BIOLOGY OF FIVE SPECIES OF SEAROBINS (PISCES, TRIGLIDAE) FROM THE NORTHEASTERN GULF OF MEXICO

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ABSTRACT

Geographically, Gulf populations of *Prionotus alatus* appear to be restricted almost exclusively to the eastern portion of the Gulf of Mexico, while *Bellator militaris, P. martis, P. roseus*, and *P. stearnsi* occur over the entire Gulf. Bathymetrically, *P. martis* is a shallow shelf species; *B. militaris* and *P. roseus*, middle shelf species; *P. alatus*, middle to deep shelf species; *P. stearnsi*, deep shelf species. The size (standard length) of *B. militaris, P. alatus, P. martis*, and *P. roseus* showed a significant positive correlation with increasing depth of capture. *Bellator militaris* showed a significant "preference" for fine sandy silt, clay, or mud bottoms. *Prionotus stearnsi* was captured in significantly greater numbers during daytime trawling and is postulated to swim actively in the water column at night. It appears to spawn from late summer to fall or early winter, while the remaining species spawn from fall to spring or early summer. Adult *P. stearnsi* differed in food habits by consistently consuming relatively large fishes, while juveniles of this species and all the age groups of the other four species fed consistently on crustaceans.

Searobins of the family Triglidae are commonly taken in shrimp trawls along the coast of the Gulf of Mexico where they comprise an important element of the benthic shelf ichthyofauna (Miles 1951; Hildebrand 1954; Springer and Bullis 1956; Bullis and Thompson 1965; Roithmayr 1965; Franks et al. 1972). They are not commercially important in the Gulf of Mexico, but at least some species are included among the bottomfishes that are canned for pet food and reduced for fish meal by commercial Gulf fisheries (Roithmayr 1965). Triglids also present a rich source of food for the larger, commercially important fishes from the Gulf. *Prionotus ophryas, P. roseus*, and *P. stearnsi* have been found in the stomachs of red snapper, *Lutjanus campechanus*, taken off Pensacola, Fla. (Jordan and Swain 1885; Jordan and Evermann 1887). *Prionotus roseus* was reported from the stomachs of red grouper, *Epinephelus morio*, off Tampa, Fla. (Jordan and Evermann 1887). Hildebrand (1954) regarded *P. stearnsi* as one of the most important forage fishes in the western Gulf where it was noted in the stomachs of rock sea bass, *Centropristis philadelphica*; red snapper; sand seatrout, *Cynoscion arenarius*; and inshore lizardfish, *Synodus foetens*.

Despite their importance as forage fishes, few or no data are available on the biology of the Gulf species, particularly on those found in deeper water. What little is known appears widely scattered in the literature, usually in faunal lists. The only in-depth studies on the biology of western North Atlantic triglids (Marshall 1946; McEachran and Davis 1970) are on the two species (*Prionotus carolinus* and *P. evolans*) that do not occur in the Gulf.

Our study was undertaken to analyze the species composition of the northeastern Gulf triglid fauna on the continental shelf between 20 and 190 m, to determine the distribution and abundance of this fauna, and to investigate aspects of their biology. Thirteen species (*Bellator brachychir, B. egretta, B. militaris, Prionotus alatus, P. martis, P. ophryas, P. paralatus, P. roseus, P. rubio, P. salmonicolor, P. scitulus, P. stearnsi, P. tribulus*) were collected, but only five species (*B. militaris, P. alatus, P. martis, P. roseus, P. stearnsi*) were taken in sufficient numbers to report on their biology.

MATERIALS AND METHODS

Specimens were collected from July 1969 to October 1971 aboard the RV *Tursiops* and the USNS *Lynch*. Most cruises were conducted aboard the *Tursiops* from October 1970 to October 1971 as part of the "Gulf Shelf Project" conducted by the Edward Ball Marine Laboratory, Department of Oceanography, Florida State University. Fishes were captured in a 16-foot (4.9-m) try-net otter trawl with a ¾-inch (1.9-cm)

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square mesh body and a ⅛-inch (0.3-cm) square mesh cod end liner.

The study area extended along the northeastern Gulf of Mexico from east of the Mississippi River Passes, La., to the western edge of Apalachee Bay, Fla., over a depth range of 20 to 190 m (Figure 1). The easternmost stations (between long. 84°37′W and 85°30′W) were visited, with few exceptions, in October and December 1970, and January, April, May, July, August, and September 1971. The remaining stations were visited only once during cruises conducted in one of the following months: July, October, and December 1969; October and November 1970; January, February, April, July, and October 1971. Station locations were determined through loran. Station depth was recorded from fathometer readings. Depths for a few stations were extrapolated from soundings recorded for that location on "1100 Series" U.S. Coast and Geodetic Survey maps. (For complete station data and specimens examined see Lewis 1973.) The principal investigators of the Gulf Shelf Project determined the sampling regime for each station. One trawl sample was taken at each station. Trawling time on the bottom ranged from 10 to 60 min. The time duration for the majority of trawls at shallow stations (i.e. less than 90 m) was 10 min; for the deeper stations, 20 min. In order to standardize these trawling efforts, catches were recorded as number of fish collected per 10 min trawling (catch per unit effort), and transformed [$Y = \log (X + 1)$] for analysis of the variance. Data for all stations (when available) were used for analysis regardless of whether or not the particular species was present.

