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LONG-TERM ADULT POPULATION FLUCTUATIONS AND DISTRIBUTION OF THE SPOT, *LEIOSTOMUS XANTHURUS*, IN MISSISSIPPI

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ABSTRACT Adult specimens of the spot, *Leiostomus xanthurus*, were collected from bayou, Mississippi Sound, and barrier island locations along the Gulf Coast of Mississippi from November 1982 to July 1989. The mean total length of all spot sampled in comparable gill net sets was 219 mm (± 14 standard deviation, n=4,338). Ninety-five percent of the spot were collected in the island and sound areas, where the salinity was higher than in the bayous. Catch per unit effort was high at island and sound stations in spring and autumn, with relatively few fish caught during the winter spawning season and summer. The relatively high frequency of spot observed at the island stations in the autumn was probably influenced by spawning migrations, and the high spring values may represent a combination of two abundant year classes. The two greatest yearly collections, in 1983 and 1986, may have been influenced by sampling conditions or by environmental conditions favorable to survival either during those years or earlier when those fish were postlarvae. The smallest yearly catch occurred in 1985 and may have reflected the harsh weather conditions that year.

Introduction

The spot, *Leiostomus xanthurus*, is a common fish in estuaries along the Gulf Coast of Mississippi. Several studies on the life history of this species have been conducted (e.g., Pearson 1929; Hildebrand and Schroder 1928; Hildebrand and Cable 1930; Dawson 1958; Parker 1971). Limited information is available on long-term population fluctuations. Kobylinski and Sheridan (1979) examined the long-term seasonal distribution and abundance of spot in Apalachicola Bay, Florida, and Joseph (1972) studied population trends along the mid-Atlantic Coast. Long-term monitoring of adult spot may indicate fluctuations in populations influenced by natural changes in the environment. The objectives of this study were to examine the seasonal and annual variation in catch rates of larger spot at island, sound, and bayou habitats in Mississippi in relation to temperature, salinity, and reproductive influences.

Materials and Methods

Spot samples and hydrological data were collected monthly from November 1982 through July 1989 at six stations along the Mississippi Gulf Coast (Figure 1). Specimens were collected with 183-m long by 2.4-m deep monofilament gill nets. The nets were comprised of four 45.7-m panels with 7.0, 9.5, 15.2, and 20.3-cm stretch mesh that were attached together. The net was set on the substratum perpendicular to the shore with the smallest mesh panel abutted to or near the shoreline. It was set in a water depth of 0.5 to 3.0-m one hour before sunset and retrieved four hours later.

Spot were returned to the laboratory where total length (TL) and standard length (SL) were measured to the nearest millimeter. Representative samples were examined to determine the state of sexual maturity using methods similar to those established by Overstreet (1983). The date, water temperature, salinity, turbidity, cloud cover, and sea conditions were recorded prior to each net set. Water temperature was measured to the nearest 1°C with a hand-held thermometer. Salinity was measured to the nearest 1 ppt with a temperature-compensated refractometer or conductivity meter, and turbidity was measured with a secchi disk to the nearest cm. Most water temperatures and salinities were taken within 10 cm of the surface.

Three habitat types, represented by a total of six locations, were sampled from the study area (Figure 1). Bayou stations were located adjacent to Biloxi Bay near Fort Bayou and Popps Ferry bridges. Sound stations were located off the north central portion of Deer Island and the northwest portion of Round Island. Island stations were located on the northcentral areas of Horn and Ship Islands.

A one-way analysis-of-variance test (ANOVA) was used to detect significant differences between mean values. In cases where differences were detected, means were compared using Tukey's multiple range test (Tukey 1953). Mean catch values in Figures 2 and 3 are presented as arithmetic means. The variance was proportional to mean values, hence $\log_{10}$ transformations of data were performed prior to using the ANOVA and multiple range tests.

