Adults	0.19 (0.50)	0.07 (0.26)	-	-	-
All	3.24 (2.54)	0.53 (1.13)	2.22 (3.23)	-	-

(c) Bull shark, *Carcharhinus leucas*

Life stage	Round Island	Horn Island	Cat Island	Deer Island	Davis Bayou
Young-of-the-year	-	-	-	-	0.38 (0.52)
Juveniles	-	0.13 (0.52)	0.56 (0.88)	-	-
Adults	-	-	0.11 (0.33)	-	-
All	-	0.13 (0.52)	0.67 (1.12)	-	0.53 (0.39)

(d) Finetooth shark, *Carcharhinus isodon*

Life stage	Round Island	Horn Island	Cat Island	Deer Island	Davis Bayou
Young-of-the-year	-	-	-	0.20 (0.45)	-
Juveniles	-	-	-	-	-
Adults	-	-	-	-	-
All	-	-	-	0.20 (0.45)	-

(e) Scalloped hammerhead, *S. lewini*

Life stage	Round Island	Horn Island	Cat Island	Deer Island	Davis Bayou
Young-of-the-year	1.33 (1.19)	-	-	-	-
Juveniles	-	-	-	-	-
Adults	-	-	-	-	-
All	1.33 (1.19)	-	-	-	-

Table 30. Summary of CPUE (number of rays per net hr) for rays by major area sampled in Mississippi coastal waters FY-07. Means (standard deviations) are presented. Young-of-the-year includes neonate life stage. Specimens with an undetermined life stage are included in total CPUE calculation. Species are listed alphabetically by common name.

(a) Atlantic stingray, *Dasyatis sabina*

Life stage	Round Island	Horn Island	Cat Island	Deer Island	Davis Bayou
Young-of-the-year	-	-	-	-	-
Juveniles	-	-	-	-	-
Adults	-	0.07 (0.26)	0.45 (1.01)	-	-
All	-	0.07 (0.26)	0.45 (1.01)	-	-

(b) Cownose ray, *Rhinoptera bonasus*

Life stage	Round Island	Horn Island	Cat Island	Deer Island	Davis Bayou
Young-of-the-year	-	0.20 (0.56)	-	-	-
Juveniles	-	-	-	-	-
Adults	-	-	0.22 (0.44)	-	-
All	-	0.20 (0.56)	0.22 (0.44)	-	-

Table 31. Summary of the habitat associations for the Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, by life stage in Mississippi coastal waters FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (^{o}C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the year	29.1 (29.0-29.2)	28.7 (28.1-29.2)	3.7 (2.7-4.7)	142 (126-157)	5.7 (5.6-5.8)	Silt/Clay/ Sand
Juvenile	25.2 (21.4-29.0)	30.0 (28.1-32.0)	4.7 (4.7-4.8)	130 (103-157)	5.5 (5.3-5.6)	Silt/Clay/ Sand
Adult	27.0 (21.4-29.2)	28.4 (24.4-32.0)	4.1 (2.7-4.8)	153 (103-225)	6.0 (5.3-7.5)	Sand/Silt/ Clay

Table 32. Summary of the habitat associations for the blacktip shark, *Carcharhinus limbatus*, by life stage in Mississippi coastal waters FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the year	30.2 (29.2-31.2)	27.8 (26.4-29.2)	3.8 (2.7-4.8)	107 (87-126)	5.5 (5.1-5.8)	Silt/Clay/Sand
Juvenile	28.5 (25.1-31.2)	27.0 (26.4-29.2)	4.0 (2.7-4.6)	148 (87-225)	6.1 (5.1-7.5)	Sand/Silt/Clay
Adult	28.9 (28.6-29.2)	26.8 (24.4-29.2)	3.4 (2.7-4.1)	176 (126-225)	6.6 (5.8-7.5)	Silt/Clay/Sand

Table 33. Summary of the habitat associations for the bull shark, *Carcharhinus leucas*, by life stage in Mississippi coastal waters FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	32.6 -	21.9 -	1.1 -	56 -	4.5 -	Mud/Clay
Juvenile	26.3 (21.4-31.2)	29.2 (26.4-32.0)	4.8 (4.8-4.8)	95 (87-103)	5.2 (5.1-5.3)	Silt/Sand/Clay
Adult	31.2 -	26.4 -	4.8 -	87 -	5.1 -	Silt/Sand/Clay

Table 34. Summary of the habitat associations for the finetooth shark, *Carcharhinus isodon*, by life stage in Mississippi coastal waters FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the year	26.2 -	28.0 -	2.7 -	129 -	6.0 -	Sand/Silt/Clay
Juvenile	- -	- -	- -	- -	- -	-
Adult	- -	- -	- -	- -	- -	-

Table 35. Summary of the habitat associations for the scalloped hammerhead shark, *Sphyrna lewini*, by life stage in Mississippi coastal waters FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the year	29.2 -	29.2 -	2.7 -	126 -	5.8 -	Sand/Silt/Clay
Juvenile	- -	- -	- -	- -	- -	-
Adult	- -	- -	- -	- -	- -	-

Table 36. Summary of the habitat associations for skates and rays in Mississippi coastal waters FY-07. Means (ranges) are presented. Bottom type is presented in descending predominance unless otherwise stated. Species are alphabetized by common name.

Species	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Atlantic stingray	26.3 (21.4-31.2)	29.2 (26.4-32.0)	4.8 (4.8-4.8)	95 (87-103)	5.2 (5.1-5.3)	Sand/Silt/Clay
Cownose ray	26.3 (21.4-31.2)	29.2 (26.4-32.0)	4.8 (4.8-4.8)	95 (87-103)	5.2 (5.1-5.3)	Sand/Silt/Clay

Table 37. Summary of CPUE (number of animals per net hr) for elasmobranchs by life history stage sampled in Terrebonne Bay, Louisiana, for FY-07. Means (standard deviations) are presented. Young-of-the-year includes neonate life stage. Sexes are combined. Specimens with an undetermined life stage are included in total CPUE calculation. Species are listed alphabetically by common name.

