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Short Papers and Notes:

METHODS

OCCURRENCE OF *Lepomis* (Osteichthys: Centrarchidae) IN HORN ISLAND PONDS

Horn Island is a long (21 km), narrow (ca. 0.8 km), barrier island in the northern Gulf of Mexico, located approximately 10 km off the coast of Mississippi. The island is part of the Gulf Islands National Seashore, under the administration of the National Park Service. Horn Island contains an abundance of aquatic habitats; as of 1981 there were 59 ponds and 4 lagoons on the island (Shabica and Watkins 1982).

The fishes of Horn Island were sampled intensively by Franks in 1965 and 1966. During these two years he made 41 collecting trips to Horn Island, and using seines, trammel nets, a cast net, and a brail net, sampled all of the island's ponds and lagoons (Franks 1970). Franks collected 28,587 fishes, representing 69 species, during this investigation. One of the goals of Franks' study was to determine whether any freshwater fish species inhabited the ponds and lagoons of the island. Despite his intensive sampling he concluded that "no true freshwater fishes were obtained." No *Lepomis* were collected in his study. Richmond, who documented the fauna and flora of Horn Island, also did not report the presence of *Lepomis* (Richmond 1962, 1968).

From July 1989 to September 1990 we sampled the macroinvertebrates and monitored the physical-chemical parameters of several of Horn Island's ponds. During this time we noticed a number of fishes in our study ponds which appeared to be members of the genus *Lepomis*. Subsequent sampling of these ponds confirmed that *Lepomis* species were present on the island, and documented the salinity levels in which they existed.

Physical-chemical parameters, including salinity, were determined for five of Horn Island's ponds on 13 dates (ca. every five weeks) from July 1989 to September 1990. The study ponds (numbers 18, 19, 20, 40, and 43, numbers assigned by the Coastal Field Research Laboratory (CFRL) of the National Space Technology Laboratories; see Shabica and Watkins 1982) were all "permanent" (contained water throughout the year) and had surface areas ranging from 1.67 to 10.09 hectares. All of the island's ponds are relatively shallow, with a maximum depth of 2.0 m or less. These five ponds were chosen because they presented a range of salinity conditions from relatively fresh to brackish, as based on the perceptions of people familiar with the island and some preliminary sampling we had performed.

Salinity measurements were made with a Yellow Springs Instrument Model 33 S-C-T meter. We checked the accuracy of the salinity measurements by making "sea water" with Instant Ocean, determining the salinity level with a refractometer, then making a series of dilutions of known salinities, and checking the known salinities against measurements made with the meter. Known salinities and meter salinity readings agreed very closely from "full strength" sea water down to 1 ppt. Below a salinity of 1 ppt, meter readings were consistently lower than the actual (known) salinity levels. Since the relationship between conductivity and salinity is fairly linear, we constructed a graph of specific conductance vs. salinity, based on the conductivities of our various dilutions and their known salinities. In those instances when salinity measurements in the field were less than 1 ppt we assigned salinity levels to the ponds using this graph, on the basis of their field-measured conductivities.

Lepomis were collected from Horn Island on four dates. Using a dip net we collected a single specimen from pond 18 on 17 June 1988. On 15 October 1988 a seine (3 m in length, mesh of 4.8 mm) was used to collect specimens of *Lepomis* from pond 20. On 17 April 1990 three seine hauls were made in pond 19, with only the largest of the *Lepomis* kept for measurement and identification. We made 5 to 10 seine hauls in each of the study ponds (18, 19, 20, 40, and 43) on 19 September 1990, and retained all of the *Lepomis* collected. Standard lengths of *Lepomis* were determined in the laboratory.

RESULTS

We collected three species of *Lepomis* from Horn Island: *L. macrochirus* Rafinesque (bluegill), *L. microlophus* (Günther) (reardear sunfish), and *L. punctatus* (Valenciennes) (spotted sunfish) (Table 1). *Lepomis* were found in four of our five study ponds (18, 19, 20, and 40); pond 43 was the only pond in which no *Lepomis* were collected.