Linear regression was performed to compare the relationship between TL and SL in northern Gulf of Mexico spot to that calculated by Dawson in 1958 using South Carolina spot. Spot measured by the same biotechnician were compiled from a larger database consisting of spot we collected in the same geographical area as the data used for other statistical analyses performed in this study. The regression equation was calculated using the mean TL for a given SL to compare to Dawson's (1958) equation calculated from means of 5 mm class intervals.

Results

Gill nets selected larger spot; 96% of the specimens caught were greater than 200 mm TL (Table 1). Mesh sizes of 7.0, 9.5, 15.2, and 20.3 cm captured 95.3, 4.4, 0.2, and 0.1% of the spot, respectively, from the combination of bayou, sound, and island stations. Mean size of spot captured did not vary significantly among the bayou, sound, and island stations: 219 mm ± 16 (n=224), 221 mm ± 16 (n=1,382), and 219 mm ± 12 (n=2,732), respectively. The linear regression between TL and SL calculated for specimens from the northern Gulf of Mexico spot was TL=1.135[SL] + 14.2, r^2=0.994.

Monthly mean catch rates of adult spot varied among bayou, sound, and island stations (Figure 2). A high percentage (63%) of the total catch occurred in the high-to-moderate salinities of the island stations, whereas 32% occurred in the moderate-salinities of the sound and 5% occurred in the lower-salinities of the bayou. Temperature and salinity varied among locations and seasons (Table 2), and correlation analysis indicated a weak but significant relationship between salinity and the number of spot caught (r= 0.20, Table 3). A bimodal frequency of catch was evident because relatively large numbers of adult spot were collected at the island and sound stations in March-April and in October (Figure 2). Numbers of spot captured from the bayou stations were relatively low during each month throughout the study period. Although mean catch values among years were not significantly ($p > 0.05$) different within each station, the total catch values from island and sound stations exhibited considerable annual variation, with especially large catches occurring in 1983 and 1986 (Figure 3).

Examination of spot gonads taken from bayou, sound, and island stations demonstrated that gravid females and ripe males occurred in all three habitats (Figure 4). Most of these individuals were observed from the island and sound stations in October and November. A low number of ripe males and gravid females, however, were collected from the bayou from October to December.

Discussion

Townsend (1956) examined the age-length relationship of spot in Florida using scales and length-frequencies, and he determined that spot between 150-185 mm SL (TL= 187-230 mm using the equation TL=1.233[SL] + 2 from Dawson [1958]) were primarily age-2 fish. Parker (1971) determined that spot taken from the Gulf of Mexico grew approximately 11 mm per month during their first year and 5.5 mm per month during their second year. Consequently, these data would suggest that 220 mm TL fish were approximately 2.5 years old. Our data indicated 79% of the spot captured were between 190 and 229 mm TL and were probably 2 years old. Although our data represent length-frequency distribution skewed toward larger spot (190-331 mm TL), presumably in the 2- and 3-year age classes, we rarely observed individual spot larger than 250 mm TL. Only 66 out of 4,330 (1.5%) spot caught by gill net were larger than 255 mm. Gunter (1950) similarly noted only 2% of 1,246 spot longer than 255 mm TL captured by trawl along the Gulf Coast. Southeast Area Monitoring and Assessment Program (SEAMAP) data from 1982-1989 on spot captured from stations in Gulf of Mexico offshore waters bounded by 29°10' to 30°10'N latitude and 87°30' to 89°00'W longitude indicated only 1% of the 1,595 spot measured were larger than 255 mm (personal communication, Kenneth Savastano, National Marine Fisheries Service, NSTL, MS 39529 SEAMAP 1991). In addition, Dawson (1958) summarized catch data of spot collected by trawlers off the Atlantic Coast (Hildebrand and Schroder 1928; Hildebrand and Cable 1930) and reported 10 of 27,227 (0.04%) ≥ 255 mm TL. Our data from the Mississippi gill net study and those by others mentioned above demonstrate the infrequency of large spot in both estuarine and offshore areas, suggesting low survival of spot beyond 3 years of age.

Our TL/SL regression equation was not used because we did not have age data corresponding to that of Dawson (1958). Our regression equations and those of Dawson are more similar for smaller spot than larger ones and are probably not significantly different from each other in the 150-185 mm SL range. However, the lengths differ by more than 10 mm for fish greater than 220 mm SL.