Bottom temperature was recorded for most stations by bathythermograph and on a few occasions either by expendable bathythermograph or reversing thermometers. Bottom type was determined by examination of samples taken in a bucket dredge dragged over the trawl area. Bottom type was divided into two major classes; coarse sand overlain with shell hash (type I), and fine sandy silt, clay, or mud (type II). Data for bottom type were not collected at some stations and consequently fishes taken at these stations were not used in analysis of bottom type. Night was considered to be that interval of time between 1 h after sunset and 1 h before sunrise at that time of the year, while day was considered to be between 1 h after sunrise and 1 h before sunset. Fish collected at dawn or dusk were not used in the analysis of time of capture data.

The standard length (SL) of each fish was measured to the nearest millimeter. Identifications were made following Ginsburg (1950), Miller (1965), and Miller and Kent (1971). Specimens were preserved in 10% Formalin[2] origi-

[2]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

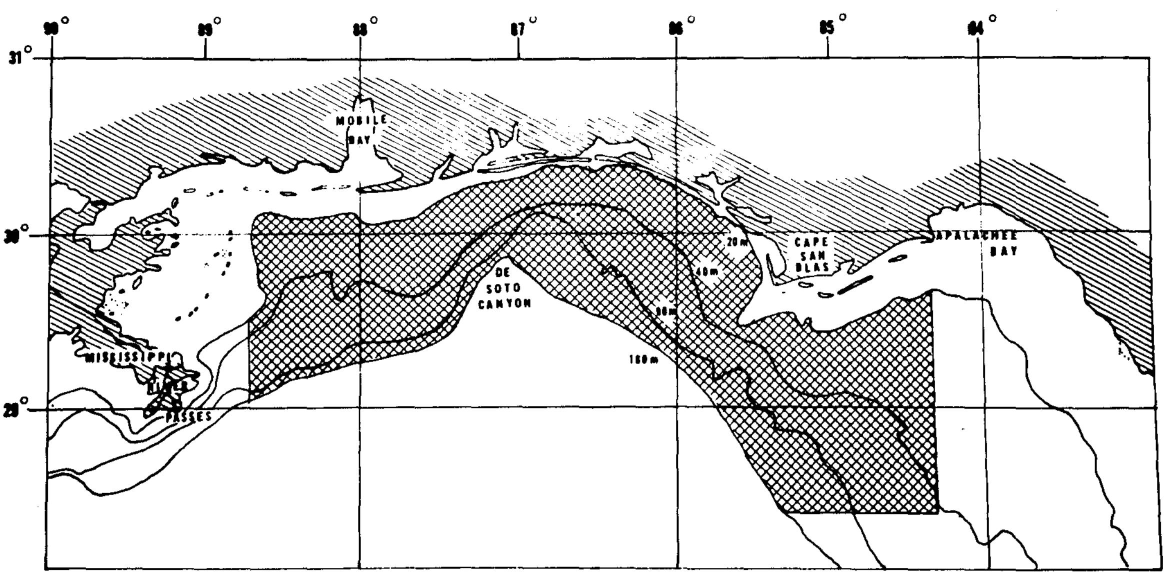

FIGURE 1.—Map of the study area sampled by the RV *Tursiops* and USNS *Lynch* between July 1969 and October 1971.

nally, transferred to 40% isopropyl alcohol and deposited in the Florida State University collection.

Gonads were examined from specimens taken in October, November, and December 1970, and January, February, April, May, July, August, September, and October 1971. Size at sexual maturity was determined by the first appearance of ripe or developing ova in females and enlarged testes in males. Females with numerous ripe ova were judged to be ready to spawn at or very near the date of capture. A ripe egg was determined to be one that was transparent and filled with numerous oil globules. Its size was measured to the nearest 0.1 mm with an ocular micrometer.

Stomachs (including the posterior esophagus) were removed and the contents analyzed for identifiable remains. Food items were identified at least to class, and where possible to order and suborder. The importance of food taxa was judged by their numerical abundance.

RESULTS

Bellator militaris (Goode and Bean) Horned Searobin

Bellator militaris was collected widely at depths of approximately 20 to 100 m (Figure 2a) and temperatures of 15° to 28°C. Specimens ranged in size from 24 to 111 mm SL. This species showed the greatest density of all the species