(a) Atlantic sharpnose shark, *Rhizoprionodon terraenovae*

Life stage	Terrebonne Bay
Young-of-the-year	0.49 (1.00)
Juveniles	-
Adults	-
All	0.49 (1.00)

(b) Blacktip shark, *Carcharhinus limbatus*

Life stage	Terrebonne Bay
Young-of-the-year	1.26 (3.16)
Juveniles	0.15 (0.45)
Adults	0.03 (0.09)
All	1.44 (3.22)

(c) Bull shark, *Carcharhinus leucas*

Life stage	Terrebonne Bay
Young-of-the-year	-
Juveniles	0.16 (0.34)
Adults	-
All	0.16 (0.34)

(d) Cownose ray, *Rhinoptera bonasus*

Life stage	Terrebonne Bay
Young-of-the-year	-
Juveniles	-
Adults	-
All	0.19 (0.57)*

*n=3, all from the same set

(e) Finetooth shark, *Carcharhinus isodon*

Life stage	Terrebonne Bay
Young-of-the-year	0.35 (1.04)
Juveniles	-
Adults	0.15 (0.45)
All	0.50 (1.08)

Table 38. Summary of the habitat associations for the Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, by life history stage in Terrebonne Bay, Louisiana, for FY-07. Sexes are combined. Young-of-the-year includes neonate life stage. Means (ranges) are presented for young-of-the-year. Raw data are presented for juveniles. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	32.25 (32.2-32.3)	23.9 (23.0-25.7)	2.5 (2.4-2.6)	75 (60-105)	8.5 (6.7-12.2)	Clay/Shell/Mud
Juveniles	32.3 -	25.7 -	2.4 -	105 -	12.2 -	Mud
Adults	- -	- -	- -	- -	- -	-

Table 39. Summary of the habitat associations for the blacktip shark, *Carcharhinus limbatus*, by life history stage in Terrebonne Bay, Louisiana, for FY-07. Young-of-the-year includes neonate life stage. Means (ranges) are presented for young-of-the-year. Raw data are presented for juveniles and adults. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	31.9 (26.9-32.2)	23.1 (23.0-25.3)	2.5 (1.8-2.6)	59.9 (45-70)	6.7 (5.9-7.2)	Clay/Shell/Mud
Juveniles	32.3 -	25.7 -	2.4 -	105 -	12.2 -	Mud
Adults	32.2 -	23 -	2.6 -	60 -	6.7 -	Clay/Shell

Table 40. Summary of the habitat associations for the bull shark, *Carcharhinus leucas*, by life history stage in Terrebonne Bay, Louisiana, for FY-07. Means (ranges) are presented for juveniles. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (°C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	- -	- -	- -	- -	- -	-
Juveniles	32.5 (32.3-32.7)	21.15 (18.1-24.2)	1.2 (1.1-1.3)	32.5 (18.0-47.0)	6.9 (6.5-7.2)	Mud/Detritus Clay/Shell
Adults	- -	- -	- -	- -	- -	-

Table 41. Summary of the habitat associations for the finetooth shark, *Carcharhinus isodon*, by life history stage in Terrebonne Bay, Louisiana, for FY-07. Young-of-the-year includes neonate life stage. Raw data are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (^{o}C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Young-of-the-year	32.2	23	2.6	60	6.7	Clay/Shell
	-	-	-	-	-	
Juveniles	-	-	-	-	-	-
	-	-	-	-	-	
Adults	32.3	25.7	2.4	105	12.2	Mud
	-	-	-	-	-	

Table 42. Summary of the habitat associations for the cownose ray, *Rhinoptera bonasus*, by life history stage in Terrebonne Bay, Louisiana, for FY-07. Young-of-the-year includes neonate life stage. Raw data are presented. Bottom type is presented in descending predominance unless otherwise stated.

Life stage	Temperature (^{o}C)	Salinity (ppt)	Depth (m)	Water clarity (cm)	Dissolved oxygen (mg l^{-1})	Bottom type
Undetermined	32.3	18.1	1.3	18	7.2	Clay/Shell
	-	-	-	-	-	

Table 43. 2007 recapture information for sharks tagged in GULFSPAN survey. Data are sorted by days at liberty in descending order. – indicates minimal distance moved.

Species Common Name	Sex	Mode of Recapture	Days at Liberty	Distance Moved (km), Direction	Location Tagged	Location Recaptured
Atlantic sharpnose	M	GULFSPAN	1385	20.3, E	St. Joseph Bay, FL	Gulf-side St. Vincent Island, FL
Atlantic sharpnose	M	GULFSPAN	1258	-	Crooked Island Sound, FL	Crooked Island Sound, FL
Atlantic sharpnose	M	GULFSPAN	862	-	Crooked Island Sound, FL	Crooked Island Sound, FL
Atlantic sharpnose	M	Recreational Angler	762	40.2, W	St. Joseph Bay, FL	Offshore Panama City Beach, FL
Bonnethead	M	GULFSPAN	724	-	Crooked Island Sound, FL	Crooked Island Sound, FL
Atlantic sharpnose	M	Recreational Angler	408	120.7, E	St. Joseph Bay, FL	St. Marks River Apalachee Bay, FL
Atlantic sharpnose	M	Recreational Angler	380	-	Crooked Island Sound, FL	Crooked Island Sound, FL
Atlantic sharpnose	M	GULFSPAN	379	-	Crooked Island Sound, FL	Crooked Island Sound, FL
Atlantic sharpnose	M	Recreational Angler	377	-	St. Joseph Bay, FL	St. Joseph Bay, FL
Bonnethead	M	GULFSPAN	364	-	Crooked Island Sound, FL	Crooked Island Sound, FL
Atlantic sharpnose	M	Recreational Angler	359	-	St. Joseph Bay, FL	St. Joseph Bay, FL
Blacktip	M	Recreational Angler	349	32.0, E	Crooked Island Sound, FL	St. Joseph Bay, FL
Atlantic sharpnose	M	Recreational Angler	315	-	St. Joseph Bay, FL	St. Joseph Bay, FL
Spinner	M	Recreational Angler	268	-	Gulf-side St. Vincent Island, FL	Gulf-side St. Vincent Island, FL
Atlantic sharpnose	M	Recreational Angler	249	-	Crooked Island Sound, FL	Crooked Island Sound, FL
Atlantic sharpnose	M	Recreational Angler	228	56.0, W	St. Joseph Bay, FL	Panama City Beach, FL
Atlantic sharpnose	M	Recreational Angler	124	-	Crooked Island Sound, FL	Crooked Island Sound, FL
Blacktip	F	GULFSPAN	100	32.2, SE	Crooked Island Sound, FL	St. Joseph Bay, FL
Spinner	F	Recreational Angler	41	-	St. Joseph Bay, FL	St. Joseph Bay, FL
Atlantic sharpnose	M	Recreational Angler	40	129.0, E	Crooked Island Sound, FL	St. Marks River Apalachee Bay, FL
Spinner	M	Recreational Angler	3	-	St. Joseph Bay, FL	St. Joseph Bay, FL
Blacktip	F	Recreational Angler	3	-	Apalachicola Bay, FL	Apalachicola Bay, FL

Figure 1. Locations of sets made in FY-07 for areas in St. Andrew Bay and Crooked Island Sound in the panhandle of Florida. The opening to St. Andrew Bay located at approximately 30°5'N is no longer open.

