NOAA Technical Report NMFS SSRF-685

An Annotated List of Larval and Juvenile Fishes Captured With Surface-Towed Meter Net in the South Atlantic Bight During Four RV *Dolphin* Cruises Between May 1967 and February 1968

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SEATTLE, WA

March 1975

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UNITED STATES
DEPARTMENT OF COMMERCE
Frederick B. Dent, Secretary

NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION
Robert M White, Administrator

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An Annotated List of Larval and Juvenile Fishes Captured With Surface-Towed Meter Net in the South Atlantic Bight During Four RV *Dolphin* Cruises Between May 1967 and February 1968

MICHAEL P. FAHAY[1]

INTRODUCTION

In December 1965, the Sandy Hook Laboratory began a 2 yr preliminary survey of the Atlantic continental shelf to determine spawning times and locations for marine fishes and to describe dispersal patterns of larvae and juveniles. During the first year we worked from Martha's Vineyard, Mass., to Cape Lookout, N.C. (Clark et al. 1969). Beginning in May 1967, we sampled the South Atlantic Bight from New River, N.C., to Palm Beach, Fla., at quarterly intervals. A description of our sampling technique, temperature and salinity profiles, zooplankton volumes, and a familial list of young fishes collected in a surface-towed meter net are presented in Clark et al. (1970). The purpose of this report is to list the fishes caught in the meter net by species and to comment on some of the occurrences.

Several faunal lists (mostly of demersal fishes) pertaining to the South Atlantic Bight have recently been published. Struhsaker (1969) presented a list of demersal fishes captured during a 5 yr trawling survey of the continental shelf off southeastern United States. Bullis and Thompson (1965) listed fishes taken with a variety of gears (mostly trawls) during a four-vessel survey of the shelf and slope from Cape Hatteras to Brazil. Anderson (1968) presented records of fishes taken during shrimp trawling operations between Cape Romain, S.C., and Cape Kennedy, Fla.

Dooley (1972) listed fishes closely associated with sargassum in the Florida Current near Miami. An important difference between his work and that reported here is depth and location of sampling. Dooley intended to sample fishes associated with sargassum while our intent was to sample the surface ichthyofauna at stations along the cruise track of our survey. Dooley thus used a purse seine to collect fishes in the upper 5.2 m of the water column around sargassum accumulations, while we used a net which never sampled deeper than 1 m and we also sampled the surface close to shore and away from weed accumulations. Furthermore, Dooley selected large rafts of sargassum to surround with his purse seine while we sampled along straight lines originating at predetermined stations, and sampled sargassum only as chance provided small clumps in the path of our net. Therefore, Dooley specifically sampled the sargassum community while we sampled the surface fauna which occasionally included the sargassum community. Although we noticed close associations of some species to sargassum clumps, it was a shortcoming of our sampling procedure that we neglected to record the volume of weed contained in the net on each tow.

MATERIALS AND METHODS

Collecting stations are shown in Figure 1 and their positions are listed in Table 1. The Appendix Table contains dates, times, and physical data pertaining to each cruise and station. Positions are based on LORAN navigation and are accurate to within 1.8 km (1 nautical mile). Surface temperatures were obtained with stem thermometers, accurate to ±0.1°C, mechanical bathythermographs, and a strip-chart recorder which provided a continuous record over the cruise track. Salinities were measured with a Tsurumi Salinity, Temperature, Depth Recorder during the May cruise; thereafter with a Beckman RS5-3 Salinometer. Sunrise and sunset times (U.S. Coast and Geodetic Survey 1967, 1968) were corrected for latitude, longitude, and local time. When any part of a tow occurred within 1 h of sunrise or sunset, that tow was considered a crepuscular one and is labelled either "dawn" or "dusk" in the Appendix Table.

The net we used to sample the surface ichthyofauna consisted of a reinforced steel ring 1 m in diameter to which was attached a 4 m long conical nylon net with rectangular apertures of 3.3 × 6.4 mm (0.13 × 0.25 in). The net was connected to the fixed towing line with a three-legged bridle and was towed from an outboard boom which held the net about 2 m away from the hull of the vessel while sampling. The mouth of the net was amidships, well behind the bow wake. Approximately 75% of the mouth was submerged at all times. Tows lasted 30 min and covered about 4.6 km (2.5 nautical miles). When the net contained sargassum weed, we picked through it manually

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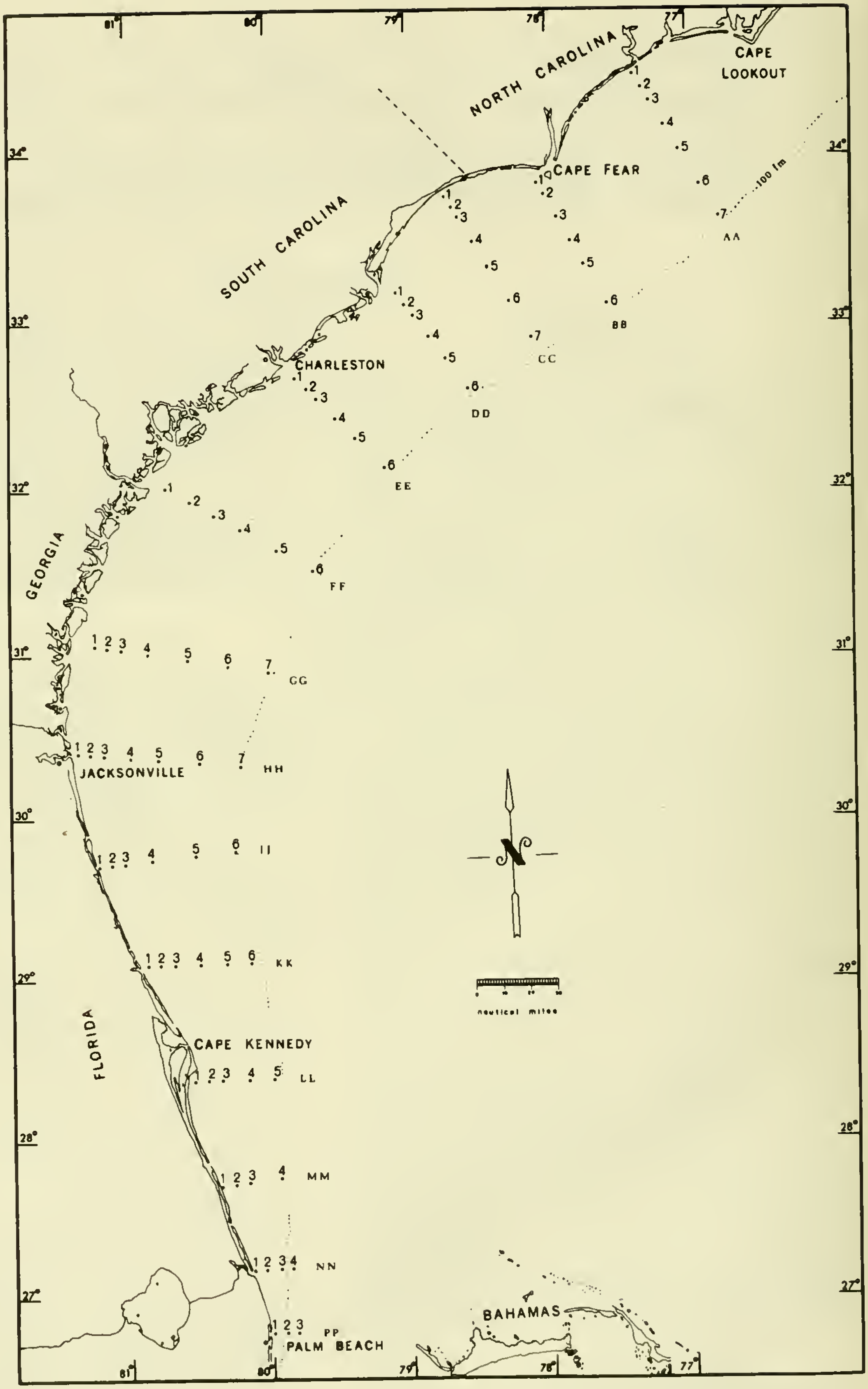


Figure 1.—RV *Dolphin* survey, 1967-68. Locations of transects and collecting stations.

Table 1.—RV *Dolphin* survey, 1967-68. Locations of collecting stations. Locations are given by coordinates of north latitude over west longitude, listed to the nearest 0.5 nautical mile (0.9 km).

	Stations						
Transect	1	2	3	4	5	6	7
AA	34°28.5′	34°24.0′	34°20.0′	34°11.0′	34°02.5′	33°49.5′	33°37.0′
	77°23.0′	77°19.5′	77°16.5′	77°10.5′	77°04.5′	76°55.5′	76°47.0′
BB	33°49.5′	33°45.5′	33°36.5′	33°28.0′	33°19.5′	33°06.0′	
	78°03.5′	78°01.0′	77°55.0′	77°49.5′	77°44.0′	77°35.0′	
CC	33°44.5′	33°40.5′	33°36.0′	33°27.5′	33°19.5′	33°06.5′	32°54.0′
	78°44.0′	78°41.0′	78°37.5′	78°31.5′	78°25.0′	78°15.5′	78°06.5′
DD	33°10.5′	33°06.5′	33°02.5′	32°54.5′	32°46.5′	32°35.5′	
	79°05.5′	79°02.0′	78°58.0′	78°51.0′	78°44.0′	78°34.0′	
EE	32°39.5′	32°35.5′	32°32.0′	32°25.0′	32°18.0′	32°07.5′	
	79°49.0′	79°44.0′	79°40.0′	79°31.0′	79°22.0′	79°09.5′	
FF	32°00.0′	31°55.0′	31°49.5′	31°44.5′	31°37.5′	31°30.0′	
	80°43.0′	80°32.5′	80°21.5′	80°10.5′	79°56.0′	79°40.5′	
GG	31°03.0′	31°02.0′	31°01.5′	31°00.0′	30°58.0′	30°55.5′	30°54.0′
	81°14.0′	81°08.0′	81°02.5′	80°51.0′	80°34.0′	80°17.0′	80°00.0′
HH	30°24.0′	30°23.5′	30°23.0′	30°22.0′	30°21.5′	30°20.0′	30°19.0′
	81°22.0′	81°16.0′	81°10.0′	80°59.0′	80°47.5′	80°30.0′	80°13.0′
JJ	29°42.5′	29°43.0′	29°43.5′	29°45.0′	29°46.5′	29°48.5′	
	81°13.0′	81°07.0′	81°02.0′	80°49.5′	80°32.0′	80°14.0′	
KK	29°05.0′	29°05.0′	29°05.5′	29°05.5′	29°06.0′	29°06.0′	
	80°53.5′	80°47.5′	80°42.0′	80°30.5′	80°19.0′	80°08.0′	
LL	28°22.5′	28°22.5′	28°23.0′	28°23.5	28°24.0′		
	80°32.0′	80°26.5′	80°21.0′	80°09.5′	79°58.0′		
MM	27°42.5′	27°43.0′	27°44.0′	27°46.0′			
	80°21.0′	80°15.5′	80°10.0′	79°55.5′			
NN	27°10.0′	27°10.5′	27°11.0′	27°11.5′			
	80°08.0′	80°02.5′	79°56.5′	79°50.5′			
PP	26°46.0′	26°46.5′	26°47.0′				
	80°01.0′	79°55.5′	79°50.0′				

because we found that agitating the weed in water did not dislodge certain fishes (notably balistids, antennariids, syngnathids, gadids, and anguilliform leptocephali). All fishes captured were preserved for later identification and measurement.

The arrangement of the list of fishes is phylogenetic and follows Greenwood et al. (1966). Names follow Bailey et al. (1970). The catch of each species is separated by cruise (italicized) then listed as follows: station where caught, total number captured, length or length range in millimeters. Measurements are of fork length, unless SL (standard length) or TL (total length) are specified. The designation "mut" indicates that identification or measurement was impossible due to mutilation of the specimen.

RESULTS

We caught 10,741 fishes belonging to 158 categories including 51 families and 107 identified species (Table 2). Variety of species was greatest within the families Carangidae (17 species), Balistidae (13 species), and Exocoetidae (15 species). The proportions of the total catch contributed by each family are shown in Figure 2.

Over the inshore part of the shelf, catches were augmented when we sampled along windrows of debris and stems of *Phragmites* sp. and *Spartina* sp. Offshore catches were augmented when we sampled among rafts of sargassum.

Surface temperatures over the offshore part of the shelf varied little throughout the year (Fig. 3-6, and Clark et al. 1970) and this stability was reflected in a fairly uniform catch during all four seasons. Fishes strongly seasonal in occurrence (such as *Mugil cephalus*, *Mullus auratus*, *Pomatomus saltatrix*, and *Urophycis regius*) were taken mainly over the inshore part of the shelf where temperatures ranged from 7.8°C in January to 28.1°C in July.

Several species were surprisingly absent from our collections (for example the carangids *Trachurus lathami* and *Selene vomer* and larvae of the family Acanthuridae) or were collected only rarely despite their reportedly common status (for example *Selar crumenophthalmus*, *Lobotes surinamensis*, and *Cantherhines pullus*). These species may be common under rafts of sargassum and susceptible to capture by Dooley's (1972) purse seine but may not be strongly enough surface oriented to be susceptible to capture with a net towed within 1 m of the surface.

Opportunities for comparing day and night catches are limited since we never occupied a station long enough to sample consecutively during both light regimes. Catches of some species, however, were noticeably greater at night. The halfbeaks

Table 2.—Summary of fish categories showing numbers caught and seasons present.

Category	Total number caught	Number caught per occurrence	Seasons present
Elops saurus	12	1.09	SpSFW
Unidentified Muraenidae	33	1.94	SpSF
Unidentified Congridae	7	1.16	SFW
Bascanichthys sp.	1	1.00	W
Myrophis punctatus	1	1.00	W
Unidentified Ophichthidae	44	2.44	SpSFW
Unidentified Nemichthyidae	3	1.00	WSp
Brevoortia tyrannus	17	8.50	W
Brevoortia sp.	87	9.66	W
Etrumeus teres	34	11.33	W
Opisthonema oglinum	3	1.00	SF
Sardinella anchovia	49	9.80	SpSFW
Unidentified Clupeidae	112	7.46	SpSFW
Anchoa hepsetus	219	24.33	SpSFW
A. mitchilli	33	8.25	WSp
A. nasuta	81	13.50	SFW
Anchoa sp.	123	9.46	SpSFW
Engraulis eurystole	1	1.00	W
Unidentified Engraulidae	61	3.38	SpSFW
Synodus foetens	7	1.75	WSp
Unidentified Synodontidae	2	1.00	W
Unidentified Myctophidae	10	2.50	FW
Histrio histrio	48	1.65	SpSFW
Urophycis earlli	2	1.00	W
U. floridanus	15	2.14	W
U. regius	2,678	58.22	WSp
Urophycis sp.	5	2.50	Sp
Unidentified Ophidiidae	3	1.00	SpF
Chriodorus atherinoides	1	1.00	W
Cypselurus cyanopterus	1	1.00	F
C. exsiliens	1	1.00	F
C. furcatus	1	1.00	Sp
C. heterurus	75	1.70	SpSFW
Cypselurus sp.	1	1.00	F
Euleptorhamphus velox	1	1.00	F
Exocoetus obtusirostris	10	2.50	WSp
E. volitans	3	1.00	WSp
Hemiramphus brasiliensis	64	2.06	SpSFW
Hirundichthys affinis	2	1.00	WSp
H. rondeleti	7	1.40	SpS
Hyporhamphus unifasciatus	40	3.07	SpSFW
Oxyporhamphus micropterus	5	1.66	SF
Parexocoetus brachypterus	164	3.72	SpSF
Prognichthys gibbifrons	62	1.59	SpSFW
Unidentified Exocoetidae	11	1.22	WSpS
Tylosurus acus	3	1.00	SpSF
Tylosurus sp.	1	1.00	F
Membras martinica	144	28.80	FW
Menidia menidia	41	5.85	FW
Holocentrus sp.	16	1.60	SpSF
Amphelikturus dendriticus	1	1.00	W
Hippocampus erectus	14	1.27	SpSFW
Hippocampus sp.	9	1.12	WSpS
Syngnathus elucens	2	1.00	WSp
S. fuscus	1	1.00	W
S. pelagicus	9	1.00	SpSFW
S. springeri	12	1.20	WSp
Syngnathus sp.	2	2.00	F
Pristigenys alta	44	3.66	S
Apogon maculatus	1	1.00	S
Apogon sp.	1	1.00	Sp
Astrapogon sp.	2	2.00	W
Pomatomus saltatrix	14	1.27	Sp
Remora remora	2	2.00	S
Caranx bartholomaei	19	1.26	SpSFW
C. fusus	59	3.10	SpSFW
C. hippos	5	1.66	SpS
C. latus	2	1.00	SpS
C. ruber	59	2.68	SpSF
Caranx sp.	11	1.57	WSpS
Chloroscombrus chrysurus	8	1.60	SpSF
Decapterus punctatus	826	12.32	SpSFW
Elagatis bipinnulata	8	1.14	SpS
Naucrates ductor	2	1.00	Sp
Selar crumenophthalmus	3	1.00	SpS
Seriola dumerili	11	1.57	FWSp
S. fasciota	2	1.00	SF
S. rivoliana	8	1.33	SF
S. zonata	1	1.00	Sp
Seriola sp.	73	1.97	SpSFW
Trachinotus carolinus	15	1.87	Sp
T. falcatus	9	1.28	SpSFW
T. goodei	2	1.00	SF
Trachinotus sp.	4	1.00	SpS
Unidentified Carangidae	4	1.33	S
Coryphaena equisetis	16	1.60	SpSFW
C. hippurus	76	1.68	SpSFW
Rhomboplites aurorubens	1	1.00	S
Unidentified Lutjanidae	2	1.00	S
Lobotes surinamensis	1	1.00	F
Stenotomus chrysops	3	1.00	Sp
Unidentified Sparidae	637	26.54	FWSp
Cynoscion nothus	5	5.00	F
Larimus fasciatus	1	1.00	F
Leiostomus xanthurus	22	2.44	FW
Stellifer lanceolatus	1	1.00	F
Mullus auratus	126	4.06	WSp
Pseudupeneus maculatus	1	1.00	Sp
Unidentified Mullidae	23	2.87	WSp
Kyphosus incisor	9	1.12	SFW
K. sectatrix	9	2.25	F
Holacanthus tricolor	1	1.00	F
Pomacanthus arcuatus	1	1.00	F
Unidentified Chaetodontidae	1	1.00	S
Abudefduf saxatilis	17	1.70	FW
Chromis sp.	1	1.00	F
Unidentified Pomacentridae	2	1.00	Sp
Mugil cephalus	174	4.83	FWSp
M. curema	393	6.14	SpSFW
Mugil sp.	67	3.04	WSp
Sphyraena barracuda	2	1.00	S
S. borealis	10	1.11	FWSp
Unidentified Uranoscopidae	19	1.58	SpSFW
Unidentified Blenniidae	35	2.18	SpSFW
Unidentified Gobiidae	2	2.00	S
Diplospinus multistriatus	2	1.00	FW
Auxis sp.	31	2.81	WSpS
Euthynnus alletteratus	8	2.00	S

Table 2.—Summary of fish categories showing numbers caught and seasons present—Continued.

Category	Total number caught	Number caught per occurrence	Seasons present
Scomber japonicus	6	1.20	WSp
Scomberomorus maculatus	4	1.00	SpS
Thunnus sp.	2	1.00	SpS
Xiphias gladius	8	1.33	FWSp
Istiophorus platypterus	1	1.00	Sp
Makaira nigricans	1	1.00	S
Unidentified Istiophoridae (a.)	5	1.66	Sp
Unidentified Istiophoridae (b.)	27	1.92	SpSF
Nomeus gronovii	6	1.50	WSp
Peprilus triacanthus	166	6.15	SpSFW
Psenes cyanophrys	13	1.00	WSpS
Scorpaena sp.	8	1.14	SpSFW
Unidentified Triglidae	7	1.40	SpF
Dactylopterus volitans	3	1.00	SpS
Bothus ocellatus	266	4.29	SpSFW
Unidentified Bothidae	31	2.81	SpSFW
Gymnachirus melas	1	1.00	W
Symphurus sp.	1	1.00	F
Aluterus heudeloti	5	1.00	SpSF
A. monoceros	3	1.50	SF
A. schoepfi	9	1.12	SpSF
A. scriptus	13	1.44	SpSF
Aluterus sp.	1	1.00	Sp
Balistes capriscus	44	2.20	SF
Balistes sp.	4	2.00	S
Cantherhines pullus	7	1.40	SF
Canthidermis maculatus	17	1.42	SpSFW
C. sufflamen	8	4.00	SpF
Monacanthus ciliatus	154	2.96	SpSFW
M. hispidus	421	4.43	SpSFW
M. setifer	301	11.58	SpSFW
M. tuckeri	3	1.50	SW
Xanthichthys ringens	1	1.00	F
Unidentified triggerfishes	5	1.00	SpS
Unidentified filefishes	1,536	11.63	SpSFW
Unidentified Ostraciidae	4	1.00	FWSp
Sphoeroides sp.	312	3.95	SpSFW
Diodon holocanthus	1	1.00	S
Diodon hystrix	1	1.00	S
Unidentified	47	1.74	SpSFW
Totals	10,741	39.63	

Hemiramphus brasiliensis and *Hyporhamphus unifasciatus*, for example, were both more numerous and larger in night tows than in day tows. Conversely the round scad, *Decapterus punctatus*, and puffers of the genus *Sphoeroides* were prevalent in day tows. The accumulating effect of weed during all hours, however, might modify the diel behavior of juvenile fishes for day-night differences in the catch of most species closely associated with sargassum were not apparent.

Although the larvae of many species were caught during more than one cruise, if not throughout the year, spawning which contributes young fishes to the surface fauna of the South Atlantic Bight is at a maximum in the spring and summer. Figures 7 through 10 show the seasonal diversity in larval and juvenile ichthyofauna at the surface. During the winter (Fig. 10), the ranges of the few species occurring in inshore surface waters (notably *Urophycis regius*, *Mugil cephalus*, *Mullus auratus*, *Leiostomus xanthurus* and unidentified sparid larvae) extend offshore and overlap with the ranges of Gulf Stream inhabitants, resulting in an area of increased variety over the middle shelf north of Cape Kennedy.

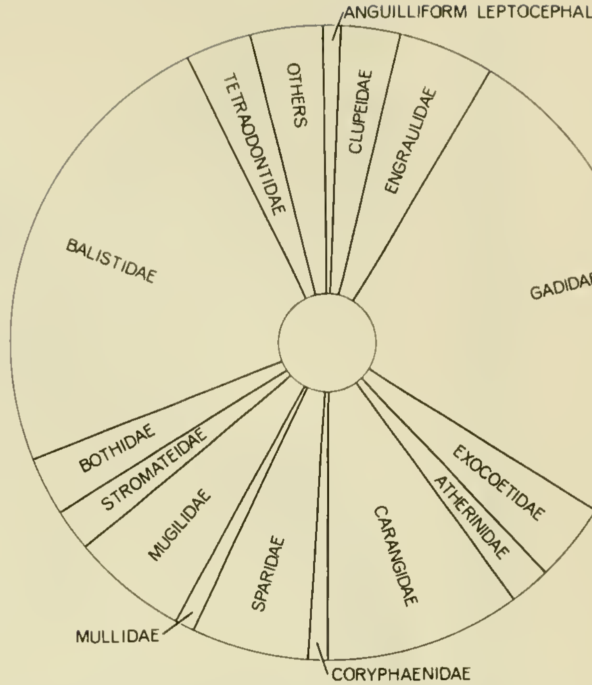


Figure 2.—Familial constituents of total surface-towed, meter net catch during 1967-68.

Except for the obvious inshore species such as *Anchoa mitchilli* and offshore species such as istiophorids and exocoetids, lines between inshore and offshore species are not clearly drawn. A more definite separation exists between those species occurring primarily in the Gulf Stream (*Histrio histrio*, and some flyingfishes) and those ranging over the continental shelf.