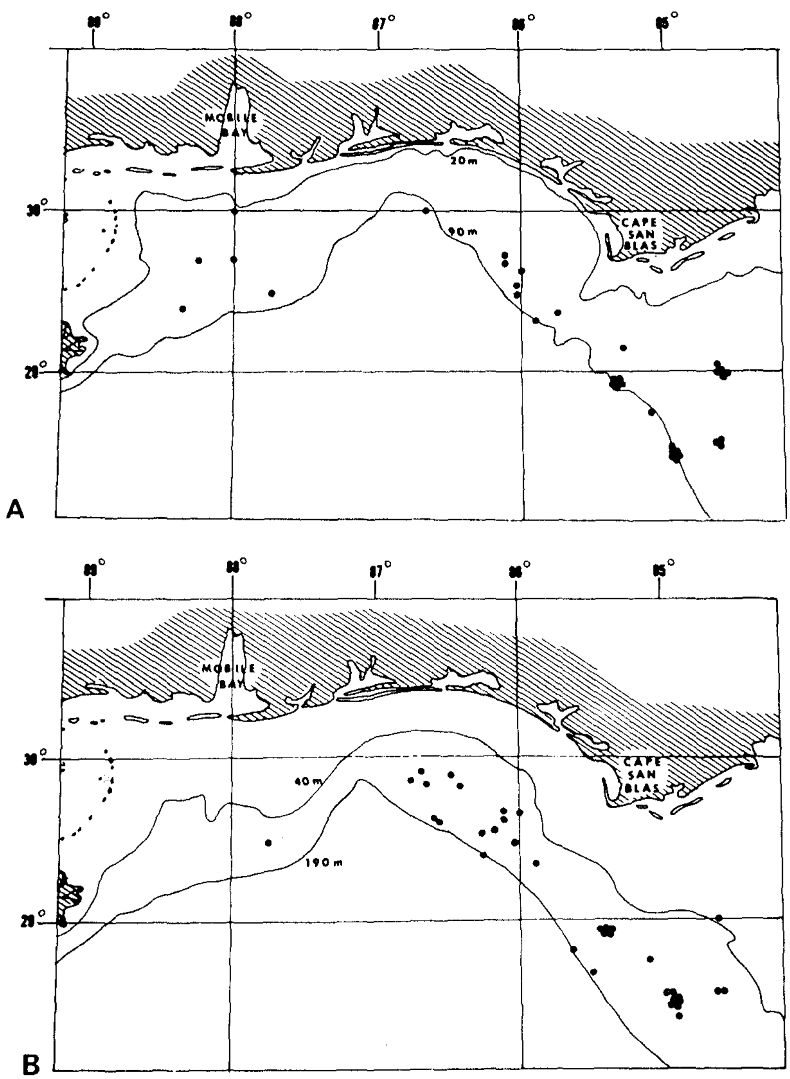

FIGURE 2.—Distribution within the study area of: A, *Bellator militaris* and B, *Prionotus alatus*.

caught, yielding 1.8 specimens per 10 min trawling within its depth range (Table 1).

This species was most abundant between 80 and 90 m (Figure 3a). There was a gradual increase in abundance to this depth range followed by a sharp decrease. There was a significant ($P<0.001$) positive relationship between increasing size and increasing depth of capture.

A statistically greater ($P<0.025$) number of *B. militaris* were taken over a fine sandy mud, silt, or clay bottom (Table 2). There was no statistical difference in catch for day versus night trawling (Table 3).

Bellator militaris appeared to reach sexual maturity at about 65 mm SL in both sexes. The spawning season was protracted as indicated by the presence of females with numerous ripe ova (0.7 to 0.9 mm in diameter) from November 1970 to July 1971.

Bellator militaris fed primarily on crustaceans (90 to 95% of the total stomach contents). Juveniles (Table 4) appeared to feed primarily on amphipods and natantian decapods; adults (Table 5), on natantian decapods, amphipods, and mysids. Adults also fed to a lesser extent on very small fishes (usually less than 15 mm SL), polychaetes, bivalves, and gastropods.

TABLE 1.—Number of specimens of five species of triglids collected and the mean number of fish per 10 min trawling.

Species	No. of specimens	Mean no. per 10 min trawling[1]
Bellator militaris	277	1.8
Prionotus alatus	162	1.0
P. martis	109	1.2
P. roseus	162	1.2
P. stearnsi	113	0.7

[1]For trawls within the depth and geographic range of the species.