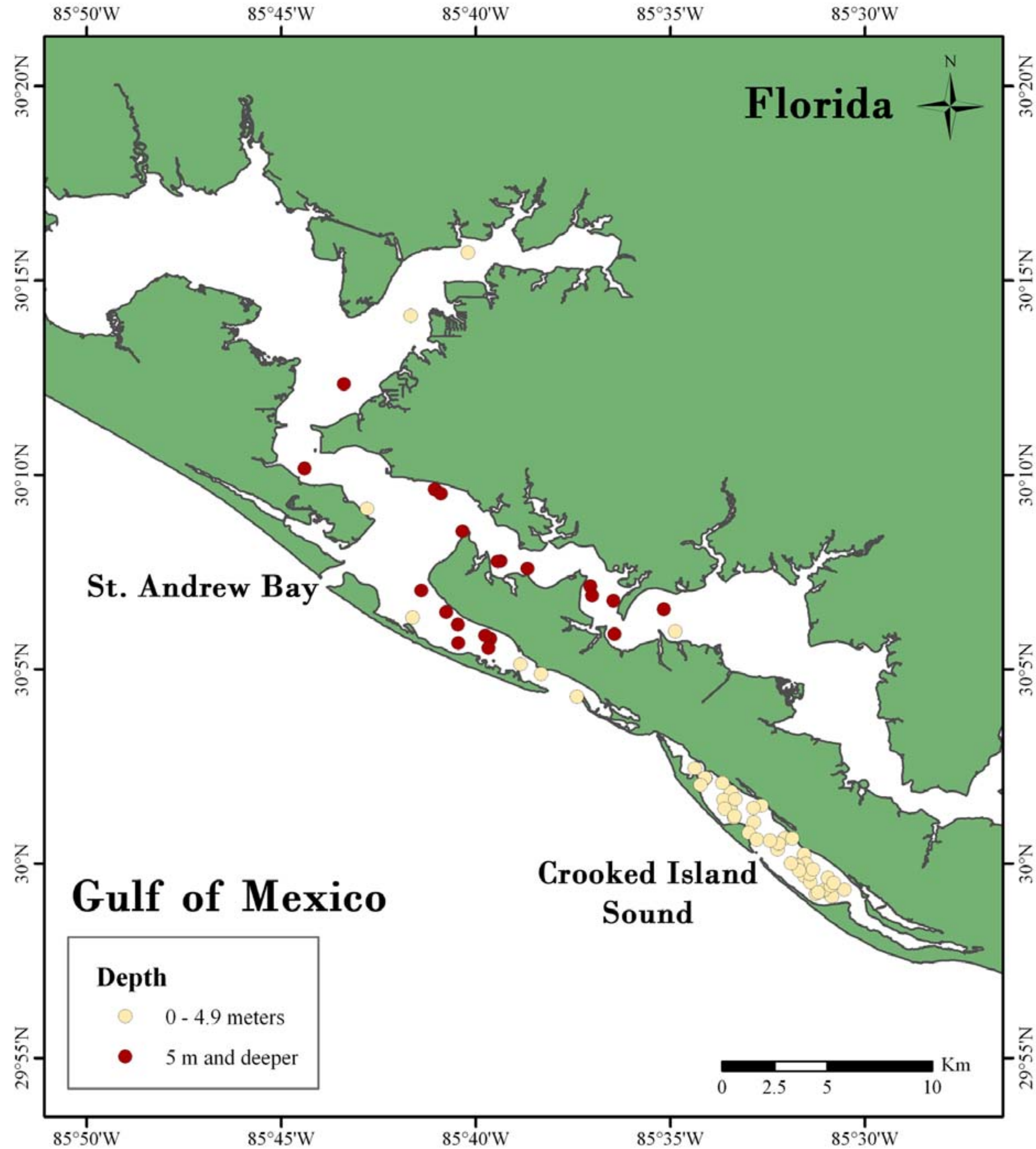


Figure 2. Locations of sets made in FY-07 for areas in St. Joseph Bay, the gulf-side of St. Vincent Island, and Apalachicola Bay in the panhandle of Florida.

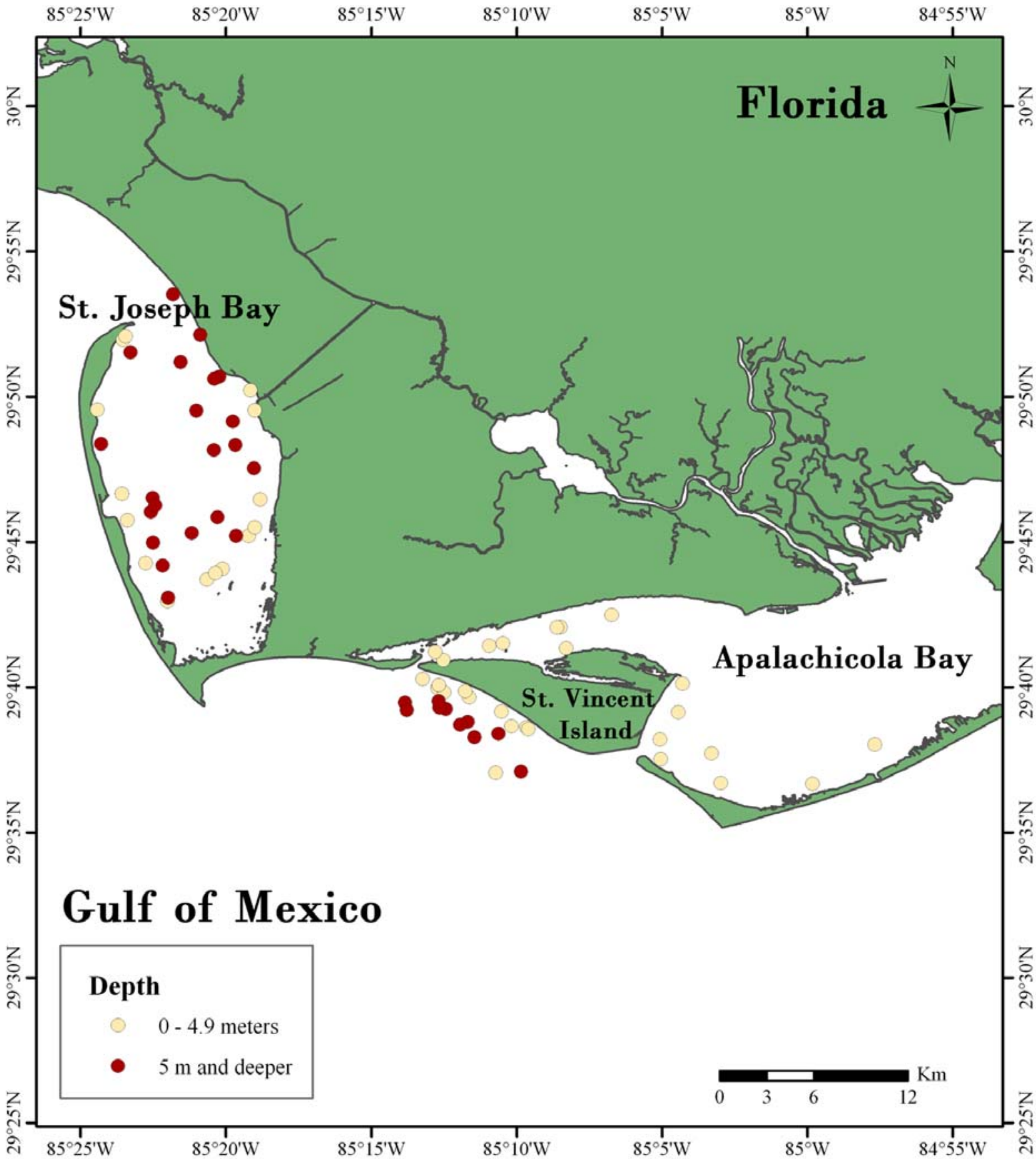


Figure 3. CPUE by month and life stage for three most abundant shark species and most abundant batoid species collected in all areas combined in the panhandle of Florida, FY-07.