The average number of each species taken per successful tow (Table 2) indicates that most of the fishes caught had not yet begun to aggregate or at least occurred in such low densities that large catches were precluded. Schooling was apparent in very few species (i.e., anchovies, silversides, scads, and butterfish). Possibly the protective value of schooling (Breder 1967) is less necessary in surface waters where weed or debris are available for cover.

An area used as a nursery by developing fishes must provide a food source, protection from predation, and suitable hydrographic conditions. Both the Gulf Stream, with its floating mats of sargassum, and inshore bays and estuaries fulfill the first two requirements, but the two areas differ markedly in

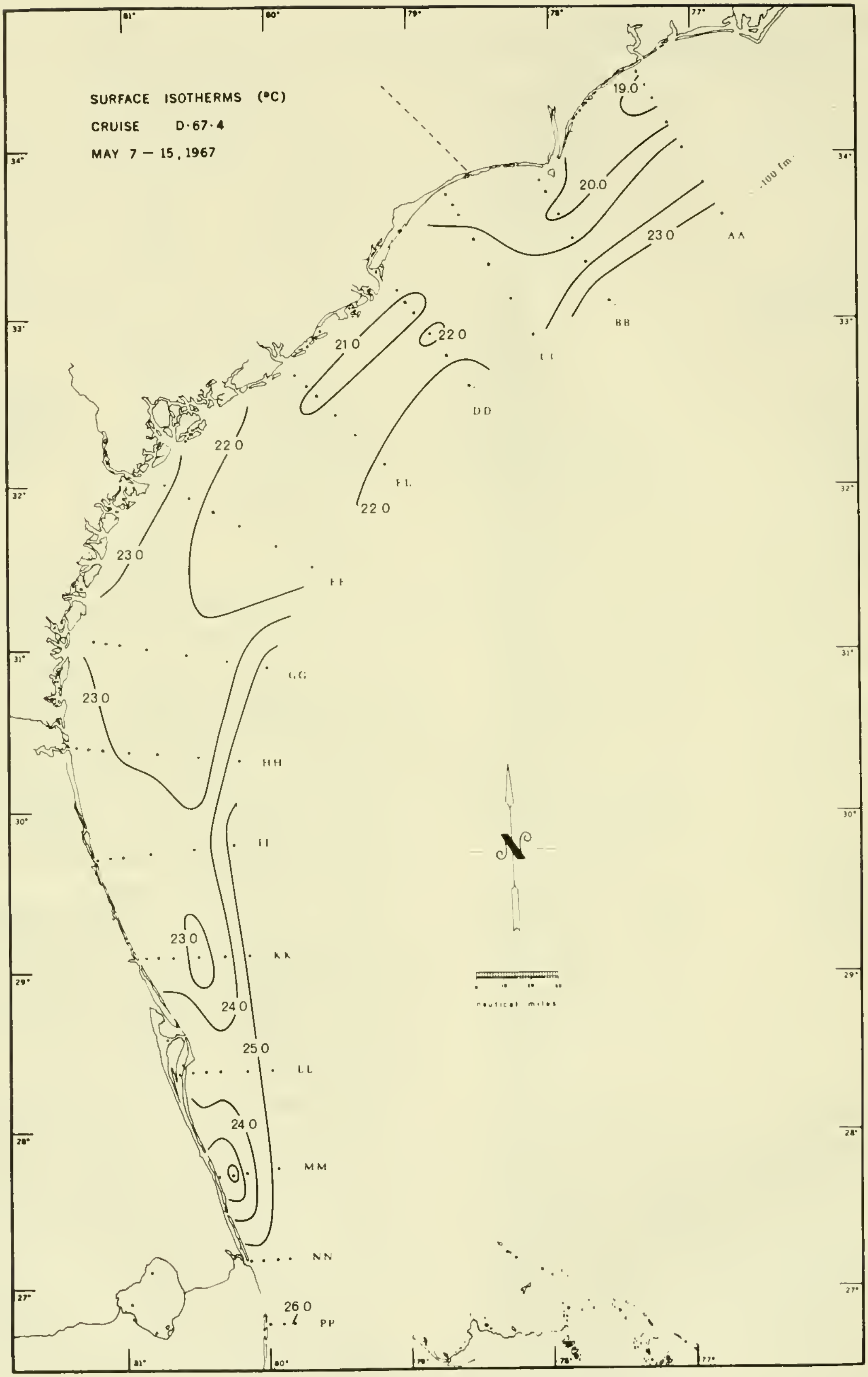


Figure 3.—Surface temperatures observed during spring, 1967.

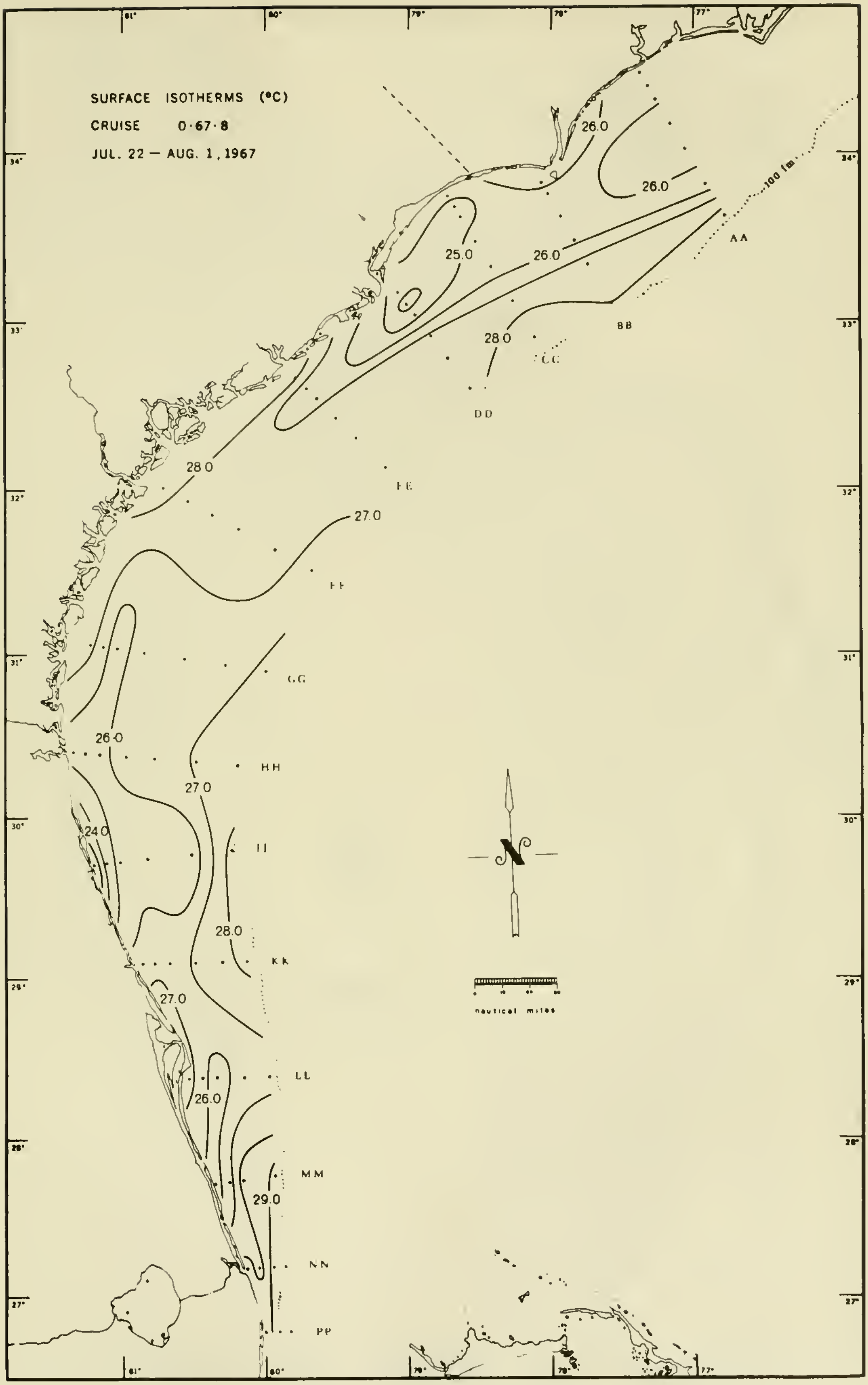


Figure 4.—Surface temperatures observed during summer, 1967.

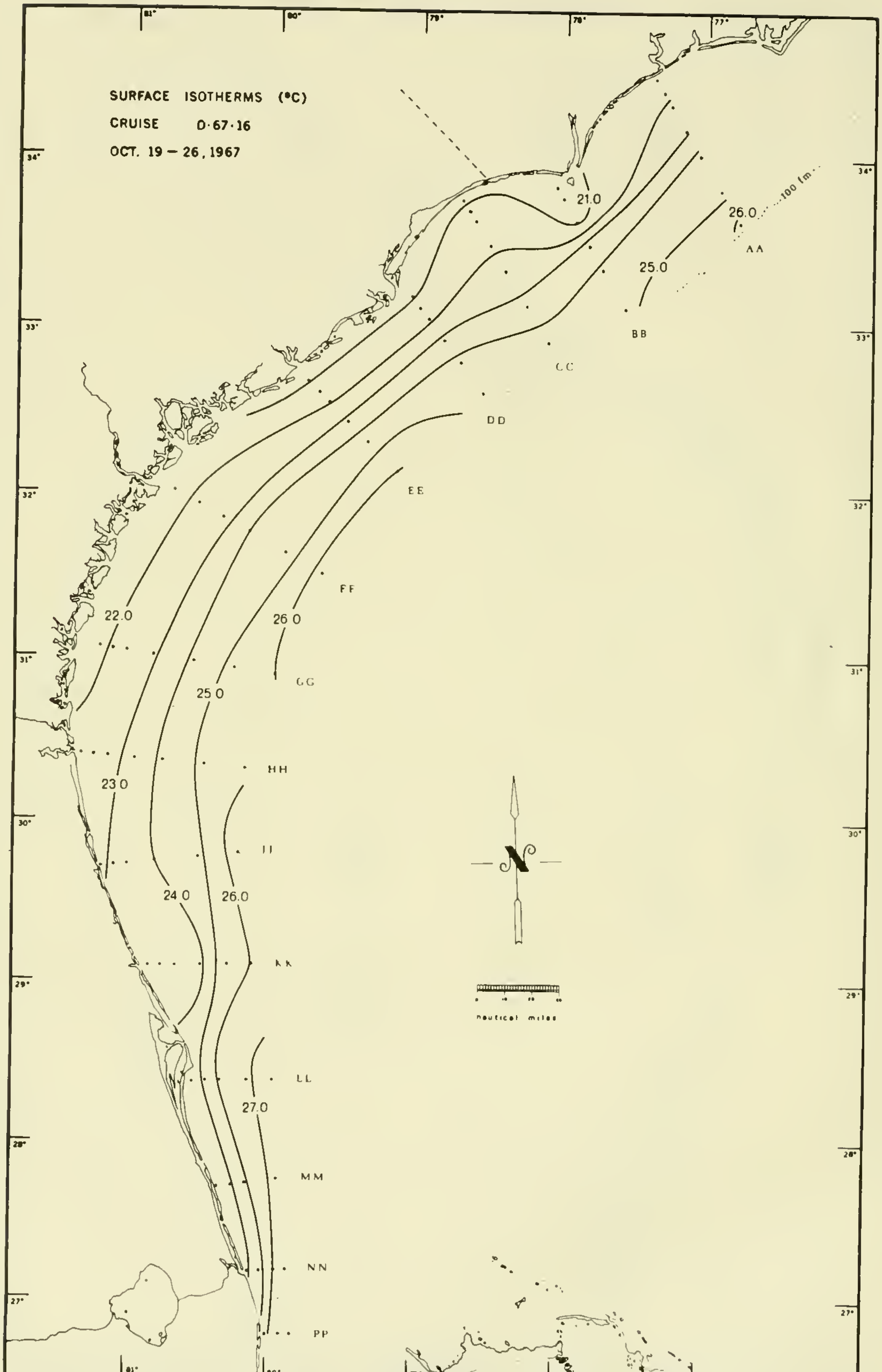


Figure 5.—Surface temperatures observed during fall, 1967.

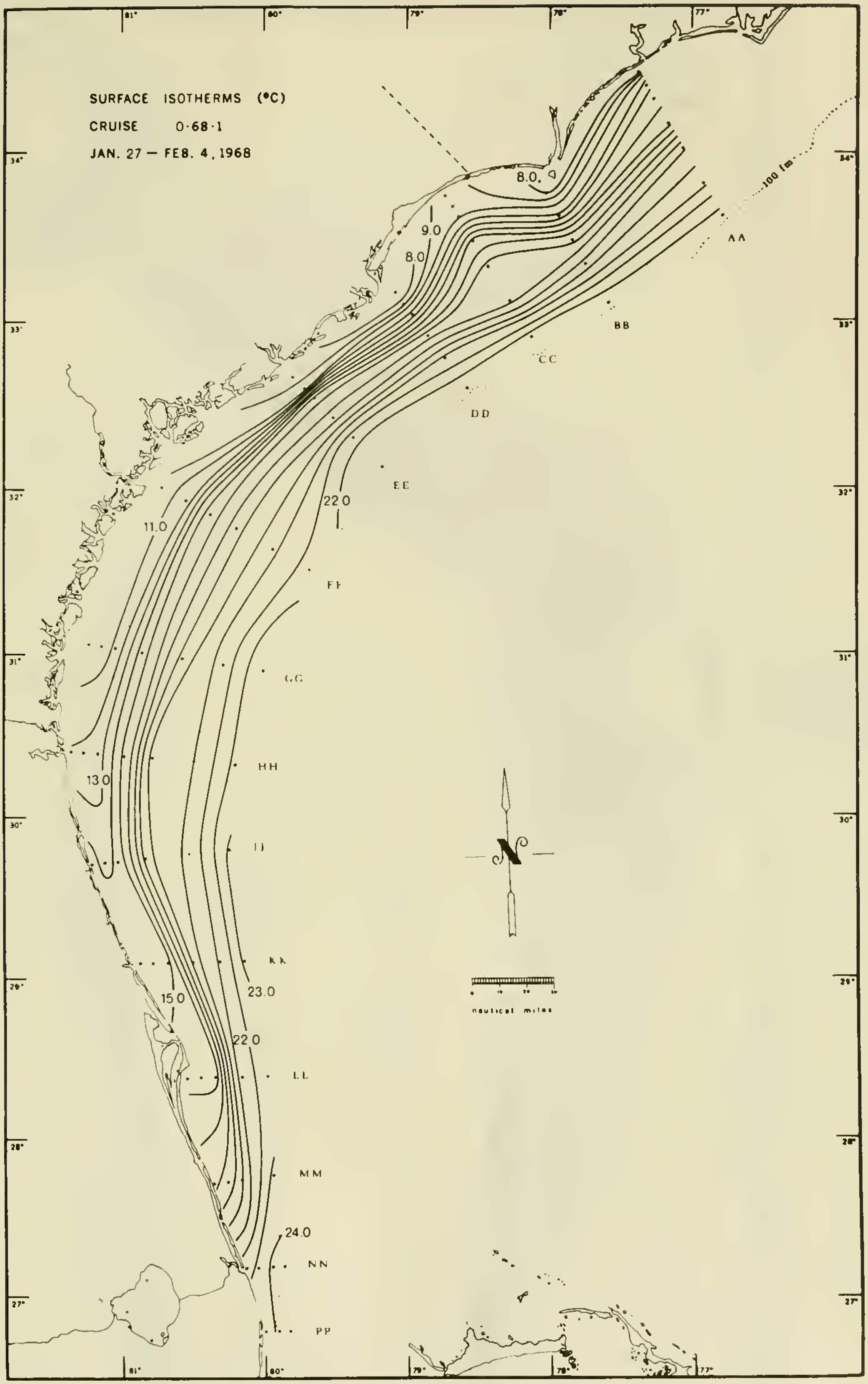


Figure 6.—Surface temperatures observed during winter, 1968.

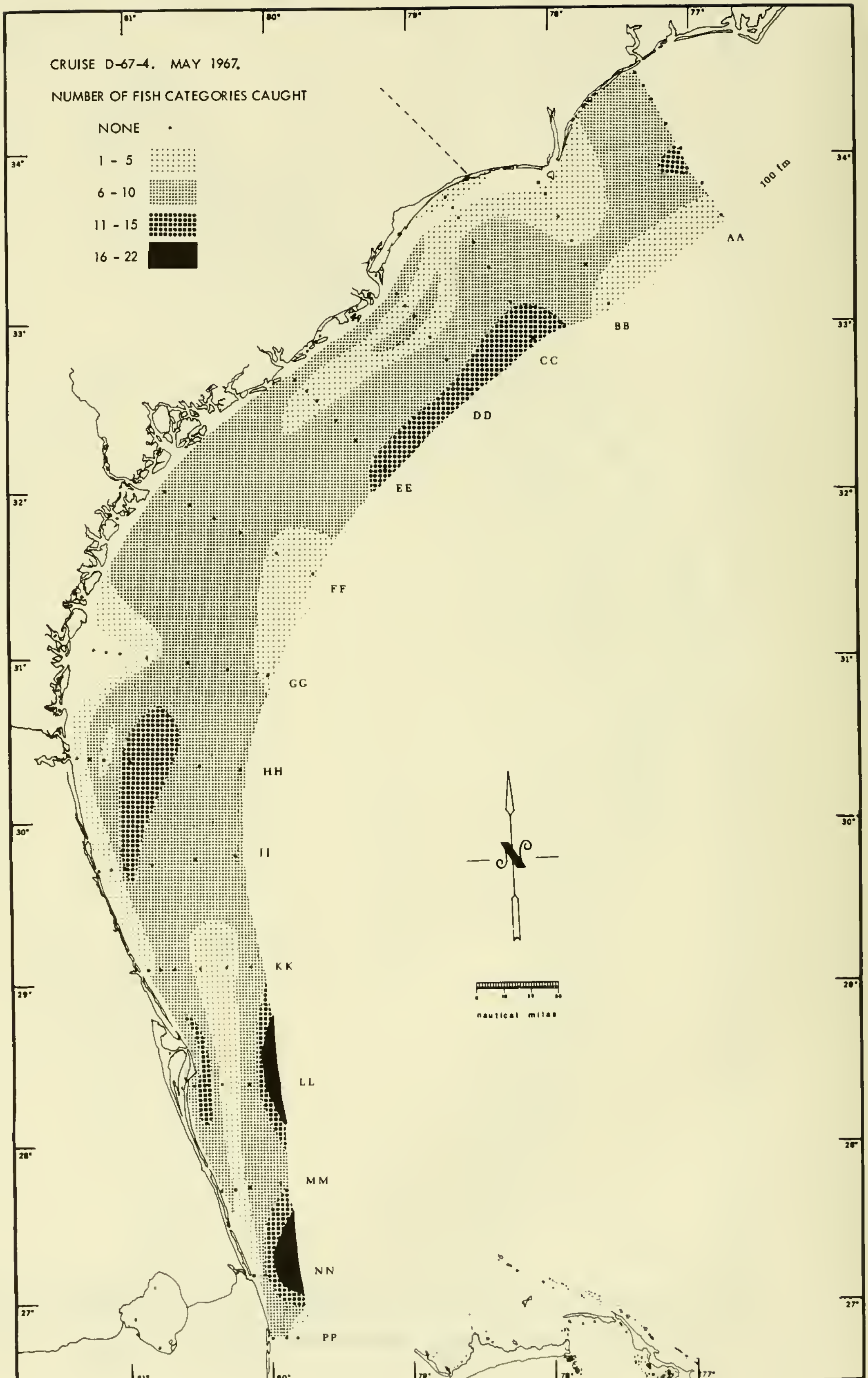


Figure 7.—Number of fish categories caught during spring, 1967.

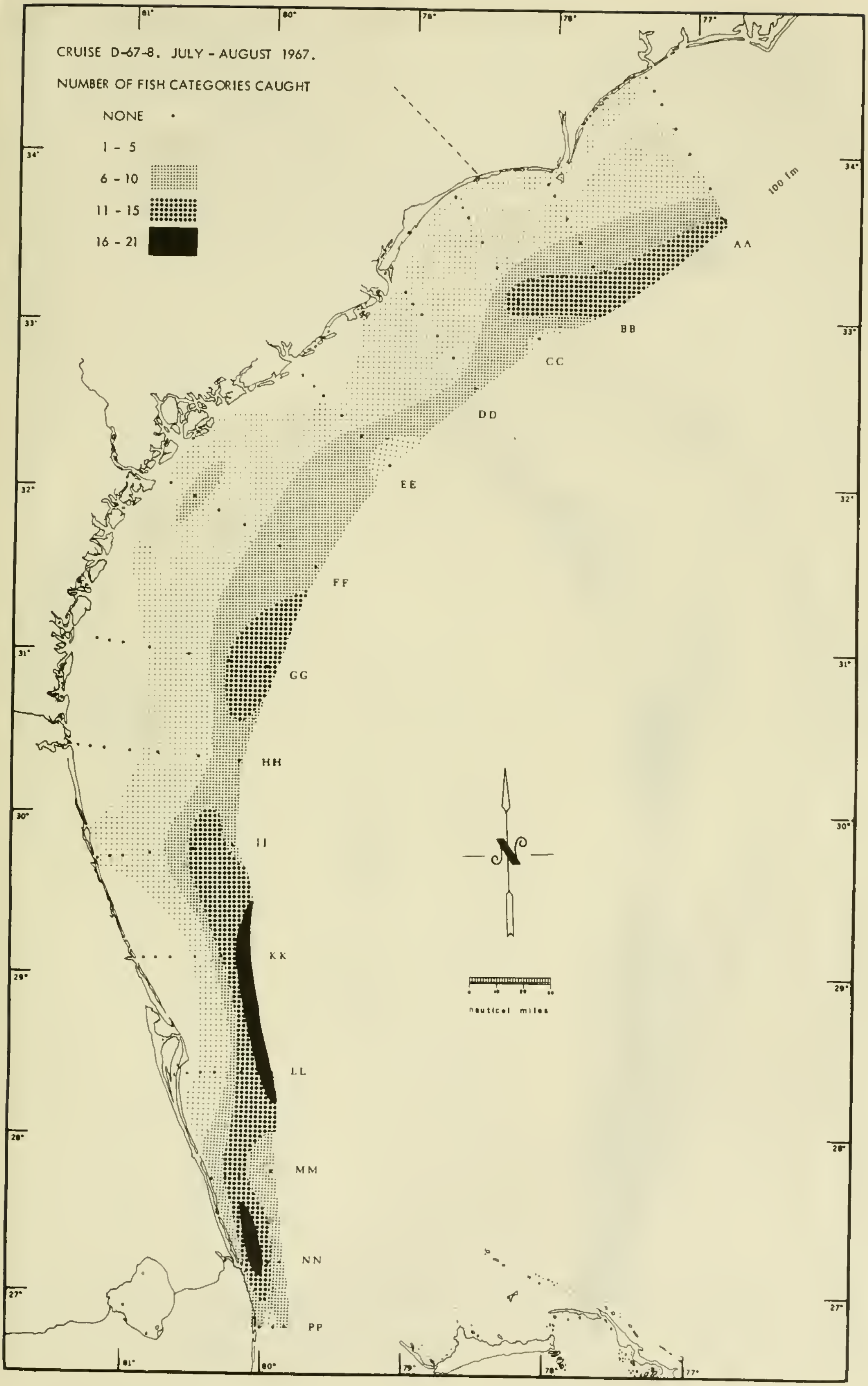


Figure 8.—Number of fish categories caught during summer, 1967.