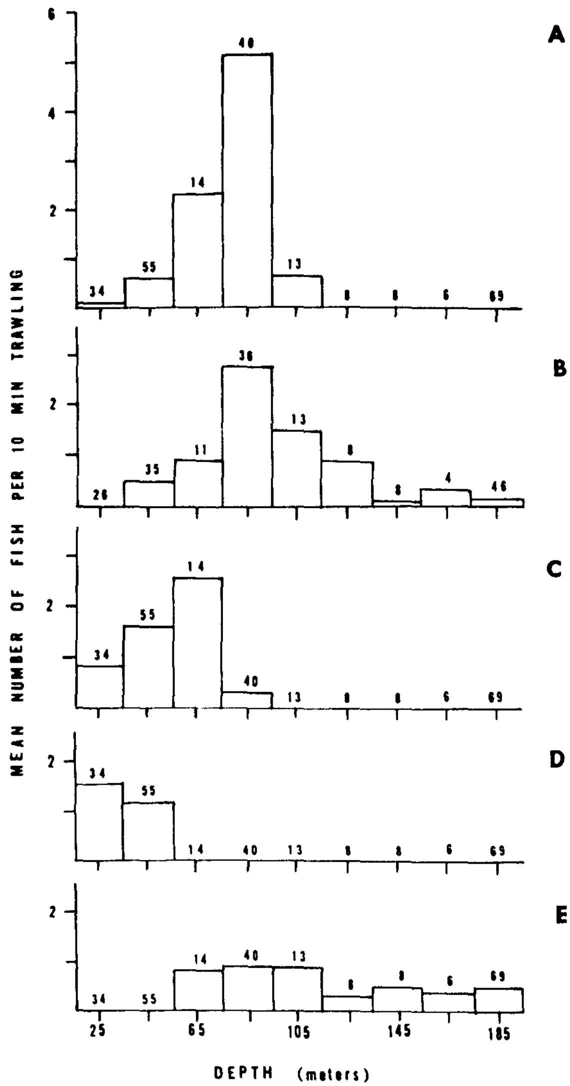

FIGURE 3.—Relationship of depth of capture versus catch per unit effort. A. *Bellator militaris*, B. *Prionotus alatus*, C. *Prionotus roseus*, D. *Prionotus martis*, and E. *Prionotus stearnsi*. Number above each bar refers to the number of 10-min trawling intervals at that particular depth.

Prionatus alatus Goode and Bean Spiny Searobin

With one exception, all specimens of *P. alatus* were collected east of the De Soto Canyon (Figure 2b). For this reason all analyses of this species were based only on data from stations east of the Canyon. Sizes ranged from 24 to 140 mm SL; collection depth, from 40 to 190 m; temperature, from 14° to 28°C. *Prionotus alatus* ranked fourth in density over its depth and geographic ranges (Table 1).

Prionotus alatus appeared to be most abundant around the 80- to 90-m interval of its depth range (Figure 3b). There was a rapid increase in catch to this point followed by a gradual decline. As in *B. militaris*, there was a significant ($P<0.001$) positive relationship between increasing size and increasing depth of capture.

There were no statistical differences in catch per unit efforts between bottom types (Table 2) and between day and night (Table 3).

Prionotus alatus appeared to reach sexual maturity at about 100 mm SL for both sexes. Females with numerous ripe ova (0.8 to 1.0 mm in diam-

TABLE 2.—The relationship of bottom type to density for five species of triglids.

Species	Type I[1] Mean no. per 10 min trawling	Variance	[2]N	Type II[1] Mean no. per 10 min trawling	Variance	[2]N	[3]F
Bellator militaris	0.8	4.7	75	3.1	37.7	42	6.3*
Prionotus alatus	0.8	2.2	53	0.7	2.3	85	0.6
P. martis	1.7	27.5	38	0.6	1.3	14	0.3
P. roseus	1.4	8.8	71	1.3	11.4	38	0.0
P. stearnsi	1.1	9.5	30	0.8	2.5	80	0.2

[1]Type I = coarse sand bottom overlain with shell hash. Type II = fine sandy mud, silt or clay bottom.
[2]N = the number of 10-min trawling intervals within the depth and geographic range of the species.
[3]For one factor analysis of the variance for data transformed to $Y = \log(X + 1)$.
*Significant at $P<0.025$.

TABLE 3.—Comparison of day versus night trawling for five species of triglids.

Species	Night Mean no. per 10 min trawling	Variance	[1]N	Day Mean no. per 10 min trawling	Variance	[1]N	[2]F
Bellator militaris	1.9	30.5	67	2.1	24.3	61	0.1
Prionotus alatus	1.4	14.9	76	0.8	3.4	65	0.3
P. martis	2.0	27.0	33	1.1	4.7	29	1.8
P. roseus	1.0	5.6	64	0.9	9.4	56	0.4
P. stearnsi	0.2	1.7	55	1.6	7.9	59	16.5*

[1]N = the number of 10-min trawling intervals within the species' depth and geographic range.
[2]For one factor analysis of the variance for data transformed to $Y = \log(X + 1)$.
*Significant at $P<0.001$.

TABLE 4.—Percent of total stomach contents for the juveniles of five species of searobins (n = the number of stomachs that contained identifiable remains).

Taxa	*Bellator militaris* $n = 15$	*Prionotus alatus* $n = 24$	*P. martis* $n = 5$	*P. roseus* $n = 14$	*P. stearnsi* $n = 10$
Crustacea:					
Ostracoda	1.1	3.0	—	—	—
Copepoda	7.9	—	—	—	2.2
Stomatopoda	—	10.4	—	—	—
Amphipoda	41.6	16.4	38.4	10.2	86.8
Isopoda	—	3.0	7.7	—	2.2
Mysidacea	4.5	13.4	—	13.3	—
Decapoda:					
Natantia	25.8	31.3	7.7	71.6	2.2
Reptantia	7.9	9.0	23.1	1.8	—
Megalops	1.1	4.5	—	—	4.4
Zoea	—	—	—	—	—
Annelida:					
Polychaeta	6.7	1.5	23.1	1.3	—
Mollusca:					
Bivalvia	3.4	1.5	—	1.8	—
Chordata:					
Vertebrata					
Osteichthyes	—	6.0	—	—	2.2

eter) were collected from November 1970 to April 1971. No females were collected in May or June and those collected in July 1971 were not ripe, indicating that spawning ceased somewhere during this interval.