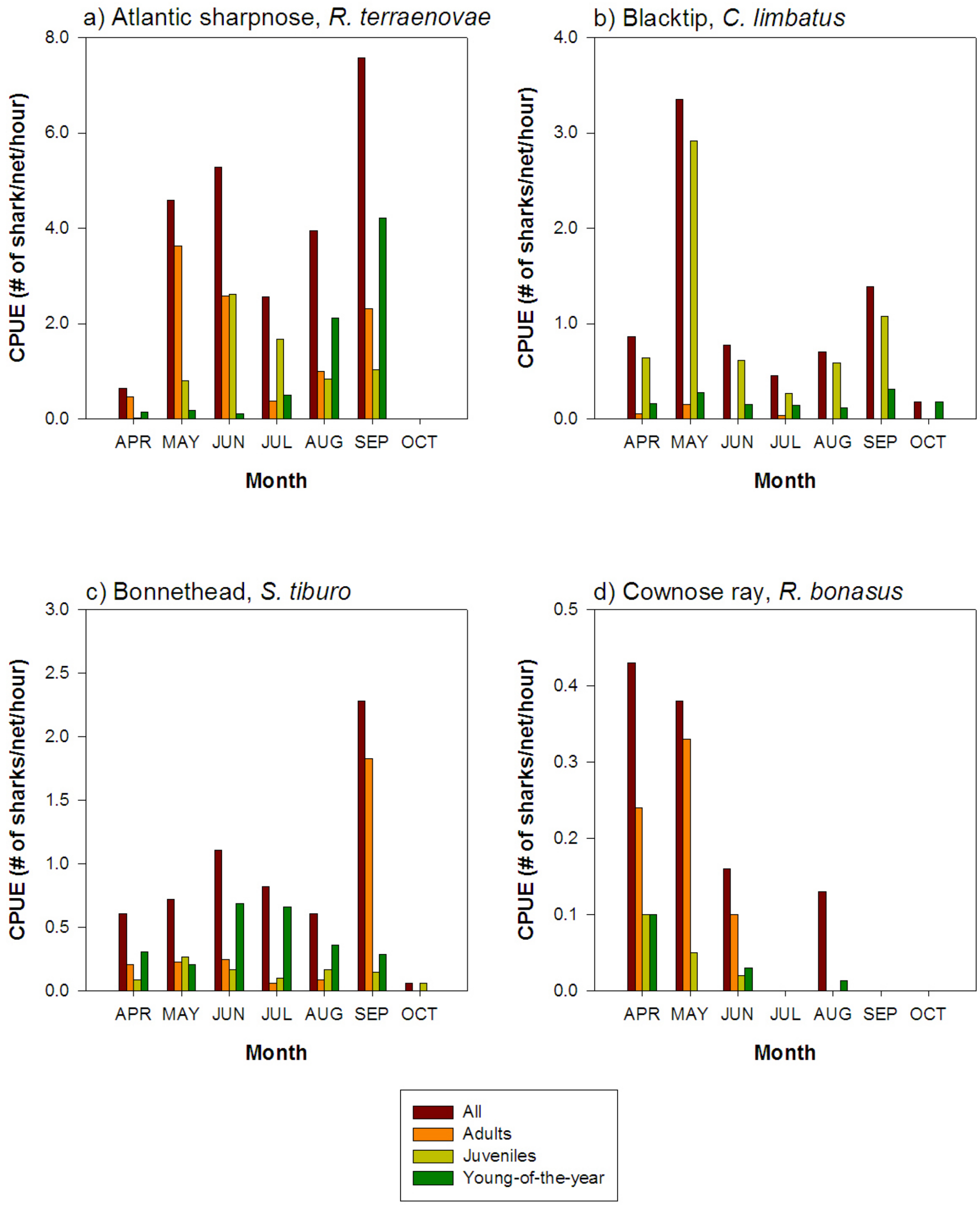


Figure 4. CPUE by time period for species collected in Crooked Island Sound, FL, in the panhandle of Florida, FY-07. Dawn = 0400-0900, Day = 0900-1500, Dusk = 1500-2100.

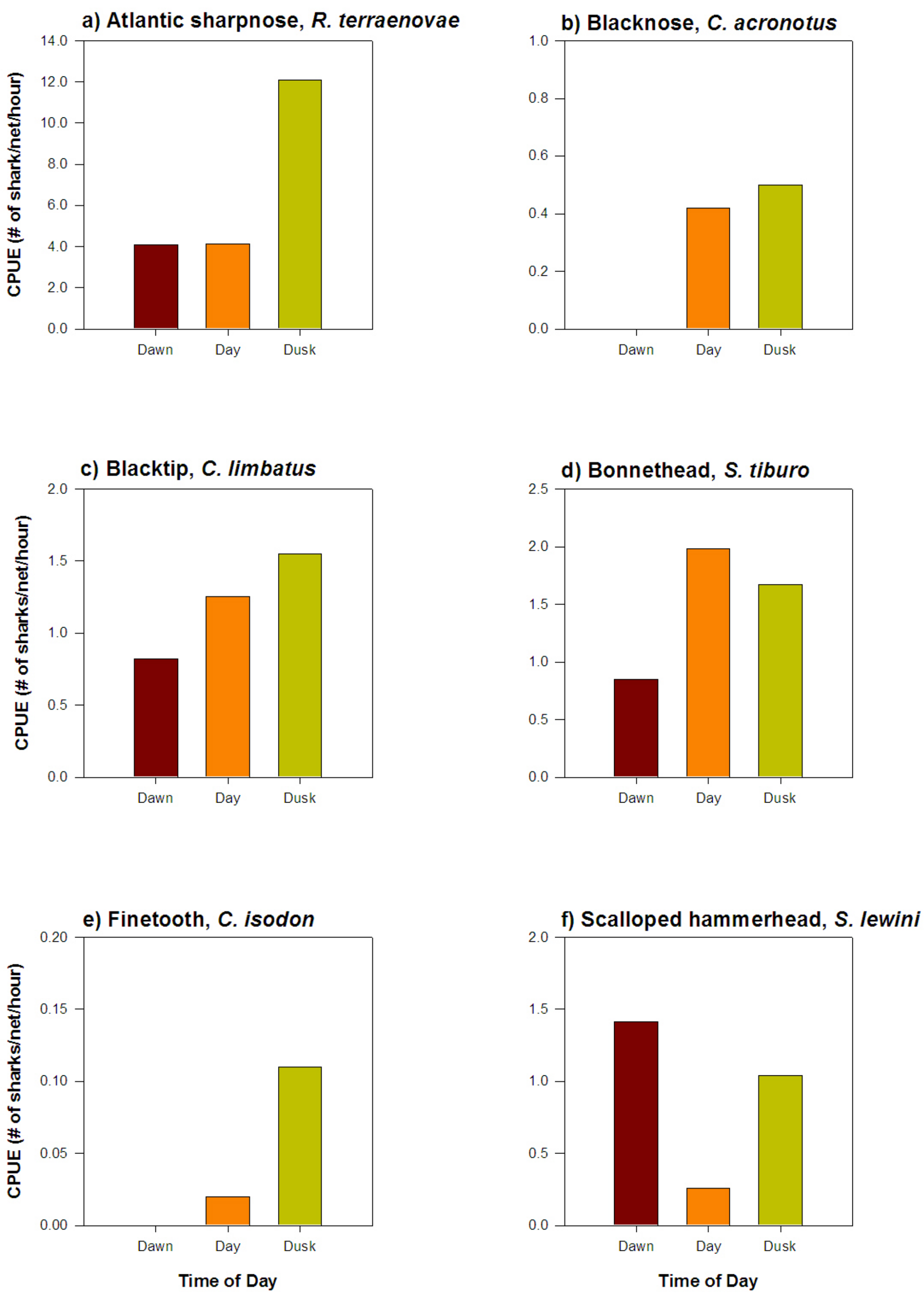
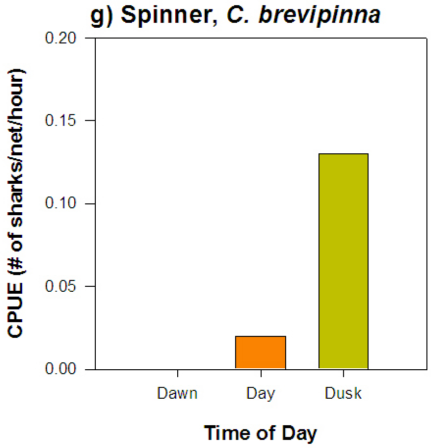