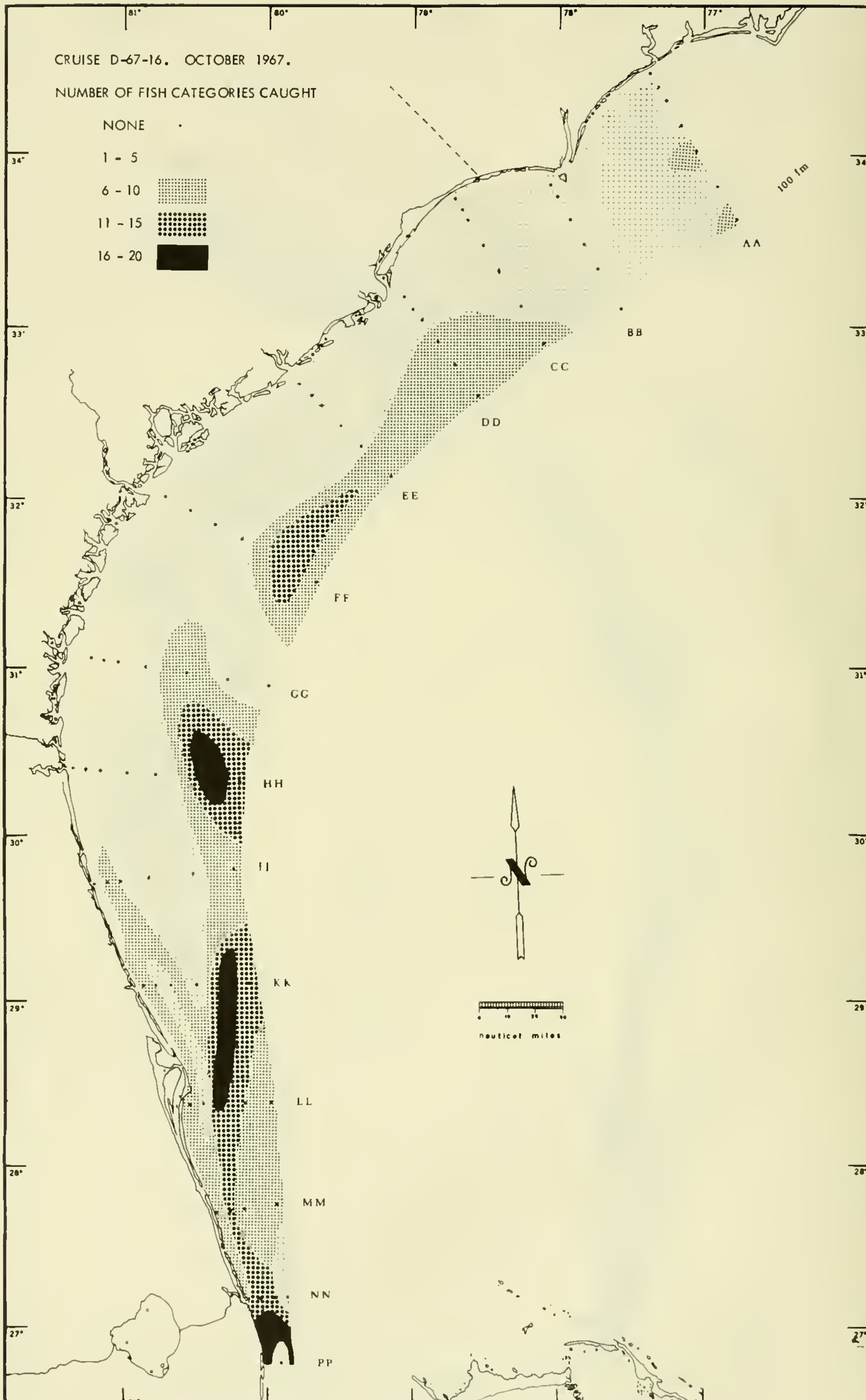


Figure 9.—Number of fish categories caught during fall, 1967.

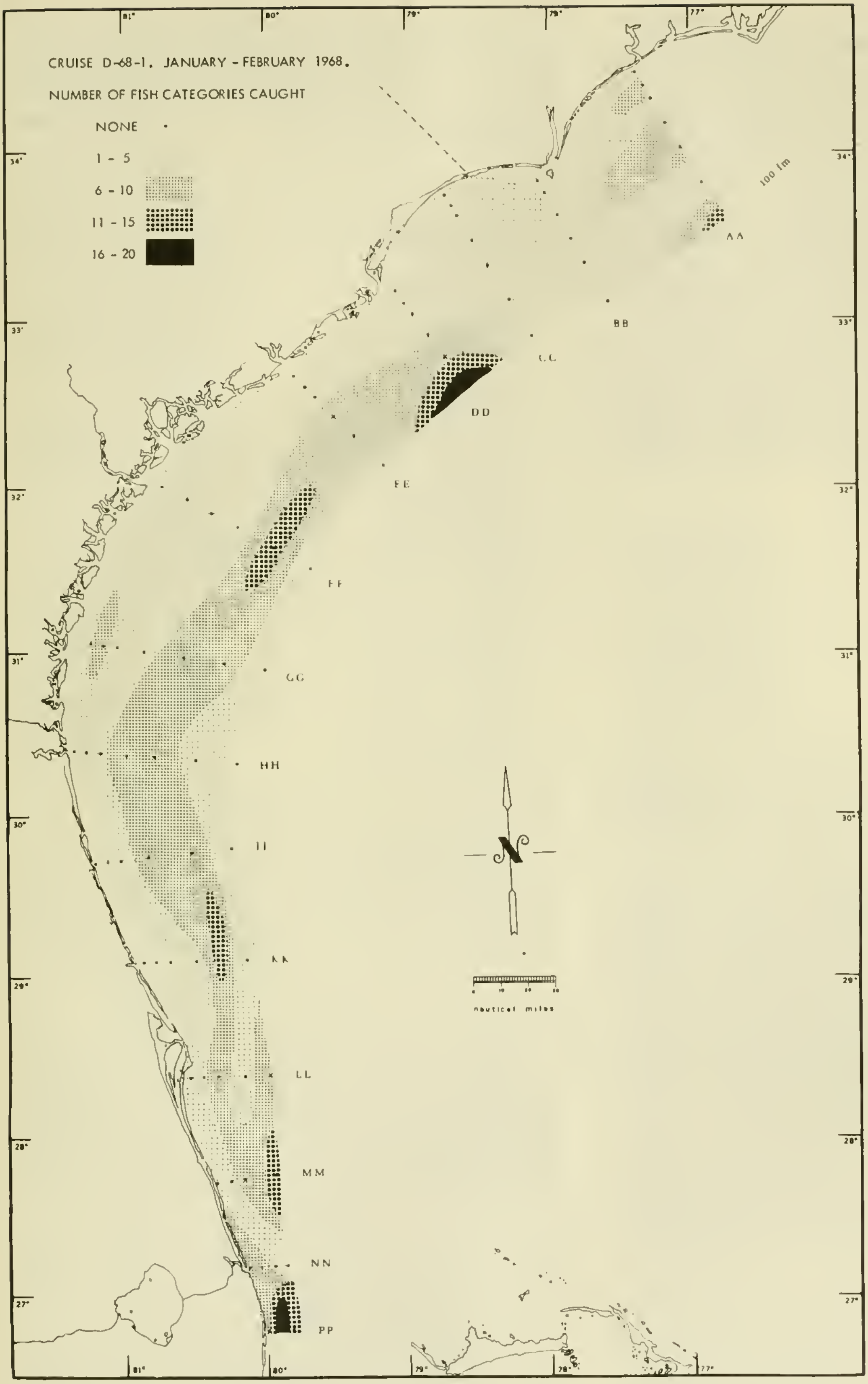


Figure 10.—Number of fish categories caught during winter, 1968.

hydrographic characteristics, especially temperature, and the differences are magnified during the winter. Those species which apparently spawn offshore and whose larvae migrate toward inshore nurseries as they grow do so in winter and spring when temperatures inshore and offshore differ greatly. Examples from our collections include *Elops saurus*, *Mugil* spp., *Leiostomus xanthurus*, *Brevoortia* sp., *Synodus* spp., *Urophycis regius*, *Trachinotus carolinus*, and *Scomberomorus maculatus*. Offshore spawning and inshore migration of larvae does not occur during summer and fall, when temperatures inshore more closely approximate those in the Gulf Stream.

It should be repeated that the data reported on here are the results of only one phase of the sampling done during the *Dolphin* surveys: the surface-towed meter net collections of larval and juvenile fishes. Not included are collections made by the Gulf V plankton samplers and subsurface juvenile fish hoops and midwater trawl.

ELOPIDAE

Elops saurus Linnaeus
ladyfish
D-67-4 May
AA-2, 1, 30.8
D-67-8 Jul-Aug
AA-7, 1, 28.5
D-67-16 Oct
EE-2, 1, 29.9
GG-4, 1, 31.3
HH-6, 2, 24.3-26.3
MM-3, 1, 29.9
D-68-1 Jan-Feb
FF-1, 1, 34.3
GG-3, 1, 35.9
HH-2, 1, 30.5
HH-3, 1, 36.6
LL-1, 1, 26.8

Our catches of *Elops saurus* throughout the year do not necessarily indicate an extended spawning period, for it may be that 1) the fish we caught in winter are from the same group as those we caught in fall, 2) very little growth occurs during fall-winter, or 3) the larvae do not metamorphose and migrate into estuaries until spring warming occurs. Gehringer (1959) suggested much the same thing after examining his catches of early-, mid-, and late-metamorphic larvae. None of our specimens is in a metamorphic stage nor is any small enough to suggest point of origin. I believe that most spawning occurs offshore from spring through fall and that premetamorphic larvae (which we sampled) become more abundant over the shelf through those seasons, reaching a peak in the winter, followed by a mass migration of metamorphosing juveniles into the estuaries in the spring. It is consistent with this hypothesis that our subsurface samplers made several large catches of premetamorphic larvae (up to 346 individuals per station) during the fall and winter off Daytona Beach, Cape Kennedy, and Vero Beach (unpublished).

Eldred and Lyons (1966), mentioned a disparity in myomere numbers between most of their Florida specimens (with 74-77 myomeres) and most of Gehringer's (1959) specimens from the offing of Florida, Georgia, and North Carolina (with 78-81 myomeres). Myomere numbers in our North Carolina to Georgia specimens range from 75 to 78, and in our Florida specimens from 78 to 81. The significance of this is not understood, but interestingly, it is the reverse of the disparity mentioned above. Evidently the meristic characters differ geographically and vary from year to year, probably in response to different temperatures.

MURAENIDAE

Unidentified Leptocephali
D-67-4 May
AA-1, 1, 69.0 SL
LL-5, 2, 42.3-64.5 SL
D-67-8 Jul-Aug
AA-6, 1, 63.0 SL
DD-3, 1, 63.5 SL
EE-4, 1, 77.5 SL
FF-2, 1, 77.6 SL
JJ-4, 1, 70.0 SL
KK-5, 1, 61.5 SL
LL-4, 1, 36.8 SL
MM-1, 1, 67.0 SL
MM-2, 8, 47.5-64.5 SL
NN-1, 1, 24.5 SL
D-67-16 Oct
CC-5, 1, 70.5 SL
EE-2, 2, 72.0-74.5 SL
EE-3, 1, 70.0 SL
HH-6, 3, 60.7-72.5 SL
HH-7, 6, 55.5-72.0 SL

CONGRIDAE

Unidentified Leptocephali
D-67-8 Jul-Aug
NN-1, 1, 22.8 SL
D-67-16 Oct
FF-6, 1, 106.0 SL
GG-4, 1, 53.5 SL
LL-4, 2, 28.0-59.3 SL
D-68-1 Jan-Feb
EE-2, 1, 55.6 SL
NN-4, 1, 82.3 SL

OPHICHTHIDAE

Unidentified Leptocephali
D-67-4 May
AA-3, 1, 75.8 SL
GG-6, 1, 75.7 SL
D-67-8 Jul-Aug
DD-2, 2, 67.7-76.0 SL
FF-2, 1, 70.8 SL
D-67-16 Oct
DD-2, 1, 84.8 SL
GG-3, 3, 89.0-91.5 SL
GG-4, 5, 81.0-97.6 SL
HH-6, 16, 51.5-90.3 SL
HH-7, 1, 75.6 SL
JJ-6, 1, 73.4 SL
LL-3, 1, 71.1 SL
PP-3, 1, 75.2 SL
D-68-1 Jan-Feb
CC-4, 1, 50.7 SL
DD-3, 1, 63.0 SL
EE-1, 2, 57.4-57.8 SL
EE-2, 4, 51.8-62.3 SL
JJ-6, 1, 69.2 SL
NN-1, 2, 63.5-78.0 SL
Myrophis punctatus Lutken
speckled worm eel
D-68-1 Jan-Feb
AA-2, 1, 327.0
Bascanichthys sp.
D-68-1 Jan-Feb
JJ-3, 1, 604.0

NEMICHTHYIDAE

Unidentified Leptocephali
D-67-4 May
NN-2, 1, 77.0 SL
D-68-1 Jan-Feb
DD-6, 1, 91.2
NN-3, 1, 77.0

The surface-towed meter net apparently does not adequately sample leptocephalid larvae. The small numbers of leptocephali listed here do not reflect the many hundreds taken on the same stations by other gear (Gulf V plankton samplers or subsurface juvenile fish samplers). Only four of the eight families represented in our total leptocephalus collection were taken in the surface-towed net. The family Xenocongridae, which, according to Smith (1969) forms "a major constituent of the leptocephalus fauna in the western North Atlantic," is totally absent from our collections. We cannot account for this.

Böhlke and Chaplin (1968) reported that worm eels will approach a light hung near the surface. Our nighttime catches of adult ophichthids indicate that these fishes may forage near the surface at night and be present regardless of an artificial light source.

CLUPEIDAE

Brevoortia tyrannus (Latrobe)
Atlantic menhaden
D-68-1 Jan-Feb
BB-1, 2, 24.0-27.5
DD-1, 15, 20.9-23.9
Brevoortia sp.
D-68-1 Jan-Feb
AA-4, 1, 21.0
AA-5, 1, 18.6
BB-2, 1, 19.0
BB-3, 1, 18.7
CC-6, 3, 25.4-29.9
DD-1, 5, 20.2-21.0
EE-2, 4, 20.9-24.2
EE-4, 54, 17.9-26.2
HH-1, 17, 14.7-20.1
Etrumeus teres (DeKay)
round herring
D-68-1 Jan-Feb
EE-1, 4, 20.0-23.6
HH-5, 29, 17.4-18.4
LL-4, 1, 131.5
Opisthonema oglinum (Lesueur)
Atlantic thread herring
D-67-8 Jul-Aug
DD-1, 1, 75.5
D-67-16 Oct
LL-1, 1, 105.2
LL-2, 1, 100.5
Sardinella anchovia Valenciennes
Spanish sardine
D-67-4 May
AA-1, 10, 19.1-27.5
DD-2, 1, 40.3
D-67-8 Jul-Aug
DD-2, 7, 21.7-26.4
DD-3, 25, 24.0-31.5
MM-1, 1, 61.0
D-67-16 Oct
LL-3, 1, 59.2
MM-2, 1, 54.4
MM-3, 1, 76.0
D-68-1 Jan-Feb
JJ-4, 2, 48.0-50.6
Unidentified
D-67-4 May
AA-2, 4, 16.9-21.2
DD-4, 1, 19.0
HH-6, 1, 12.0
MM-3, 2, 16.6-18.6
D-67-8 Jul-Aug
FF-2, 35, 17.8-30.9
GG-4, 31, 11.5-16.7
GG-5, 9, 10.8-14.9
MM-2, 3, 18.1-20.1
D-67-16 Oct
HH-4, 3, 23.0-25.5
HH-6, 2, 23.5-24.0
D-68-1 Jan-Feb
BB-1, 2, 15.6-20.0
DD-6, 2, 14.0-15.8
EE-5, 9, 13.3-23.0
EE-6, 6, 15.3-18.0
FF-6, 2, 21.2-22.0

Larval *Brevoortia tyrannus* were identified on the basis of their dorsal ray and myomere counts. *Brevoortia tyrannus* has 18-24 dorsal rays (June 1958) and 45-50 vertebrae (Sutherland 1963). Those classified as *Brevoortia* sp. are specimens damaged to the extent that counts are not possible. *Etrumeus teres* larvae have relatively longer snouts than *Brevoortia* sp., few anal rays (9-12), and ventral fins located under the origin of the dorsal fin. Both dorsal and anal counts are high in *Opisthonema oglinum* (D: 20-22; A: 20-24). (The latter species spawns during the summer, *Brevoortia* sp. during the winter.) *Harengula pensacolae* and *Sardinella anchovia* share dorsal and anal ray counts, but *S. anchovia* has more myomeres (45-47) than *H. pensacolae* (40-42), and the posterior two anal rays are produced in *S. anchovia* larvae, at least in the sizes we encountered.

ENGRAULIDAE

Anchoa hepsetus (Linnaeus)
striped anchovy
D-67-4 May
EE-1, 1, 58.0
D-67-8 Jul-Aug
JJ-1, 1, 42.6
D-67-16 Oct
BB-1, 83, 53.5-61.5
CC-4, 42, 19.5-35.0
DD-2, 78, 18.5-27.4
EE-3, 1, 21.5
LL-1, 2, 28.9-29.9
MM-1, 6, 34.4-47.5
D-68-1 Jan-Feb
LL-3, 5, 52.3-56.3
Anchoa mitchilli (Valenciennes)
bay anchovy
D-67-4 May
DD-1, 1, 48.5
EE-1, 1, 48.2
KK-1, 1, 34.5
D-68-1 Jan-Feb
EE-1, 30, 42.0-56.8
Anchoa nasuta Hildebrand and Carvalho
longnose anchovy
D-67-8 Jul-Aug
DD-1, 4, 41.3-44.8
D-67-16 Oct
BB-1, 18, 42.6-53.0
LL-3, 11, 29.2-44.7
MM-2, 1, 39.8
D-68-1 Jan-Feb
CC-4, 46, 46.3-63.0
FF-2, 1, 57.9
Anchoa sp.
D-67-4 May
AA-2, 9, 18.9-29.0
AA-4, 9, 14.5-26.6
AA-5, 1, 16.9
KK-2, 74, 9.9-28.8
LL-2, 4, 12.0-28.1
D-67-8 Jul-Aug
CC-1, 2, 19.6-21.7
CC-3, 5, 54.7-58.0
D-67-16 Oct
AA-3, 1, 18.3
CC-3, 3, 15.0-21.8
CC-6, 1, 24.0
D-68-1 Jan-Feb
AA-2, 6, 20.9-22.0
AA-3, 7, 20.0-21.4
LL-5, 1, 25.6
Engraulis eurystole (Swain and Meek)
silver anchovy
D-68-1 Jan-Feb
BB-4, 1, 35.9
Unidentified
D-67-4 May
AA-3, 2, 19.0-mut.
BB-2, 2, 19.5-20.2
BB-4, 1, 17.9
CC-1, 1, 21.7
HH-2, 1, 17.4
HH-4, 5, 15.4-17.9
JJ-1, 7, 15.5-21.9
KK-1, 3, 22.5-29.5
LL-2, 2, 10.3-11.0
D-67-8 Jul-Aug
BB-1, 1, 25.0
D-67-16 Oct
CC-5, 11, 19.0-23.5
CC-6, 1, 19.2
DD-1, 1, 19.7-28.5
DD-4, 3, 19.0-23.1
DD-5, 5, 23.0-25.0
EE-2, 9, 19.9-25.7
LL-3, 4, 29.5-47.0
D-68-1 Jan-Feb
AA-4, 2, 15.6-17.5

SYNODONTIDAE

Synodus foetens (Linnaeus)
inshore lizardfish
D-67-4 May
DD-2, 2, 24.0-28.0
DD-4, 2, 16.0-19.5
FF-2, 2, 23.0-25.7
D-68-1 Jan-Feb
JJ-5, 1, 16.9
Unidentified
D-68-1 Jan-Feb
JJ-4, 1, mut.
MM-4, 1, 22.8

The synodontids are characterized by wide variation in vertebral numbers between the species (Miller and Jorgenson 1973) with *Synodus foetens* having the highest count (56-61). All those specimens here identified as *S. foetens* have myomere counts of 60 (± 1). Pigment patterns on the unidentified synodontids are not sufficient to identify them since the patterns are intermediate between those described by Anderson et al. (1966).

MYCTOPHIDAE

Unidentified
D-67-16 Oct
PP-3, 2, 17.9-mut.
D-68-1 Jan-Feb
FF-5, 1, mut.
GG-6, 1, 16.9
PP-2, 6, mut.-17.3

ANTENNARIIDAE

Histrio histrio (Linnaeus)
sargassumfish
D-67-4 May
DD-6, 3, 17.0-92.0
EE-6, 1, 31.0
GG-5, 1, 40.0
HH-3, 1, 26.5
HH-7, 4, 10.5-29.0
KK-5, 1, 13.0
KK-6, 1, 13.0
LL-5, 1, 14.0
MM-4, 3, 11.0-20.0
NN-2, 1, 20.0
NN-3, 2, 10.0-14.0
NN-4, 7, 10.0-18.0
PP-1, 1, 9.5
PP-2, 3, 10.5-24.0
D-67-8 Jul-Aug
KK-5, 2, 10.0-15.0

MM-2, 1, 15.0
NN-4, 1, 11.0
PP-1, 1, 14.0
D-67-16 Oct
AA-7, 1, 12.0
CC-7, 1, 11.0
EE-6, 1, 14.5
HH-6, 1, 23.0
KK-6, 1, 22.0
LL-3, 1, 35.0
MM-1, 1, 69.5
PP-1, 1, 21.0
D-68-1 Jan-Feb
LL-5, 2, mut.
MM-3, 2, 14.0-17.0
PP-2, 1, mut.

Adams (1960) concluded that "*Histrio* spawns year-round in the Florida Current area with a possible mid-winter interruption of reproductive activity." Dooley (1972) found an increase in the mean size of *Histrio* from April through September followed by a sudden influx of 6 to 15 mm individuals in October and suggested that "spawning occurred at least from late August through April." Our own data do not settle this disparity. We caught small specimens during all four cruises but not in numbers large enough to construct significant length-frequency curves.

GADIDAE

Urophycis earlii (Bean)
Carolina hake
D-68-1 Jan-Feb
FF-3, 1, 25.0 TL
KK-3, 1, 25.0 TL
Urophycis floridanus
(Bean and Dresel)
southern hake
D-68-1 Jan-Feb
AA-5, 2, 12.0-30.0 TL
BB-3, 1, 60.0 TL
FF-5, 4, 15.0-40.0 TL
HH-4, 3, 21.0-37.0 TL
HH-5, 3, 43.8-70.0 TL
JJ-4, 1, 25.0 TL
LL-5, 1, 51.0 TL
Urophycis regius (Walbaum)
spotted hake
D-67-4 May
CC-4, 1, 20.0 TL
DD-1, 2, 57.0-57.0 TL
DD-2, 2, 35.0-58.0 TL
EE-2, 1, 69.0 TL
EE-3, 2, 55.5-126.0 TL
HH-4, 1, 26.0 TL
D-68-1 Jan-Feb
AA-1, 8, 38.0-40.0 TL
AA-2, 69, 27.0-58.0 TL
AA-3, 60, 20.0-36.0 TL
AA-4, 564, 9.0-28.0 TL
AA-5, 17, 9.0-18.0 TL
AA-7, 17, 11.0-23.0 TL
BB-3, 268, 16.0-76.0 TL
BB-4, 60, 24.0-51.0 TL
CC-1, 8, 23.0-31.0 TL
CC-2, 21, 24.0-31.0 TL
CC-3, 1, 26.0 TL
CC-4, 469, 23.0-65.0 TL
CC-5, 8, 19.0-30.0 TL
CC-6, 8, 20.0-29.0 TL
DD-2, 5, 15.0-26.0 TL
DD-3, 7, 22.0-37.0 TL
DD-4, 30, 9.0-20.0 TL
DD-5, 59, 9.0-17.0 TL
DD-6, 19, 8.0-27.0 TL
EE-2, 24, 32.0-54.0 TL
EE-3, 180, 26.0-64.0 TL
EE-4, 23, 14.0-27.0 TL
FF-1, 81, 32.0-67.0 TL
FF-2, 163, 27.0-54.0 TL
FF-3, 2, 24.0-32.0 TL
FF-4, 23, 20.0-31.0 TL
FF-5, 248, 9.0-25.0 TL
GG-1, 7, 27.0-32.0 TL
GG-2, 6, 25.0-30.0 TL
GG-3, 4, 29.0-41.0 TL
GG-4, 3, 27.0-31.0 TL
GG-5, 94, 8.0-21.0 TL
HH-1, 40, 25.0-34.0 TL
HH-2, 7, 20.0-31.0 TL
HH-3, 1, 24.0 TL
HH-5, 1, 25.0 TL
JJ-2, 42, 20.0-49.0 TL
JJ-3, 18, 21.0-43.0 TL
KK-4, 3, 14.0-16.0 TL
KK-5, 1, 24.0 TL
Urophycis sp.
D-67-4 May
CC-7, 1, 7.5 TL
FF-5, 4, 15.0-20.0 TL

Urophycis regius juveniles were the most numerous of all species caught in the South Atlantic Bight. Spawning evidently begins in late fall or early winter and extends into spring, when adults of this species occupy inshore waters (Anderson 1968, p. 54). The resulting juveniles are then widely distributed in surface waters at least from New River, N.C., to Daytona Beach, Fla. (Fig. 11), with a center of abundance near Cape Fear, N.C. We caught no juvenile *Urophycis* sp. south of Cape Kennedy. That point probably marks the approximate southern limit to this genus' abundance and spawning range.