Monthly variation in catch could have been influenced by migration, by short-term and long-term environmental variations, by spawning periods, and by sampling. Dawson (1958) noted the number of spot ≥ 150 mm TL in his samples from South Carolina was greater in March than in late spring. Those relatively small catches in late spring persisted until the start of autumn when the number increased (Dawson 1958). A similar trend was also observed in our study for adults sampled from the island and sound

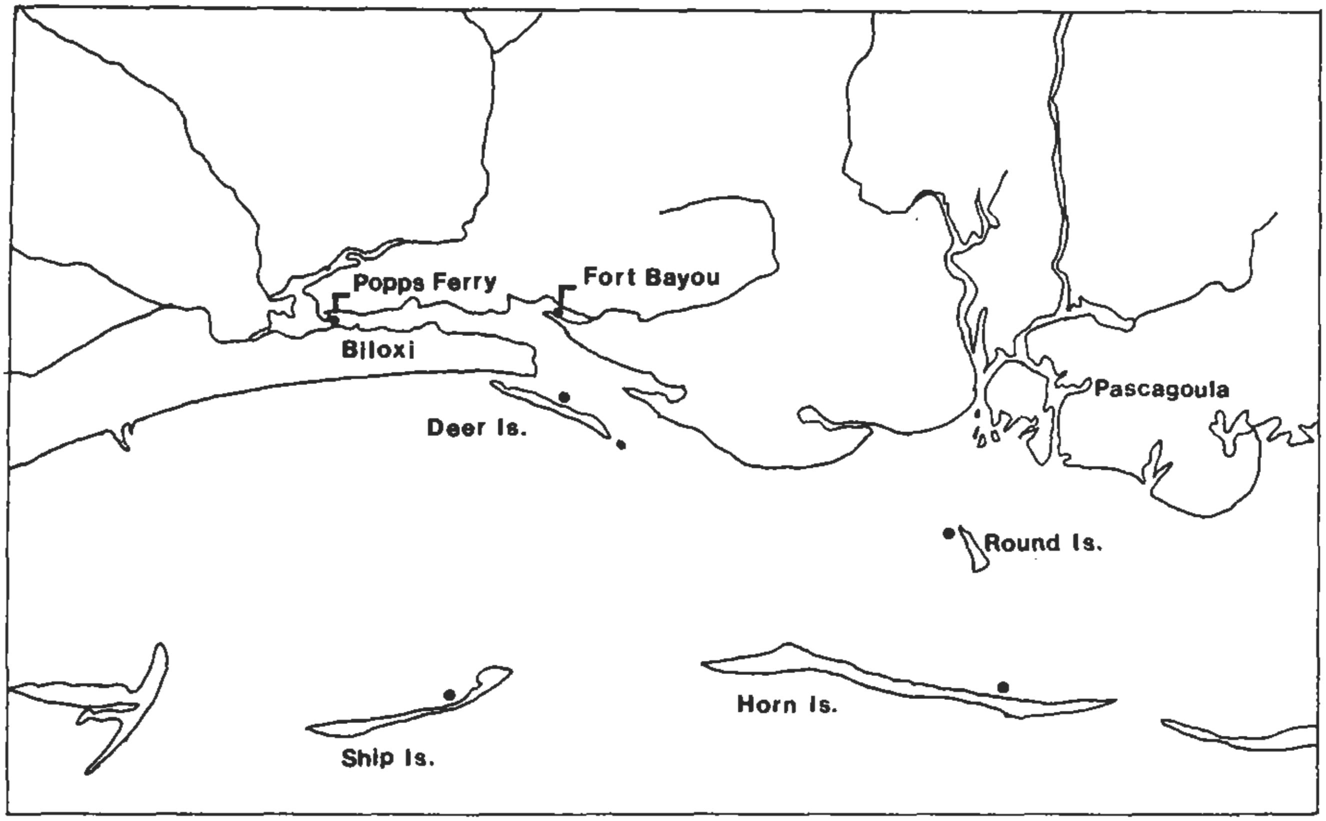

Figure 1. Locations of the six sampling areas in Mississippi: Popps Ferry, Fort Bayou, Deer Island, Round Island, Ship Island, and Horn Island.