All three of the island's *Lepomis* species were present in pond 20 (Table 1), which was the "freshest" of our study ponds. Salinity measurements taken in this pond over the 15-month sampling period averaged 0.8 ppt, with a minimum salinity of 0.4 ppt and a maximum salinity of 1.6 ppt (Table 1). Our *Lepomis* collections from ponds 18 and 19 included two species: *L. microlophus* and *L. punctatus*. The largest *Lepomis* specimens were collected from these ponds. A spotted sunfish with a standard length of 137.4 mm was collected from pond 18, while a redear sunfish of the same length was obtained from pond 19 (Table 1). Pond 18, the largest pond on the island (10.09 hectares), had a mean salinity of 1.6 ppt, with a minimum and maximum salinity of 0.4 ppt and 3.7 ppt, respectively, over our sampling period. Salinity levels changed

markedly in pond 19 over our sampling period. Although salinity was only 0.4 ppt in this pond in March 1990, salinity levels exceeded 11 ppt on all three sampling occasions in the summer of 1990 (June, July, and August), with a salinity of 12.5 ppt in August, and 11.8 ppt on the date of the capture of two *L. microlophus* (September 1990).

The redear sunfish was the only *Lepomis* species collected from pond 40 (Table 1). Mean salinity in this pond over our study period was 1.9 ppt, with a minimum of 0.3 ppt and a maximum salinity of 3.7 ppt. Pond 43, our only study pond in which no *Lepomis* were collected, had a mean salinity of 6.1 ppt, with a minimum and maximum salinity of 2.7 and 10.3 ppt, respectively.

Small specimens of *Lepomis* were collected from two ponds. Collections from pond 20 in October 1988 and September 1990 contained a number of individuals with standard lengths between 21 and 34 mm (Table 1). The April 1990 collection from pond 19 also contained a large number of small *Lepomis*, although these fishes were not retained.

All *Lepomis* specimens from Horn Island are stored in the University of Southern Mississippi Museum of Ichthyology. Their museum numbers are USM-4568, -4569, -4570, and USM-9706 through USM-9714.

DISCUSSION

Although *Lepomis* species are certainly freshwater fishes (Smith-Vaniz 1968, Douglas 1974, Moyle and Cech 1988), members of this genus are often collected in brackish water as well, especially in oligohaline areas (Peterson and Ross 1991). *Lepomis macrochirus*, *L. microlophus*, and *L. punctatus* have all been collected from environments having salinities greater than 10 ppt (see Peterson 1988). However, the *Lepomis*

Table 1. Collection sites (pond numbers), salinity of the pond over the study period (mean, minimum, and maximum), collection dates, and standard lengths (SL) of *Lepomis* from Horn Island ponds

Pond Number	Salinity (ppt)	Species Collected	Collection Date	SL
18	\bar{x} = 1.6	<i>L. punctatus</i>	6/17/88	137.4
	min. = 0.4	<i>L. microlophus</i>	9/26/90	58.5
	max. = 3.7	<i>L. punctatus</i>		35.5, 61.6, 66.2
19	\bar{x} = 5.4	<i>L. microlophus</i>	4/17/90	132.5, 134.8, 137.4
	min. = 0.3	<i>L. punctatus</i>		90.6
	max. = 12.5	<i>L. microlophus</i>	9/26/90	86.4, 120.2
20	\bar{x} = 0.8	<i>L. macrochirus</i>	10/15/88	21.6, 21.9, 23.1,
	min. = 0.4			27.6, 29.6, 31.9
	max. = 1.6	<i>L. microlophus</i>		22.4, 23.6, 23.9,
				25.0, 25.5., 26.1,
				26.3, 27.9, 28.2,
				32.3
		<i>L. punctatus</i>		26.3
		<i>L. microlophus</i>	9/26/90	65.1
		<i>L. punctatus</i>		28.2, 32.0, 32.7,
				33.7, 67.8
40	\bar{x} = 1.9	<i>L. microlophus</i>	9/26/90	81.7, 85.2
	min. = 0.3			
	max. = 3.7			