Juvenile *U. regius* evidently occupy the surface layers until they reach about 75 mm, judging from our catches. They are found in as wide a range of temperatures as the South Atlantic Bight offers during the winter (Fig. 12) but mostly in temperatures between 10° and 15°C. Catches in relatively warm water on the offshore ends of transects DD and FF account for the second peak in Figure 12.

OPHIDIIDAE

Unidentified
D-67-4 May
EE-6, 1, 35.0
D-67-16 Oct
HH-6, 1, 61.0
HH-7, 1, 28.0

EXOCOETIDAE

Chriodorus atherinoides
Goode and Bean
hardhead halfbeak
D-68-1 Jan-Feb
EE-3, 1, 78.2
Cypselurus cyanopterus
(Valenciennes)
margined flyingfish
D-67-16 Oct
KK-5,1, 46.5
Cypselurus exsiliens (Linnaeus)
bandwing flyingfish
D-67-16 Oct
KK-6, 1, 52.0
Cypselurus furcatus (Mitchill)
spotfin flyingfish
D-67-4 May
LL-5, 1, 26.5
Cypselurus heterurus
(Rafinesque)
Atlantic flyingfish
D-67-4 May
AA-6, 2, 19.0-21.9
BB-5, 2, 58.7-62.8
CC-7, 1, 19.5
DD-6, 1, 21.5
HH-4, 1, 16.4
HH-7, 1, 35.5
JJ-5, 1, 217.0
JJ-6, 1, 38.6
LL-5, 4, 40.0-66.5
NN-3, 1, 13.9
NN-4, 2, 16.5-21.0
D-67-8 Jul-Aug
AA-5, 1, 122.5
AA-7, 4, 18.7-28.5
DD-6, 2, 21.8-34.6
GG-7, 1, 30.5
HH-7, 4, 26.1-62.5
JJ-6, 1, 19.9
LL-5, 1, 26.3
NN-3, 2, 23.7-29.4
PP-1, 1, 17.4
PP-3, 1, 57.7
D-67-16 Oct
BB-4, 1, 47.0
CC-6, 1, 93.8
DD-5, 2, 20.0-38.6
EE-6, 3, 36.0-46.2
FF-4, 1, 18.0
FF-5, 2, 20.6-23.8
GG-5, 4, 19.8-41.9
GG-7, 1, 22.9
HH-3, 2, 27.0-35.0
HH-4, 2, 36.5-39.5
JJ-2, 4, 19.7-25.8
KK-1, 4, 21.5-36.5
KK-5, 1, 29.0
KK-6, 1, 54.5
LL-4, 1, 25.0
LL-5, 1, 22.1
NN-2, 1, 38.8
PP-1, 2, 31.6-49.6
D-68-1 Jan-Feb
DD-6, 1, 27.2
JJ-4, 2, 29.7-54.2
JJ-5, 1, 89.6
PP-2, 1, 55.0
PP-3, 1, 28.5
Cypselurus sp.
D-67-16 Oct
NN-2, 1, 34.9
Euleptorhamphus velox Poey
flying halfbeak
D-67-16 Oct
FF-6, 1, 37.9
Exocoetus obtusirostris Gunther
oceanic two-wing flyingfish
D-67-4 May
LL-5, 2, 16.0-22.5
D-68-1 Jan-Feb
PP-1, 1, 13.4
PP-2, 12, 9.9-21.0
PP-3, 6, 10.8-20.0
Exocoetus volitans Linnaeus
tropical two-wing flyingfish
D-67-4 May
LL-5, 1, 28.0
NN-3, 1, 21.0

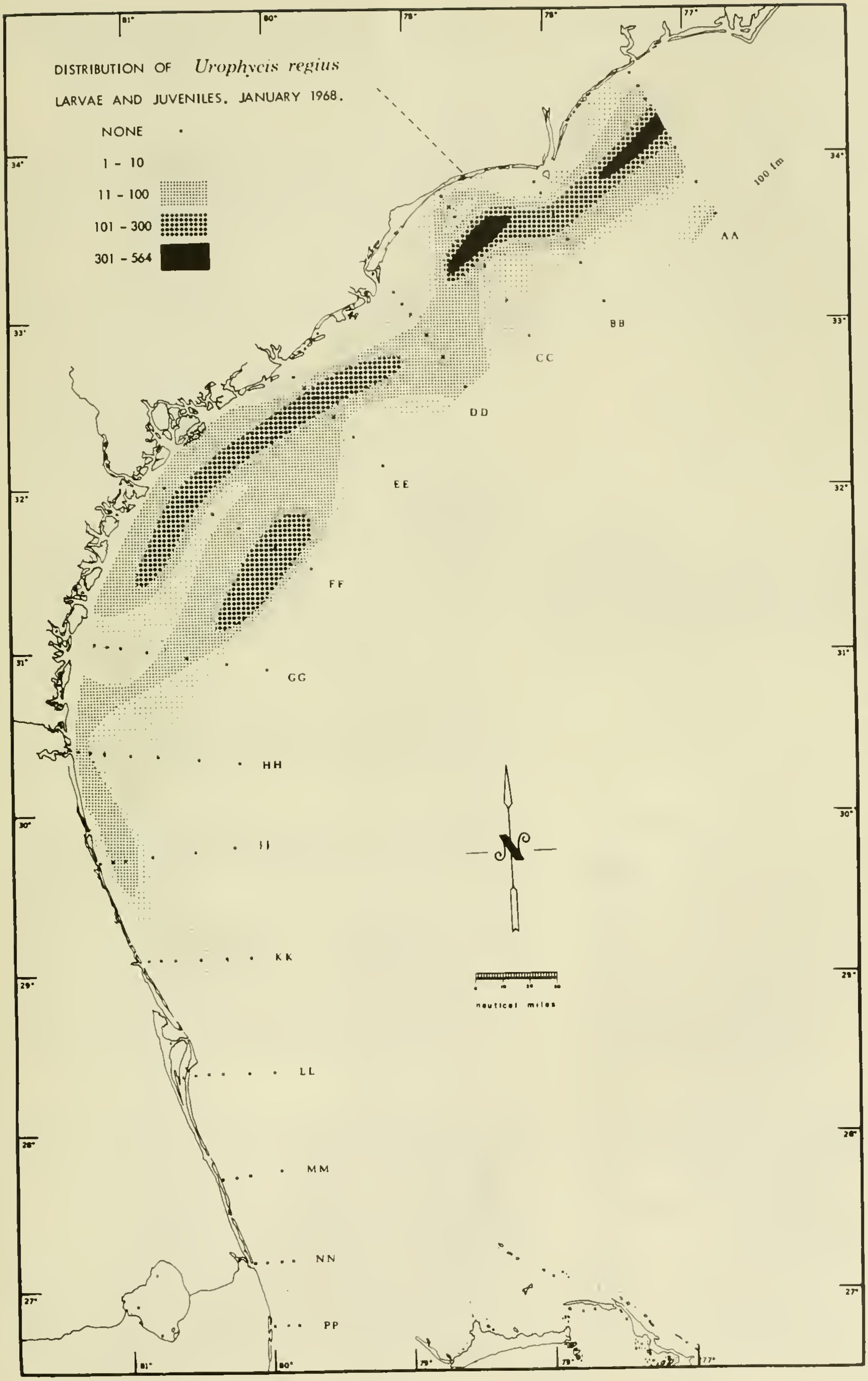


Figure 11.—Distribution of spotted hake, *Urophycis regius*, larvae and juveniles, during winter 1968.

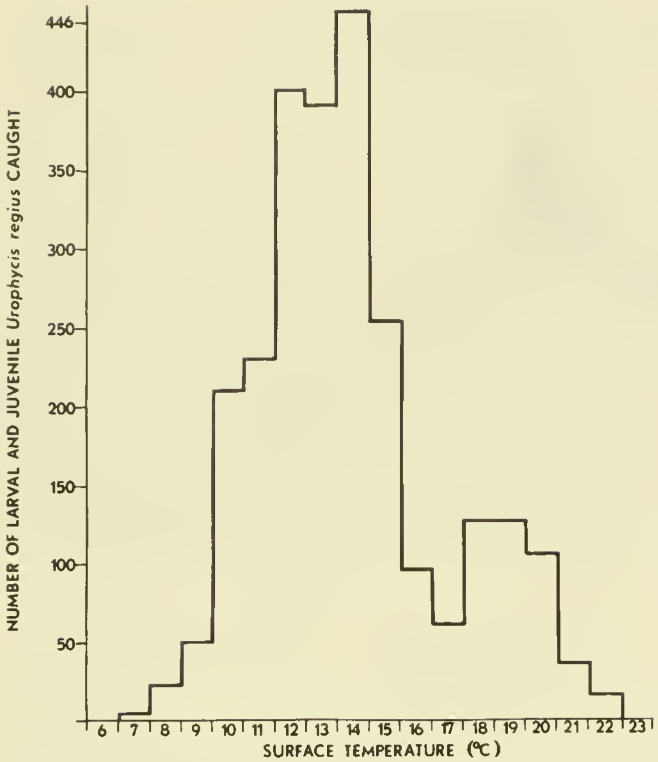


Figure 12.—Abundance of spotted hake, *Urophycis regius*, larvae and juveniles, relative to observed surface temperatures during winter 1968.

D-68-1 Jan-Feb
NN-3, 1, 30.3
Hemiramphus brasiliensis
(Linnaeus)
ballyhoo
D-67-4 May
DD-2, 2, 50.5-51.2
DD-3, 1, 49.0
DD-6, 3, 35.9-51.6
EE-1, 1, 77.0
EE-3, 1, 47.4
LL-1, 1, 40.4
NN-3, 3, 18.5-22.2
D-67-8 Jul-Aug
AA-7, 2, 23.0-43.8
FF-2, 3, 159.0-167.0
GG-6, 1, 29.7
HH-7, 3, 26.0-75.5
LL-4, 2, 25.0-34.4
MM-3, 2, 33.6-36.8
NN-3, 1, 32.7
D-67-16 Oct
AA-6, 1, 57.3
EE-2, 1, 166.0
GG-7, 2, 30.6-31.8
JJ-6, 2, 58.5-68.5
KK-1, 2, 30.9-36.8
KK-5, 5, 23.5-37.9
KK-6, 4, 28.8-78.2
LL-3, 8, 34.0-127.0
LL-4, 1, 25.3
LL-5, 1, 28.0

NN-2, 2, 12.8-14.9
PP-1, 3, 23.0-54.2
PP-3, 1, 40.0
D-68-1 Jan-Feb
JJ-5, 1, 80.4
LL-5, 1, 46.0
MM-3, 2, 34.0-67.2
PP-2, 1, 15.1
Hirundichthys affinis (Gunther)
fourwing flyingfish
D-67-4 May
NN-3, 1, 17.0
D-68-1 Jan-Feb
PP-2, 1, 9.9
Hirundichthys rondeleti
(Valenciennes)
blackwing flyingfish
D-67-4 May
HH-7, 1, 21.0
JJ-6, 1, 20.5
MM-4, 1, 24.5
NN-4, 3, 18.0-23.0
D-67-8 Jul-Aug
LL-5, 1, 19.0
Hyporhamphus unifasciatus
(Ranzani)
halfbeak
D-67-4 May
EE-1, 1, 132.0
LL-3, 1, 43.4
D-67-8 Jul-Aug
GG-7, 1, 23.0

LL-4, 2, 24.2-28.5
D-67-16 Oct
LL-1, 8, 71.0-185.0
LL-2, 4, 95.0-105.5
LL-3, 2, 58.0-62.0
MM-1, 2, 71.4-102.4
MM-2, 2, 64.2-77.5
D-68-1 Jan-Feb
HH-4, 1, 81.3
HH-5, 1, 73.9
LL-2, 8, 104.2-132.0
LL-3, 66.0-146.0

Oxyporhamphus micropterus
(Valenciennes)
smallwing flyingfish
D-67-8 Jul-Aug
BB-4, 3, 12.5-14.0
D-67-16 Oct
AA-5, 1, 15.0
DD-4, 1, 14.5

Parexocoetus brachypterus
(Richardson)
sailfin flyingfish
D-67-4 May
KK-5, 2, 122.0-123.2
LL-5, 1, 22.0
MM-4, 2, 25.0-32.2
D-67-8 Jul-Aug
AA-5, 10, 21.9-122.5
AA-7, 2, 17.8-59.1
EE-5, 2, 20.5-27.4
FF-4, 3, 10.4-17.7
GG-6, 1, 26.3
GG-7, 3, 13.0-55.0
JJ-3, 1, 108.6
KK-5, 1, 58.9
KK-6, 5, 18.4-133.2
MM-2, 1, 56.6
D-67-16 Oct
AA-2, 1, 27.4
BB-4, 3, 18.0-23.5
BB-5, 1, 23.5
CC-4, 2, 25.6-26.5
CC-5, 6, 27.6-35.2
CC-6, 8, 21.0-59.0
DD-5, 6, 6.1-38.6
DD-6, 3, 13.6-24.3
EE-5, 1, 29.2
EE-6, 2, 14.2-20.0
GG-3, 1, 26.6
GG-4, 2, 17.7-23.8
HH-2, 5, 16.9-35.4
HH-3, 9, 16.0-30.5
HH-4, 1, 23.0
HH-6, 1, 125.9
HH-7, 1, 122.6
JJ-1, 1, 34.0
JJ-2, 1, 20.5
KK-1, 1, 28.0
KK-2, 2, 24.7-28.6
KK-3, 1, 21.6
KK-4, 2, 51.8-59.7
KK-5, 20, 33.0-136.0
KK-6, 24, 22.5-50.5

LL-3, 11, 28.0-80.0
MM-1, 2, 30.8-30.8
MM-2, 2, 22.3-39.9
MM-4, 4, 19.5-29.1
PP-2, 2, 27.4-41.1
PP-3, 4, 18.3-37.8

Prognichthys gibbifrons
(Valenciennes)
bluntnose flyingfish
D-67-4 May
DD-5, 1, 26.4
DD-6, 1, 28.9
FF-6, 1, 25.5
HH-6, 1, 30.6
HH-7, 3, 18.7-30.0
JJ-3, 1, 29.4
JJ-6, 2, 15.7-22.0
LL-5, 2, 15.5-mut.
MM-3, 2, 22.0-23.7
NN-2, 2, 20.8-21.7
NN-3, 5, 13.9-23.9
NN-4, 7, 14.4-25.4
PP-2, 2, 15.9-18.5
D-67-8 Jul-Aug
AA-6, 1, 41.5
AA-7, 2, 17.8-37.0
BB-4, 2, 15.0-24.5
BB-5, 2, 16.3-22.4
EE-6, 1, 19.1
FF-6, 2, 17.2-24.9
GG-6, 1, 16.0
JJ-6, 1, 23.0
KK-5, 1, 10.9
KK-6, 1, 36.0
LL-5, 3, 15.2-17.5
MM-1, 1, 17.1
MM-3, 1, 8.0
NN-2, 1, 19.3
D-67-16 Oct
EE-5, 1, 18.6
FF-5, 1, 21.0
FF-6, 1, 24.0
KK-5, 1, 15.0
KK-6, 1, 24.0
LL-4, 1, 50.9
MM-2, 1, 22.3
NN-3, 1, 20.2
D-68-1 Jan-Feb
DD-6, 1, 20.8
NN-2, 1, 50.0
NN-4, 4, 34.3-64.5
PP-2, 1, 21.5
Unidentified
D-67-4 May
CC-5, 1, mut.
CC-7, 2, 12.9-19.5
DD-6, 1, mut.
KK-6, 1, 22.2
NN-4, 1, mut.
D-67-8 Jul-Aug
GG-6, 1, 15.3
JJ-5, 2, 10.9-15.6
MM-2, 1, 15.0
D-68-1 Jan-Feb
MM-4, 1, 15.0

Using information from Bruun (1935), Breder (1938), Staiger (1965), Blache et al. (1970), and Miller and Jorgenson (1973), the following key was constructed and used for identifying juvenile flyingfishes:

Key to Juvenile Flyingfishes

1 (2). Pectoral fins short, not reaching origin of dorsal fin . . . . *Oxyporhamphus micropterus*
2 (1). Pectoral fins long, reaching to or beyond origin of dorsal fin 3
3 (4). Pelvic fins short, less than 21% of SL 5
4 (3). Pelvic fins long, greater than 25% of SL 9
5 (8). Pectoral fins ca. 70% of SL; 13-14 dorsal rays; dorsal fin not extending to caudal base 6
6 (7). 19-21 gill rakers on lower limb of first gill arch . . . . *Exocoetus obtusirostris*
7 (6). 24-26 gill rakers on lower limb of first gill arch . . . . *Exocoetus volitans*
8 (5). Pectoral fins ca. 60% of SL or less; 10-13 dorsal rays; dorsal fin extends beyond caudal base . . . . *Parexocoetus brachypterus*
9 (20). More dorsal rays (12-16) than anal rays (8-12) 10
10 (11). Second pectoral ray simple . . . . *Prognichthys gibbifrons*
11 (10). Second pectoral ray branched 12
12 (13). Dorsal fin (at least partly) black 14
13 (12). Dorsal fin uniformly gray 16
14 (15). Less than 30 predorsal scales; 15 dorsal rays; mandibular barbels flap-like, shorter than 46% of standard length . . . . *Cypselurus exsiliens*
15 (14). More than 30 predorsal scales; 12-13 dorsal rays; mandibular barbels cylindrical, very long, reaching past origin of dorsal fin . . . . *Cypselurus cyanopterus*
16 (17). Palatine teeth visible; 12 dorsal rays; 42 vertebrae (26-27 precaudal) . . . . . *Cypselurus comatus*
17 (16). No palatine teeth; 13-14 dorsal rays; 45-47 vertebrae (29-31 precaudal) 18
18 (19). First pectoral ray longer than 38% of standard length; 29-33 total caudal rays . . . . *Cypselurus furcatus*
19 (18). First pectoral ray shorter than 38% of standard length; 26-29 total caudal rays . . . . *Cypselurus heterurus*
20 (9). More anal rays (11-13) than dorsal rays (10-12) 21
21 (22). Second pectoral ray simple; 12 dorsal rays . . . . *Hirundichthys rondeleti*
22 (21). Second pectoral ray branched; 10-11 dorsal rays . . . . *Hirundichthys affinis*

Of the three species of flyingfishes most commonly taken, only *Parexocoetus brachypterus* demonstrates marked seasonality in size of fish and numbers taken (Table 3).

The halfbeaks *Hemiramphus brasiliensis* and *Hyporhamphus unifasciatus* were both more numerous and larger in night tows than in day tows (Table 4), attesting either to the ability of these fast-moving predators to avoid the net during daylight or to the fact that they avoid surface waters during the day and actively feed there primarily at night.

BELONIDAE

Tylosurus acus Lacepede
agujon
D-67-4 May
MM-2, 1, 206.0
D-67-8 Jul-Aug
GG-7, 1, 197.0
D-67-16 Oct
PP-1, 1, 208.0
Tylosurus sp.
D-67-16 Oct
KK-5, 1, 35.5

ATHERINIDAE

Membras martinica (Valenciennes)
rough silverside
D-67-16 Oct
BB-1, 41, 29.9-51.4
FF-1, 25, 66.0-80.6
D-68-1 Jan-Feb
EE-1, 1, 63.2
LL-1, 5, 71.0-76.0
LL-2, 72, 73.8-107.8

Table 3.—Number caught and length range (mm FL) of specimens less than 100.0 mm for three species of flyingfishes.

	Cypselurus heterurus		*Parexocoetus brachypterus*		*Prognichthys gibbifrons*	
	N	Length range	*N*	Length range	*N*	Length range
May	16	13.9-66.5	3	22.0-32.2	30	13.9-30.6
Jul-Aug	17	17.4-62.5	26	10.4-59.1	20	8.0-41.5
Oct	34	18.0-93.8	127	6.1-80.0	8	15.0-50.9
Jan-Feb	6	27.2-89.6	—	— —	7	20.8-64.5

Table 4.—Diel occurrences and maximum sizes of two species of halfbeaks.

	Hemiramphus brasiliensis		*Hyporhamphus unifasciatus*	
	N	Maximum Size	*N*	Maximum Size
Day	14	67.2	1	43.4
Dusk	14	127.0	2	62.0
Night	30	167.0	34	185.0
Dawn	6	51.6	3	81.3

Menidia menidia (Linnaeus)
Atlantic silverside
D-67-16 Oct
EE-1, 4, 66.1-80.4
MM-3, 1, 26.0
D-68-1 Jan-Feb
BB-1, 1, 67.3
BB-2, 4, 74.3-107.8
DD-1, 1, 59.8
LL-1, 12, 71.4-93.2
LL-2, 18, 81.0-105.0

The catch of 25 *Membras martinica* at station FF-1 in October is a subsample of 496 atherinids. The remaining fish were discarded at sea and are not included here.

HOLOCENTRIDAE

Holocentrus sp.
D-67-4 May
LL-5, 4, 9.0-11.2
MM-4, 1, 13.0
D-67-8 Jul-Aug
FF-5, 1, 12.5
GG-6, 1, 13.2
GG-7, 2, 10.2-12.4
KK-6, 2, 6.9-9.9
MM-4, 1, 13.2
D-67-16 Oct
HH-6, 1, 16.7
MM-4, 1, 15.1
PP-3, 2, 11.8-12.9

Although we only took 16 holocentrids, and these are not specifically identified, one comparison may be made with the study of *Holocentrus vexillarius* by McKenney (1959). McKenney caught specimens from 5.8 to 24.9 mm only at dusk or night. All our catches were also made in periods of twilight or night, never during the day. Evidently these nocturnal fishes begin their avoidance of light at an early age. The depth to which they descend during daylight is unknown.

