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Foods of Juvenile Spotted Seatrout in Seagrasses at Seahorse Key, Florida

WILLIAM T. MASON, JR., AND SCOTT A. ZENGEL

Early juvenile [<1 yr; 10-100 mm total length (TL)] spotted seatrout in the shallow seagrasses at Seahorse Key, Florida, in the Northeast Gulf of Mexico, fed on 12 kinds of foods. Although the total diversity of major food items of juvenile seatrout is about the same as 50 years ago, for some unexplained reasons, the juvenile diets have apparently switched to other invertebrate species and to small fish. The 10-30 mm TL seatrout ate small Crustacea, e.g., amphipods and grass shrimps, and fed mostly in the Halodule seagrass zone (average depth 0.5 m). In addition to these species, the 50-80 mm TL seatrout, feeding primarily in the Halodule and Thalassia (average depth 0.8 m) zones, consumed copepods, a combination of decapod shrimps (Mysidopsis bahia, Palaemonetes pugio, P. vulgaris, Periclimenes longicaudatus, Penaeus duorarum), and small fish. Seatrout of 80-100 mm TL appeared to feed only in *Thalassia*, and larger juveniles (not collected) probably fed in the mixed-grass zone beyond our study area (>1 m depth). Seatrout food resources at the Keys were robust. Peak densities and diversities of hyperbenthic invertebrates in the seagrasses were inversely proportional (maximum average number of individuals = 12,000/sled trawl, Sep.; maximum average number of taxa = 35 spp., March).

The spotted seatrout Cynoscion nebulosus: Sciaenidae (Cuvier) remains one of the prime fish of commercial and recreational importance in the Northeast Gulf of Mexico. During the 1940s and the 1950s, this seatrout was second only to the mullet in pounds of harvest at the Cedar Keys, Florida (Reid, 1954). Although many factors contribute to a successful seatrout population, the presence of littoral submerged aquatic vegetation (SAV) is a major one (Moody, 1950; Reid, 1954; Joseph and Yerger, 1956; Klima and Tabb, 1959; Carr and Adams, 1973; Moffett, 1961; Tabb, 1961; Mc-Michael and Peters, 1989). Seagrass meadows provide natural spawning ground for adult seatrout, protection and living space for the young, and unpolluted, warm-water estuaries of the southeastern United States usually contain an abundance of benthic foods.

Juvenile seatrout feeding is highly influenced by major habitat differences, especially in the transitional ecotone between SAV and open water (Lorio and Schafer, 1966; Minello and Zimmerman, 1984; Ruiz et al., 1993). Microscale habitat changes in seagrass meadows are known to greatly affect the composition and distribution of hyperbenthic organisms (Stoner, 1980a, 1980b, 1983; Lewis, 1984; Schneider and Mann, 1991), and, in extreme cases, changes undoubtedly affect seatrout feeding.

In coastal areas with limited SAV or denuded bottom substrates, seatrout depend on margin-

al emergent vegetation for feeding and nursery habitat (Peterson, 1986; Baltz et al., 1993; Ruiz et al., 1993). The coastal shelf in the vicinity of the Cedar Keys, Florida, is extensive and the slope from shore is quite gradual. Luxuriant stands of three dominant species of shallow-water SAV are present. Thus, the spotted seatrout and other finfish populations at the Keys have benefited from a stable, productive habitat for life activities.

Adult spotted seatrout are present in the seagrass meadows at the Keys from late March to Oct., preferentially at depths of 1–2 fathoms. Spawning begins as early as April and lasts through Oct. (Moody, 1950; Reid, 1954). Juveniles occupy the most shallow beds (Moody, 1950) and feed almost exclusively on shrimps and marine fish. They mostly eat small, freeliving crustaceans found in the "hyperbenthos," or those organisms that dwell above the bottom substrate and are closely associated with submerged objects in the water column (Mees and Hamerlynck, 1992; Mason et al., 1994).

Our purposes were to determine the diet of early juvenile (<100 mm TL) spotted seatrout at Seahorse Key, Florida, and to compare our results, if possible, with those of Moody (1950) and Reid (1954). Thirdly, we wanted to determine the status (distribution, abundance, and composition) and health of the seatrout's food resources.



Fig. 1. Map of the Cedar Keys, Florida.

MATERIALS AND METHODS

Study Area.—The five islands composing the Cedar Keys (Fig. 1) are just south of the "Big Bend" area in the northeast Gulf of Mexico and in the path of the Gulf stream's southward

TABLE 1. Habitat characteristics in three habitat zones at Seahorse Key, Florida, Sep. 1992–Sep. 1993. Averages of physicochemical measurements (ranges in parentheses) taken at midpoint of study area: transect 16, *Halodule*.

	Bore cand	Seagras	s zones
	zone	Halodule	Thalassia
Depth (m)	0.4	0.5	0.7
Seaward distance (max. m)	7	28	63–107
Bottom slope (m)	0.021	0.005	0.003
Temperature (C)		21	
Salinity (ppt)	36 max.	(11-31) 25 (17-28)	
Dissolved oxygen (mg/liter)		7.5	

ally clear, except after local storms, and are well mixed by the winds and tides.
Seahorse Key is part of the U.S. Fish and Wildlife Service's Cedar Keys National Wildlife Refuge. A brown pelican rookery is part of the wildlife management area, and part of the University of Florida's estuarine research is conducted from a renovated lighthouse.

The study site lies along the southwestern beach and is bounded to the north by a high embankment, to the northwest by stands of *Spartina* and *Typha*, and to the southeast by palmetto-scrub (island's primary vegetative cover). The narrow beach (25–30 m wide) is windswept and bare and gradually slopes onto the coastal shelf (Table 1). A broad seagrass meadow, extending 1.5 km from shore, stabilizes the sand bottom substrate (average depth <1 m). Three habitat zones proceed from the shoreline: 25–50-m-wide bare sand (average depth 0.3 m); 25–50-m-wide shoal grass *Halodule*

flow. Seahorse Key is a crescent-shaped, outermost island that lies about 5 km offshore and

about 10 km south of the mouth of the Suwan-

nee River. The waters at Seahorse Key are usu-

wrightii (average depth 0.5 m); and a 75-400m-wide band of turtle grass *Thalassia testudinum* (average depth 0.8 m). The mixed stand of *Thalassia* and *Syringodium filiforme*, extending beyond 400 m from shore (>1 m depth), was not included in our study.

Climatic conditions were normal during the study, except for a localized torrential storm during the week preceding the March 1993 collections. Prior to sampling, however, conditions returned to near normal.

Physicochemical methods.—The waters at the site were well mixed and little variation among the seagrass zones was encountered. Measurements of water temperature, salinity, pH, and dissolved oxygen (DO) were taken monthly in the *Halodule* zone (representative zone). Nightly conditions were recorded only during the March, May, Aug., and Sep. invertebrate collections.

Seatrout and food collections.—A quad-grid sampling design was selected for the study. It was formed by 32 transects, perpendicular to shore and 30 m apart, each bisecting the three habitat zones. Due to relatively uniform bottom substrate type (coarse sand) and contours, the quads within each major habitat zone were spatially and volumetrically about equal. Junctures at each habitat zone were delineated by PVC rods (2.54 cm diameter) driven into the substrate. Floats, attached to the tips of rods, marked the junctures at high tide and facilitated their recognition during night sampling.

Attempts to collect spotted seatrout and other finfish (Zengel 1993) were made monthly (June 1992 to Oct. 1993) with a 15-m-wide pole seine (3-mm mesh nylon bag and 3-m-long wing panels of 6-mm mesh). Seining was conducted parallel to shore for 20 m. Fish catches were rough sorted in the field and later identified and enumerated in the laboratory.