Figure 4 (cont'd).



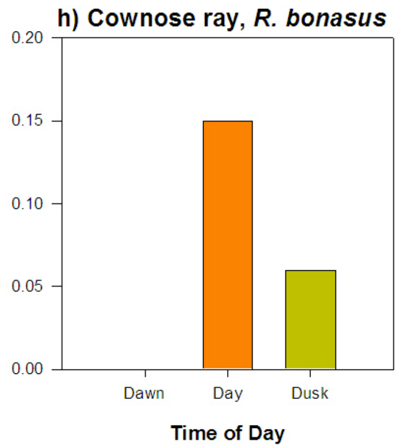


Figure 5. Generalized additive model function of young-of-the-year Atlantic sharpnose shark CPUE in relation to turbidity/water clarity for sets made in northwest Florida GULFSPAN FY03-06. Turbidity/water clarity is measured as the depth of the photic zone using a secchi disk (turb, in cm). The model showed a slight correlation in CPUE with turbidity/water clarity 150-210 cm.

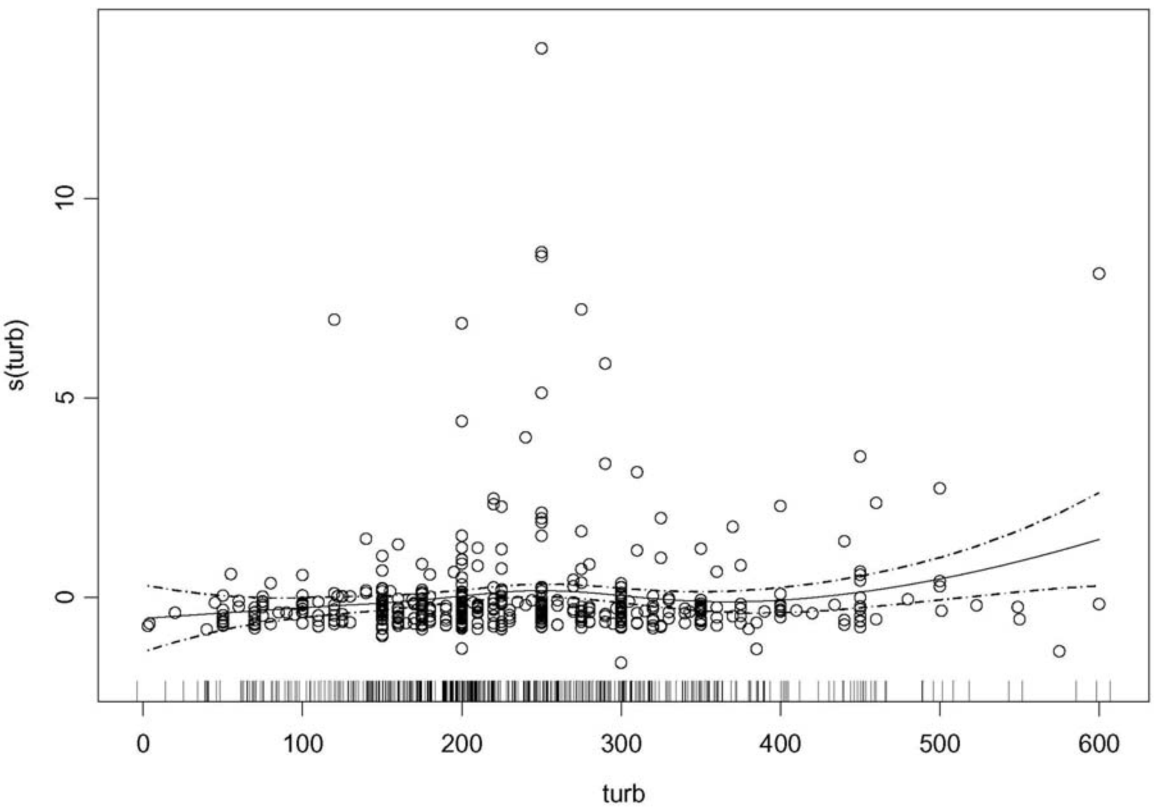


Figure 6. Generalized additive model function of for juvenile blacktip shark CPUE in relation to turbidity/water clarity for sets made in northwest Florida GULFSPAN FY03-06. Turbidity/water clarity is measured as the depth of the photic zone using a secchi disk (turb, in cm). The model showed a slight correlation in CPUE with turbidity/water clarity 150-305 cm.