Prionotus alatus fed primarily on crustaceans (91 to 97% of total stomach contents). Juveniles (Table 4) fed on decapods, amphipods, mysids, and stomatopods; adults (Table 5), chiefly on decapods. Small fishes (usually less than 15 mm SL) made up the only substantive non-crustacean food item in both adults and juveniles.

TABLE 5.—Percent of total stomach contents for the adults of five species of searobins (n = the number of stomachs examined that contained identifiable remains).

Taxa	*Bellator militaris* $n = 59$	*Prionotus alatus* $n = 30$	*P. martis* $n = 25$	*P. roseus* $n = 54$	*P. stearnsi* $n = 14$
Crustacea:					
Ostracoda	1.2	0.3	—	0.1	—
Copepoda	3.9	—	—	—	—
Stomatopoda	2.4	4.3	—	1.5	—
Amphipoda	30.1	2.5	21.1	3.0	4.5
Isopoda	1.7	1.8	—	0.5	—
Mysidacea	18.6	5.0	6.4	4.7	—
Decapoda:					
Natantia	30.9	71.3	39.8	82.4	9.1
Reptantia	5.2	11.0	10.5	4.5	9.1
Megalops	0.9	1.0	1.2	—	9.1
Zoea	0.5	—	—	—	—
Annelida:					
Polychaeta	0.8	—	4.6	2.0	—
Mollusca:					
Bivalvia	1.5	0.3	0.6	0.2	—
Gastropoda	0.3	—	—	0.1	—
Cephalopoda	—	—	—	—	4.5
Echinodermata:					
Ophiuroidea	—	—	1.2	0.2	—
Chordata:					
Cephalochordata	—	—	11.7	—	—
Vertebrata:					
Osteichthyes	2.0	2.5	2.9	0.8	63.7

Prionotus roseus Jordan and Evermann Bluespotted Searobin

Specimens of *P. roseus* ranging in size from 240 to 170 mm SL were collected throughout the study area at depths of 20 to 90 m (Figure 4a) and bottom temperatures of 16° to 28°C. It ranked, with *P. martis*, second in density within its depth range (Table 1).

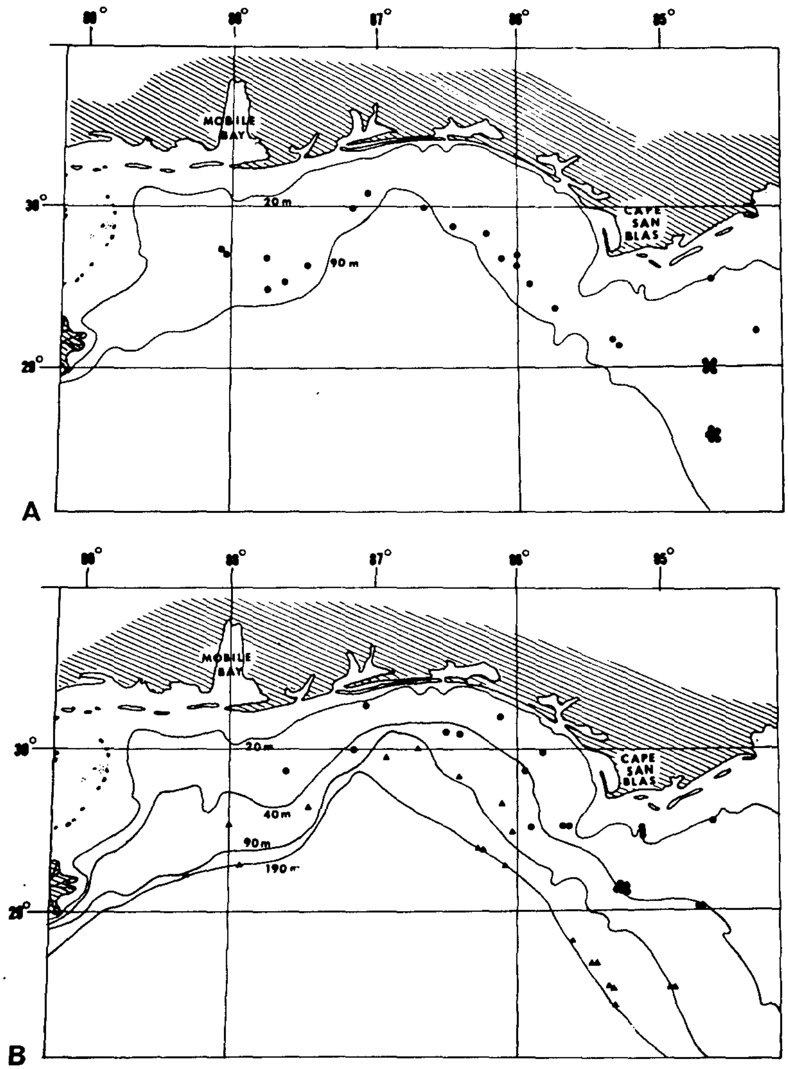

FIGURE 4.—Distribution within the study area of: A, *Prionotus roseus* and B, *Prionotus martis* (●) and *Prionotus stearnsi* (▲).