Sampling for invertebrate foods of the seatrout was conducted from Sep. 1992 through Sep. 1993 at randomly selected points within each of the habitat zones: two quads each for the bare sand zone and *Halodule* zone, and four quads for the *Thalassia* zone (total = 8 samples/mo). To check on diel periodicities of the hyperbenthos, day sampling (0900–1300 h) and night sampling (2000–0100 h) were taken within the same 24-h period; March, May, July, and Sep. 1993 only.

Seatrout stomach content analysis.—to avoid possible contamination of stomach contents with other fish tissues, the entire belly of the fish (anus to opercle) was cut from the body and placed in a petri dish filled with 95% ethanol preservative. The alimentary canal was then removed intact and placed in a watch glass, and the stomach was dissected away from the canal. After the stomach was opened, materials were flushed from the lining and food items were identified and tallied.

Heads of partially digested foods were counted as whole organisms. Dry weights (103 C; 4 h) and ash-free dry weights (500 C; 1 h) of total food materials in the stomachs were recorded on electronic balance (nearest 0.01 mg). Biomass estimates for highly fragmented stomach contents (e.g., parts of amphipods and remains of shrimps) were based on average weights (2–4 replicate samples of six whole specimens each) of representative life-stage specimens of the species (W. T. Mason, 1989–1993, unpubl. data).

Plankton analysis of stomach contents was performed by randomly withdrawing 10-ml subsamples of intestinal fluids (four reps/ stomach). Dense materials in the extracts were concentrated by centrifugation (140 \times g; 3) min) and then the top 8 ml of supernatant was withdrawn by pipette and discarded. The remaining centrifugate was remixed and 1 ml was placed in a Sedgwick-Rafter counting cell and scanned (3 strip counts at $\times 200$ magnification). In addition, a 0.5-ml aliquot of the remix was permanently slide-mounted in CMC-10 medium (Mention of manufacturers and their products does not necessarily constitute endorsement by the U.S. Department of the Interior or of the authors and their firms.) and 10 random field counts were examined $(\times 400 \text{ magnification}).$

Invertebrate sample collection and analysis.—Pullen et al.'s (1968) "marsh net," referred to as "sled trawl," was used to collect the hyperbenthic foods of the seatrout. The trawl (weight 5 kg), made of two heavy-guage stainless steel runners (5-cm wide) held apart by steel rods (collection aperture 18 high \times 53 cm wide), is fitted with a 1-m-long drift net (450-µm pore mesh).

To minimize organism avoidance during the collection process, the boat motor (and auxiliary lights at night) was turned off during approach to the sampling point, so that the boat drifted into position. First the trawl was placed gently on the seagrass bed and its tether was played out as the boat was poled in an arc to a point 14 m away and parallel to shore. After the boat was staked into place, the trawl was winched in at a rate of 0.3 mps. Inside the

rose bengal stain preservative (Mason and Yevich, 1967) provided by a pressurized sprayer (4-liter cap.). As most trawl samples netted about 500 cc of sample that contained hundreds to thousands of organisms, those samples containing >200 organisms were halved using the sieve sample splitter (Mason, 1991a).

boat, the sample collection bag was inverted and its contents were emptied into a shallow

tub partially filled with water. Materials were

thoroughly flushed from the bag. Easily recognizable large organisms (e.g., adult tuni-

cates, mussels, and crabs) were immediately

counted and replaced in the water. Remaining

small clinging organisms that required identi-

Although use of the trawl removed some epibenthos on sand windrows, overall the device was gentle on the bottom substrate and left it relatively undisturbed after sampling. Blades of the seagrasses flexed as the trawl slid over. A performance trial for the sled trawl in *Halodule*, conducted in August 1992 prior to initiation of benthic sampling, yielded an SEM for individuals and taxa of about 40% each, which is acceptable for semiquantitative benthological sampling (Elliott, 1993).

Data interpretive methods.—General descriptive statistics (Zar, 1984) (e.g., Student's t-test) were applied to the data through computer software (Hintze, 1987). The total diversity of the trawlcaptured macrofauna was determined as a bioindicator of community health as was d, the community diversity index (Zar, 1984). The latter index is Florida's only legal measure of "biological balance" for class I-III surface waters [Florida Surface Water Quality Standards, 1992; Sec. 17-302.540(8), 550(7), and 560(9)]. It is calculated based on the total number of individuals and the number of invertebrates in the *i*th species occupying a U.S. EPA standard hardboard multiplate sampler after incubation for 30 consecutive days. Although the error for d is known to be high in samples containing <200 individuals (Zar, 1984), our sled trawl samples, usually >500 individuals/trawl, likely minimized the error.

Sled trawl sampling highly favors capture of organisms in the hyperbenthos and some epibenthos (surface-dwelling organisms). Sled trawls collect little of the embenthos (partially buried organisms) and hardly any hypobenthos (tunneling organisms living well below the substrate). Thus, we did not feel justified in expressing our sled trawl data in traditional benthological sampling units for epibenthos and embenthos $(no./m^2)$, or in volumetric units $(no./m^3)$ for pelagic and drift organisms. Instead, we used counts per trawl (sample). Enumeration of organisms on a "per-sampler basis" has precedence in other kinds of benthological sampling, e.g., of artificial substrates as conducted in the nearby Suwannee River (Mason, 1991b; Mason et al., 1994).

Experience shows that, excluding large-bodied individuals, benthic bioassessments using individual counts of organisms/taxon produce similar results to those using individual weights (biomass). Individual tallies have a distinct advantage over weight measurements, especially when small organisms are encountered (such as amphipods and highly fragmented organisms), and permit comparisons of species-specific food preferences of fish and other wildlife, e.g., as used for waterfowl by Johnson (1980). Nonetheless, counts of small food organisms (e.g., amphipods) may distort their importance among other food items. For example, it requires 5-10 mysid shrimps, 2-4 Palaemonetes shrimps, and just 1-2 Penaeus shrimp to fill the stomach of a 60-mm-TL juvenile seatrout. Therefore, we elected to determine both individual counts and biomass, but relied mostly on individual counts for reporting results in figures and text.

RESULTS

Physicochemical conditions.—Annual average daytime water temperature in Halodule was 21 C (range 11 to 31 C), and was stable at 25 C. A synoptic survey of water temperatures in the habitat zones in Sep. 1992 revealed a day temperature of 36 C (0.1-m depth) in the shoreline bare sand zone. The lowest salinity measurement (17 ppt) occurred in winter and maximum salinity was during late summer (Table 1). Salinity during May-Sep. averaged 25-26 ppt. Values for pH were uniform at 8 standard units (SU). DO concentrations averaged 7.5 mg/liter (Table 1) and ranged narrowly between 7-8 mg/liter. DO concentrations for each quarterly night sampling revealed little variation within the habitat zones or by water depth.

Juvenile seatrout diet.—Of the 62 juvenile seatrout <100 mm TL in 1992–93 (Table 2), 95% of the stomachs contained foods. During the year, the juveniles consumed 12 major foods in the seagrasses at Seahorse Key (Table 3) averaging 1.4 food items/stomach. On average combined, the seatrout ate 28 food items in *Halodule* and 66 food items in the *Thalassia*.

TABLE 2. Number of spotted seatrout collected for stomach content analysis in two seagrass zones at Seahorse Key, Florida, 1992–93 (none collected in the bare sand zone).