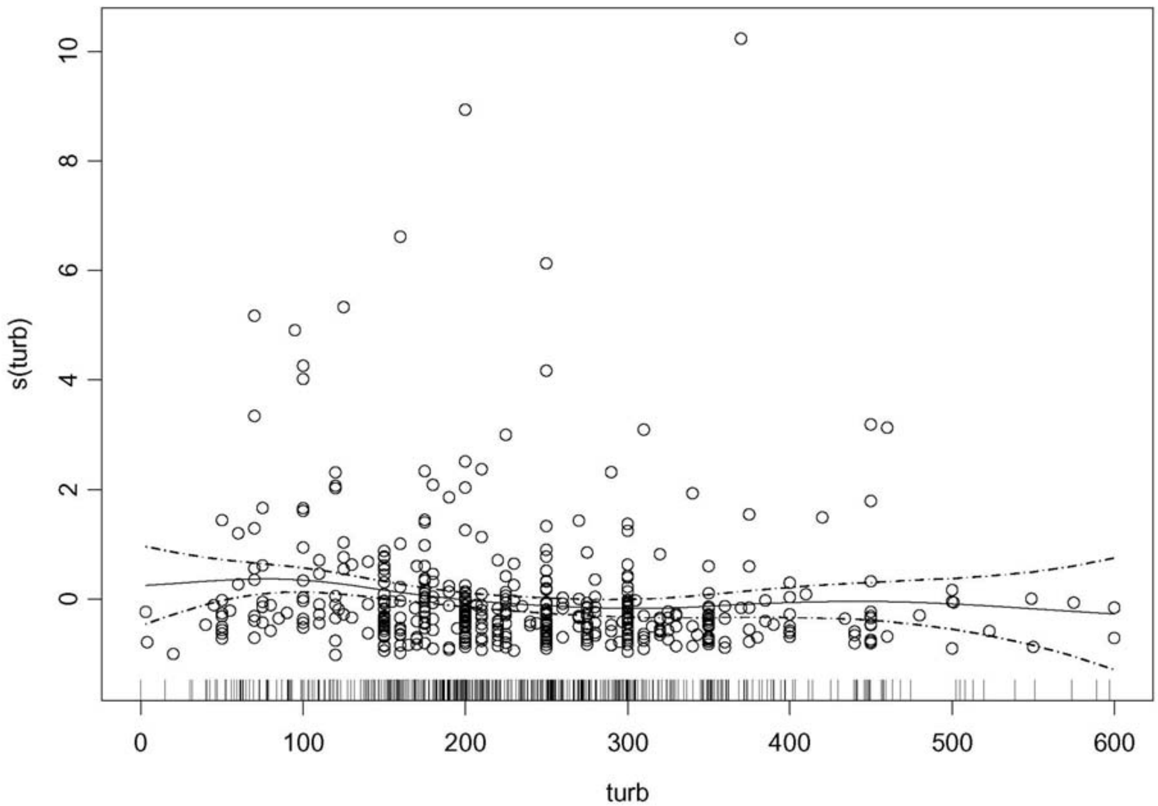


Figure 7. Generalized additive model function of for juvenile bonnethead shark CPUE in relation to salinity for sets made in northwest Florida GULFSPAN FY03-06. Salinity is measured in ppt (parts per thousand) using an YSI environmeter. The model showed a slight correlation in CPUE with salinities 30-34 ppt.

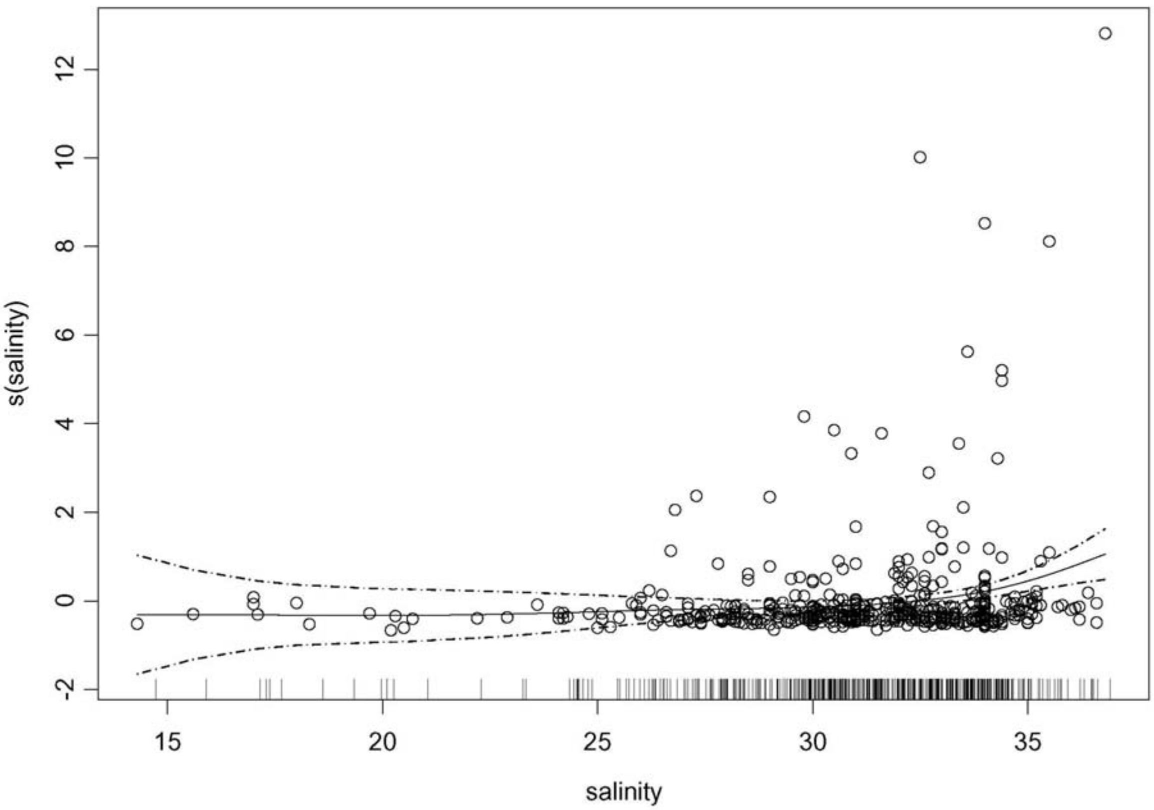


Figure 8. Cedar Key Region station map for FY-07 with the Suwannee Sound, Cedar Key, and Waccasassa Bay regions delineated (n=24).