stations in Mississippi. Hildebrand and Cable (1930) noted a comparable trend for juvenile spot from near Beaufort, North Carolina. The large number of adults we collected in October (Figure 2) may have resulted in part from a migration of the fish from inshore and coastal habitats to offshore spawning areas. Several studies have reported spawning migrations of spot during autumn based on large catches of adults from offshore spawning grounds relative to simultaneous small catches from inshore areas (Hildebrand and Schroder 1928; Pearson 1929; Gunter 1938, 1945; Dawson 1958). We corroborate that conclusion with similar observations (Figure 2).

Large numbers of migrating spot collected from the sound and island stations during late autumn had fully developed gonads. As expected from earlier reports (Gunter 1938, 1945; Dawson 1958), few spot were collected during December-February. Larger mean catches of spot from the island stations in March (mean=75) and April (mean=75) may have been influenced by the spent (spawned) or developing adults moving into and out of the area. These movements may have been triggered by gradual increases in water temperature in conjunction with consistent moderate-to-high salinities that occurred during those months. The relatively high number of spot observed for the seven-year period at the island stations during March and April were influenced by especially high catch rates in those months in 1983, 1984, and 1986. Collections made in March of 1983 and 1986 accounted for 67% of the total seven-year catch for March, and 57% of the total number for April was caught in 1983 and 1984. A review of salinity and temperature data we collected each week during and a few months preceding the peak collection periods revealed no variations in conditions that would readily explain why the above periods were more productive than intermediate periods. Samples of a non-dispersed population during different conditions of water and air probably contributed to some of the variation. Perhaps favorable environmental conditions existed when these fish were larvae and postlarvae, contributing to the development of strong year classes. If data for the months of March 1983 and 1986 and April 1983 and 1984 were removed from the total data, the total number of occurrences for the months of March and April would not be significantly different ($p > 0.05$) from those of May-September. The data indicate long-term stability of the spot population from March to September during the years 1983 to 1988.

Annual variation in the spot population is typical of a fish with a relatively short life cycle (Joseph 1972). Joseph also stated that population fluctuations could be influenced by survival of early stages, possibly resulting from environmental conditions that prevailed on the spawning grounds. However, detrimental conditions in the nursery grounds,

TABLE 1

Total length-frequency distribution in 10 mm increments of all specimens of *Leiostomus xanthurus* measured from Mississippi waters on a monthly basis from November 1982 to July 1989

TL (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
120–129			2										2
130–139		1										1	2
140–149		1				1							2
150–159				1								1	2
160–169	1								1			1	3
170–179									1	2	1	1	5
180–189				1		3	2	3		2	2	2	15
190–199	1	2	5	29	9	19	25	16	15	22	9	5	157
200–209	9	15	42	160	65	51	61	60	53	129	35	9	689
210–219	25	12	160	270	104	100	97	105	87	281	85	37	1,363
220–229	23	35	264	230	64	71	55	65	37	251	97	23	1,215
230–239	20	23	147	120	25	24	12	10	18	100	70	7	576
240–249	8	6	58	28	6	7	1	1	3	48	30	3	199
250–259	1	1	14	3		2	1		1	7	29	1	60
260–269			3	1	1					3	18		26
270–279	1			1							5		7
280–289				3						1			4
290–299										1			1
300–309													
310–319													
320–329								1					1
330–339				1									1

TABLE 2

Mean salinity (ppt) and temperature (°C) of bayou, sound, and island stations by months — November 1982 to July 1989