	E	lalodule zone	T	halassia zone
	n	Average TL mm (range)	n	Average TL mm (range)
June 1992	4	49 (33–55)	0	
July 1992	1	63	0	
Aug. 1992	7	37 (16-61)	8	55 (30-86)
Sep. 1992	10	41 (32–56)	4	75 (44–92)
June 1993	1	32	0	
July 1993	0		2	36 (22-49)
Aug. 1993	4	45 (38-51)	2	36 (18-53)
Sep. 1993	7	60 (49–72)	12	41 (25–71)
Total	34	46 (16-61)	28	49 (18–92)

For both SAV zones combined, the primary foods of juveniles were; Copepoda (28%), *P.* duorarum (22%), *H. pleuracanthus* (16%), *Pa*laemonetes (2 spp.) (10%), free-living Amphipoda (9%), Osteichthyes (7%), *M. bahia* (5%), and Periclimenes longicaudatus (3%).

Average gut fullness for the 62 fish was estimated at 68%. Examination of stomach fluids of the seatrout revealed only an occasional diatom that could have been inadvertently ingested or secondarily ingested as part of the foods consumed by the invertebrate prey. All five of the 20–30-mm-TL seatrout and two of the four 50–60-mm-TL seatrout in *Thalassia* had consumed copepods (Table 3). Invertebrate food densities.—The abundance of hyperbenthic food resources in the seagrass meadows was greatest in May–June and Aug.–Dec. (Figs. 3 and 4a) and closely mirrored the densities of the most abundant crustacean at the site, the caridean shrimp *H. pleuracanthus* (Fig. 4b). It alone averaged 84% of the individuals/trawl, or 77% dry weight/trawl.

93

Decapods exhibited two density peaks; a minor one in April-June and a major one in Aug.-Sep. (Table 4 and Fig. 4a). Other abundant crustaceans were (in descending order); decapod *Tozeuma carolinense*, cumacean Oxyurostylis smithi and Almyracuma sp. A (Heard 1982), decapods Palaemonetes pugio and pink shrimp Penaeus duorarum, and the tanaid isopod Hargeria rapax. Amphipods were most abundant in Jan.-March, decapods were most abundant in April-Dec., and mysids were most abundant in Jan. only (Fig. 4a).

The diversities and densities of invertebrates were inversely proportional. Generally, lowest densities occurred in winter when diversities peaked, and greatest densities in late summerfall were marked by low diversities (Table 4 and Figs. 3, 4a–b).

We found that invertebrate densities between the two adjacent seagrass zones varied considerably. For example (Fig. 3), the average density in Sep. 1992 *Halodule* was twice as great as in *Thalassia*, but the Sep. 1993 densities in both seagrass zones were about equal.

A single trawl collected in *Halodule* during Sep. 1992 contained about 14,000 individuals.

TABLE 3. Average number of food items in stomachs of juvenile spotted seatrout in seagrasses at Seahorse Key, Florida, Aug. 1992–Sep. 1993. Co = Copepoda; Amphipoda-Amphithoidae, Cc = Cymadusa compta, Cr = Corophiidae, Gm = Gammaridae spp., Mn = Monoculodes n. sp.; Tanaidacea, Hr = Hargerian rapax; Decapoda, Hp = Hippolyte pleuracanthus, Mb = Mysidopsis bahia, Pd = Penaeus duorarum, Pl = Periclimenes longicaudatus, Pp = Palaemonetes pugio, and Os = Osteichthyes. * = Actual numbers/stomach.

					Ha	lodule	zone	:								The	ulassie	zone	:			
TL (mm)	Sea- trout (n)	Hr	Сс	Cr	Gm	Mn	Нр	Mb	Pd	Pl	Рр	Os	Sea- trout (n)	Со	Cc	Gm	Нр	МЬ	Pd	Pl	Рр	Os
10-20	2								1				1*			1						
20-30	1*	1		1	1		1						5	25		1	1		1			1
30-40	5						1	1		1	1	1	5		1			1				• 1
40-50	11						1	1	1	1	2	1	5			1	1				2	
50-60	10		1		1	1	1		1		1	1	4	1			1	1	1	1	1	1
60-70	4						2		2		1		2				1		1			1
70-80	1^{*}						1						3				4		1			
80-90	0												2								2	
90-100	0												1*					1	10		1	
Totals																						
Fish	34												28									
Food items		1	1	1	2	1	7	2	5	2	5	3		26	1	3	8	3	14	1	6	4

TABLE 4. Monthly average total number of individuals and percent of primary (i.e., >10% of total individuals) hyperbenthic invertebrates/trawl in day (D) and night (N) collections from combined zones; bare sand, shoal grass *Halodule wrightii*, and turtle grass *Thalassia testudinum*, Sep. 1992–Sep. 1993, Seahorse Key, Florida.

	Year: Month:	1992 Sep.	Oct.	Nov.	Dec.	1993 Jan.	Feb.	March	April	May	June	July	Aug.	Sep.
		•			Av	verage tota	l individua	ls/trawl	1	,			0	
	D	4,860	3,498	2,436	3,099	1,251	1,293	1,190	1,318	3,796	3,871	1,428	5,752	6,311
	Ν							1,146		4,469		1,958		5,052
					A	Average %	individuals	/trawl						
Taxa														
Crustacea														
Amphipoda	D				14	45	30	21	13	12				
	Ν							28		16		18		
Decapoda	D	94	92	60	64	10	16	14	51	53	74	23	92	94
	N							32		66		33		81
Mysidacea	D					11								
	Ν													
Mollusca														
Bivalvia	D											13		
	Ν													
Gastropoda	D			26	12	32	29	37	20	24	20	42		
1	Ν							18		11		37		13

This peak was confirmed by 12,000 individuals/trawl in fall 1993. The cyclic abundance of dominant decapod crustaceans paralleled the growth of seagrasses from spring through fall. Lowest densities coincided with winter low water temperature (minimum 11 C) and salinity (minimum 17 ppt) and natural seagrass dieback and reduced habitat.

Invertebrate food diversities.—The total inventory of 198 hyperbenthic invertebrate taxa at Seahorse Key (Table 5) was split almost evenly among Arthropoda, Mollusca, and Annelida. Seasonal diversity became evident (Fig. 2) from fall (about 13–17 taxa) to the March night collections (37 taxa) (Fig. 5). Thereafter, the diversity gradually tailed off during summer and early fall.

Values of d ranged from 1 to 2.5 in summer and fall, and from 3 to 4 in winter and early spring. These d values are comparable to those for the macrobenthos of lower Suwannee River and Estuary system, Florida, collected during the previous 5 yr (Mason, 1991b; Mason et al., 1994). Values of d for the seagrass hyperbenthic community (Figs. 3 and 4b) reflected the increase in diversity during winter and peak in number of individuals in fall (Jan., 5.37; Sep., 0.92).

Diel food patterns.—The differences between day and night densities and diversities of hyperbenthos in each habitat zone for each of the four quarterly collections were minor (Fig. 5a–b and Table 4). However, seasonal differences were obvious. For example, the combined day and night March diversities (average total taxa–day = 30; average total taxa–night = 38) were about 26% greater than for May (not significantly different $P \le 0.05$) and May densities were significantly greater than for March (t = 4.5, 14 df).

DISCUSSION

Fish-food habit studies are difficult because of the variables encountered for fish, e.g., seasonal migrations and competition with other species for habitat and foods, and, on the food side, cyclic periods of food abundance and local environmental and habitat conditions. For both, sampling biases are major problems. Thus, most fish-food habit studies, although well designed, are seldom quantitative. We encountered most of these problems. However, our study provides a good basis for comparison with the food habits of juvenile spotted seatrout at the Keys 50 yr ago. Food resources.—The gradual decline in total density of hyperbenthic invertebrates in *Halodule* traced from May to Aug. 1993 (Fig. 3) was primarily due to fewer *H. pleuracanthus*. This reduction might reflect predation on the food stock by juvenile finfish, including the spotted seatrout, and large epibenthic decapod crustaceans, e.g., the blue crab *Callinectes sapidus* (Fig. 4a), then in the beds. Heavy foraging by blue crab on the benthos in the denuded intertidal zone of the Chesapeake Bay, Maryland, was also recorded by Ruiz et al. (1993).