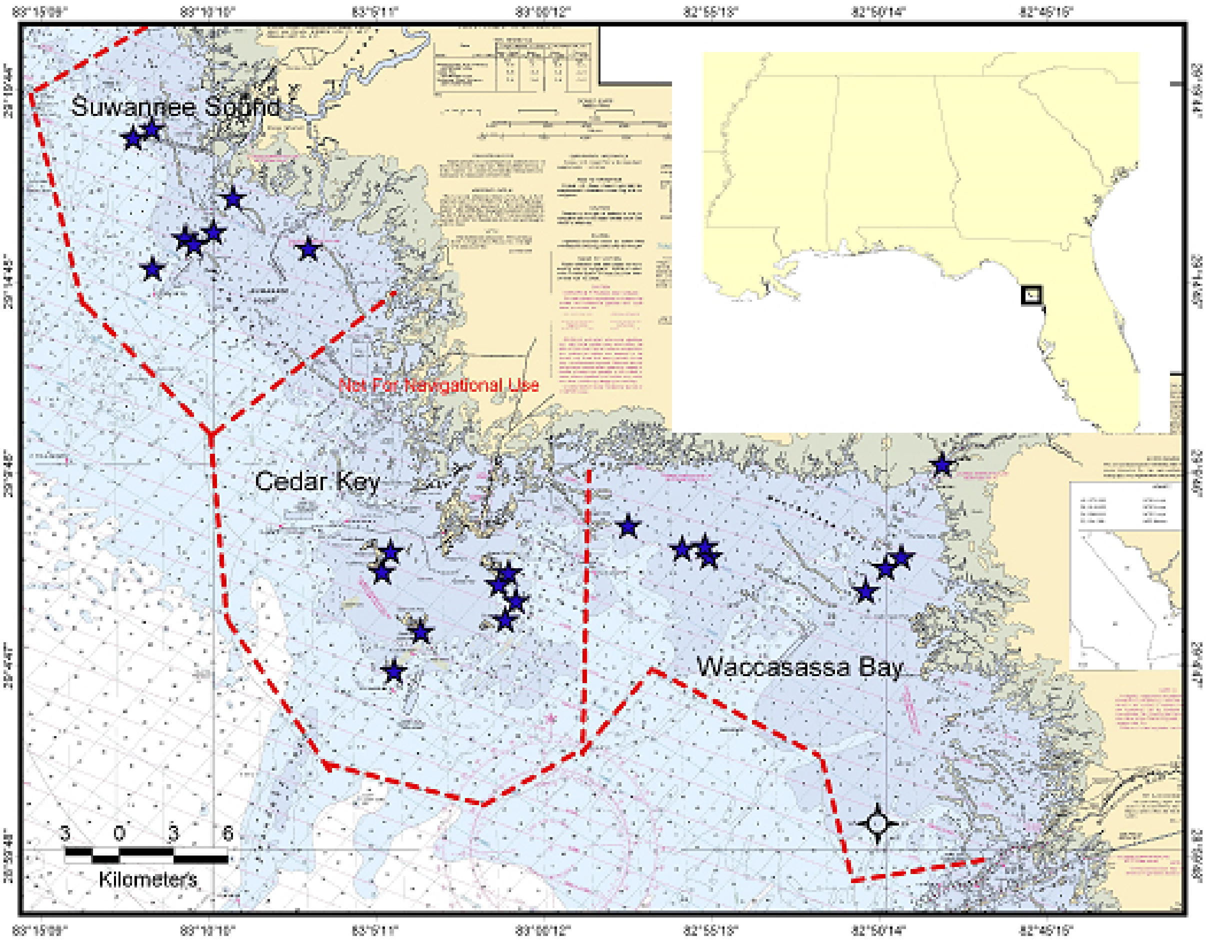


Figure 9. Locations of sets (n=19) made in Alabama coastal waters, FY-07.

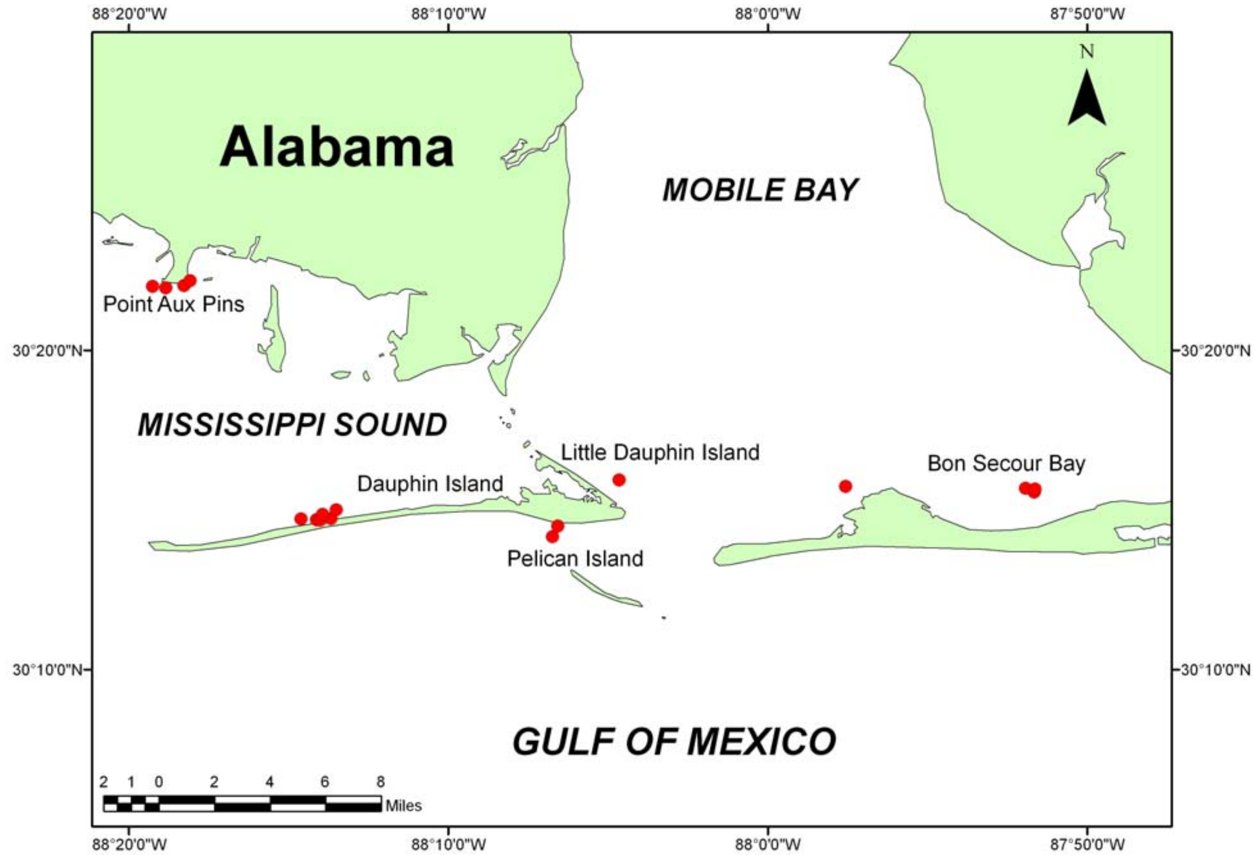


Figure 10. Locations of sets (n=44, 9 sampling stations) made in Mississippi coastal waters, FY-07.