This species was most abundant between 60 and 70 m. As with the previous two species, *P. roseus* showed a significant ($P<0.001$) positive relationship between increasing size and increasing depth of capture.

There were no statistical differences in catches between bottom types (Table 2) or between night and day collections (Table 3).

Prionotus roseus appeared to reach sexual maturity at 100 mm SL for both sexes. Spawning period was protracted. Females with numerous ripe ova (0.7 to 0.8 mm in diameter) were collected from December to May 1971.

Prionotus roseus also fed primarily on crustaceans (97% of the total stomach contents). Juveniles (Table 4) fed chiefly on decapod shrimp, mysids, and amphipods; adults (Table 5) even more exclusively on decapods.

Prionotus martis Ginsburg Barred Searobin

Prionotus martis was collected widely except at the western edge of the study area at depths of approximately 20 to 45 m (Figure 4b). Sizes of specimens ranged from 51 to 159 mm SL and bottom temperature from 17° to 28°C. *Prionotus martis* ranked, with *P. roseus*, second for density within its depth range (Table 1).

Prionotus martis was most abundant at the 20- to 30-m interval of its depth range (Figure 3d). As was the case for *B. militaris*, *P. alatus*, and

P. roseus, this species showed a significant ($P<0.001$) positive relationship between increasing size and increasing depth.

No statistical differences in catch per unit effort between bottom types (Table 2) or night and day collections (Table 3) were observed.

Determination of size at sexual maturity in *P. martis* was inexact due to a paucity of specimens less than 100 mm SL. Individuals of both sexes at 100 mm SL were mature, while nine specimens below this size were immature. Consequently 100 mm SL was tentatively given as the size at sexual maturity for both sexes. Likewise, the exact spawning season for this species was difficult to determine. Females with numerous ripe ova (0.6 mm in diameter) were collected from October to December 1970. A large sample of females in January 1971 contained no ripe individuals, while a sample from April 1971 contained one ripe female.

Prionotus martis fed primarily on crustaceans but not as extensively as the previous three species (around 80% of the total stomach contents). Juveniles (Table 4) appeared to feed heavily on amphipods, polychaetes, and decapod crabs; adults (Table 5) on decapod crabs and shrimp, amphipods, and cephalochordates. The only other important food items for adults were polychaetes and very small fishes (usually less than 15 mm SL).

Prionotus stearnsi Jordan and Swain Shortwing Searobin

Prionotus stearnsi was collected widely at depths of approximately 60 to 185 m (Figure 4b) and temperatures from 14° to 21°C. Specimens ranged in size from 11 to 117 mm SL. It ranked fifth in density within its depth range.

Prionotus stearnsi was fairly evenly distributed within its depth range, but was slightly more abundant at shallower depths (Figure 3e). Unlike the previous four species, there was no significant relationship between increasing size and increasing depth of capture.

There was no significant difference in catch between bottom types (Table 2). There was, however, a significantly ($P<0.001$) greater catch during daytime trawling (Table 3).

Prionotus stearnsi appeared to reach sexual maturity at about 60 mm SL in both sexes. No ripe females were collected during the 1970-71 season and only one female in October and two in December of 1969 contained numerous ripe ova (0.6 mm in diameter).

This species appeared to have different feeding habits between adults and juveniles. The latter (Table 4) fed primarily on small crustaceans (98% of the number of food organisms), the former (Table 5) chiefly on relatively large fishes (usually larger than 25 mm SL; 64% of the number of food organisms). The only other important food among adults was decapod crustaceans.

DISCUSSION

Geographic Distribution

Four of the five species (*B. militaris, P. martis, P. roseus, P. stearnsi*) have been previously recorded over the entire northern Gulf of Mexico (Ginsburg 1950; Springer and Bullis 1956; Bullis and Thompson 1965; Burns 1970; Franks et al. 1972). *Prionotus alatus* has been reported almost exclusively from east of the De Soto Canyon, but Ginsburg (1950), Burns (1970), Miller and Kent (1971), and Franks et al. (1972, based on the same two specimens examined by Burns) reported small numbers west of the Canyon. Our study confirms this distribution and we conclude that *P. alatus* is quite rare in the western portion of the northeastern Gulf, where it is replaced by *P. paralatus*.

Depth Distribution

The triglids collected in this study fit into four bathymetric categories: 1) shallow shelf and inshore species, 2) shallow shelf to midshelf species, 3) shallow to deep shelf species, and 4) midshelf to deep shelf species.

Prionotus martis is a shallow shelf and inshore species. Springer and Bullis (1956) reported it from 200 fathoms (366 m) but we feel that this record is based on either a misidentification or incorrect station data. All other specimens in their paper came from 25 fathoms (46 m) or less. The maximum depth for our study, 44 m (24 fathoms), is probably the maximum depth reached by this species. It also enters shallow water, being reported from 6 fathoms or less by Reid (1954), Bullis and Thompson (1965), Richmond (1968), and Hastings (1972).