The diversity of hyperbenthic invertebrates (taxonomic richness) is considered one of the best measures of "biological balance." Our findings show a highly diverse and, therefore, healthy hyperbenthic community (Table 5). Usually in freshwaters, d values of <1 reflect an "unbalanced" situation, i.e., few taxa, but each taxon represented by a large population. Values of 1-3 are indicative of normal communities, and d values of >4 are seldom encountered in natural situations. Based on our survey where d values ranged from 3.75 to 5 from Jan. through July (Fig. 2), Florida's biological classification of surface waters needs modification for use in estuarine waters. The "clean water" indicator level may need elevation and the "polluted water" category may need to be lowered.

During Jan.-March, free-swimming amphipods Cymadusa compta and Gammarus spp., adapted for solitary life in the water column, were numerically dominant crustaceans. Conversely, densities of epibenthic Corophiidae amphipods, dense at the mouth of the Suwannee River (Mason, 1991b), contributed <10% to densities in the Seahorse Key trawls. Corophiids depend on detrital materials for tubemaking and some protection from strong tidal currents and shifting sediments, contrary to site conditions.

Densities of mysid populations were relatively even compared to other crustacean groups during the winter and early spring cool-water, low-salinity, and reduced-seagrass habitat. These small crustaceans, intermediate in size between the amphipods and decapods, occupied 11% of the average total densities in Jan. (Table 4). Thereafter, mysid densities declined to <10% of the average total of hyperbenthos and did not recover until Nov.–Dec. (Fig. 4a). Mysid seasonal abundance at Seahorse Key was thus similar to some species of estuarine zooplankton and amphipods.

In other northeastern Gulf estuaries, such as the Apalachicola River Estuary (Livingston, 1976) and Apalachee Bay, Florida (Ryan,

Gulf of Mexico Science, Vol. 14 [1996], No. 2, Art. 5 GULF OF MEXICO SCIENCE, 1996, VOL. 14(2)

TABLE 5.	Benthic invertebrates and	allied macrofauna	in seagrass	meadows o	during Sep.	1992–Sep.	1993 at
		Seahorse Key	y, Florida.				

Taxa	Таха
Surface-	dwelling fauna
Cnidaria—Coelenterates Siphonophora—Portuguese man-of-war Physaliidae <i>Physalia physalia</i> (Linnaeus)	Scyphozoa—Scyphozoans Rhizostomeae—jellyfishes Stomolophidae—cannonball jellyfish Stomolophus meleagris L. Agassiz
Нур	erbenthos
Arthropoda Crustacea Amphipoda—free-living amphipods Ampelscidae Ampleisca vadorum Mills A. verrilli Mills Ampithoidae Ampithoe longiamanna Smith Cymadusa compta (Smith) Aoridae Grandidierella bonnieroides Myers Unicola dissimilis Shoemaker Dexaminidae Polycheria Gammaridae Gammaridae Gammarus mucronatus Say G. nr. tigrinus Haustoriidae Parahaustorius cf. longimerus Bousfield Hyalidae Hyale plumosa (Stimpson)? Lynassidae Unidentified 2 spp. Melitidae Melita nitida Smith Oedicerotidae Monoculodes nyeri Schoemaker M. n. sp.	Penaeidae—penaeid shrimps Penaeus duorarum Burkenroad—pink shrimp P. setiferus (Linnaeus)—white shrimp Sergestidae Acetes americanus carolinae Hansen Pleocyemata: Caridea—caridean shrimps Alpheidae—snapping shrimps Alpheidae—snapping shrimps Alpheus heterochaelis Say Hippolytidae—grass shrimps Hippolyte pleuracanthus (Stimpson) Latreutes fucorum (Fabricius) L. parvulus (Stimpson) Thor dobkini Chace Tozeuma caroliense Kingsley Palaemonidae—prawns, grass shrimps Palaemonidae—prawns, grass shrimps Palaemon floridanus Chace Palaemonetes vulgaris Say P. paludosus (Gibbes) Periclimenes iridescens Lebour P. longicaudatus (Stimpson) Processidae—deep water shrimps Ambidester symmetricus Manning and Chace Pleocyemata: Brachyura Portunidae—swimming crabs Callinectes sapidus Rathbun—blue crab Portunus sp. Weber Mysidacea Mysidae—mysid shrimps Mysidae—mysid shrimps
Decapoda—decapods, shrimps, shellfish Dendrobranchiata	Mysidopsis almyra Bowman M. bahia Molenock Taphromysis bowmani Bacescu T. louisianae Banner
Epibenth	nos—Section I
Porifera—sponges Demospongiae	Eudistoma hepaticum E. carolinense van Name
Calcarea—purse sponges Tunicata (=Urochordata)—tunicates Didemnidae	Nemertea—nemerteans <i>Prostoma</i> Duges Mollusca
Didemnum duplicatum F. Minniot Perophoridae Ecteinascidia turbanata Herdman Polyclinidae Aplidium constellatum Verrill Polycitoridae Clavelina Distaplia bermudensis van Name	Bivalvia—mussels and oysters (part) Dreissenidae <i>Ischadium recurvum</i> (Rafinesque) <i>Parastarte triquetra</i> Conrad Ostreidae <i>Crassostrea virginica</i> (Gmelin)—eastern oyster

TABLE 5. Continued.