Month	N[a]	Bayou		Sound		Island	
		Sal ± (SD)[b]	Temp ± (SD)	Sal ± (SD)	Temp ± (SD)	Sal ± (SD)	Temp ± (SD)
Jan	14	10 ± (4)	12 ± (3)	19 ± (8)	12 ± (3)	27 ± (4)	12 ± (3)
Feb	14	3 ± (3)	13 ± (3)	16 ± (7)	14 ± (3)	26 ± (6)	13 ± (4)
Mar	14	4 ± (4)	16 ± (2)	17 ± (6)	16 ± (2)	22 ± (6)	17 ± (3)
Apr	14	3 ± (3)	20 ± (2)	16 ± (6)	20 ± (2)	20 ± (5)	20 ± (3)
May	14	6 ± (5)	26 ± (2)	14 ± (8)	26 ± (3)	22 ± (7)	25 ± (2)
Jun	14	3 ± (3)	28 ± (3)	15 ± (6)	27 ± (2)	20 ± (7)	27 ± (2)
Jul	14	6 ± (4)	29 ± (2)	16 ± (7)	30 ± (2)	23 ± (4)	29 ± (1)
Aug	12	3 ± (4)	30 ± (2)	16 ± (7)	29 ± (2)	23 ± (5)	29 ± (2)
Sep	12	6 ± (4)	28 ± (3)	17 ± (7)	29 ± (2)	24 ± (5)	28 ± (3)
Oct	12	9 ± (6)	25 ± (3)	23 ± (5)	25 ± (3)	27 ± (5)	25 ± (3)
Nov	14	13 ± (7)	22 ± (3)	22 ± (6)	20 ± (3)	29 ± (6)	20 ± (3)
Dec	14	8 ± (7)	15 ± (2)	20 ± (6)	16 ± (2)	26 ± (7)	17 ± (4)