collected in these higher salinity conditions may be there for only a short period, and may move along a salinity gradient toward fresher waters. *Lepomis* in Horn Island's ponds are, of course, in a different situation, since they are "trapped" and must cope with existent salinities or perish. *Lepomis* in ponds 18, 20, and 40 persisted under relatively low salinities throughout the duration of our study (Table 1), and it is apparent from the large number of small specimens collected from pond 20 that successful reproduction occurred under these conditions. It is also apparent from our study that *Lepomis microlophus* is able to survive several months of continuously elevated salinities, as evidenced by our capture of two individuals in pond 19 following three months of salinities equaling 11-12 ppt.

Our collection of the three species of *Lepomis*, and their absence from Franks'

collections in 1965-1966, suggest four possible hypotheses: 1) *Lepomis* was present on the island during Franks' sampling, but was not collected; 2) *Lepomis* was absent from the island's ponds during Franks' sampling but has since been introduced by humans; 3) *Lepomis* had never been present in Horn Island's ponds prior to and during the time of Franks' sampling and has only recently "naturally" colonized the ponds; and 4) the presence of *Lepomis* on Horn Island is characterized by a repeating sequence of colonization and extinction. *Lepomis* are fairly large in size (and hence are readily noticed), and as evidenced by the results of our rather small-scale collection efforts, are fairly easily captured. As indicated earlier, Franks' sampling of the island's aquatic habitats was very extensive, and we think it highly unlikely that he would fail to obtain even a single

specimen of *Lepomis*, if fishes of this genus had been present on the island. It seems probable, then, that *Lepomis* was absent from the island during his investigation.

It remains a possibility that *Lepomis* populations have been introduced to the island's ponds by humans (perhaps by fishermen). However, the lack of human habitation on the island (with the exception of the rangers of the National Park Service), the control of the island by the Park Service, the relative lack of use of *Lepomis* as a bait fish, and the inaccessibility of the *Lepomis*-containing ponds and their concealment behind dunes argues against this possibility. In addition, the widespread presence of *Lepomis* on the island suggests that this genus has not been placed there by people.

Horn Island has been in existence for approximately 6000 years (Moore 1961). It seems highly improbable that *Lepomis* would be absent from the island for approximately 5975 years (until, at the earliest, 1966) and then suddenly appear within the last 0.4% (in time) of the island's existence. Instead, we suggest that *Lepomis* has colonized, and then been extirpated from Horn Island a number of times over the island's history.

A comparison of salinity data from our study ponds between 1965-1966 (Franks 1970) and the present shows that some of these ponds are markedly fresher than they were at the time of Franks' study. Although Franks reported only one salinity value from pond 20 (our "freshest" pond and the site in which we found all three *Lepomis* species), his salinity measurement of 9.3 ppt is much higher than any of our measurements from this pond (mean salinity = 0.8 ppt and a maximum salinity = 1.6 ppt, Table 1) (see Shabica and Watkins 1982 for the correspondence of CFRL and Franks' numbering systems for Horn Island's