Epibenthos—Section IIEchinodermataLittorinidac—periviniklesHolothuroidea—sea cucumbersLittorini irrorata (Say)Lepiosynappa parvipatinaLittorini arrorata (Say)Sclendadyla brainesLittorini arrorata (Say)Stelleroidea—starfishesMarginellidaeOphiacidaeOphiacidaeOphiacidaeOphiacidaeOphiacidaeMarginellidaeOphiacidaeMarginellidaeAmphiophus abditusMarginellidaeA. hurombidesMoluscaOphiothrix angulata (Say)Modulidae—button snailsOhiothrix angulata (Say)Nasteriidae—mushasis, nasasActeon idaeNasseriidae—mushasis, nasasCaccidaeConcurritatus (C. B. Adams)Arteon punctostriatus (C. B. Adams)Naticidae—mushasis, nasasAdtidaeSeplonarialeCaccidaeContikaeCarcidaeContikaeCarcidaeContikaeCarcidaeContaidaeCarcidaeContaidaeCarcidaeContaidaeCarcidaeContaidaeCarcidaeContaidaeMardiala kanata Brugatum (Say)Sultentae (Say)CarcidadaeContaidaeMardiala kanata (Say)Sultana sultaa (Corrigon)CarcidaeContaidaeCarcidaeContaidaeCarcidaeContaidaeCarcidaeContaidaeCarcidaeContaidaeMarceonidaeContaidaeCarcidaeContaidaeMarceonidaeContaidaeCarcidaeC	Taxa	Taxa
Echinodermata Holohuroidea—sea cuumbers Liptopagpa paruipatina Selenoidea—starfishes Ophiadis rubmpoda Singletary Ophiadis rubmpoda Singletary Amphiuridae A. hrubholdes Ophiotrix angulata (Say) Mollusca Castropoda—snails Acteonidae A. travibides Castropoda—snails Acteonidae A. travibides Castropoda—snails Adteon punctostriatus (C. B. Adams) Acteonidae Castropoda—snails Adteon punctostriatus (C. B. Adams) Acteonidae Castropoda—snails Adteon punctostriatus (C. B. Adams) Acteonidae Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Castropoda Conthidae Carithiapsis geni (C. B. Adams) Contaile (Say) Conitae Carithiapsis geni (C. B. Adams) Contailidae Compliand abott Mirela lunata (Say) Conitae Castropoda Contailidae—tube-twelling subles Faciolari fordana (Pheiffer) Epitoniidae—tube-twelling subles Faciolari fordam (Pheiffer) Epitoniidae—tube-twelling subles Faciolari fordam (Pheiffer) Epitoniidae—tube-twelling subles Litorinicae—tube-twelling amphipods Compliande—tube-twelling subles Faciolari fordam fordam Caropola =sopods, qau	Epibent	hos—Section II
Holothuroidea—sea cucumbers Litarina irrarata (Say) Leptosynapsa paroipatina Marginellidae Stelleroidea—starfishes Granulina avuilgranis (C)Orbigny) Ophiactidae Marginellidae Ophiactidae Marginellidae Ophiactidae Marginellidae Ophiactidae Marginellidae Ophiactidae Marginellidae Amphiophus additus Marginellidae A. puchella Marginellidae Antombiodes Modulicae—outon snails Ophintrix angulata (Say) Motalus modulus (Canu).—fig whelk A. thrombiodes Modulidae—outons nails Ophiotrix angulata (Say) Naticidae—moonsnails Acteonidae Naritidae—olive snails Caccua puckellum Stimpson Olivedla mutica (Say) Columbellidae Syelfa hemphiliti (Dall) Contidae Carithiua musarum Say Contidae Carithua musarum Say Contidae Carithua musarum Say Contidae Carithua musarum Say Contidae Carithua mutica (Say) Contidae Carithua mutica (Say) Contidae Carithua mutica (Say) <tr< td=""><td>Echinodermata</td><td>Littorinidae—periwinkles</td></tr<>	Echinodermata	Littorinidae—periwinkles
Leptosynchya horvipadina Sckerodastyla brairens Stelleroidea—starfishes Ophiacidae—starfishes Ophiacidae—starfishes Ophiacidae—starfishes Ophiacidae—starfishes Ophiacidae—starfishes Ophiacidae—starfishes Ophiacidae—starfishes Ophiacidae—starfishes Ophiacidae—starfishes Ophiacidae—starfishes Ophiacidae—starfishes Anphipus addutus A. hurdhella A. hurdhella A. hurdhella A. hurdhella Satteonidae A. thormikotes Ophiadrix angulata (Say) Mollusca Castropoda—snails Acteonidae A. thormikotes Ophiadrix angulata (Say) Mollusca Castropoda—snails Acteonidae Acteonidae Acteonidae Acteonidae Acteonidae Castropoda—snails Acteonidae Acteonidae Castropoda—snails Acteonidae Castropoda—snails Castropoda—snails Castropoda—snails Castropoda—snails Atyidae Hamineeu succinea (Conrad) Bullidae Bullidae Caciciae Caecidae Caecidae Caecidae Caecidae Columbellidae Columbellidae Columbellidae Condiae Corphidul auaatolsos Conrad Ellobiidae Derienda foridana (Pheiffer) Epitoniidae—thortex Say Fasciolariidae—thortex Say Arthropoda Arthorpoda Arthorpoda Anphipoda—amphipods, scuds Corophine -cl. insidiosum Crawford Corphidue audusa boliphemus Linnaeus Corophine -cl. insidiosum Crawford Corapus cf. thuberukturis Say Anphipoda—amphipods, scuds Corophine -cl. insidiosum Crawford Corphine -cl. insidiosum Crawford Corapus cf. thuberukturis Say Satterata (Say) Arthropoda Anphipoda—amphipods, scuds Corophine -cl. insidiosum Crawford C. cf. Intervitae—thoreshoe crabs Linnalus polyphemus Linnaeus Corophine -cl. insidiosum Crawford Corphidue—thoreshoe maker Corophisen cf. insidiosum Crawford Corophisen cf. insidiosum Crawford Corapus cf. thuberukturi bolim Stimpson Carabus cf. thubraitas Say Eliotonis basiliensis Jasa foleata Smith Nadacostraca Anphipoda—amphipods, scuds Corophism cf. insidiosum Crawford Corapus cf. thubraita basiliensis Jasa foleata Smith Nadacostraca Anphipoda—amphipods, scuds Corophism cf. insidiosum Crawford Corapus cf. thubraita basiliensis Jasa foleata Smith	Holothuroidea—sea cucumbers	Littorina irrorata (Say)
Sdemolasiyla havitanis Gamutina avuliformis (d'Orbigny) Stelleroidea—starfishes Hjafina valii (Donovan) Ophiactidae Marginella apicina Menke Ophiattidae Marginella apicina Menke Ophiattidae Minuellea apicina Menke Ophiattidae Marginella apicina Menke Amphioplus adultus Haminea valiformis (d'Orbigny) Amphioplus adultus Marginella apicina Menke Amphioplus adultus Haminea valiformis (d'Orbigny) Antrombiodes Marginella apicina Menke Ophiattris angulata (Say) Moluusca Gastropoda—snails Mossariitae —mudsmails, nassas Acteonidae Nassariitae (Say) Acteon punctostriatus (C. B. Adams) Nuiticiae—monsnails Andris angulata (Say) Nuiticiae Bullidae Olivide—olive snails Ocrithidae Orbinomuscarum Say Coritidae Coradiae Coritidae Coradiae Anachris semiplicata Abbott Siphonariidae—auger snails (part) Margina bulli Turbiaca-uuteran snails Coritidae Coraduus polyphenus Limaeus Coritidae Coraduus apulsterius Coritidae Coraduus aroineasi Bush Anachris semiplicata Abbott Mangelia biconica C. B. Adams Coritidae </td <td>Leptosynapya parvipatina</td> <td>Marginellidae</td>	Leptosynapya parvipatina	Marginellidae
Stelleroideastarfishes Hydina velici (Donovan) Ophiacidae Marginella apicina Menke Ophiacidis rebrohoda Singletary Marginella apicina Menke Ophiacitis rebrohoda Singletary Melongenidaeconchs, whelks Amphiophas abditus Buildeana Orbigary A. hurdhella Melongenidaeconchs, whelks A. pulchella Buildeana Orbigary A. thrombiodes Melongenidaeconchs, whelks Ophiacitar ubrohodus Marginella apicina Menke Ophiacitar ubrohodus Melongenidaeconchs, whelks A. pulchella Melongenidaeconchs, whelks A. thrombiodes Melongenidaebutton strails, nassas Castropodasnails Nassartidaemudsnails, nassas Acteonidae Nassartidaemornalis Hamineea sucinea (Conrad) Oliviedaeolive snails Bullidae Orbidue strintae Bruguiere Caecidae Neritidaeorive snails Carithiopisi greeni (C. B. Adams) Neritidaeorive snails Ochumbellidae Sayella hemphiliti (Dall) Carithiopisi greeni (C. B. Adams) Siphonarialeafase sulcata (Orbigny) Coritidae Corrad Carithiopisi greeni (C. B. Adams) Siphonarialeagauger snails (part) Mittella tunata (Say) Salternata (Say) Conidae Anachnoidea	Sclerodastyla brairens	Granulina ovuliformis (d'Orbigny)
OphiartidaeMarginella apicina MenkeOphiartis rubropoda SingletaryM. lavalteeana OrbignyOphiartis rubropoda SingletaryM. lavalteeana OrbignyAmphinuridaeM. lavalteeana OrbignyAmphinuridaeM. lavalteeana OrbignyAmphinoidisBusyoon sp. Roding—whelkA. pudchellaB. spiratum (Lam.)—fig whelkA. thrombiodesModulidae—button snailsOphiartisri angulata (Say)Modulidae—mudsnails, nassasActeon junctostriatus (C. B. Adams)Nassaritae albus (Say)AdridaeNaticidae—moonsnailsAntoin punctostriatus (C. B. Adams)Naticidae—moonsnailsAntoin sensitiva fluctureOlividae—olive snailsCaecidaeOlividae—olive snailsCaecidaeNertitiadae—neritesCaecidaeNertitiade—neritesCaecidaeNertitiade—neritesCaecidaeNertitiade—neritesCareithideaSayella hemphilit (Dall)CerithidaeCatulus carolinensis BushMitrella hunata (Say)Siphonaria peetinata (Linnaeus)ConidaeCorrejidulidaeDetracia floridana (Pheiffer)Saltenata (Say)Epitonidae—neutletrapsMargelia bionica C. B. AdamsEpitonidae—neutletrapsSiphonaria peetinata (Say)Fasciolaria hunteriaNudibranchia—sas slugsArthropodaC. c. tubutaris SayKiphosura—horseshoe crabsLimutus polyphemus LinnaeusLimutus polyphemus LinnaeusC. c. cubularis SayKiphogaia—nhoideaCarawfordiaeAnachnoideaCarawfordiae= auger snails	Stelleroidea-starfishes	Hyalina veliei (Donovan)