[a]Number of samples measured per habitat

[b]Standard deviation

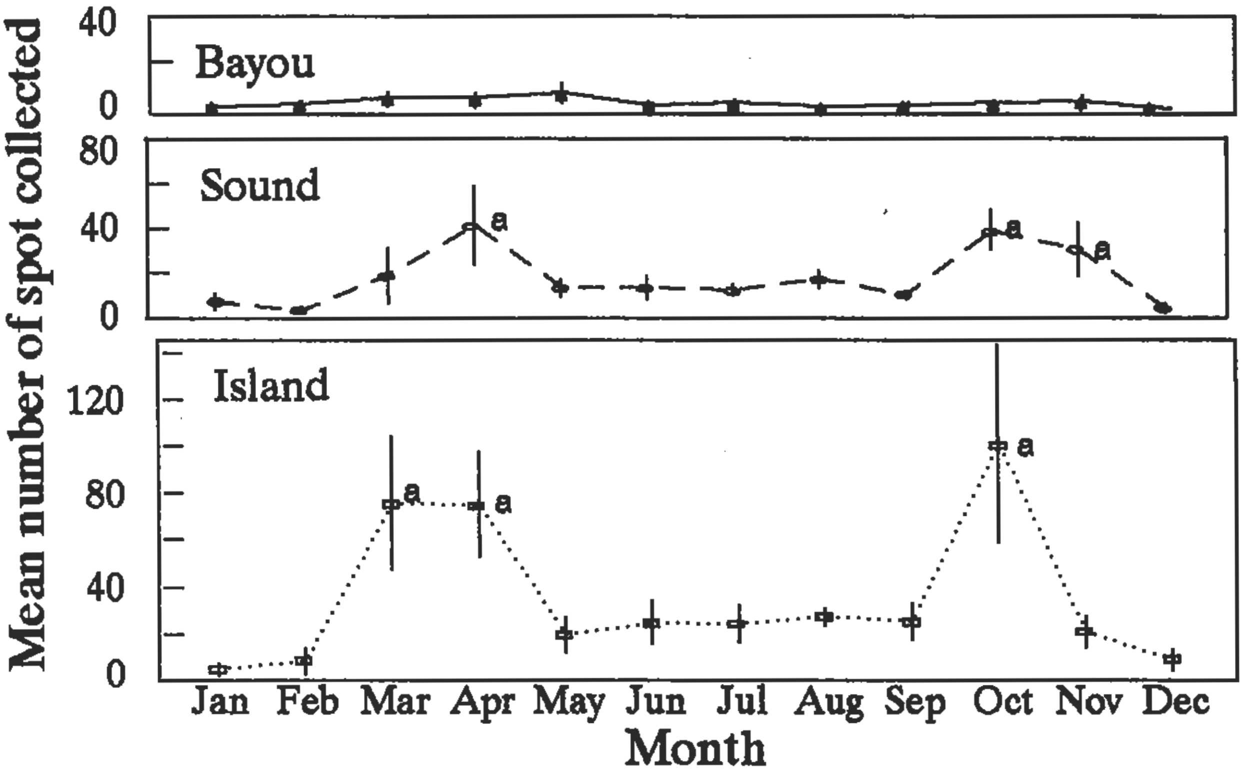

Figure 2. Mean number of adult spot by month from three sampling locations from November 1982 through July 1989. The letter "a" indicates a significant difference (p > 0.05).

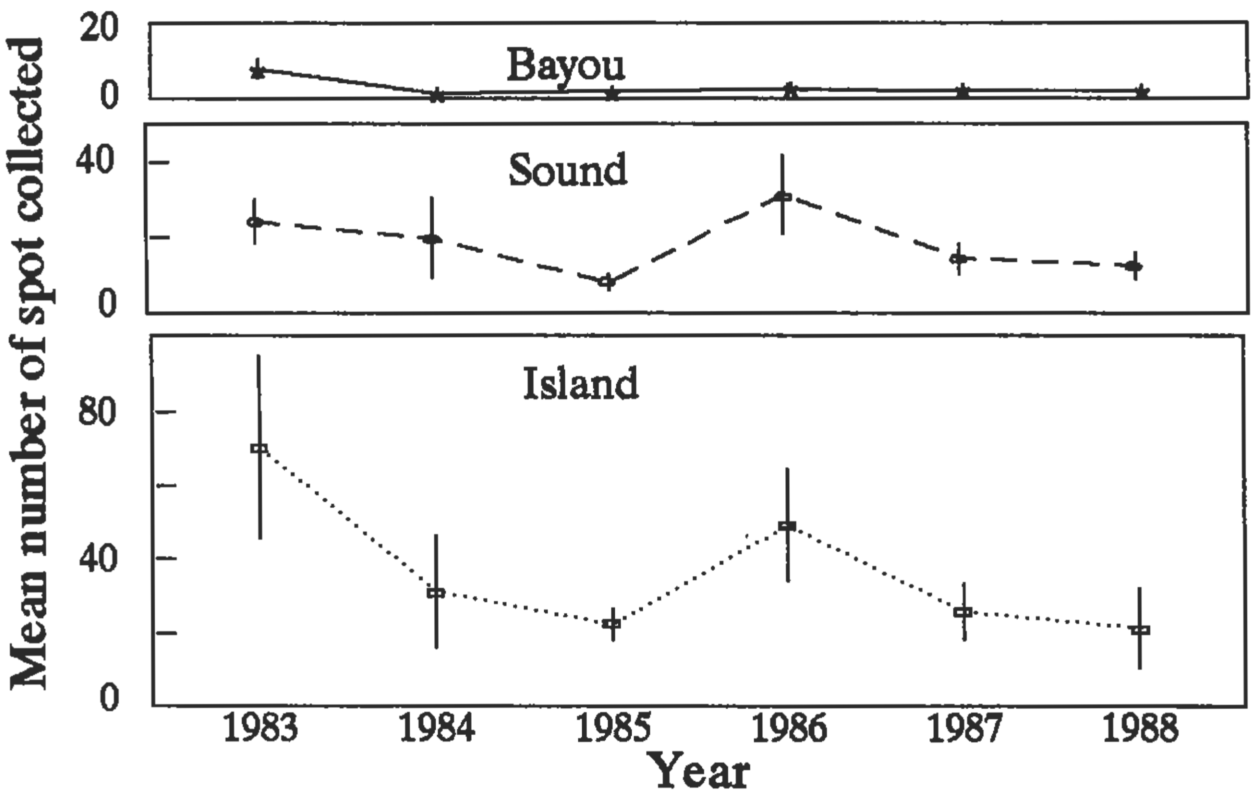

Figure 3. Mean number of adult spot by year from three sampling locations from 1983 through 1988.