SYNGNATHIDAE

Amphelikturus dendriticus (Barbour)
pipehorse
D-68-1 Jan-Feb
KK-5, 1, 16.4
Hippocampus erectus Perry
lined seahorse
D-67-4 May
FF-5, 2, 17.5-18.5
JJ-3, 1, 23.0
JJ-6, 1, 14.7
D-67-8 Jul-Aug
CC-3, 1, 23.9
JJ-2, 1, 11.3
D-67-16 Oct
AA-2, 1, 15.8
CC-2, 1, 16.8
JJ-3, 1, 28.0
KK-2, 2, 15.2-28.3
D-68-1 Jan-Feb
KK-5, 2, 16.4-30.0
MM-4, 1, 19.9
Hippocampus sp.
D-67-4 May
CC-7, 1, 31.4
PP-1, 1, 22.5
D-67-8 Jul-Aug
CC-6, 1, 13.4
D-68-1 Jan-Feb
AA-7, 1, 33.1
DD-6, 1, 30.2
EE-5, 1, 18.1
GG-6, 1, 26.3
NN-2, 2, 22.4-39.5
Syngnathus elucens Poey
shortfin pipefish
D-67-4 May
FF-3, 1, 117.4
D-68-1 Jan-Feb
JJ-5, 1, 118.0
Syngnathus fuscus Storer
northern pipefish
D-68-1 Jan-Feb
LL-1, 1, 65.0
Syngnathus pelagicus Linnaeus
sargassum pipefish
D-67-4 May
DD-6, 1, 132.9
D-67-8 Jul-Aug
KK-5, 1, 131.2
MM-3, 1, 85.5
D-67-16 Oct
LL-3, 1, 103.9
NN-2, 1, 109.6
PP-1, 1, 117.6
PP-3, 1, 79.8
D-68-1 Jan-Feb
HH-4, 1, 83.8
MM-3, 1, 141.0
Syngnathus springeri Herald
bull pipefish
D-67-4 May
AA-2, 1, 66.7
CC-4, 1, 45.3
JJ-3, 1, 61.0
LL-2, 1, 59.0
D-68-1 Jan-Feb
FF-2, 2, 77.9-80.0
FF-5, 1, 60.0
GG-4, 1, 63.0
HH-4, 1, 62.3
KK-5, 2, 64.0-69.1
LL-3, 1, 71.9
Syngnathus sp.
D-67-16 Oct
KK-5, 2, 90.6-124.0

The pipehorse, *Amphelikturus dendriticus*, is rarely caught and is known only from the Bahamas and Bermuda (Böhlke and Chaplin 1968). The presence of the young specimen in shelf waters off Florida indicates that the Gulf Stream may affect to some extent the dispersal of its progeny.

The capture of the northern pipefish, *Syngnathus fuscus*, at Cape Kennedy represents a range extension of about 85 miles beyond its previously reported southern limit at St. Augustine (Briggs 1958).

Syngnathids were present the year-round in our collections, but during the winter most occurrences were restricted to waters with temperatures above 20°C. *Syngnathus springeri*, however, was caught during the winter at temperatures as low as 10.4°C. Evidently, this coastal species tolerates lower temperatures than more pelagic species of pipefishes.

PRIACANTHIDAE

Pristigenys alta (Gill)
short bigeye
D-67-8 Jul-Aug
BB-4, 1, 10.8
BB-5, 1, 18.2
CC-6, 5, 10.0-18.8
FF-4, 4, 9.5-14.6
FF-5, 2, 10.3-15.4
GG-6, 12, 8.0-11.4
GG-7, 4, 8.6-11.4
JJ-5, 1, 10.3
KK-6, 3, 10.7-13.0
LL-5, 1, 9.6
MM-3, 2, 8.4-10.8
NN-2, 8, 6.2-11.9

The short bigeye spawns from early July to mid-September, at the latest (D. K. Caldwell 1962), and drifts at the surface before metamorphosing and assuming a demersal existence. The fact that we took no specimens during the October cruise indicates that the premetamorphic pelagic stage lasts less than 2 mo.

APOGONIDAE

Apogon maculatus (Poey)
flamefish
D-67-8 Jul-Aug
BB-5, 1, 22.0
Apogon sp.
D-67-4 May
LL-2, 1, mut.
Astrapogon sp.
D-68-1 Jan-Feb
NN-1, 2, 12.9-14.5

Because most meristic characters are shared by western Atlantic apogonids, color patterns are important in identifying species. The postlarva here identified as *Apogon maculatus* (Fig. 13) has acquired the pattern characteristic of adults: a band of pigment posterior to the eye and across the opercle, a spot on the body under the second dorsal fin, and a saddle of pigment on both sides and top of the caudal peduncle.

Figure 13.—Postlarval *Apogon maculatus*, 22.0 mm FL.

POMATOMIDAE

Pomatomus saltatrix (Linnaeus)
bluefish
D-67-4 May
AA-1, 2, 32.0-33.5
AA-5, 2, 18.5-24.0
BB-2, 1, 23.5
CC-1, 1, 30.8
CC-6, 1, 25.1
FF-1, 1, 29.4
HH-4, 2, 20.7-28.9
HH-5, 1, 17.7
JJ-3, 1, 25.4
JJ-4, 1, 18.5
LL-3, 1, 18.0

Little is known of the life history of the bluefish south of Cape Hatteras. Our catches indicate spawning occurs in the entire area at least as far south as Cape Kennedy and is restricted to the spring. At the same time the sport fishery catch consisting of small fish (ca. 1.5 lbs) in the Cape Kennedy area reaches a peak (Anderson and Gehringer 1965). It is not known whether the parents of the postlarvae we caught are these 1-yr old fish or an offshore group of older and larger fish. It is known, however, that 1-yr old fish with running ripe gonads are caught off Florida (David G. Deuel, National Marine Fisheries Service, Narragansett, R.I., pers. commun.) and are thus capable of spawning.

ECHENEIDAE

Remora remora (Linnaeus)
remora
D-67-8 Jul-Aug
NN-4, 2, 25.3-32.0

CARANGIDAE

Caranx bartholomaei Cuvier
yellow jack
D-67-4 May
MM-2, 1, 23.2
NN-2, 1, 23.9
NN-4, 1, 76.0
D-67-8 Jul-Aug
BB-5, 4, 13.8-19.1
EE-5, 1, 65.4
LL-5, 1, 34.2
MM-4, 1, 59.0
PP-2, 1, 38.9
D-67-16 Oct
KK-5, 2, 48.2-55.9
LL-3, 1, 50.7
PP-1, 1, 56.6
PP-3, 1, 21.3
D-68-1 Jan-Feb
MM-3, 1, 26.1
PP-1, 1, 11.5
PP-2, 1, 11.0
Caranx fusus (Mitchill)
blue runner
D-67-4 May
NN-2, 1, 15.5
NN-4, 3, 11.0-16.5
D-67-8 Jul-Aug
BB-6, 1, 22.4
CC-6, 4, 13.0-27.8
FF-5, 9, 12.0-22.7
FF-6, 1, 11.6
GG-6, 2, 8.5-11.3
HH-7, 1, 19.7
JJ-5, 2, 16.7-28.4
KK-6, 12, 8.4-40.0
LL-5, 5, 10.0-19.3
NN-2, 4, 13.1-24.4
NN-3, 2, 10.6-52.0
D-67-16 Oct
EE-6, 1, 11.5
JJ-5, 1, 25.8
MM-2, 1, 46.3
MM-3, 1, 17.1
MM-4, 1, 26.9
PP-3, 6, 38.2-49.4
D-68-1 Jan-Feb
PP-3, 1, 13.0
Caranx hippos (Linnaeus)
crevalle jack
D-67-4 May
NN-2, 3, 17.7-22.5
NN-3, 1, 13.6
D-67-8 Jul-Aug
LL-5, 1, 12.2
Caranx latus Agassiz
horse-eye jack
D-67-4 May
NN-4, 1, 11.4
D-67-8 Jul-Aug
NN-3, 1, 18.7
Caranx ruber (Bloch)
bar jack
D-67-4 May
EE-6, 1, 14.9
GG-7, 1, 62.1
JJ-5, 1, 16.3
NN-3, 2, 13.7-15.0
D-67-8 Jul-Aug
BB-6, 1, 27.9
JJ-6, 6, 45.0-71.5
KK-5, 5, 37.3-44.1
KK-6, 1, 35.0
LL-5, 4, 40.2-59.2
MM-4, 4, 35.0-37.5
NN-4, 1, 40.5
PP-1, 1, 48.6
PP-2, 3, 14.1-40.7
PP-3, 14, 20.7-68.4
D-67-16 Oct
KK-4, 1, 73.9
KK-5, 5, 28.5-62.7
LL-3, 2, 41.0-66.7
LL-5, 1, 59.9
MM-3, 1, 52.9
NN-3, 1, 44.9
PP-1, 1, 38.3
PP-3, 2, 29.8-39.1
Caranx sp.
D-67-4 May
NN-2, 2, 12.7-13.8*
D-67-8 Jul-Aug
BB-6, 4, 8.0-20.0*
LL-4, 1, 11.2*
LL-5, 1, mut.
MM-2, 1, 22.5
PP-1, 1, 13.0
D-68-1 Jan-Feb
JJ-6, 1, 11.7

Chloroscombrus chrysurus
(Linnaeus)
Atlantic bumper
D-67-4 May
JJ-2, 3, 14.6-22.4
JJ-3, 2, 20.2-21.0
D-67-8 Jul-Aug
BB-1, 1, 13.4
CC-7, 1, 20.3
D-67-16 Oct
NN-1, 1, 27.7

Decapterus punctatus (Agassiz)
round scad
D-67-4 May
AA-4, 6, 12.6-23.7
AA-5, 107, 16.0-39.8
AA-6, 2, 37.0-46.9
BB-6, 1, 35.1
CC-5, 4, 9.9-22.0
CC-6, 7, 12.7-22.0
CC-7, 13, 6.5-31.9
DD-5, 1, 32.3
EE-5, 1, 31.9
EE-6, 87, 16.3-36.8
FF-2, 1, 30.9

* either *C. hippos* or *C. latus*

FF-3, 99, 12.9-38.3
FF-4, 138, 12.0-37.5
FF-5, 4, 20.0-29.8
HH-2, 1, 28.4
HH-4, 63, 9.7-38.8
HH-5, 68, 16.3-24.8
JJ-4, 1, 29.9
KK-3, 14, 23.0-34.4
LL-1, 1, 25.8
LL-2, 1, 23.0
LL-4, 3, 23.8-43.6
MM-1, 1, 25.5
MM-3, 1, 27.2
NN-1, 1, 11.8
NN-2, 1, 16.9
NN-3, 2, 17.9-23.8
NN-4, 5, 17.3-20.0
PP-1, 6, 13.0-26.6
PP-2, 1, 20.5

D-67-8 Jul-Aug
AA-4, 1, 35.8
AA-5, 2, 13.8-18.7
BB-6, 20, 13.6-22.9
DD-6, 1, 14.9
EE-4, 2, 21.6-27.3
EE-5, 1, 31.3
FF-6, 17, 15.6-43.1
GG-5, 3, 17.8-22.9
JJ-5, 12, 9.0-29.1
LL-3, 2, 19.5-25.8
LL-4, 22, 15.0-43.9
LL-5, 4, 10.5-23.9
MM-2, 1, 13.1
MM-3, 1, 20.3
NN-2, 2, 11.0-24.2
PP-1, 1, 14.8

D-67-16 Oct
AA-4, 13, 23.6-35.9
DD-5, 8, 13.2-38.7
DD-6, 32, 9.7-37.5
FF-6, 1, 18.9
HH-4, 1, 16.9
PP-1, 1, 16.1

D-68-1 Jan-Feb
AA-5, 1, 14.8
AA-7, 4, 10.8-19.5
DD-5, 3, 15.2-37.4
DD-6, 4, 14.0-23.0
EE-6, 1, 20.9
FF-5, 2, 16.6-16.8
GG-6, 5, 12.4-27.1
HH-4, 1, 18.8
JJ-4, 1, 19.3
JJ-5, 1, 17.2
JJ-6, 1, 30.2
KK-4, 2, 11.5-22.0
KK-5, 8, 8.9-19.6
MM-3, 1, 24.0
PP-1, 2, 17.2-21.3

Elagatis bipinnulata (Quoy and Gaimard)
rainbow runner
D-67-4 May
NN-2, 1, 15.0
NN-3, 1, 18.4
NN-4, 1, 15.8

D-67-8 Jul-Aug
KK-5, 1, 27.5
MM-2, 1, 27.2
NN-2, 2, 22.0-26.7
NN-3, 1, 11.5

Naucrates ductor (Linnaeus)
pilotfish
D-67-4 May
CC-7, 1, 11.9
PP-2, 1, 10.6

Selar crumenophthalmus (Bloch)
bigeye scad
D-67-4 May
NN-3, 1, 27.0
NN-4, 1, 30.4

D-67-8 Jul-Aug
JJ-6, 1, 49.2

Seriola dumerili (Risso)
greater amberjack
D-67-4 May
GG-6, 1, 29.8

D-67-16 Oct
CC-7, 4, 18.0-26.3
FF-5, 1, 36.9
GG-5, 2, 37.3-39.4
PP-1, 1, 76.0

D-68-1 Jan-Feb
JJ-5, 1, 27.4
KK-5, 1, 23.8

Seriola fasciata (Bloch)
lesser amberjack
D-67-8 Jul-Aug
MM-4, 1, 47.0

D-67-16 Oct
JJ-6, 1, 54.1

Seriola rivoliana Valenciennes
almaco jack
D-67-8 Jul-Aug
HH-7, 1, 21.3
JJ-5, 1, 47.5
KK-5, 1, 30.8
LL-5, 1, 18.0

D-67-16 Oct
FF-5, 3, 20.0-40.7
KK-5, 1, 63.2

Seriola zonata (Mitchill)
banded rudderfish
D-67-4 May
AA-5, 1, 29.8

Seriola sp.
D-67-4 May
AA-3, 1, 18.7
HH-7, 7, 16.3-34.2
KK-6, 2, 23.2-24.8
LL-5, 1, 23.5
NN-2, 4, 9.2-19.0
NN-3, 10, 10.0-24.1
NN-4, 1, 14.0
PP-1, 3, 8.4-22.1
PP-2, 1, 14.2

D-67-8 Jul-Aug
BB-5, 2, 8.6-9.5
CC-6, 2, 8.5-11.6
EE-6, 1, 14.3
FF-6, 2, 14.5-16.2
HH-5, 1, 9.9
JJ-5, 1, 6.3
KK-5, 1, 18.4

D-67-16 Oct
DD-4, 1, 7.2 SL
DD-5, 1, 21.7
DD-6, 2, 10.3-14.6
FF-5, 1, 14.0
GG-6, 1, 17.2
JJ-2, 1, 21.9
LL-4, 1, 13.9
NN-2, 1, 13.3
NN-3, 1, 11.4
PP-1, 5, 11.2-18.0

D-68-1 Jan-Feb
AA-7, 2, 11.6-14.8
GG-5, 1, 10.7
JJ-4, 1, 21.9
LL-3, 2, 19.5-20.4
LL-5, 1, 29.2
MM-1, 2, 19.2-29.5
MM-3, 3, 17.0-35.8
MM-4, 1, 17.2
PP-1, 1, 15.6
PP-2, 3, 9.0-13.0
PP-3, 1, 20.1

Trachinotus carolinus (Linnaeus)
Florida pompano
D-67-4 May
DD-1, 2, 14.7-14.9
HH-5, 2, 10.2-11.5
JJ-1, 2, 18.5-18.5
JJ-3, 5, 15.7-19.2
KK-2, 1, 17.4
KK-3, 1, 15.1
LL-1, 1, 12.5
LL-3, 1, 14.6

Trachinotus falcatus (Linnaeus)
permit
D-67-4 May
CC-6, 1, 9.0
CC-7, 2, 5.2-9.4
HH-5, 1, 13.9

D-67-8 Jul-Aug
HH-5, 1, 9.0
JJ-5, 2, 6.7-7.9

D-67-16 Oct
MM-4, 1, 11.4

D-68-1 Jan-Feb
BB-5, 1, 12.7

Trachinotus goodei Jordan and Evermann
palometa
D-67-8 Jul-Aug
NN-1, 1, 10.0

D-67-16 Oct
NN-1, 1, 12.5

Trachinotus sp.
D-67-4 May
EE-5, 1, 10.8
LL-2, 1, 14.6

D-67-8 Jul-Aug
FF-6, 1, 8.6
GG-6, 1, 9.4

Unidentified
D-67-8 Jul-Aug
GG-5, 1, mut.
LL-4, 1, mut.
LL-5, 2, mut.

Berry (1959) reported on young *Caranx* spp. from off the southeastern Atlantic coast of the United States and found that *C. ruber* was most widely distributed, *C. fusus* most abundant, and *C. bartholomaei* more restricted both in range of occurrences and numbers. Our material substantiates these observations. Berry (1959) attributed the scarcity of *C. hippos* and *C. latus* to their tendency to migrate inshore at relatively small sizes (21-50 mm SL). Since our net was quite successful in catching other *Caranx* species up to these sizes, the scarcity of these two species in our collections must be due to a genuine absence of young in offshore waters. Dooley (1972) caught very few *C. hippos* and no *C. latus*, thus ruling out the possibility that juveniles of these species may be found in slightly deeper water. Perhaps the major spawning of *C. hippos* and *C. latus* occurs in areas to the south of the Florida Straits. Our catches were made off Cape Kennedy and St. Lucie Inlet in water of high salinity (up to 37.5 ‰) which indicate a high seas or Gulf Stream origin.

In numbers of individuals taken at one time, Berry (1959, p. 439) averaged 10 *C. fusus* per occurrence, highest of all the species. In our collections too, *C. fusus* was highest, averaging 3.1 per occurrence (Table 2). This suggests that *C. fusus* is a gregarious species, occurring in small groups or forming small schools earlier than other species.

Our catches of *C. hippos and C. latus* are too small to allow remarks on spawning periods. Our catches of *C. ruber* substantiate Berry's contention that spawning occurs from mid-February to mid-August; and the lack of small individuals in our catches implies most spawning occurs to the south of the Florida Straits or in waters contributing to the Gulf Stream. The 14.9 mm specimen we caught off South Carolina indicates some spawning takes place off the southeastern coast of the United States. Berry (1959) reported that *C. bartholomaei* spawned from mid-February to mid-September. Our catches (11.0 and 11.4 mm) on 4 February indicate a slightly earlier start in 1968, probably in mid- to late-January. McKenney et al. (1958) thought that *C. fusus* spawned the year-round, mostly from January through August with a peak in the summer. Berry (1959) thought most spawning occurred from April through September. Our catches are consistent with these observations, both in year-round occurrence of juveniles and increased summer abundance.

The various species of the genus *Caranx* were about equally distributed in temperatures from 25.0° to 30.0°C. Although they were caught in salinities ranging from 34.0 to 38.0 ‰, 74% were taken from water with salinities between 35.0 and 35.9 ‰.

Decapterus punctatus apparently spawns the year-round with a peak in activity during the spring (Table 5). It is a creature of the middle shelf, not directly associated with inlets, estuaries, or the Gulf Stream. We caught this species during all seasons and over the entire range of our sampling area. Judging by our catches juveniles apparently rise to the surface during the pre-dawn period, occupy the surface during the day, and descend at night (Table 5). The diel difference breaks down in October due to a single catch of 32 fish made at 0544 h, a time within my definition of night. Our specimens are generally smaller than Dooley's (1972) possibly because smaller fishes are more strongly surface oriented, than larger ones.

Little is known of the early life history of the rainbow runner, *Elagatis bipinnulata*. Its restriction in our collections to Gulf Stream waters off Florida indicates an oceanic origin south of the Florida Straits. These specimens were identified following the description by Okiyama (1970). Key features are the serrated preopercular spines in fishes less than about 20.0 mm and the pair of unpigmented lines on each side of the otherwise darkly pigmented caudal peduncle (Fig. 14).

Because the diagnostically important body bands are not yet present on small *Seriola* sp. (Mather 1958), I was able to identify only those fish greater than 18.0 mm FL to species. Many larger fish (up to 35.8 mm) are identified only to genus but are probably either *S. dumerili* or *S. rivoliana*—all have seven spines in the first dorsal fin, five body bands plus a sixth on the peduncle, and intergrading numbers of rays in the second dorsal fin.

Dooley (1972) concluded that *S. dumerili* and *S. rivoliana* spawn during the spring. Munro et al. (1973) caught ripe *S. dumerili* in August and November and ripe *S. rivoliana* in November on Pedro Bank in the Caribbean. Our catches indicate spawning during fall, winter, and spring for the former species, summer and fall for the latter.

Our catches of three species of *Trachinotus* confirm Fields' (1962) observations: 1) spawning of *T.*

Table 5.—Summary of catch data for *Decapterus punctatus*.

Month	Transect Range	Number Caught	Size Range (mm FL)	Diel Analysis Dawn-Day-Dusk	Diel Analysis Night
May	AA-PP	641	6.5-46.9	640	1
Jul-Aug	AA-PP	91	9.0-43.9	89	2
Oct	AA-PP	56	13.2-38.7	24	34
Jan-Feb	AA-PP	37	8.9-37.4	34	3

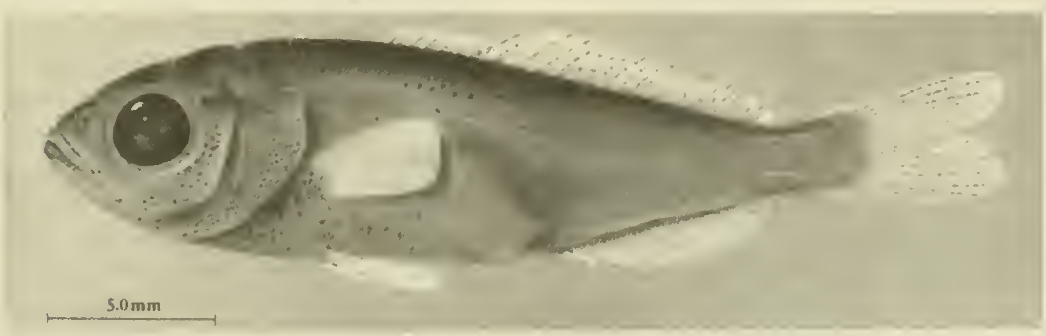


Figure 14.—Juvenile *Elagatis bipinnulata*, 27.5 mm FL.

carolinus and *T. falcatus* occurs offshore. (We caught the smaller specimens further offshore than the larger.) 2) *Trachinotus carolinus* begins spawning in May, and subsequently juveniles begin arriving inshore in waves. (We evidently sampled the first wave.) 3) Recruitment of *T. falcatus* occurs year-round on Florida beaches; May through October on Georgia beaches. (To this we can add the 12.7 mm individual caught off Cape Fear in January, which attests both to the possibility of winter spawning and to the utilization of the Gulf Stream by postlarvae.) 4) *Trachinotus goodei* is comparatively rare along the south Atlantic coast—the main part of its range occurring further south—and spawning apparently occurs in late summer and fall. (Our summer and fall catches off St. Lucie Inlet near the Gulf Stream indicate an origin to the south.)

CORYPHAENIDAE

Coryphaena equisetis Linnaeus
pompano dolphin
D-67-4 May
HH-7, 2, 17.9-24.5
LL-5, 2, 34.0-37.8
D-67-8 Jul-Aug
KK-6, 1, 11.4
D-67-16 Oct
KK-6, 5, 28.7-43.4
LL-4, 1, 16.7
MM-3, 1, 19.0
NN-2, 1, 17.7
PP-3, 1, 17.8
D-68-1 Jan-Feb
NN-4, 1, 70.6
PP-3, 1, 10.8

Coryphaena hippurus Linnaeus
dolphin
D-67-4 May
EE-6, 2, 25.4-28.5
HH-7, 3, 18.0-26.1
KK-6, 2, 30.4-32.3
LL-5, 4, 17.8-18.5
NN-2, 3, 13.9-28.4
NN-3, 1, 14.7
NN-4, 2, 13.7-21.5
PP-2, 1, 17.0
D-67-8 Jul-Aug
AA-7, 1, 30.5
BB-4, 1, 13.6
BB-6, 1, 23.7
CC-6, 2, 17.5-22.1
DD-6, 1, 23.2
GG-7, 2, 23.1-32.3
JJ-2, 1, 16.1
JJ-6, 1, 29.8
KK-5, 1, 39.0
KK-6, 1, 11.3
LL-5, 7, 15.4-28.9
MM-2, 1, 24.4
NN-1, 1, 15.1
NN-2, 3, 15.7-49.0
NN-3, 1, 17.9
PP-1, 1, 15.7
PP-2, 1, 17.3
D-67-16 Oct
AA-7, 2, 18.6-29.9
CC-7, 1, 32.0
DD-6, 1, 13.8
EE-6, 1, 18.9
FF-5, 1, 35.6
FF-6, 2, 16.0-mut.
JJ-4, 1, 32.0
KK-3, 1, 15.2
KK-4, 1, 112.9
KK-5, 2, 28.4-46.6
KK-6, 5, 28.7-43.4
MM-1, 1, 41.8
NN-1, 1, 17.1
NN-2, 2, 15.5-18.0
D-68-1 Jan-Feb
LL-3, 1, 48.8
MM-4, 1, 23.1
NN-4, 1, 31.3
PP-1, 2, 18.8-31.5
PP-2, 3, 16.9-21.0
PP-3, 1, 24.4

All coryphaenids were X-rayed in order to count vertebrae. No overlap was found between the species. The counts were: *Coryphaena equisetis* 33 (13-14 + 19-20), *C. hippurus* 31 (13 + 18). Table 6 shows the size range of *C. hippurus* caught during each cruise and indicates spawning occurs at least sometime in every season if not continuously throughout the year. However, neither species was caught north of Cape Kennedy during the winter, suggesting that spawning then is restricted to areas to the south.