OphiactidaeM. lavalleana OrbignyOphiactis rubropoda SingletaryMelongenidae—conchs, whelksAmphiophus dobitusBusicaA. huhdeltaBusicaA. thrombiodesModulus modulus (Lamacus)Ophiactis rubropoda—snailsModulus modulus (Linnacus)MolluscaCastropoda—snailsCastropoda—snailsModulus modulus (Say)ActeonidaeNusescritae—monsmailsActeonidaeNusescritae—monsmailsActeonidaeOlividae—houtostriatus (C. B. Adams)Anten plundostriatus (C. B. Adams)Nusiex (Say)Anten plundostriatusOlividae—neritesBullidaeOlividae—neritesBullidaeOlividae—neritesCaccidaeNeritiaae Giouta (Say)CarcithidaeNeritiae formation agreeni (C. B. Adams)ColumbellidaeNeritiae formation (Say)Carithiopis greeni (C. B. Adams)SiphonodentalidaeColumbellidaeRetussidaeCanus stearnsi ConradCarepiduidaeCerpiduidaeCadulus carolinensis BushMitrella lunata (Say)SiphonodentalidaeCarada foridana (Pheiffer)Turbinidae—uruban snailsElibobiidaeNudibranchia—sea slugsCrustaceNudibranchia—sea slugsArthropodaC. cf. laustive Vanhoffen Crepiduidae—tube-dwelling amphipods Corophiaae—tube-dwelling amphipods Corophilae—tube-dwelling amphipods Corophilae—tube-dwelling amphipods Corophilae—tube-dwelling simmsonArthropodaSeude Cacus fubbulabulations SayCacus adamia humeriaNudibranchia—sea slugs <t< td=""><td>Ophiuridae</td><td>Marginella apicina Menke</td></t<>	Ophiuridae	Marginella apicina Menke
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Amphinridae Busyon sp. Rodingwhelk Amphiophus abditus B. spiratum (Lam.)fig whelk A. thrombiodes Medongena cornad (Gmelin)crown conch A. thrombiodes Modulidaebutton snails Ophiothrix angulata (Say) Modulidaebutton snails Mollusca Nassarius albus (Say) Mollusca Nassarius albus (Say) Acteon functostriatus (C. B. Adams) Naticidaenoires albus Atrion functostriatus (C. B. Adams) Naticidaenoires Bullidae Oliviela mutia (Say) Bullidae Oliviela mutia (Say) Caecum pulchellum Stimpson Pyramidellidae C. extitium Folin Seplea hemphill (Dall) Cerithiopsis greeni (C. B. Adams) Siphonodentallidae Columbellidae Retusa sulcata (Orbigny) Corithidae Siphonaria peetinata (Linnaeus) Conicae Salemata (Say) Conicae Salemata (Say) Conicidae Siphonaria peetinata (Linnaeus) Corithidaeuuler aps Salemata (Say) Elibolidae Turbiadeauger snails (part) There aforidana (Pheiffer) Turbiadeauger snails Epitonium angulatum (Say) Salemata (Say) Fasciolariidaeuuler aps C. cf. lacustr Vanhoffen Arachnoidea C. cf. lacustr Vanhoffen <td>Ophiactis rubropoda Singletary</td> <td>Melongenidae-conchs, whelks</td>	Ophiactis rubropoda Singletary	Melongenidae-conchs, whelks
Amphiophys additus B. spiratum (Lam,)=fig whelk A. putchelia Melongena corona (Gmelin)—crown conch A. putchelia Melongena corona (Gmelin)—crown conch Mollusca Nassariidae—mutsnais, nasasa Castropoda—snails Nassariidae—mutsnais, nasasa Acteon idae Nassariidae—mutsnais, nasasa Acteon punctostriatus (C. B. Adams) N. vikex (Say) Acteon punctostriatus (C. B. Adams) Naticidae—moonsnails Builidae Polinics duplicatus (Say) Builidae Olividae—olive snails Builidae Olividae—olive snails Caecidae Neritina rectivata (Say) Caecidae Neritina rectivata (Say) Caecidae Neritina rectivata (Say) Careithium muscarum Say Sighonaria pecinata (Corbigny) Cerithiidae Retusae Colombellidae Cadutus carolinensis Bush Anachis semiplicata Abbott Sighonaria pecinata (Carutus Say) Conidae Salternata (Say) Conidae Salternata (Say) Conidae Salternata (Say) Conidae Salternata (Say) Careidula maculosa Conrad Turbinidae—turba snails <td>Amphiuridae</td> <td>Busycon sp. Roding-whelk</td>	Amphiuridae	Busycon sp. Roding-whelk
A. pidchella Melongena corona (Gmelin)—crown conch A. thrombiodes Moduluidae—button snails Ophiothrix angulata (Say) Modulus adulus (Linnacus) Molusca Nassariidae—mudsnails, nassas Castropoda—snails Nassariidae—mudsnails, nassas Acteon junctostriatus (C. B. Adams) Naticidae—moonsnails Atteon punctostriatus (C. Danacus) Naticidae—moonsnails Bullidae Olividae—olive snails Bullidae Olividae—olive snails Bullidae Olividae—olive snails Caccidae Neritina reclivata (Say) Carcithidae Sayella hemphilli (Dall) Cerithidae Cadulus carolinensis Bush Columbellidae Siphonariia peetinata (Unnaeus) Anachios seniplicata Abbott Siphonariia peetinata (Linnaeus) Mitrella lunata (Say) Terebridae—auger snails (part) Crepiduidae Turbinidae—urban sails Detracia foridana (Pheiffer) Furbropoda Arrchnoidea Siphonaria peetinata (Say) Crustacea Nudibranchia—sea slugs Crustacea C. cf. lacustre Vanhoffen Carabino angulatum (Say) Saselaleata Smith Isopoda—	Amphioplus abditus	B. spiratum (Lam.)—fig whelk
A. thrombiodes Moduluidae—button snails Ophiothrix angulata (Say) Modulus modulus (Linnaeus) Mollusca Nassarius albus (Say) Acteonidae Nassarius albus (Say) Arteonidae Nassarius albus (Say) Arteonidae Olividae—moonsnails Bullidae Olividae—olive snails Caecidae Neritina rectivata (Say) Caecidae Neritina rectivata (Say) Caecidae Neritina rectivata (Say) Caecidae Neritina rectivata (Say) Carithium muscarum Say Retusa sulcata (Orbigny) Cerithium muscarum Say Siphonaridae—false limpets Olividae—olive anails Siphonaridae—false limpets Mitrella lunata (Say) Siphonaria peetinata (Say) Conidae Siphonaria peetinata (Say) Conidae Siphonaria peetinata (Say) Corepiduidae—nuento eraps Siphonaria peetinata (Say) Epitoniiaae—wentletraps Siphonariae alus Epitoniiaa publicata hunteria Mangelia biconi	A. pulchella	Melongena corona (Gmelin)—crown conch
Ophiothrix angulata (Say)Modulus modulus (Linnaeus)MolluscaNassarius albus (Say)Gastropoda—snailsNassarius albus (Say)ActeonidaeN. vibex (Say)Acteon punctostriatus (C. B. Adams)Naticidae—moonsnailsAyidaePolinices duplicatus (Say)Haminoea succinea (Conrad)Olividae—olive snailsBullidaeOlividae—olive snailsBullidaeOlividae—olive snailsBullidaeOlividae—olive snailsCaccidaeNeritida refluctatus (Say)CaccidaeNeritidae—neritesCaccidaeNeritidae—neritesCaccidaeSayella hemphilli (Dall)Cerithiopsis greeni (C. B. Adams)SiphonodentaliidaeColumbellidaeGalutus carolinensis BushAnachis semiplicata AbbottSiphonaria faectinata (Linnaeus)Mitrella hunata (Say)Salemata (Say)ConidaeSiphonaria pectinata (Linnaeus)ConidaeTurbinidae—turban snailsConidaeSiphonaria pectinata (Linnaeus)ConidaeTurbinidae—turban snailsElitobiidaeTurbinidae—turban snailsPatacia floridana (Pheiffer)Turbinae—turban snailsEpitoniima angulatum (Say)M. cf. ceraplusta BushFasciolaria hunteriaSindamachia—sea slugsCrustaceaJassa falcata SmithMalacostracaJassa falcata SmithMalacostracaJassa falcata SmithMalacostracaSiopoda—siopods, aquatic sow bugsArchnoideaCoraphium oft, insidiosum CrawfordCrustaceaCoraphium Cri, insidios	A. thrombiodes	Modulidae—button snails
MolluscaNassariidae—mudsnails, nassasGastropoda—snailsNassariidae—mudsnails, nassasActeon punctostriatus (C. B. Adams)NaticidaeArteon punctostriatus (C. B. Adams)NaticidaeApyicaePolinices duplicatus (Say)Haminoea succinea (Conrad)Olivelia mutica (Say)Bullia striata BruguiereNeritidae—neritesCaccidaeNeritidae—neritesCaccidaeNeritidae—neritesCaccidaeNeritidaeC. vestitum FolinSayella hemphilli (Dall)CerithiidaeRetusidaeCarithiopsis greeni (C. B. Adams)SiphonadentalidaeColumbellidaeCadulus carolinensis BushAnachis semiplicata AbbottSiphonartidae—false limpetsMitrella hunata (Say)Siphonartidae—false limpetsConidaeSiphonartidae—false limpetsConidaeSiphonartidae—false limpetsConidaeSiphonaria pectinata (Innaeus)ConidaeSiphonaria pectinata (Innaeus)ConidaeSiphonaria pectinata (Say)ConidaeTurbo castanea GmelinDetracia floridana (Pheiffer)Turbinidae—turban snailsEllobiidaeTurbo castanea GmelinDetracia floridama (Say)M. ef. ceroplasta BushFasciolaria hunteriaSiphonaria -sea slugsCrustaceaJassa falcata SmithMitable polyhemus LinnaeusSiphona-amphipods, scudsCorophium ef. insidosum CrawfordGrathiideaCorophiuma cf. insidosum CrawfordGrathiideaCorophiudae—tube-dwelling amphipodsCoraphium cf. insidosum Crawfo	Ophiothrix angulata (Say)	Modulus modulus (Linnaeus)
Gastropoda—snailsNassarius albus (Say)ActeonidaeN. vibex (Say)ActeonidaeN. vibex (Say)ActeonidaeN. vibex (Say)ApidaePolinices duplicatus (Say)Haminees succinea (Conrad)Olividae—ononsnailsBullidaeOlividae—ononsnailsBullidaeOlividae—olive snailsBullidaeOlividae—olive snailsCaccidaeNeritidae—oritesCaccidaeNeritidae—oritesCaccidaeNeritidaeCarcithicaSayella hemphilil (Dall)Cerithicine muscarum SayRetusidaeColumbellidaeCaduuts asulicata (Orbigny)Corithela lunata (Say)Siphonacria pectinata (Linnaeus)Conubs etarnsi ConradSiphonaria dectinata (Linnaeus)Corepidula maculosa ConradSiphonaria dectinata (Linnaeus)EllobiidaeTurbindae—turban snailsEllobiidaeMarelia buonteraDetracia Joridana (Pheiffer)Turbindae—turban snailsEpitonium angulatum (Say)Marelia biconica C. B. AdamsFasciolaria hunteriaSucharaca C. B. AdamsArthropodaSiphonaeamplipods, scudsCrustaceaNudibranchia—sea slugsCrustaceaSiphonaeamplipods, scudsCorophiuma c, LinnaeusSipas falcata SmithMalacostracaJassa falcata SmithMalacostracaIsopoda—stopod, aquatic sow bugsArchnoideaCorophium Cr, insidosum CrawfordCrustaceaCorophium Cr, insidosum CrawfordCorophiumae, LinnaeusCorathirdeaCorophiumaeCoroph	Mollusca	Nassariidae—mudsnails, nassas
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C. cf. tuberculatum Shoemaker Coathura holita Stimpson	Corobhium cf. insidiosum Crawford	Anthuridae
A DETENDED FOR A DETENDED A DETENDE	C. cf. tuberculatum Shoemaker	Conthura bolita Stimpson