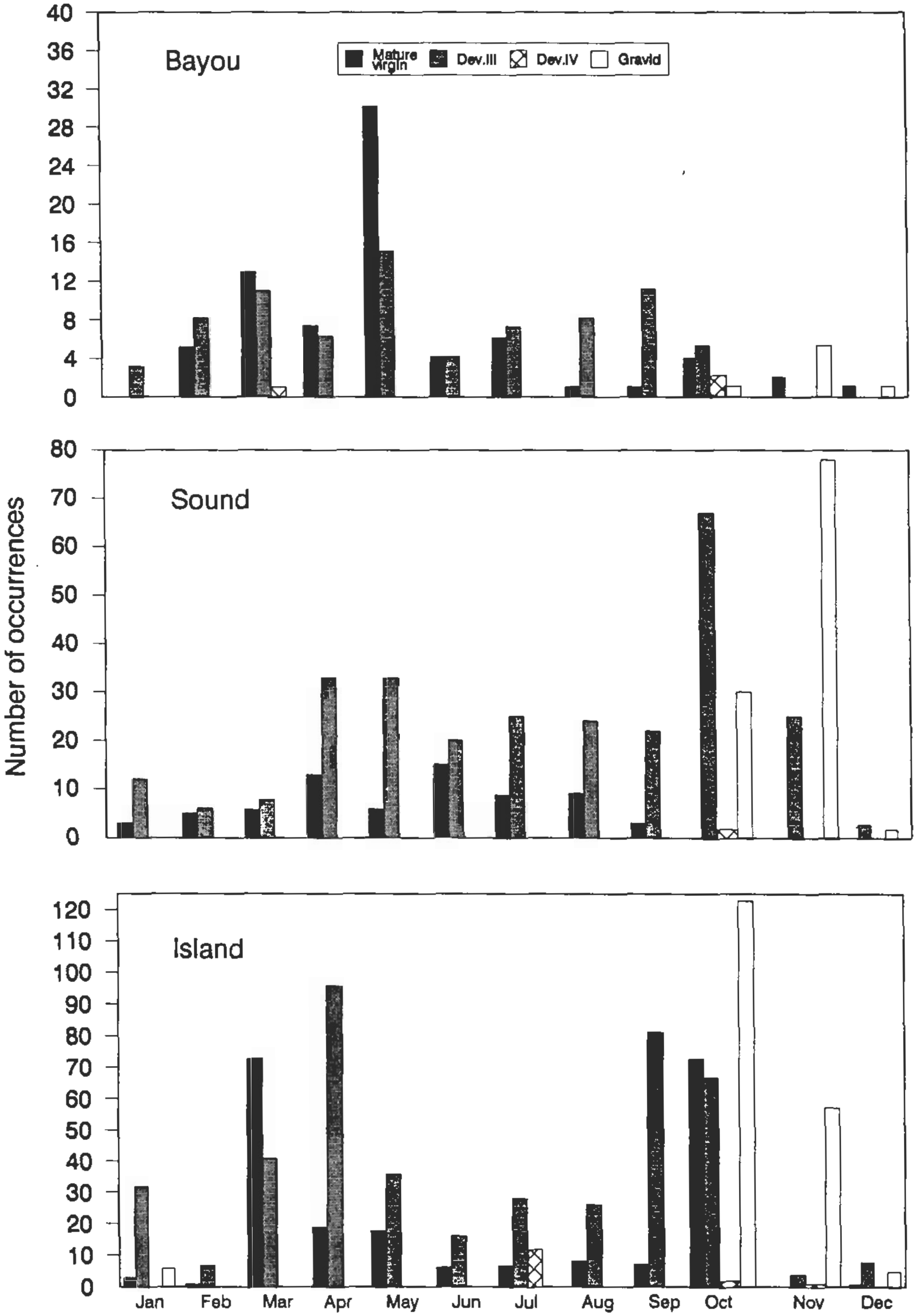

Figure 4. Number of occurrences of maturing virgins, developing, and gravid grouped male and female spot examined from bayou, sound, and island stations (see Table 1 of Overstreet, 1983 for explanation of developmental stages).