Table 6.—Dolphin (*C. hippurus*): number caught and length range (mm FL) by cruise. One specimen (112.9 mm FL) from October cruise not included.

Month	Length range (mm FL)	*N*
May	13.7-32.3	18
Jul-Aug	11.3-49.0	27
Oct	13.8-46.6	21
Jan-Feb	16.9-48.8	9

There were no significant differences between day and night tows in numbers or sizes caught. Apparently, a towing speed of 5 knots (9.27 km/h) is sufficient to prevent daytime net avoidance, at least in postlarvae less than about 50.0 mm. At larger sizes, juvenile dolphin may acquire the adult habit of lurking below rafts of sargassum and other flotsam and thus may not be susceptible to capture by surface nets.

LUTJANIDAE

Rhomboplites aurorubens (Cuvier)
vermilion snapper
D-67-8 Jul-Aug
FF-3, 1, 23.0

Lutjanus sp.
D-67-8 Jul-Aug
MM-1, 1, 14.2
NN-1, 1, 17.7

The vermilion snapper was identified by its dorsal count which is distinctive among lutjanids: D: XII, 11. The meristic characters of the unidentified *Lutjanus* are as follows: D: X, 14; A: III, 9; Pect: 16; Caudal: 8, 9, 8, 8; vertebrae: 24 (10 + 14). Three western North Atlantic lutjanids share these meristic characters: *Lutjanus aya*, *L. blackfordii*, and *L. lutjanoides* (Anderson 1967). The smaller specimen is illustrated in Figure 15. In the larger specimen, pigment is generally heavier and extends over the dorsal fin between the third and tenth spines. Pigment on the body forms six bars from nape to peduncle; the posterior three reaching from the dorsal edge of the body to the ventral edge; the anterior three ending at about the midline. The cluster of spots anterior to the eye is extended to the snout tip, and together with a group of spots on the preopercle and opercle creates the impression of a bar through the eye.

LOBOTIDAE

Lobotes surinamensis (Bloch)
tripletail
D-67-16 Oct
FF-5, 1, 44.3

SPARIDAE

Stenotomus chrysops (Linnaeus)
scup
D-67-4 May
AA-2, 1, 17.3
AA-5, 1, 15.9
FF-3, 1, 49.5

Unidentified
D-67-4 May
HH-2, 1, 15.7
D-67-16 Oct
BB-2, 3, 13.8-14.6
DD-2, 1, 13.4
EE-2, 1, 13.3
HH-6, 2, 10.8-11.1
KK-3, 7, 11.7-14.0
D-68-1 Jan-Feb
AA-3, 34, 12.6-15.5
AA-4, 39, 11.8-23.1

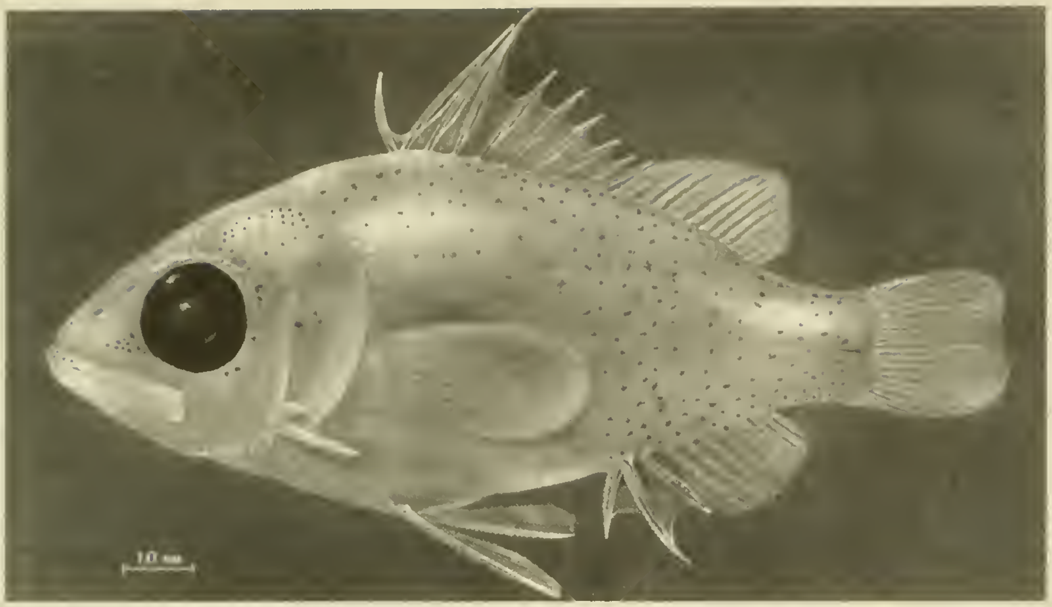


Figure 15.—Unidentified postlarval *Lutjanus* sp., 14.2 mm FL.

BB-1, 431, 11.9-15.9
BB-2, 46, 13.2-16.3
CC-1, 7, 12.2-14.5
CC-2, 9, 11.5-15.3
CC-3, 9, 12.2-15.5
DD-1, 4, 11.0-15.8
DD-2, 23, 12.4-16.8
EE-1, 7, mut.-15.7
EE-3, 1, 20.0
EE-4, 3, 10.0-14.9
EE-5, 1, 14.0
FF-5, 1, 15.6
GG-1, 1, 15.4
HH-1, 2, 13.0-13.5
HH-5, 2, mut.-12.4
NN-1, 2, mut.-14.8

SCIAENIDAE

Cynoscion nothus (Holbrook)
silver seatrout
D-67-16 Oct
HH-6, 5, 15.1-17.9

Larimus fasciatus Holbrook
banded drum
D-67-16 Oct
HH-6, 1, 7.7 SL

Leiostomus xanthurus Lacepede
spot
D-67-16 Oct
HH-7, 1, 8.4
D-68-1 Jan-Feb
AA-2, 1, 15.2
CC-3, 1, mut.
DD-1, 3, 13.6-15.8
DD-2, 6, 10.8-16.2
DD-3, 6, 12.1-17.4
EE-4, 1, 6.5 SL
GG-2, 1, 12.8
JJ-3, 2, 9.8-12.8

Stellifer lanceolatus (Holbrook)
star drum
D-67-16 Oct
LL-1, 1, 28.2

MULLIDAE

Mullus auratus
Jordan and Gilbert
red goatfish
D-67-4 May
AA-1, 1, 28.0
BB-4, 9, 16.0-25.0
BB-5, 5, 23.0-31.0
CC-4, 1, 32.0
CC-6, 1, 25.0
DD-3, 13, 19.0-31.1
DD-4, 1, 23.0
DD-5, 19, 16.0-26.0
DD-6, 2, 16.5-40.0
EE-3, 3, 21.0-27.5
EE-4, 11, 16.0-19.5
EE-5, 1, 23.5
FF-2, 1, 28.5
GG-5, 1, 48.0
GG-7, 1, 21.0
HH-4, 1, 48.5
HH-5, 1, 22.0
KK-5, 1, 34.0
D-68-1 Jan-Feb
AA-7, 6, 8.5-12.0
DD-6, 3, 11.0-12.5
EE-5, 2, 19.0-20.0
FF-5, 1, 11.0
FF-6, 1, 14.5
GG-7, 2, 17.5-19.5
HH-6, 1, 25.0
JJ-5, 5, 16.0-19.0
KK-6, 1, 20.0
LL-5, 2, 17.0-17.5
MM-4, 25, 12.0-29.0
NN-2, 1, 18.5
PP-2, 3, 8.0-11.0

Pseudupeneus maculatus (Bloch)
spotted goatfish
D-67-4 May
LL-4, 1, 49.5

Unidentified
D-67-4 May
BB-4, 2, mut.
DD-5, 5, 19.0-23.5
DD-6, 2, mut.-40.5
EE-4, 1, mut.
D-68-1 Jan-Feb
AA-7, 6, 10.0-15.0
HH-5, 1, 23.0
MM-4, 4, 11.0-mut.
PP-2, 2, 7.0-13.0

The catches made by the Gulf V plankton sampler (unpublished) indicate that spot spawn in the winter in offshore waters and the larvae approach the beach as they grow (Peter L. Berrien, National Marine Fisheries Service, Sandy Hook Laboratory, pers. commun.). Spawning apparently occurs at least as far south as Cape Kennedy judging from the occurrences of small larvae. The sizes of young we caught in the surface net are about the same as those caught in the Gulf V.

Although we caught many Atlantic croaker larvae in the Gulf V plankton nets, which sampled to a depth of 33 m, we caught none in the surface net. Perhaps these larvae are less strongly surface oriented than spot larvae.

M. C. Caldwell's data (1962, Table 7) indicates a spawning period lasting from January into May for *Mullus auratus* and our catches substantiate this for two year classes. A difference exists, however, between her data and ours in the abundance of *Pseudupeneus maculatus*. Whereas her data suggest that *P. maculatus* is a rather common constituent of the pelagic fauna, ours indicate the species to be rare, at least compared to *M. auratus*. Struhsaker (1969) caught *M. auratus* at more than 50% of the stations in the species' primary habitat; *P. maculatus* at between

10% and 50%. Thus the latter species is probably less common than the former but not so rare as to preclude its progeny being encountered. If, as M. C. Caldwell (1962) suggests, *P. maculatus* has two juvenile stages, one pelagic, the other a shallow-water, bottom-living stage, then the pelagic stage must not be a strongly surface oriented one except under the influence of a night-light (the method most used to collect her specimens) and is thus not susceptible to capture with a net towed within 1 m of the surface.

KYPHOSIDAE

Kyphosus incisor (Cuvier)
yellow chub
D-67-8 Jul-Aug
AA-7, 1, 16.4
D-67-16 Oct
AA-7, 1, 14.7
LL-4, 1, 15.4
LL-5, 1, 17.9
NN-3, 2, 23.0-28.7
PP-1, 1, 14.5
PP-3, 1, 11.3
D-68-1 Jan-Feb
LL-5, 1, 21.8
Kyphosus sectatrix (Linnaeus)
Bermuda chub
D-67-16 Oct
FF-5, 5, 28.5-34.0
GG-5, 2, 50.4-55.0
JJ-6, 1, 56.1
KK-6, 1, 51.9

The seasonality indicated by our catches of *Kyphosus sectatrix* is misleading. Dooley (1972, Table 4) reported taking small specimens throughout the year, and Moore (1962, Fig. 5) showed size frequency data indicating that spawning "occurs over a wide period of time during the year," probably throughout the year. Both authors suggested that young *K. sectatrix* were common among rafts of sargassum. Why we failed to catch this species during all seasons cannot be explained.

CHAETODONTIDAE

Holacanthus tricolor (Bloch)
rock beauty
D-67-16 Oct
HH-7, 1, 12.9
Pomacanthus arcuatus (Linnaeus)
gray angelfish
D-67-16 Oct
KK-5, 1, 11.2
Unidentified
D-67-8 Jul-Aug
KK-6, 1, mut.

POMACENTRIDAE

Abudefduf saxatilis (Linnaeus)
sergeant major
D-67-16 Oct
AA-5, 2, 19.5-25.3
AA-6, 3, 16.3-22.0
DD-6, 2, 16.8-17.1
FF-5, 3, 17.5-22.3
FF-6, 1, 17.5
HH-7, 1, 11.0
JJ-6, 1, 31.9
NN-3, 1, 22.0
PP-1, 2, 14.9-18.4
D-68-1 Jan-Feb
MM-3, 1, 17.1
Chromis sp.
D-67-16 Oct
LL-5, 1, 13.3
Unidentified
D-67-4 May
DD-6, 1, 9.8
NN-3, 1, mut.

Munro et al. (1973) reported a spawning maximum in April for *Abudefduf saxatilis*, a secondary peak in September, and no spawning from January through March. The primary occurrence of this species in October in our catches is probably a result of the fall spawning, but the absence of this species in the May and July-August cruises cannot be explained.

MUGILIDAE

Mugil cephalus Linnaeus
striped mullet
D-67-4 May
DD-3, 1, 19.0
DD-6, 1, 10.5
D-67-16 Oct
AA-6, 1, 14.0
D-68-1 Jan-Feb
AA-1, 4, 21.0-24.5
AA-2, 8, 18.0-23.5
AA-3, 5, 21.0-26.5
AA-4, 1, 24.0
AA-5, 6, 17.5-20.0
AA-7, 13, 8.0-22.0
BB-1, 3, 21.0-22.0
BB-2, 2, 19.0-20.0
BB-3, 6, 17.0-24.5
BB-4, 7, 23.0-26.0
BB-5, 15, 17.0-25.0
CC-1, 5, 23.0-25.5
CC-2, 2, 21.5-22.0
CC-3, 3, 21.0-24.0
CC-5, 3, 24.5-25.0
CC-6, 6, 18.0-24.5
DD-5, 1, 21.0
DD-6, 37, 7.0-20.5
EE-3, 1, 19.5
EE-4, 7, 19.0-22.5
FF-4, 2, 20.5-22.0
FF-5, 7, 18.5-22.0
GG-1, 1, 21.5
GG-2, 3, 20.0-20.5
GG-3, 7, 20.0-26.0
GG-4, 1, 17.0
GG-5, 3, 6.0-19.0
HH-1, 3, 20.0-21.0
JJ-2, 2, 20.5-23.0
JJ-5, 3, 24.0-25.5
KK-5, 2, 21.0-22.0
PP-2, 1, 11.5
PP-3, 1, 12.0
Mugil curema Valenciennes
white mullet
D-67-4 May
AA-1, 4, 19.5-23.0
AA-5, 4, 17.5-21.5
AA-6, 4, 6.0-14.0
BB-3, 8, 19.6-21.9
BB-4, 8, 17.0-21.0
BB-5, 3, 14.0-20.0
BB-6, 2, 17.0
CC-3, 1, 22.0
CC-4, 1, 19.0
CC-5, 6, 14.5-20.0
CC-6, 40, 8.0-22.5
CC-7, 20, 5.5-12.5
DD-1, 15, 21.0-23.5
DD-2, 19, 19.0-24.0
DD-3, 40, 17.5-24.0
DD-4, 40, 16.0-22.0
DD-5, 34, 15.5-19.0
DD-6, 8, 12.5-23.5
EE-1, 10, 20.0-25.0
EE-2, 4, 20.5-21.0
EE-3, 6, 20.0-22.0
EE-4, 20, 16.0-23.0
EE-5, 4, 17.0-24.0
FF-1, 1, 25.5
FF-4, 4, 10.5-20.0
GG-4, 6, 19.5-25.0
GG-5, 10, 19.0-23.5
GG-6, 2, 17.0-21.0
HH-4, 1, 25.0
HH-5, 6, 16.5-23.0
HH-6, 4, 8.5-22.0
JJ-2, 1, 26.0
JJ-5, 8, 18.5-24.0
KK-5, 6, 20.0-23.0
LL-1, 2, 18.0-21.0
LL-4, 3, 15.0-17.0
MM-3, 3, 14.0
D-67-8 Jul-Aug
AA-5, 1, 21.0
KK-6, 1, 16.0
LL-5, 1, 12.5
D-67-16 Oct
AA-6, 1, 13.5
DD-5, 1, 18.5
DD-6, 1, 11.0
EE-6, 2, 13.5-14.0
HH-6, 1, 18.0
KK-5, 2, 15.0-18.0
LL-5, 1, 10.0
MM-2, 1, 17.0
MM-3, 4, 14.0-17.0
NN-2, 2, 10.0-15.0
NN-3, 1, 12.5
PP-1, 2, 11.5-14.0
D-68-1 Jan-Feb
AA-7, 1, 22.0
BB-3, 1, 23.0
BB-4, 1, 25.0
BB-5, 1, 25.5
CC-3, 1, 23.0
DD-6, 2, 7.0-18.0
EE-5, 1, 17.0
GG-2, 1, 21.0
GG-6, 1, 15.0
JJ-5, 1, 21.0
JJ-6, 1, 20.0
MM-4, 1, 21.0
Mugil sp.
D-67-4 May
AA-6, 2, 6.0-mut.
BB-5, 1, 12.0
CC-3, 1, 4.4
CC-6, 18, mut.-14.0
CC-7, 3, 5.0-8.5
DD-1, 2, mut.
DD-3, 3, mut.-20.5
DD-5, 4, mut.-16.0
EE-4, 4, mut.-20.5
EE-5, 3, mut.-17.5
GG-5, 1, mut.
HH-5, 1, 19.0
HH-6, 2, mut.-16.0

LL-4, 1, mut.
D-68-1 Jan-Feb
AA-7, 7, mut.
BB-5, 2, 17.5-20.0
DD-6, 7, 7.5-12.5
EE-4, 1, 22.0
FF-5, 1, 11.0
FF-6, 1, 10.0
MM-4, 1, 21.0
PP-2, 1, 5.5 SL

Our catches (Table 7) support Anderson's (1958) contention that *Mugil cephalus* spawns during early winter (Fig. 16) when continental shelf water temperatures are falling and *M. curema* spawns during the spring (Fig. 17) when temperatures are rising. However, our catches show no inshore movement with growth in either species (as reported for both species by Anderson 1957, 1958). The largest mullet we caught was 26.5 mm FL, approximating the maximum size caught by Anderson (1957, Table 2) offshore. Perhaps growth of juveniles is arrested at about this size and resumes with the migration of postlarval mullet from ocean to estuary. Were this not the case, larger fish would occasionally be caught offshore.

Table 7.—Seasonal catch of two species of mullet.

	Spring	Summer	Fall	Winter
Mugil curema	348	3	19	14
Mugil cephalus	2	0	1	171

A second examination of all mullets was made to determine whether the freshwater mullet, *Agonostomus monticola*, was present. None was found. *Mugil cephalus* and *M. curema* occurred together in only 12 tows.

SPHYRAENIDAE

Sphyraena barracuda (Walbaum)
great barracuda
D-67-8 Jul-Aug
NN-1, 1, 16.3
NN-2, 1, 16.8
Sphyraena borealis DeKay
northern sennet
D-67-4 May
AA-4, 1, 40.4
FF-1, 2, 38.4-49.4
KK-2, 1, 33.7
LL-2, 1, 37.8
D-67-16 Oct
AA-4, 1, 42.1
D-68-1 Jan-Feb
DD-5, 1, 23.9
DD-6, 1, 30.0
EE-6, 1, 42.9
PP-1, 1, 34.3

If *Sphyraena borealis* and *S. picudilla* are valid separate species, those specimens here identified as the former species may well include the latter, for I was unable to find a character which separates the two species in fishes less than 50 mm. I found that characters such as relative eye size and nature of the interorbital space (de Sylva 1963, p. 34) were insufficiently different in small specimens to permit separation into two species.

URANOSCOPIDAE

Unidentified
D-67-4 May
FF-3, 1, 23.5
FF-4, 1, 21.9
HH-4, 2, 15.9-18.3
JJ-3, 1, 16.0

KK-3, 1, 17.7
D-67-8 Jul-Aug
JJ-3, 2, 8.1-8.9
D-67-16 Oct
DD-3, 1, 11.7
DD-4, 1, 9.4
GG-5, 1, 13.1
HH-6, 2, 9.5-12.8
D-68-1 Jan-Feb
GG-5, 5, 9.2-10.9
KK-5, 1, 14.9
KK-2, 3, 11.4-16.4
MM-1, 5, 20.1-20.6
D-67-8 Jul-Aug
BB-3, 1, 10.5
D-67-16 Oct
CC-2, 2, 14.8-16.5
DD-3, 1, 11.2
KK-3, 1, 16.9
D-68-1 Jan-Feb
AA-4, 1, 19.8
NN-1, 1, 13.6

BLENNIIDAE

Unidentified
D-67-4 May
AA-4, 1, 21.4
AA-5, 1, 21.8
CC-5, 1, 14.9
FF-1, 4, 13.3-16.7
FF-3, 6, 9.3-21.0
FF-4, 1, 21.0
HH-2, 4, 11.7-13.4
JJ-3, 2, 13.8-14.8

GOBIIDAE

Unidentified
D-67-8 Jul-Aug
MM-2, 2, 4.1-4.5

GEMPYLIDAE

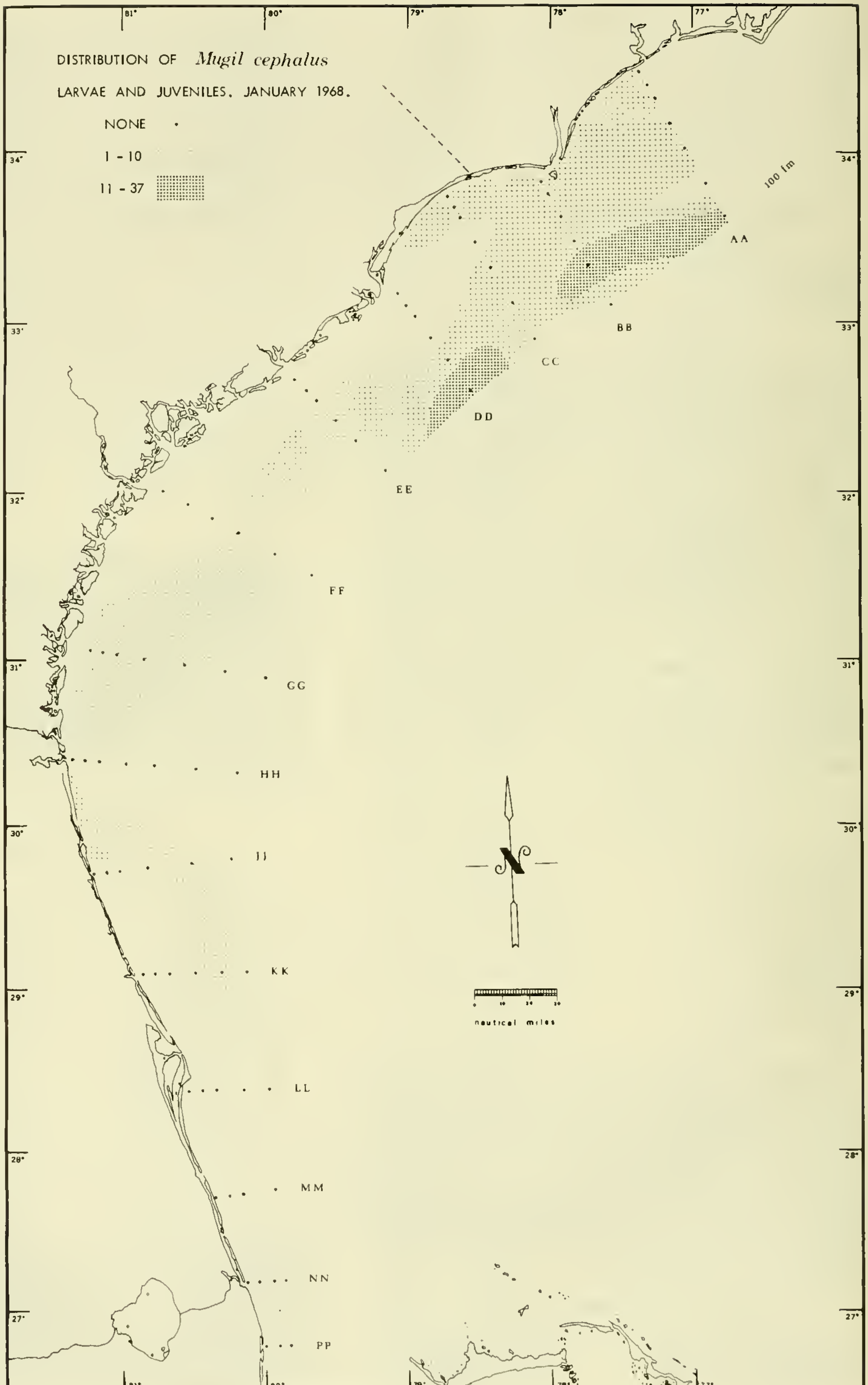
Diplospinus multistriatus Maul
D-67-16 Oct
NN-3, 1, 26.9
D-68-1 Jan-Feb
PP-2, 1, 14.7

Voss (1954) described and assigned larvae to two types within the genus *Gempylus*: *Gempylus* A and *Gempylus* B. The two specimens reported on here are assignable to her *Gempylus* A by virtue of the preopercular spination and lack of rays following the serrated pelvic spine. As Ahlstrom (1971) reported, Voss' *Gempylus* A larvae are *Diplospinus multistriatus.* Voss (1954) reported larval occurrences in winter, spring, and summer. The addition of our catch in the fall (October) indicates this species spawns throughout the year.