TABLE 5. Continued.

Taxa	Таха
Epibenthos—Se Nudibranchia—	ection II (Continued)
Valvifera Idoteidae <i>Chiridotea</i> Harger <i>Edotea</i> cf. montosa (Stimpson) <i>Erichsonella attenuata</i> <i>Idotea baltica</i> (Pallas) Flabellifera Sphaeromidae <i>Sphaeroma quadridentatum</i> Say <i>Cassidinidea ovalis</i> (Say) Tanaidacea (=Chelifera) Paratanaidae <i>Hargeria rapax</i> (Harger) Decapoda—shellfish, decapods Grapsidae—wharf crabs <i>Sesarma cinereum</i> (Bosc) Ocypodidae—fiddler crabs <i>Uca minax</i> LeConte	sea sitigs (Continued) Pinnotheridae—commensal crabs Pinnixa chaetopterana Stimpson P. cylindrica (Say) P. pearsi Wass P. retinens Rathbun P. sayana Stimpson Xanthidae—mud crabs Panopeus texana (Stimpson) Rhithropanopeus depressus R. harrisii (Gould) Cumacea—Cumaceans Nannasticidae Almyracuma sp. A Heard Oxyurostylis smithi Calman Cirripedia—barnacles Thoracica—acorn barnacles Balanidae Balanus eburneus Gould?
Paguridae—hermit crabs Pagurus Say	
Em	benthos
Brachiopoda (lamp shells) Inarticulata Lingulida Lingulidae <i>Glottidia pyramidata</i> (Stimpson)	Magelonidae <i>Magelona</i> Muller Maldanidae <i>Maldane</i> Grube <i>Axiothella</i> Verrill
Polychaeta—polychaetes, marine bloodworms Ampharetidae Hobsonia florida (Hartman) Isolda pulchella Muller Melinna Malmgren Sabellides Milne Capitellidae Capitellidae Capitella capitata (Fabricius) Heteromastus filiformis (Claparede) Mediomastus Hartman	Clymenella torquatus (Leidy) Nephtyidae Aglaophamus Kinberg Nephtys Cuvier Nereidae Kinbergonuphis Pettibone Laeonereis culveri (Webster) Nereis succinea (Frey & Leuckart) N. occidentalis Platynereis Kinberg
Notomastus Sars Polydora Bosc Cirratulidae Tharyx Webster et Benedict Dorvilleidae Schistomeringos rudolphii (delle Chiaje)	Onuphidae Diopatra Audouin et Milne-Edwards Onuphis eremita Audouin et Milne-Edwards Opheliidae Polyophthalmus pictus Orbiniidae Habloscalablos Monro
Glyceridae Glycera Savigny Glycinde Muller Hesionidae Gyptis Marion et Bobretzky Hesione Savigny Parahesione Pettibone Lumbrineridae Lumbrineris Blainville	Orbinia Quatrefages Scoloplos Blainville Oweniidae Myriochele Malmgren Paraonidae Aricidea Webster Phyllodocidae Eteone Savigny Eumida sanguinea (Orsted) Phyllodoce Savigny

TABLE 5. Continued.