Bellator militaris and *P. roseus* fall into the second category; the maximum depth for both species was about 90 to 100 m. However, *B.*

militaris appears to reach 100 fathoms (183 m) off southwestern Florida (Longley and Hildebrand 1941; Springer and Bullis 1956; Moe and Martin 1965) as does *P. roseus* (Springer and Bullis 1956). *Bellator militaris* has been recorded by Bullis and Struhsaker (1970) from the 100- to 150-fathom (180- to 270-m) interval in their Caribbean study, and at 100 and 1,175 fathoms (180 and 2,150 m) in the northern Gulf by Springer and Bullis (1956). The latter figure is likely wrong. Since neither species was collected at 100 fathoms (183 m) in the present study despite intensive collecting at this depth, we conclude they rarely if ever reach this depth in the northeastern Gulf. Both are seldom recorded from less than 20 m. Moe and Martin (1965) recorded *B. militaris* in less than 3 fathoms (5.5 m) and *P. roseus* from approximately 6 fathoms (11 m) off Tampa, Fla.

Miller and Kent (1971) gave the depth range for *P. alatus* as 30 to 250 fathoms (55 to 457 m) which would place it in the shallow to deep shelf category. Our study reveals that this species occasionally enters water shallower than 30 fathoms (55 m); two specimens were collected in 44 m of water.

Our study indicates that *P. stearnsi* is a midshelf to deep shelf species. Like that of *P. alatus*, its depth range extends to deeper waters than those found in our study area. Excluding the armored searobins (which are often placed in Triglidae), it is one of the deepest dwelling western North Atlantic triglids. Ginsburg (1950) examined specimens from 169 fathoms (309 m). Bullis and Struhsaker (1970) reported it from the 150- to 200-fathom (274- to 366-m) interval. Springer and Bullis (1956) reported *P. stearnsi* from as deep as 250 fathoms (457 m, excluding the same erroneous 1,175-fathom station reported for *B. militaris*). *Prionotus stearnsi* has also been recorded from shallower waters. Ginsburg (1950) listed specimens from 13 fathoms (24 m), Hildebrand (1954) from 12 fathoms (22 m), and Springer and Bullis (1956) from 5.5 fathoms (10 m), though this last figure is based on a field identification and is subject to error. We never collected *P. stearnsi* at depths less than 60 m despite intensive collecting and conclude that it rarely enters shallower waters in the northeastern Gulf.

Size-Depth Relationship

In their study in Gulf waters off Pinellas County, Fla., Moe and Martin (1965) reported that larger specimens of various fishes consistently occurred at deeper depths. They pointed out that this phenomenon had been noted before and was correlated with increasing salinity (e.g. Gunter 1945). However, they were unable to draw such a correlation, since salinity changed so little over their study area. Topp and Hoff (1972) showed statistically significant increases in the mean size of *Syacium papillosum* (a bothid) collected between 18 and 37 m and between 37 and 55 m off southwestern Florida. Our results point to similar conclusions. We found a highly significant ($P<0.001$) positive relationship between increasing size and increasing depth of capture for all species except *P. stearnsi*. We concur with Moe and Martin (1965) that this is not correlated with salinity changes (which are small in our study area).

Temperature

The four species in the first three bathymetric categories occurred over a wide range of temperatures. The only species that could in any way be restricted by the temperature of its environment is *P. stearnsi*, the deep shelf species, which was taken over a limited range from 14° to 21°C.

Bottom Type

Bellator militaris was the only species which showed any significant bottom type preference; it was found in greater abundance over fine sandy mud, silt, or clay bottoms. We conclude that bottom type, at least as categorized in this study, does not play a very important part in the distribution of four of the five species studied.

Time of Capture

Only one species, *P. stearnsi*, showed a significant difference in the catch per unit effort between day and night trawls; it was more abundant in daytime trawls. *Bellator militaris* and *P. roseus* were equally abundant in both day and night trawls, while *P. alatus* and *P. martis* tended, though not conclusively so, to be caught in greater numbers at night. Hoese et al. (1968) noted that *P. tribulus crassiceps* as well as other unidentified triglids tended to be caught more frequently at night, though not significantly so.

The occurrence of *P. stearnsi* in such greater numbers during the day is difficult to explain. Two opposing hypotheses can be postulated. First, *P. stearnsi* may be a diurnal species, active over the bottom during the day, and perhaps burrowing during the night and thus eluding capture. Or second, *P. stearnsi* may be nocturnal; during the day it may rest on the bottom exposed to daytime trawls, while at night it may ascend into the water column to feed beyond the reach of the trawl. We favor the second possibility because of the general physiognomy of this species. Food habits, as will be discussed, also suggest a more actively swimming existence compared with other triglids.