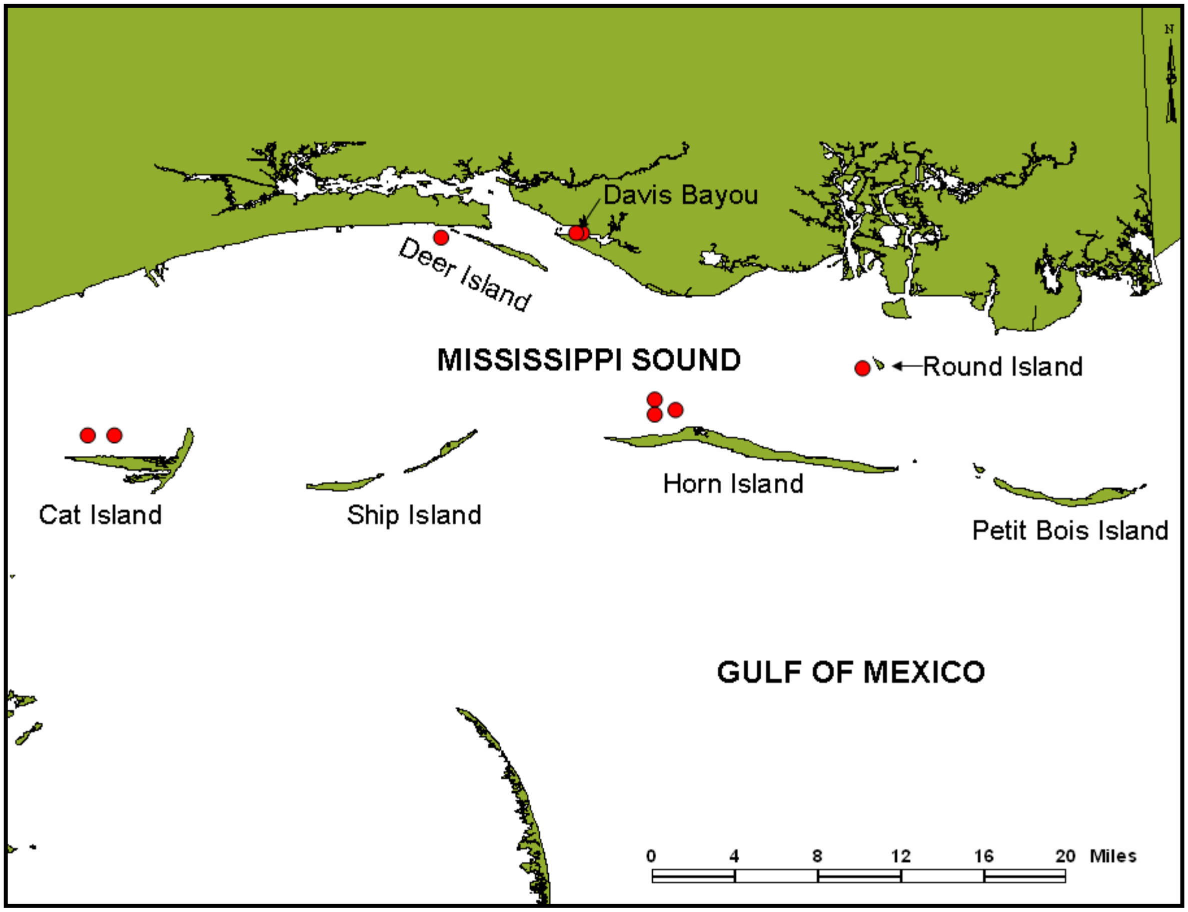
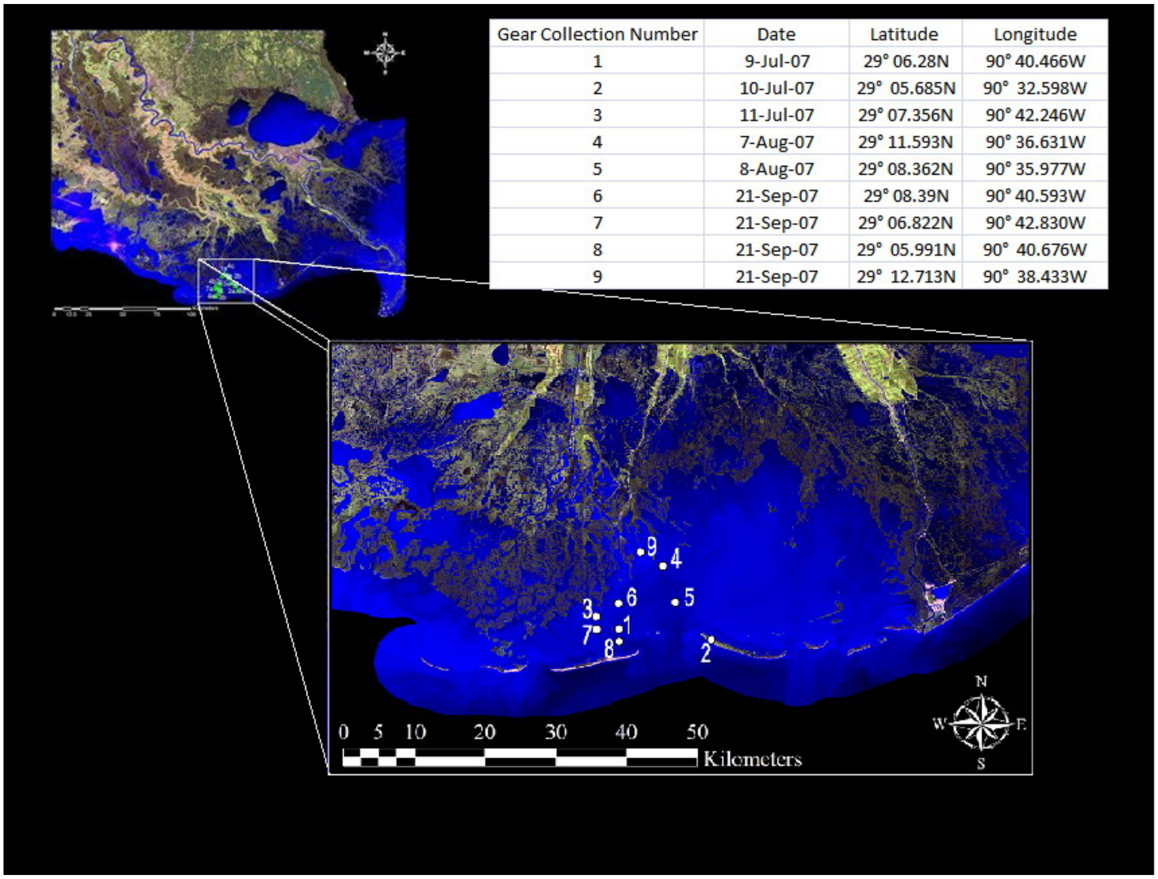


Figure 11. Locations of sets made in Louisiana coastal waters (n=9), FY-07.



Gear Collection Number	Date	Latitude	Longitude
1	9-Jul-07	29° 06.28N	90° 40.466W
2	10-Jul-07	29° 05.685N	90° 32.598W
3	11-Jul-07	29° 07.356N	90° 42.246W
4	7-Aug-07	29° 11.593N	90° 36.631W
5	8-Aug-07	29° 08.362N	90° 35.977W
6	21-Sep-07	29° 08.39N	90° 40.593W
7	21-Sep-07	29° 06.822N	90° 42.830W
8	21-Sep-07	29° 05.991N	90° 40.676W
9	21-Sep-07	29° 12.713N	90° 38.433W