Taxa	Таха
Epibenthos—Sec	tion II (Continued)
Embenthos	G (Continued)
Pilargidae	Mollusca
Loandalia Monro	Bivalvia—clams and mussels
Parandalia Emerson et Fauchild	Carditidae
Sigambra Muller	Carditamera floridana Conrad
Polynoidae	Corbiculidae—marsh clams
Halosydna Kinberg	Polymesoda caroliniana (Bosc)—Carolina
Harmothoe Kinberg	marsh clam
Lepidonotus Leach	Donacidae
Phyllohartmania taylori Pettibone	Donax variabilis Say
Sabellidae	Mactridae
Fabricia sabella (Ehrenberg)	Rangia cuneata
Jasmineira Langerhans	Nuculanidae
Serpulidae	Nuculana acuta (Conrad)
Hydroides dianthus (Verrill)	Tellinidae
Spionidae	Macoma tenata (Say)
Paraprionospio pinnata (Ehlers)	Veneridae—quahors
Prionospio Malmgren	Mercenaria cambechiensis (Gmelin)
Scolelepis squamatus (O. F. Muller)	
Spiophanes Grube	Cephalochordata—lancelets
Sterblospio benedicti Webster	Branchiostomidae
Spionidae	Branchiosioma carioaeum Sundevan
Polydora Bosc/Boccardia Carazzi complex	Hemichordata
Pseudopolydora Czerniavsky	Enteropneusta—acorn worms
Spirorbidae	Harrimaniidae
Syllidae	Saccoglossus kowalevskii (A. Agassiz)
Syllis Savigny	Sipuncula—peanut worms
Нуро	benthos
Arthropoda	
Crustacea	
Decapoda	
Callianassidae—mud shrimps, ghost shrimps	
Lepidophthalmus louisianensis (Schmitt)	
Epizoos	/parasites
Arthropoda	-
Crustacea	
Branchiura: Arguloidea—fish lice	
Argulus japonicus Thiele	

1981), where the littoral substrate is nearly devoid of SAV, diel periodicities of the hyperbenthos may be extreme. The lack of diel rhythms in abundance of hyperbenthos in seagrass meadows at Seahorse Key fits Ledoyer's Class(a) ecological grouping for Madagascar where caridean shrimps occur in equal densities both day and night. This was also true of the hyperbenthos in seagrass meadows of coastal southwest Japan (Kikuchi and Peres, 1977).

Juvenile seatrout diet.—The overall findings on juvenile seatrout foods of the 1940s and 1950s (Moody, 1950; Reid, 1954), i.e., reliance on decapod crustaceans, is supported by the results of our 1992–93 survey. Our survey showed that the seatrout selected 12 kinds of foods from a total menu of 199 items. Copepods and amphipods are still key foods of <60-mm-TLstage juvenile spotted seatrout and are not usual food items of >60-mm-TL seatrout. Further, the largest juvenile seatrout had gorged on



Fig. 2. Total taxa (solid bar) and community diversity index *d* (gray bar) for hyperbenthic communities for combined shoreline bare sand, *Halodule*, and *Thalassia* habitats at Cedar Keys, Florida, Sep. 1992–Sep. 1993.

adult pink shrimp, usually found in deeper water.

We found that the 10–100-mm-TL fish in the *Thalassia* zone consumed about double the number of food of an almost equal number of fish in the *Halodule* zone (Table 3). This significant difference (based on individual food items) was due to a total of 127 copepods in five seatrout in *Thalassia* during June 1993. Minimizing the importance of this perhaps anomalous event and considering the capture of 80–100-mm-TL fish only in *Thalassia*, we suspect that >100-mm-TL juvenile seatrout, as 50

yr ago (Moody, 1950), feed in the stands of mixed seagrasses beyond >1 m average depth.

Moody (1950) did not find small fish of major importance in the diet of 50–150-mm-TL juvenile seatrout. However, our findings reveal that that large decapods, *Penaeus* and *Palaemonetes*, and also small fish are important foods of the 20–30-mm-TL juvenile seatrout. Also, we found that *Hippolyte* was not the prime food item of the juveniles, as was reported by Moody (1950). This is unusual considering its overwhelming dominance in the seagrasses. In fact, *Hippolyte* was absent from juveniles >80 mm TL



Fig. 3. Average number of hyperbenthic individuals in day sled trawls from bare sand (solid bar), *Halodule* (gray bar), and *Thalassia* (stippled bar) zones during Sep. 1992–Sep. 1993, Seahorse Key, Florida.



Fig. 4. (a) Average percent of crustacean individuals/sled trawl: Amphipoda (solid bar), Decapoda (gray bar), and Mysidacea (stippled bar); and (b) average number of individuals of *Hippolyte pleuracanthus*/sled trawl, Sep. 1992–Sep. 1993, Seahorse Key, Florida.

(Table 3). Although other epibenthic and sedentary crustaceans were present in the seagrasses (i.e., *Tozeuma carolinense*, tanaid *Hargeria rapax*, cumaceans *Oxyurostylis smithi* and *Almyracuma* sp.) (Table 5), <100-mm-TL juvenile seatrout did not prey on them. The lack of *T. caroliense* as another prominent member of the diet of juvenile seatrout reported by Moody (1950) is unexplainable. The shrimp's greenish color and long rostrum, giving it a bladelike appearance on the grasses, is good camouflage. Also, the importance of the decapod *P. longicaudatus,* a primary seatrout food of the 1940s and 1950s, was not confirmed by us.

Populations of several dozen species of epibenthic organisms, e.g., mollusks, hermit crab, and mud crab (often comprising 20% of total individuals/trawl), were not included in the diet of juvenile spotted seatrout. This may be due to hard body armature that would make ingestion by early juvenile seatrout more difficult.

Average gut fullness for adult and juvenile seatrout reported by Moody (1950) was somewhat lower (54%) than our finding of 68%, but



Fig. 5. (a) Average number of individuals/trawl and (b) average number of total taxa in quarterly day and night sled trawls from bare sand (solid bar), *Halodule* (gray bar), and *Thalassia* (stippled bar), Sep. 1992–Sep. 1993, Seahorse Key, Florida.

is within the range of sampling error. Based on the evidence at hand, we suspect that the food habits of early juvenile spotted seatrout at the Cedar Keys have not changed appreciably in the past half century.

Moody's (1950) extensive survey of the entire Cedar Keys area compared to our localized study at Seahorse Key and his focus on larger individuals in deeper water and our relatively low n for juvenile seatrout makes us cautious about reporting real dietary changes. However, in terms of food quality, i.e., reliance on crustacean diet, there has been little change in the diet of the juveniles in the past 50 yr. It is apparent that the juvenile seatrout <100 mm TL have switched to feeding on large hyperbenthic invertebrates. These larger organisms are abundant in the seagrasses at Seahorse Key and their use by the seatrout would represent an energy conservation measure. Habitat management to protect the SAV and the invertebrate foods at the Key bodes well for continuance of a healthy spotted seatrout community.

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