Reproduction

Sexual Maturity

Bellator militaris and *P. stearnsi* are rather small triglids maturing at 65 and 60 mm SL and reaching a maximum size around 120 and 135 mm, respectively (Ginsburg 1950). *Prionotus alatus, P. martis,* and *P. roseus* mature at about 100 mm SL and attain at least 189 mm (Ginsburg 1950), 166 mm (Reid 1954), and 225 mm (Ginsburg 1950), respectively. Marshall (1946) found that *P. carolinus* and *P. evolans* mature at about 140 and 180 mm SL, respectively, and attain a much larger size than any Gulf species. It appears that the size at sexual maturity is largely a function of the size attained by the particular species.

Spawning Season

Spawning seasons for the triglids collected in this study can be separated into two ill-defined categories: 1) Late summer to fall or early winter and 2) late fall to spring or summer (see Figure 5).

Prionotus stearnsi appears to fit into the first category. In our study ripe females were collected only in October and December. Longley and Hildebrand (1941) reported collecting a ripe female in August off the Tortugas. These limited data and a large number of very small specimens in collections from October, December, and January indicate that *P. stearnsi* probably spawns from late summer to late fall or early winter. The paucity of ripe females suggests that this species may spawn at greater depths than those sampled in this study.

Three of the remaining four species (*B. militaris, P. alatus, P. roseus*) had obviously protracted spawning seasons from fall to late spring or summer. The presence of a number of small individuals collected throughout the year further corroborated the length of the reproductive period.

Prionotus martis was in spawning condition in October, December, and April. The presence of only a few juveniles in this study leads us to

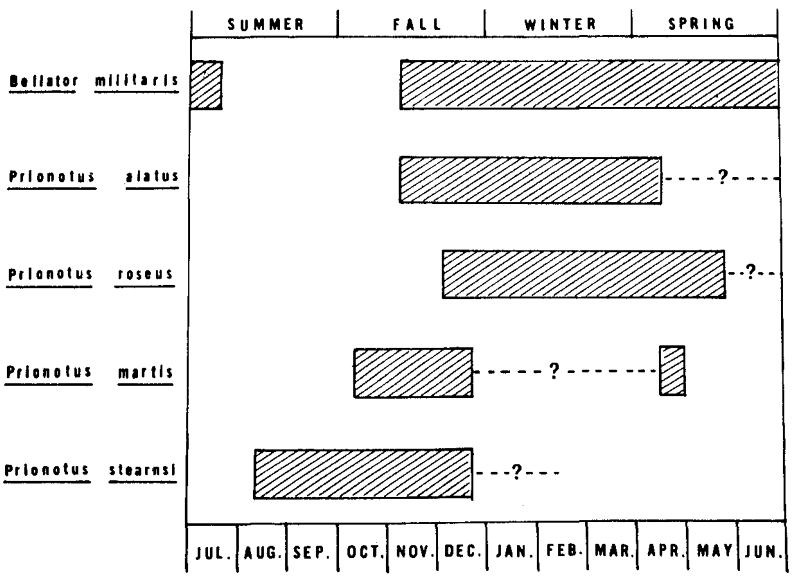

FIGURE 5.—Spawning seasons for five species of searobins.

believe that the young develop in shallower water. The bulk of spawning appears to take place from late fall to late winter or early spring since all specimens less than 45 mm SL that we have examined came from March and April collections from water less than 20 m deep. Also, Hastings (1972) collected small specimens of *P. martis* during February to April only (greatest abundance in April) during his seasonal studies of the jetty fauna at Destin and Panama City, Fla.

Food Habits

Rapid retrieval of the trawl from the bottom often resulted in eversion of stomachs, especially in the deeper water species. Hence, analysis of food habits was impeded by small sample sizes. Also, the use of numerical abundance of taxa to determine dietary preferences presents an obvious bias. Large numbers of small individuals would appear dominant when, in fact, they might make only a small percentage of the volume of food consumed. This was the case in the dominance of amphipods in the stomachs of juvenile *P. stearnsi*. In general, however, individuals of the numerically dominant taxa tended to be dominant in size also.

On the basis of these limited data, four of the five species (*B. militaris, P. alatus, P. martis, P. roseus*) and the juveniles of the fifth (*P. stearnsi*) appear to feed primarily on benthic crustaceans and other benthic organisms. Reid (1954) and Springer and Woodburn (1960) examined *P. scitulus latifrons* and *P. tribulus crassiceps* from the northeastern Gulf and also found that both species fed primarily on crustaceans. Likewise, Marshall (1946) found the same to be true for *P. carolinus* and *P. evolans* from the Atlantic coast.

In contrast, the adults of *P. stearnsi* appear to consume primarily other fishes. The food habits of the adults of this species are different from all other western North Atlantic triglids examined. Its piscivorous habit lends support to our earlier contention that this species is more mobile than its congeners. This type of diet would imply an active pursuit of their prey.

The fusiform shape of this species also implies an active mode of existence. The head of *P. stearnsi* with its terminal mouth does not appear to be adapted for bottom feeding. The free rays of the pectoral fins are more slender and less developed; they likely are not used extensively as tools for searching along the bottom as in other triglids.

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