TABLE 3
Correlation matrix for salinity, temperature, locality, and number of spot collected

	Salinity	Temperature	Location	No. fish collected
Salinity	____	-0.07	0.74*	0.20*
Temperature	____	____	0.003	0.03
Locality	____	____	____	0.32*
Number of Cases	492			

*1-tailed significance .001

such as extended periods of low temperature, could also affect survival and migration of young spot into the bays during spring, subsequently effecting the strength of those year classes. For example, our collection of weekly weather data indicated that in January 1985, water temperature plunged from a mean of 10.3°C to a low of 2.5°C for at least 48 hours, with ice forming in many bayous. Also during that year, three hurricanes moved through the area. Those extreme weather conditions possibly dispersed or moved many adults into offshore waters in 1985 and negatively influenced survival of young fish in the bayous and sound. The lower total catch of adult spot seen in 1985 may be related to the harsh weather conditions occurring in that year. Moreover, the relatively low numbers of larger, adult spot in 1987 and 1988 may also have been influenced by those same harsh conditions adversely effecting the survival of larvae or young-of-the-year fish during the winter of 1985.

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LITERATURE CITED

Dawson, C. E. 1958. A survey of the biology and life history of the spot, *Leiostomus xanthurus*, with special reference to South Carolina. *Contributions from Bears Bluff Laboratory* 28:1-48.

Gunter, G. 1938. Seasonal variations in the abundance of certain estuarine and marine fishes in Louisiana, with particular reference to life histories. *Ecological Monographs* 8:313-346.

Gunter, G. 1945. Studies on marine fishes of Texas. *Publications of the Institute of Marine Science, University of Texas* 1:9-190.

Gunter, G. 1950. Correlation between temperature of water and size of marine fishes on the Atlantic and Gulf Coast of the United States. *Copeia* 1950(4):298-304.

Hildebrand, S. F. and L. Cable. 1930. Development and life history of fourteen teleostean fishes at Beaufort, North Carolina. *Bulletin of the United States Bureau of Fisheries* 46:383-488.

Hildebrand, S. F. and W. C. Schroder. 1928. Fishes of Chesapeake Bay. *Bulletin of the United States Bureau of Fisheries* 43:1-366.

Joseph, E. B. 1972. The status of the sciaenid stocks of the middle Atlantic Coast. *Chesapeake Science* 13:87-100.

Kobylinski, G. J. and P. F. Sheridan. 1979. Distribution, abundance, feeding and long-term fluctuations of spot, *Leiostomus xanthurus*, and croaker, *Micropogonias undulatus*, in Apalachicola Bay, Florida, 1972-1977. *Contributions in Marine Science* 22:149-161.

Overstreet, R. M. 1983. Aspects of the biology of the spotted seatrout, *Cynoscion nebulosus*, in Mississippi. *Gulf Research Reports*, Supplement 1:1-43.

Parker, J. C. 1971. The biology of the spot, *Leiostomus xanthurus*, and the croaker, *Micropogonias undulatus*, in two Gulf nursery areas. Texas A&M Sea Grant Publication Number TAMU-SG-71-210, 182 pp.

Pearson, J. C. 1929. Natural history and conservation of the red fish and other commercial sciaenids on the Texas coast. *Bulletin of the United States Bureau of Fisheries* 44:29-214.

Townsend, B. C. 1956. A study of the spot, *Leiostomus xanthurus* Lacepede, in Alligator Harbor, Florida. M.S. Thesis, Oceanography Institute, Florida State University, 43 pp.

Tukey, J. W. 1953. The problem of multiple comparisons. *Ditto*, Princeton University, Princeton, New Jersey.