SCOMBRIDAE

Auxis sp.
D-67-4 May
LL-5, 2, 15.5-19.1
MM-4, 4, 17.4-23.7
D-67-8 Jul-Aug
BB-6, 1, 22.4
GG-6, 2, 12.2-mut.
GG-7, 1, 11.0
HH-7, 5, 13.3-21.3
KK-6, 3, 7.9-13.9
D-68-1 Jan-Feb
GG-7, 1, 15.0
JJ-6, 1, 13.7
KK-6, 1, 17.5
MM-4, 10, 12.6-21.7
Euthynnus alletteratus (Rafinesque)
little tunny
D-67-8 Jul-Aug
FF-4, 1, 11.2
GG-6, 5, 12.2-14.5
GG-7, 1, 12.0
JJ-4, 1, 16.7
Scomber japonicus Houttuyn
chub mackerel
D-67-4 May
FF-4, 1, mut.
HH-5, 1, 22.2
D-68-1 Jan-Feb
AA-5, 1, 15.7
AA-7, 2, 18.6-22.2
KK-5, 1, 29.5
Scomberomorus maculatus (Mitchill)
Spanish mackerel
D-67-4 May
LL-2, 1, 21.9
MM-1, 1, 22.1
D-67-8 Jul-Aug
DD-1, 1, 27.1
DD-3, 1, 20.8
Thunnus sp.
D-67-4 May
PP-1, 1, 13.7
D-67-8 Jul-Aug
GG-7, 1, 9.9

Figure 16.—Distribution of striped mullet, *Mugil cephalus*, larvae and juveniles, during winter, 1968.



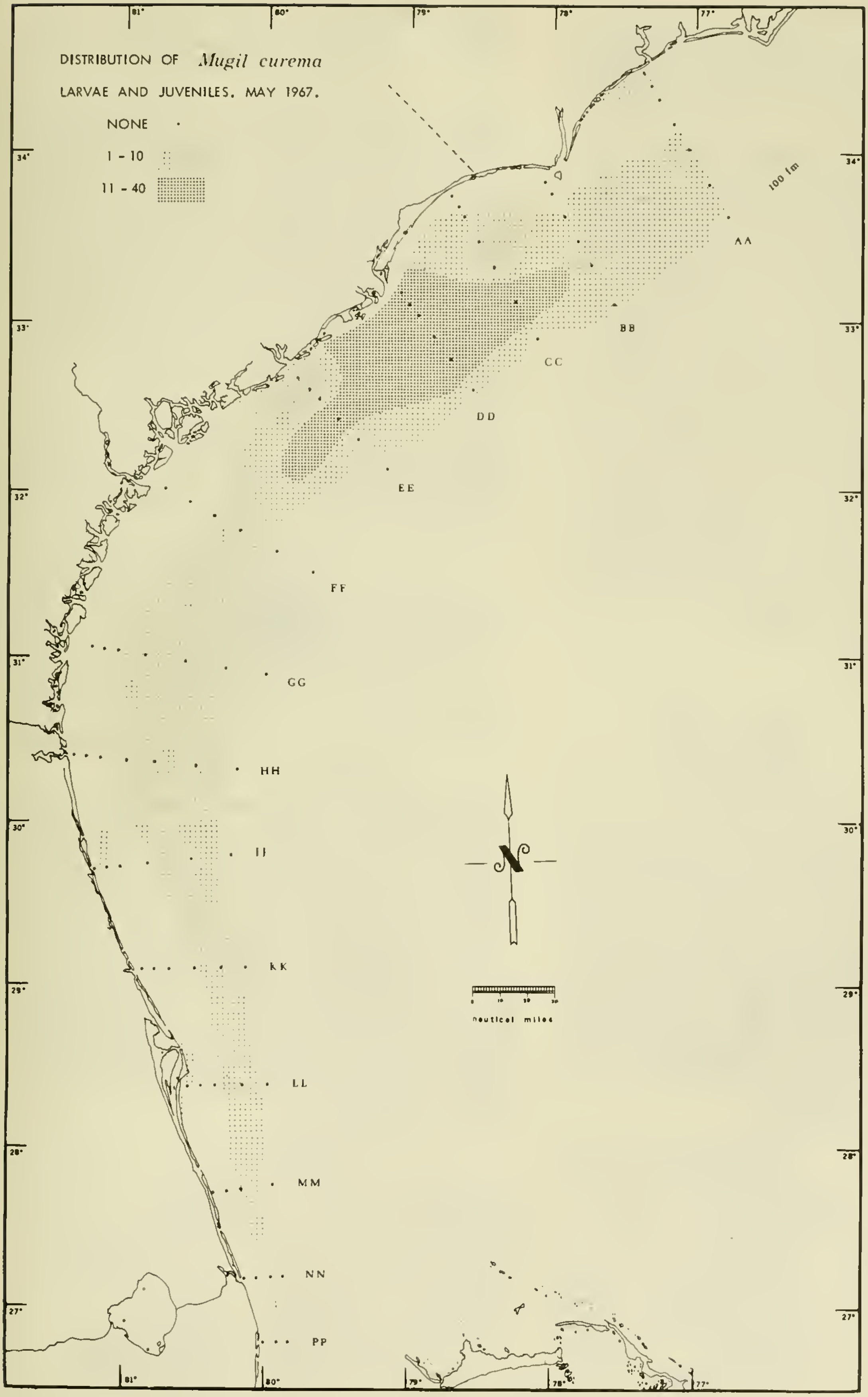


Figure 17.—Distribution of white mullet, *Mugil curema*, larvae and juveniles during spring, 1967.

Of the 51 scombrids in the collections, only 8 (16%) were captured in day tows. Postlarval scombrids apparently 1) are able to see and avoid nets approaching at 5 knots, or 2) engage in diel vertical migrations and are only available to surface samplers during twilight or night.

Dooley (1972) reported taking young (37-78 mm) *Scomber japonicus* schooling with *Trachurus lathami* and *Decapterus punctatus*. Our *S. japonicus* specimens were all taken in association with juveniles of *Decapterus punctatus* (and was the only scombrid species so associated). Judging from our catches in January, February, and May, and Dooley's (1972) catches in March, this species probably spawns during winter and spring in the South Atlantic Bight.

We did not catch enough postlarval Spanish mackerel to determine the length of the spawning period, but in 1967 spawning began at least as early as May off the east coast of Florida. We caught larvae in Gulf V plankton samplers as far north as Jacksonville on 10 May (unpublished) and the size of the postlarvae caught on 8 May indicates an onset of spawning perhaps as early as late April. The postlarvae reported on here were all taken within 15 miles (27.81 km) of shore while smaller larvae were taken as far offshore as 62 miles (114.95 km), indicating an offshore spawning and inshore migration with growth.

XIPHIIDAE

Xiphias gladius Linnaeus
swordfish
D-67-4 May
NN-4, 2, 20.6-23.9
D-67-16 Oct
FF-4, 1, 26.4
FF-6, 2, 31.0-94.5
GG-7, 1, 25.9
D-68-1 Jan-Feb
PP-2, 1, 21.5
PP-3, 1, 28.0

Our data do little to support the contention of Arata (1954) and Tåning (1955) that swordfish spawning occurs in two centers in the Atlantic: 1) west of the Florida Straits in the Gulf of Mexico; 2) in the southern part of the Sargasso Sea. The specimens we caught off Georgia in October could have arrived from the former area via the Florida Current and from the latter area via the Antilles Current. The specimens caught in the Florida Straits in May and February probably originated in the Gulf of Mexico.

ISTIOPHORIDAE

Istiophorus platypterus (Shaw and Nodder)
sailfish
D-67-4 May
LL-4, 1, 79.3
Makaira nigricans Lacepede
blue marlin
D-67-8 Jul-Aug
NN-3, 1, 14.8
Unidentified (a.)
D-67-4 May
LL-5, 2, 49.3-58.5
NN-3, 1, 37.8
PP-2, 2, 34.4-42.9
Unidentified (b.)
D-67-4 May
NN-3, 1, 13.1
NN-4, 1, mut.
D-67-8 Jul-Aug
BB-4, 3, 10.4-11.8
BB-6, 8, 10.9-24.3
CC-6, 3, 13.4-15.4
DD-6, 1, 8.1
FF-6, 1, 12.3
GG-6, 1, 15.3
KK-6, 3, 11.9-16.9
LL-5, 1, 27.4
NN-2, 1, 11.0
NN-3, 1, 17.7
NN-4, 1, 10.3
D-67-16 Oct
NN-3, 1, 8.5

The blue marlin, *Makaira nigricans*, was positively identified by its vertebral count (11 + 13) and short snout length relative to eye diameter. The sailfish, *Istiophorus platypterus*, was identified by vertebral count (12 + 12) and dorsal fin formula (44 spines, 7 rays). The five specimens in "Unidentified (a.)" have 12 + 12 vertebrae (thus eliminating *M. nigricans*) and 49 or 50 total dorsal fin elements (too low a count for *Tetrapterus pfluegeri*). Distinguishing between the remaining two species of western North Atlantic istiophorids at this size is not possible. The 27 specimens in "Unidentified (b.)" have 12 + 12 vertebrae and long snout length relative to eye diameter. Because posterior dorsal fin rays are not visible on X-rays, no counts were made. All specimens between 8.1 and 16.9 mm FL have two secondary spines on the vertical limb of the preopercle (Fig. 18),

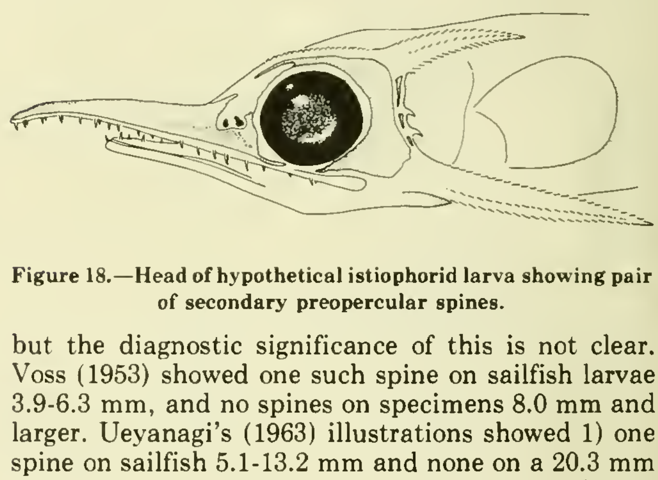


Figure 18.—Head of hypothetical istiophorid larva showing pair of secondary preopercular spines.

but the diagnostic significance of this is not clear. Voss (1953) showed one such spine on sailfish larvae 3.9-6.3 mm, and no spines on specimens 8.0 mm and larger. Ueyanagi's (1963) illustrations showed 1) one spine on sailfish 5.1-13.2 mm and none on a 20.3 mm specimen, and 2) one spine on *Tetrapterus* sp. larvae 4.5 and 5.0 mm and two spines on specimens 12.0-21.2 mm. Gehringer's (1956) illustrations showed two spines on sailfish larvae 11.3-20.9 mm (except one spine on a 14.6 mm specimen), and mentioned that character in his text, thus ruling out "artist's license". Until the ontogeny of all istiophorid species is described and compared, the 27 specimens at hand must remain unidentified.

STROMATEIDAE

Nomeus gronovii (Gmelin)
man-of-war fish
D-67-4 May
LL-5, 1, 18.3
D-68-1 Jan-Feb
DD-6, 1, 15.8
LL-3, 1, 28.8
PP-2, 3, 10.1-18.7

Peprilus triocanthus (Peck)
butterfish
D-67-4 May
AA-2, 2, 12.0-12.2
CC-6, 1, 19.0
EE-1, 2, 23.5-24.2
EE-5, 1, 18.8
EE-6, 1, 14.8
FF-2, 11, 14.5-39.6
FF-3, 40, 11.3-52.1

FF-4, 39, 12.7-28.7
HH-1, 1, 32.4
HH-2, 3, 14.8-22.5
HH-4, 5, 12.8-24.3
HH-5, 1, 14.8
JJ-3, 7, 8.6-26.9
KK-1, 4, 21.6-25.4
KK-2, 8, 12.9-32.9
KK-3, 1, 22.8
MM-1, 1, 15.9
D-67-8 Jul-Aug
DD-2, 1, 13.3
FF-2, 4, 12.4-14.1
D-67-16 Oct
LL-3, 2, 11.3-12.2
D-68-1 Jan-Feb
AA-2, 1, 14.9
AA-4, 2, 14.2-15.4
FF-5, 3, 10.8-18.2
GG-2, 18, 11.3-38.0
GG-3, 3, 16.6-41.7
GG-5, 1, 18.2
HH-3, 3, 20.8-24.0

Psenes cyanophrys Valenciennes
freckled driftfish
D-67-4 May
EE-6, 1, 21.0
JJ-6, 1, 24.2
MM-4, 1, 30.1
PP-2, 1, 15.2
D-67-8 Jul-Aug
AA-7, 1, 23.4
BB-5, 1, 19.8
BB-6, 1, 22.5
CC-7, 1, 14.3
DD-6, 1, 23.7
LL-5, 1, 15.4
NN-3, 1, 19.9
D-68-1 Jan-Feb
DD-6, 1, 22.2
PP-2, 1, 60.9

Small butterfish are probably more typical of surface waters north of Cape Kennedy than south. Dooley (1972) caught none off Miami, and except for one specimen from the offing of Vero Beach, our records were all north of Cape Kennedy. Lengths of specimens indicate spawning occurs throughout the year, and is not restricted to summer and early fall as is true north of Cape Hatteras (Haedrich 1967).

I cannot report how strongly associated with medusae any of these stromateids are since the net only rarely contained jellyfish or Portugese man-of-war, and not on any of the stations where stromateids were taken.

SCORPAENIDAE

Scorpaena sp.
D-67-4 May
JJ-3, 1, 11.8
D-67-8 Jul-Aug
PP-3, 1, 10.5
D-67-16 Oct
CC-5, 1, 11.2
HH-6, 1, 10.3
MM-4, 2, 9.3-10.1
D-68-1 Jan-Feb
AA-5, 1, 11.6
NN-2, 1, 11.5

TRIGLIDAE

Unidentified
D-67-4 May
AA-1, 1, 11.2
D-67-16 Oct
CC-5, 2, 5.2-6.4
CC-6, 1, 9.8
HH-6, 2, 12.7-13.5
HH-7, 1, 11.5

DACTYLOPTERIDAE

Dactylopterus volitans (Linnaeus)
flying gurnard
D-67-4 May
NN-3, 1, 10.5
D-67-8 Jul-Aug
DD-6, 1, 6.3 SL
NN-3, 1, 11.2 SL

BOTHIDAE

Bothus ocellatus (Agassiz)
eyed flounder
D-67-4 May
AA-2, 15, 15.2-23.8
AA-3, 4, 17.6-21.9
AA-4, 2, 20.1-20.7
AA-6, 1, 19.3
BB-4, 1, 13.0
CC-7, 1, 11.7
KK-4, 1, 19.5
LL-4, 1, 16.6
LL-5, 1, 17.5
MM-3, 2, 10.0-15.7
NN-4, 1, 13.2
PP-1, 1, 13.5
D-67-8 Jul-Aug
AA-1, 1, 11.5
AA-6, 2, 15.0-15.2
AA-7, 5, 7.4-21.4
DD-3, 1, 7.1
DD-6, 1, 19.1
FF-1, 1, 19.5
FF-2, 10, 14.3-19.6
HH-6, 3, 10.1-16.0
JJ-4, 3, 12.0-17.2
JJ-5, 2, 9.4-12.8
KK-6, 2, 11.2-14.5
MM-1, 7, 10.3-18.4
MM-2, 20, 13.2-19.3
MM-3, 6, 9.7-17.4
NN-2, 1, 12.8
PP-1, 3, 11.4-24.9
PP-3, 1, 21.7
D-67-16 Oct
AA-5, 1, 10.3
DD-6, 2, 13.9-15.5
HH-6, 45, 11.5-23.3
HH-7, 13, 11.5-21.9
LL-4, 4, 10.5-21.1
NN-3, 1, 18.5
PP-1, 7, 12.2-19.9
PP-2, 8, 13.4-21.6
D-68-1 Jan-Feb
AA-4, 3, 17.2-20.1
BB-2, 2, 12.4-12.9
BB-4, 5, 11.1-15.4
CC-4, 1, 17.1
DD-6, 1, 17.3
EE-2, 1, 21.6
EE-4, 2, 12.9-20.3
EE-5, 2, 14.5-15.3
EE-6, 2, 9.6-16.9
FF-3, 4, 13.7-21.1
FF-4, 12, 12.9-18.6
FF-5, 8, 13.0-23.8
GG-5, 1, 21.8
GG-6, 4, 16.3-17.3
GG-7, 1, 12.2
HH-5, 2, 12.9-16.2
JJ-5, 5, 12.5-20.1
KK-5, 6, 14.1-20.0
LL-2, 1, 16.1
NN-1, 8, 11.0-22.8
NN-2, 4, 19.3-24.0
NN-3, 2, 21.0-24.0
PP-1, 1, 17.4
PP-2, 2, 14.3-20.1
PP-3, 1, 14.9

Unidentified
D-67-4 May
AA-1, 4, 11.2-13.5
AA-2, 2, 14.2-14.4
HH-2, 1, 13.8
D-67-8 Jul-Aug
FF-2, 10, 13.2-14.5
D-67-16 Oct
GG-4, 1, 12.7
HH-6, 5, 10.3-17.0
D-68-1 Jan-Feb
AA-4, 1, 13.4
DD-3, 3, 10.1-12.4
FF-5, 2, 11.2-13.2
JJ-3, 1, 16.3
LL-5, 1, 13.2

Bothus ocellatus larvae are a common constituent of the surface fauna off the southeastern United States. They occurred during all seasons and throughout the entire range of our survey. Similar length ranges during all seasons indicate year-round spawning (Table 8), and maximum lengths of about 24.0 mm indicate that this is the maximum size before metamorphosis when the larvae begin a demersal existence and are no longer available to surface samplers.

All of the unidentified bothid larvae are either *Citharichthys* sp. or *Etropus* sp. None is assignable to *C. arctifrons* or *E. microstomus* as described by Leonard (1971). Because of overlapping meristic characters among species in these two genera we are unable to identify these specimens.

SOLEIDAE

Gymnachirus melas Nichols
naked sole
D-68-1 Jan-Feb
LL-2, 1, 123.0

Table 8.—Summary of catch data for *Bothus ocellatus*.

Month	Transect range	Number caught	Size range (mm FL)
May	AA-PP	31	10.0-23.8
Jul-Aug	AA-PP	69	7.1-24.9
Oct	AA-PP	81	10.3-23.3
Jan-Feb	AA-PP	81	9.6-24.0

I was unable to find a record in the literature of this species occurring at the surface. We caught our specimen at night over a depth of 15 m.

CYNOGLOSSIDAE

Symphurus sp.
D-67-16 Oct
HH-6, 1, 11.3

BALISTIDAE

Aluterus heudeloti Hollard
dotterel filefish
D-67-4 May
JJ-1, 1, 74.9
D-67-8 Jul-Aug
CC-5, 1, 30.6
CC-6, 1, 27.0
HH-7, 1, 59.1
D-67-16 Oct
MM-2, 1, 67.8
Aluterus monoceros (Linnaeus)
unicorn filefish
D-67-8 Jul-Aug
KK-6, 1, 53.0
D-67-16 Oct
PP-1, 2, 68.0-70.0
Aluterus schoepfi (Walbaum)
orange filefish
D-67-4 May
DD-1, 1, 11.0
JJ-5, 1, 32.9
NN-4, 1, 28.0
D-67-8 Jul-Aug
BB-5, 1, 30.5
FF-6, 1, 21.0
D-67-16 Oct
GG-5, 1, 22.5
JJ-4, 1, 34.0
NN-2, 2, 68.0-78.1
Aluterus scriptus (Osbeck)
scrawled filefish
D-67-4 May
NN-4, 1, 37.0
D-67-8 Jul-Aug
GG-6, 1, 63.9
KK-6, 1, 44.0
LL-5, 2, 49.0-98.7
MM-3, 2, 32.5-88.7
PP-3, 1, 63.8
D-67-16 Oct
KK-6, 2, 42.0-79.7
NN-3, 1, 78.1
PP-3, 2, 43.5-73.2
Aluterus sp.
D-67-4 May
CC-5, 1, 19.0
Balistes capriscus Gmelin
gray triggerfish
D-67-8 Jul-Aug
AA-7, 1, 25.0
BB-6, 1, 39.2
CC-6, 1, 32.8
HH-7, 1, 27.5
JJ-5, 1, 11.1
JJ-6, 1, 18.4
KK-5, 6, 17.5-27.7
KK-6, 2, 12.8-13.0
LL-4, 3, 20.4-32.7
LL-5, 3, 12.2-23.7
MM-2, 3, 13.1-15.3
NN-1, 1, 17.3
NN-2, 5, 14.9-23.4
D-67-16 Oct
HH-7, 1, 21.5
KK-5, 1, 30.9
KK-6, 2, 62.6-83.4
LL-2, 2, 29.2-32.5
MM-1, 1, 72.1
NN-3, 1, 20.9
PP-1, 3, 20.4-69.5
Balistes sp.
D-67-8 Jul-Aug
MM-3, 2, 18.4-22.9
NN-2, 2, 12.9-13.2
Cantherhines pullus (Ranzani)
orange spotted filefish
D-67-8 Jul-Aug
PP-3, 1, 50.5
D-67-16 Oct
FF-5, 1, 29.0
JJ-6, 2, 60.0-65.3
MM-2, 2, 53.0-57.0
PP-3, 1, 55.3
Canthidermis maculatus (Bloch)
rough triggerfish
D-67-4 May
LL-5, 1, 8.3
NN-4, 5, 8.8-10.0
PP-1, 2, 8.1-9.6
D-67-8 Jul-Aug
GG-7, 1, 16.8
NN-2, 1, 31.8
NN-3, 1, 32.5
PP-3, 1, 73.5
D-67-16 Oct
JJ-6, 1, 32.8
KK-5, 1, 36.9
LL-4, 1, 31.1
PP-1, 1, 24.0
D-68-1 Jan-Feb
PP-3, 1, 21.5
Canthidermis sufflamen (Mitchill)
ocean triggerfish
D-67-4 May
NN-3, 7, 10.0-19.6
D-67-16 Oct
LL-5, 1, 16.2
Monacanthus ciliatus (Mitchill)
fringed filefish
D-67-4 May
AA-4, 1, 16.0
AA-5, 2, 15.5-16.5
CC-7, 3, 17.0-19.0
EE-5, 1, 21.0
EE-6, 10, 17.0-27.0
FF-6, 22, 19.5-34.5
GG-5, 7, 19.7-27.5
GG-6, 6, 20.0-25.0
HH-2, 1, 21.0
HH-5, 5, 22.0-26.0
JJ-4, 1, 23.0
JJ-5, 1, 23.2
KK-3, 2, 20.0-23.1
LL-2, 1, 21.0
LL-4, 4, 20.0-22.0
NN-3, 1, 25.0
NN-4, 1, 25.5
PP-1, 1, 24.6
D-67-8 Jul-Aug
BB-5, 20, 17.5-25.0
BB-6, 6, 19.5-29.5
CC-3, 1, 17.3
CC-4, 1, 60.5
CC-6, 5, 18.0-27.5
DD-4, 2, 20.0-20.5
DD-6, 1, 26.5
EE-5, 2, 19.5-19.5
FF-5, 3, 19.0-21.2
FF-6, 1, 22.0
GG-4, 1, 21.7
JJ-1, 1, 18.8
JJ-5, 5, 17.5-22.0
JJ-6, 1, 23.5
KK-4, 1, 25.5
LL-3, 1, 20.0
LL-4, 5, 19.0-23.0
LL-5, 2, 22.0-26.0
NN-2, 3, 12.0-24.5
NN-3, 1, 25.5
D-67-16 Oct
AA-5, 2, 21.0-23.0
AA-7, 2, 21.5-24.0
CC-7, 1, 20.5
DD-4, 2, 19.5-20.5
EE-6, 2, 17.0-22.5
FF-5, 1, 25.0
GG-6, 1, 26.0
HH-7, 1, 25.0
JJ-2, 3, 23.0-24.0
JJ-5, 1, 22.0
LL-3, 2, 23.0-34.0
NN-1, 1, 20.8
D-68-1 Jan-Feb
GG-6, 1, 21.7
LL-3, 1, 25.5