ponds and lagoons). Similarly, he determined salinity on three dates for pond 18, the largest pond on the island, and found values from 7.0-13.3 ppt; we measured salinities of 0.4-3.7 ppt for the same pond in 1989-1990. Cofer-Shabica (1989) stated that all of the island's ponds consist of salt or brackish waters, and that this is related to salt water inflow during storm washover or hurricane events. He stated further that in the absence of oceanic overwash, ponds freshen as rainwater and percolation dilute and remove salts. Franks' investigation of the island's fishes took place from August 1965 to September 1966. Hurricane Betsy struck the Gulf Coast on September 9, 1965; hence the overwhelming majority of Franks' collections were made shortly after the hurricane had impacted Horn Island. Ground and aerial observations made following the incursion of Betsy showed that storm tides had invaded pre-existing bodies of water on Horn Island (Franks 1970). The higher salinity levels he found in ponds 18 and 20 (in comparison to our data) were probably a consequence of saltwater intrusion into the ponds as a result of the hurricane. The overwash of salt water into the "freshwater" ponds during hurricanes such as Betsy, Camille (1969), and Frederic (1979) would likely eliminate any populations of *Lepomis*, and would explain their absence from Horn Island's ponds during Franks' sampling. The saltwater overwash accompanying such huge storms would markedly increase the salinities in comparatively freshwater ponds, and would "reset" the communities of the ponds in favor of those animals more tolerant of salt water.

Since *Lepomis* spp. were present on Horn Island in 1989-1990, and apparently absent in 1965-1966, there must be a means by which they have colonized the ponds over this period. *Lepomis macrochirus*, *L. microlophus*, and *L. punc-*

tatus are common inhabitants of oligohaline (but not mesohaline) habitats of the Gulf Coast, including tributaries of Biloxi Bay, northwest of Horn Island (Peterson and Ross 1991). During spring when riverine input into the Mississippi Sound is high, salinities in Mississippi Sound become as low as 7 ppt (Cofer-Shabica 1989). At times of low salinities *Lepomis* could move from rivers and oligohaline marshes into the sound and enter Horn Island's lagoons. Although the ponds are normally isolated from other bodies of water, perhaps fishes could move from the lagoons into the ponds during periods of abnormally high tides (Franks 1970) or during periods of high rainfall. We suggest that for *Lepomis* this pattern of colonization, followed by elimination caused by saltwater overwash accompanying a hurricane, and then recolonization over non-hurricane intervals as the ponds freshen, periodically recurs on Horn Island.

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LITERATURE CITED

Cofer-Shabica, S.V. 1989. Ponds and lagoons of Gulf Islands National Seashore. Pages 223-237 in Proc. of Sixth Symposium on Coastal and Ocean Management, American Society of Civil Engineers, Charleston, SC.
Douglas, N.H. 1974. Freshwater fishes of Louisiana. Claitor's Publishing Division,

Baton Rouge, LA. 443 pp.
Franks, J.S. 1970. An investigation of the fish population within the inland waters of Horn Island, Mississippi, a barrier island in the northern Gulf of Mexico. Gulf Res. Rep. 3: 3-104.
Moore, D.R. 1961. The marine and brackish water mollusca of the state of Mississippi. Gulf Res. Rep. 1: 1-58.
Moyle, P.B. and J.J. Cech, Jr. 1988. Fishes, an introduction to ichthyology. 2nd ed. Prentice Hall, Englewood Cliffs, NJ. 559 pp.
Peterson, M.S. 1988. Comparative physiological ecology of centrarchids in hyposaline environments. Can. J. Fish. Aquat. Sci. 45: 827-833.
_____, and S.T. Ross. 1991. Dynamics of littoral fishes and decapods along a coastal river-estuarine gradient. Estuarine Coastal Shelf Sci. 33: 467-483.
Richmond, E. A. 1962. The fauna and flora of Horn Island, Mississippi. Gulf. Res. Rep. 1: 59-106.
_____. 1968. A supplement to the fauna and flora of Horn Island, Mississippi. Gulf Res. Rep. 2: 213-254.
Shabica, S. V. and J. Watkins. 1982. The ponds and lagoons of Horn and Petit Bois Islands, Mississippi, Gulf Islands National Seashore: their physical size, literature review and recommendations for future research. Research/Resources Management Rep. SER-60. National Park Service Southeast Regional Office, Atlanta, Georgia. 29 pp.
Smith-Vaniz, W.F. 1968. Freshwater fishes of Alabama. Paragon Press, Montgomery, AL. 211 pp.

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