Monacanthus hispidus (Linnaeus)
planehead filefish
D-67-4 May
AA-5, 3, 21.0-26.0
AA-6, 5, 33.9-167.8 SL
AA-7, 1, 47.0
BB-5, 9, 17.0-32.0
BB-6, 2, 14.0-19.0
CC-4, 1, 15.5
CC-7, 1, 15.5
DD-5, 1, 15.5
DD-6, 7, 23.0-38.5
EE-4, 1, 16.0
FF-1, 1, 21.3
FF-4, 2, 19.5-23.0
FF-6, 1, 62.5
GG-4, 1, 35.5
GG-5, 1, 46.7
GG-6, 18, 19.5-32.1
HH-2, 3, 23.0-24.8
HH-3, 9, 44.1-58.0
HH-4, 2, 19.5-29.9
HH-5, 3, 20.0-28.7
HH-6, 8, 20.0-29.9
HH-7, 4, 22.3-30.9
JJ-1, 1, 21.0
JJ-3, 3, 17.2-25.4
JJ-4, 3, 19.5-49.4
JJ-5, 2, 17.5-24.0
KK-1, 1, 24.8
KK-2, 2, 22.1-42.2
KK-3, 1, 21.0
KK-5, 1, 24.6
KK-6, 3, 19.3-20.3
LL-1, 1, 22.3
LL-2, 2, 19.5-20.0
LL-4, 1, 22.6
MM-3, 1, 19.2
D-67-8 Jul-Aug
BB-5, 3, 22.5-33.2
BB-6, 14, 20.5-42.9
CC-5, 1, 21.0
CC-6, 3, 21.0-34.0
DD-6, 3, 34.5-75.0
FF-6, 3, 19.5-26.5
GG-6, 2, 25.7-26.0
GG-7, 4, 20.0-28.9
HH-7, 9, 16.9-21.0
JJ-4, 1, 25.2
JJ-5, 3, 11.1-20.0
JJ-6, 2, 21.0-65.3
KK-4, 6, 20.0-44.7
KK-5, 17, 20.5-79.6
KK-6, 3, 26.5-71.8
LL-3, 2, 8.7-11.0
LL-4, 14, 19.5-40.3
LL-5, 18, 20.0-63.0
MM-3, 1, 20.5
NN-2, 2, 20.0-24.6
D-67-16 Oct
AA-4, 1, 37.7
AA-5, 13, 19.0-51.7
AA-6, 6, 26.4-49.6
AA-7, 2, 26.5-27.6
CC-1, 1, 23.2
CC-7, 2, 21.5-23.4
DD-6, 2, 19.0-27.1
EE-6, 2, 24.5-26.7
FF-5, 31, 20.4-73.3
FF-6, 1, 22.0
GG-5, 32, 20.0-72.0
GG-6, 1, 63.9
HH-2, 2, 24.8-30.8
HH-3, 15, 21.0-50.8
HH-6, 19, 20.0-55.3
HH-7, 4, 20.0-26.5
JJ-1, 3, 21.0-50.1
JJ-2, 4, 27.0-33.5

JJ-3, 4, 19.0-30.7
JJ-4, 4, 20.0-54.8
KK-1, 6, 20.5-31.7
KK-2, 3, 20.0-50.2
KK-3, 2, 20.0-21.0
KK-5, 1, 21.5
LL-3, 4, 19.5-22.5
LL-5, 1, 20.5
MM-2, 2, 19.5-20.2
MM-3, 1, 21.9
NN-2, 9, 21.0-30.8
PP-1, 1, 24.5

D-68-1 Jan-Feb
AA-7, 1, 21.5
DD-5, 2, 19.2-20.2
GG-6, 2, 19.0-21.7
HH-3, 1, 22.5
HH-4, 2, 24.3-34.2
HH-5, 3, 20.0-34.1
JJ-4, 4, 19.5-36.9
LL-5, 4, 21.0-26.2
MM-1, 1, 22.1
MM-3, 4, 20.0-25.0

Monacanthus setifer Bennett
pygmy filefish
D-67-4 May
EE-6, 1, 21.0
D-67-8 Jul-Aug
BB-6, 1, 37.3
KK-5, 2, 35.0-39.0
LL-3, 1, 21.0
MM-4, 1, 32.9
NN-2, 1, 28.0
NN-3, 1, 32.7
PP-3, 2, 33.4-38.0
D-67-16 Oct
GG-7, 1, 43.4
HH-7, 17, 26.8-40.0
JJ-5, 4, 34.5-41.4
JJ-6, 17, 29.4-50.0
KK-5, 10, 23.0-45.7
KK-6, 16, 34.7-50.2
LL-1, 1, 37.5
LL-2, 1, 39.6
LL-3, 7, 23.0-37.1
LL-5, 1, 50.6
MM-3, 2, 25.2-44.3
MM-4, 1, 33.3
NN-2, 5, 26.5-44.0
NN-3, 4, 22.0-46.5
PP-1, 16, 26.0-52.0
PP-2, 1, 35.2
PP-3, 186, 23.0-53.0
D-68-1 Jan-Feb
HH-4, 1, 25.3

Monacanthus tuckeri Bean
slender filefish
D-67-8 Jul-Aug
CC-6, 2, 22.0-25.5
D-68-1 Jan-Feb
AA-7, 1, 23.0

Xanthichthys ringens (Linnaeus)
sargassum triggerfish
D-67-16 Oct
NN-3, 1, 18.3

Unidentified triggerfishes
D-67-4 May
NN-1, 1, 9.0
D-67-8 Jul-Aug
JJ-6, 1, 14.4
NN-4, 1, 9.9
PP-2, 1, 13.4
PP-3, 1, 15.5

Unidentified filefishes
D-67-4 May
AA-1, 12, 7.0-11.0 SL
AA-2, 29, 6.5-13.0 SL
AA-3, 77, 5.5-13.0 SL
AA-4, 9, 6.0-12.0 SL
AA-5, 12, 5.5-13.0 SL
AA-7, 1, 11.0 SL
BB-6, 1, 8.0 SL
CC-3, 2, 5.0-12.0 SL
CC-4, 8, 9.5-13.0 SL
CC-5, 27, 6.0-13.5 SL
CC-6, 6, 9.0-13.5 SL
CC-7, 5, 9.0-9.5 SL
DD-1, 8, 9.5-14.0 SL
DD-3, 1, 13.0 SL
DD-5, 1, 13.5 SL
DD-6, 19, 10.5-19.5 SL
EE-4, 3, 6.5-14.0 SL
EE-5, 8, 5.0-12.0 SL
EE-6, 41, 6.5-11.0 SL
FF-1, 8, 14.2-18.5
FF-2, 5, 13.9-19.4
FF-3, 387, 6.1-18.4
FF-4, 2, 9.5-13.0
FF-5, 9, 11.4-19.0
FF-6, 15, 14.2-19.0
GG-5, 25, 10.5-19.5
GG-6, 16, 13.3-18.0
GG-7, 2, 15.9-18.2
HH-2, 97, 6.7-16.5
HH-4, 117, 7.4-19.0
HH-5, 47, 9.9-19.0
HH-6, 5, 15.5-19.0
JJ-4, 4, 12.2-19.5
JJ-5, 1, 13.2
JJ-6, 1, 12.4
KK-1, 2, 13.5-17.5
KK-3, 1, 16.7
KK-4, 2, 17.1-23.3
LL-1, 3, 13.7-14.2
LL-2, 9, 11.3-19.0
LL-3, 4, 10.3-19.7
LL-4, 3, 10.4-12.0
LL-5, 4, 8.0-18.2
MM-1, 2, 12.1-16.1
NN-2, 3, 14.0-15.1
NN-4, 1, 11.5
PP-2, 2, 13.2-14.9
D-67-8 Jul-Aug
AA-4, 1, 12.5
AA-7, 2, 13.3-17.0
BB-5, 5, 13.0-19.0
BB-6, 16, 13.1-19.5
CC-4, 6, 10.3-19.5
CC-5, 1, 13.9
CC-6, 7, 12.9-19.0
CC-7, 5, 12.9-17.8
DD-4, 1, 13.5
DD-6, 2, 13.1-15.1
EE-4, 2, 15.9-16.1
EE-5, 1, 14.1
FF-4, 2, 13.3-14.4
FF-5, 5, 12.7-18.5
FF-6, 5, 12.6-16.4
GG-6, 3, 15.3-19.0
GG-7, 3, 10.8-12.0
JJ-4, 1, 14.8
JJ-6, 3, 12.4-18.9
KK-4, 2, 18.5-19.5
KK-5, 18, 15.0-19.5
KK-6, 6, 11.7-14.0
LL-2, 1, 9.3
LL-3, 1, 24.6
LL-4, 14, 10.3-19.7
LL-5, 44, 7.8-19.5
MM-1, 3, 11.3-12.7
MM-2, 16, 10.8-19.0
MM-3, 23, 10.5-18.5
MM-4, 2, 15.3-15.7
NN-1, 10, 8.2-15.7
NN-2, 30, 6.9-19.0
NN-3, 1, 11.7
NN-4, 2, 10.5-14.3
D-67-16 Oct
AA-7, 7, 10.8-15.0
CC-7, 10, 12.9-19.0
DD-4, 1, 12.5
DD-5, 2, 13.3-15.7
EE-5, 1, 15.7
EE-6, 5, 13.4-19.0
FF-2, 2, 19.3-19.9
FF-4, 1, 13.1
FF-5, 20, 10.4-19.7
FF-6, 4, 11.4-19.0
GG-5, 21, 16.8-19.5
GG-6, 7, 15.3-19.5
HH-4, 1, mut.
HH-6, 20, 14.5-19.5
HH-7, 3, 14.7-15.7
JJ-2, 1, 17.6
JJ-3, 3, 16.2-17.5
JJ-4, 14, 12.1-19.5
JJ-5, 5, 11.6-16.3
KK-1, 1, 17.3
KK-2, 1, 18.1
KK-3, 1, 17.8
KK-5, 4, 11.9-19.0
LL-1, 1, 16.6
LL-3, 16, 13.3-19.0
LL-5, 1, 18.3
MM-1, 4, 14.7-17.9
MM-2, 1, 17.3
MM-4, 2, 12.5-14.0
NN-1, 21, 14.4-19.3
NN-2, 17, 12.4-19.5
NN-4, 1, 16.5
PP-1, 1, 8.7
PP-3, 1, 20.5
D-68-1 Jan-Feb
AA-7, 2, 16.5-17.5
DD-2, 2, 16.4-17.7
DD-4, 1, 13.7
DD-5, 2, 16.0-18.5
DD-6, 4, 16.3-18.6
GG-7, 1, 14.7
HH-5, 2, 13.3-19.0
JJ-4, 4, 14.9-16.0
KK-4, 2, 13.8-17.5
KK-5, 6, 11.5-14.9
KK-6, 1, 14.2
LL-3, 3, 15.7-19.0
LL-5, 8, 11.8-18.5
MM-3, 2, 13.7-19.5
MM-4, 2, 18.4-19.3
NN-4, 1, 15.0
PP-1, 1, 12.7

Our catches of filefishes are consistent with observations made by Berry and Vogele (1961). *Monacanthus hispidus* is more abundant than *M. setifer* and *M. hispidus* is distributed over the entire shelf while *M. setifer* is more restricted to Gulf Stream waters. Our catches of these species demonstrate these points (Fig. 19). South of Cape Kennedy, where the Gulf Stream is closer to shore, the species occur together. *Monacanthus tuckeri* is caught so infrequently it might be considered rare in surface waters of the South Atlantic Bight.

Spawning of *Cantherhines pullus* probably occurs south of the Florida Straits judging from the dearth of small (i.e., less than 33.0 mm) individuals in published records. Dooley (1972) took none smaller than 33.0 mm, our smallest was 29.0 mm, and Berry and Vogele (1961, p. 108-109) examined only one smaller than 33.0 mm, a 17.5 mm individual taken from the stomach of a skipjack tuna caught between Grand Bahama and Andros Island. Spawning has been reported in the Caribbean (Munro et al. 1973) and in

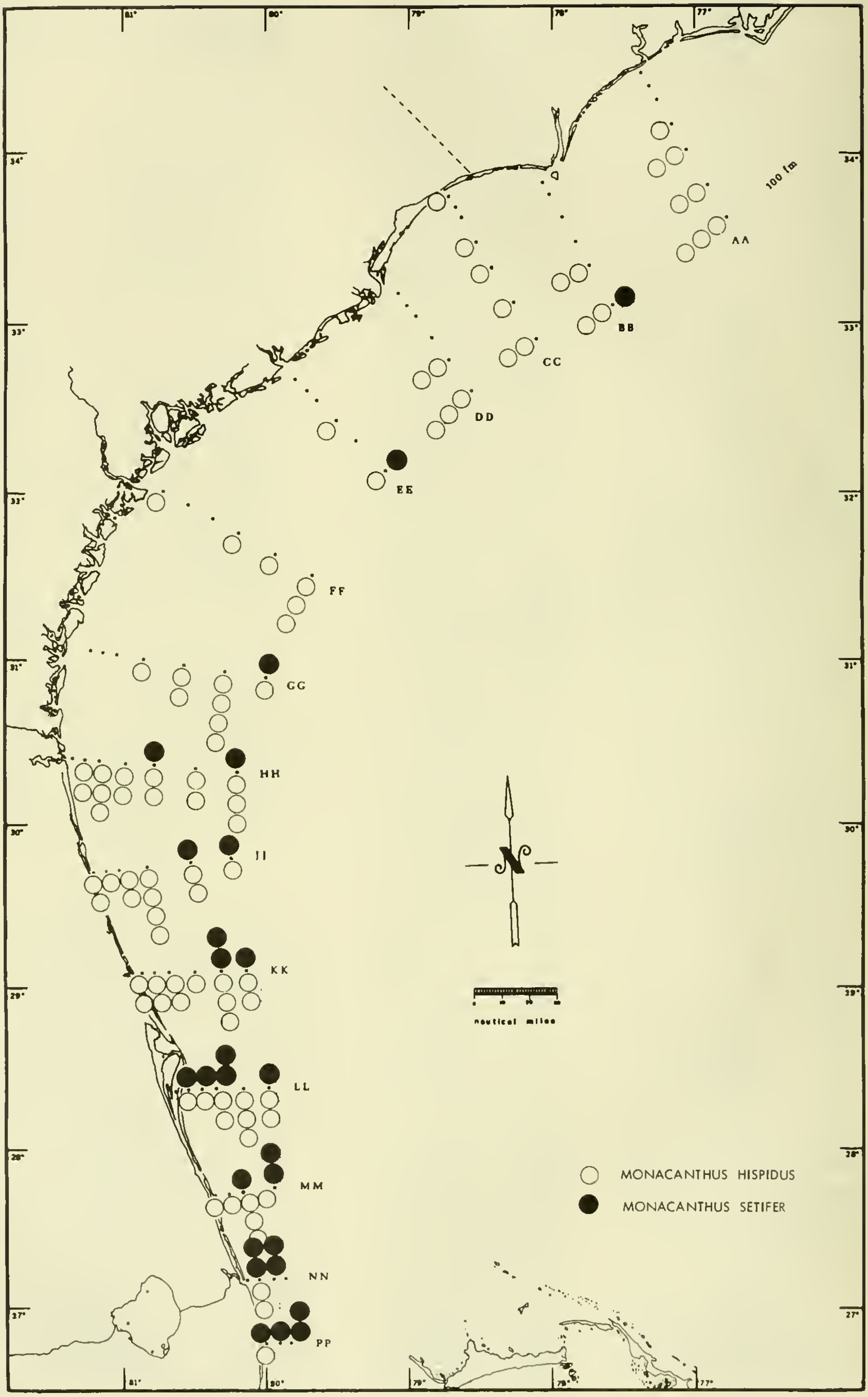


Figure 19.—Occurrence of two species of *Monacanthus* during four survey cruises; each symbol represents an occurrence in one of the four cruises.

the waters around the Virgin Islands and Puerto Rico (Randall 1964).

Most of the unidentified filefish resemble *M. hispidus*, but at small sizes we were unable to determine the nature of scale spination, an important identifying character (Berry and Vogele 1961). Because of overlapping meristic characters and relative body depths in the four species of *Monacanthus*, these specimens were not identified.

Most specimens of *Balistes capriscus* were heavily infested with parasitic copepods (*Caligus* sp.) attached to the bases of the vertical fins. No other balistid species was so affected.

OSTRACIIDAE

Unidentified
D-67-4 May
CC-5, 1, 7.9
D-67-16 Oct
PP-3, 1, 8.9
D-68-1 Jan-Feb
MM-4, 1, 6.6
PP-3, 1, 9.7

There are few records of small ostraciids in the literature. Fowler (1945) mentioned three specimens, one of 20 mm from Key West, one of 23 mm from New Jersey, and one of 21 mm from Massachusetts. The latter two records indicate that the Gulf Stream occasionally carries developing young to the north. Because postlarval ostraciids resemble the bladders of sargassum in size, shape, and color, more specimens may have been captured and overlooked during our survey.

TETRAODONTIDAE

Sphoeroides sp.
D-67-4 May
AA-1, 5, 10.1-11.3
AA-2, 10, 7.4-13.0
AA-3, 10, 9.3-18.8
AA-4, 4, 6.7-11.6
AA-5, 5, 7.4-13.8
AA-6, 1, 8.9
CC-1, 3, 11.0-15.9
CC-3, 1, 15.9
CC-4, 5, 8.7-10.3
CC-5, 12, 6.1-19.9
CC-6, 4, 8.6-15.5
CC-7, 3, 5.4-9.0
DD-3, 1, 10.9
EE-6, 6, 5.7-14.9
FF-2, 3, 11.3-17.9
FF-3, 8, 7.0-12.0
FF-4, 5, 5.7-17.9
FF-5, 2, 10.9-12.2
HH-2, 2, 14.7-15.1
HH-4, 2, 13.5-14.3
HH-5, 8, 13.2-16.5
HH-6, 3, 13.0-15.7
JJ-2, 13, 11.1-18.2
JJ-3, 55, 8.3-14.6
JJ-4, 15, 8.8-16.5
KK-3, 1, 15.0
KK-6, 1, 16.5
LL-2, 2, 7.1-12.1
LL-3, 2, 11.9-12.9
LL-4, 3, 10.3-13.9
LL-5, 2, 13.0-16.6
MM-1, 1, 8.9
MM-2, 1, 8.3
NN-1, 1, 12.5
NN-3, 8, 5.9-8.8
NN-4, 4, 9.9-12.0
PP-1, 2, 6.2-10.0
PP-2, 1, 11.0
D-67-8 Jul-Aug
AA-4, 1, 6.4
BB-4, 1, 10.4
EE-5, 2, 8.9-10.7
FF-4, 2, 8.5-10.5
FF-5, 1, 11.8
GG-5, 1, 10.6
HH-5, 2, 7.3-7.4
JJ-5, 1, 13.3
LL-4, 4, 7.7-10.5
MM-3, 1, 9.0
NN-4, 1, 6.6
D-67-16 Oct
AA-4, 3, 17.0-20.6
AA-5, 5, 12.4-18.8
DD-4, 1, 15.2
DD-5, 15, 8.6-18.2
FF-3, 1, 18.9
FF-5, 5, 14.8-21.4
GG-5, 2, 10.0-18.2
HH-3, 2, 9.4-9.6
JJ-3, 1, 9.6
JJ-4, 1, 13.4
JJ-5, 1, 14.5
KK-1, 1, 15.9
LL-4, 1, 9.4
LL-5, 3, 9.6-16.4
NN-1, 1, 14.1
NN-2, 3, 7.7-12.3
NN-3, 2, 10.6-11.4
NN-4, 4, 6.8-12.5
D-68-1 Jan-Feb
AA-5, 2, 8.1-14.9
AA-7, 3, 8.5-9.5
DD-5, 1, 10.0
DD-6, 2, 13.2-13.3
FF-5, 1, 6.7
GG-5, 2, 6.9-8.0
KK-4, 2, 12.5-13.0
MM-1, 1, 14.4
MM-2, 1, 16.5
MM-3, 8, 12.0-16.0
PP-2, 4, 8.8-13.3
PP-3, 1, 7.5

Of all fish species caught, small puffers were the most markedly diurnal in occurrence (Table 9). It appears that these fishes engage in a diel vertical migration, but the extent of the nocturnal descent is unknown.

Table 9.—Diel variations in catch of juvenile tetraodontids.

	Dawn	Day	Dusk	Night
Number of fish	19	235	42	9
Number of occurrences	9	56	9	4

DIODONTIDAE

Diodon holocanthus Linnaeus
balloonfish
D-67-8 Jul-Aug
JJ-5, 1, 70.1
Diodon hystrix Linnaeus
porcupinefish
D-67-8 Jul-Aug
NN-3, 1, 84.5

UNIDENTIFIED

D-67-4 May
BB-2, 1, mut.
BB-5, 1, mut.
CC-3, 1, mut.
CC-5, 3, mut.
CC-6, 2, mut.
CC-7, 1, 14.8
DD-6, 2, 8.9-11.0
EE-6, 2, mut.
FF-4, 1, mut.
LL-2, 1, mut.
NN-3, 1, mut.
D-67-8 Jul-Aug
GG-6, 2, 7.6-7.8
KK-6, 1, mut.
MM-2, 4, 4.5-27.2
NN-2, 2, 22.0-26.2
D-67-16 Oct
HH-7, 3, mut.-11.0
LL-4, 1, 11.2
NN-4, 1, 8.6
D-68-1 Jan-Feb
AA-2, 1, 15.8
AA-7, 9, 7.1-9.5
DD-2, 1, mut.
DD-5, 1, 14.8
EE-4, 1, 7.3
GG-2, 1, 13.0
NN-1, 1, mut.
NN-2, 1, 25.0
PP-2, 1, mut.

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APPENDIX TABLE

Station list including dates, times, observed physical conditions, and number of categories caught, including all fishes whether identified to species, identified to a higher taxon, or not identified.

Cruise 0-67-4

Station	Date 1967 D M	Tow Start Time (EDST)	Light Condition	Water Depth (M)	Surface Temp (°C)	Surface Sal (°/oo)	Number of Categories Caught
AA-1	15 5	2135	Night	10	19.2	36.10	9
AA-2	15 5	2006	Dusk	15	18.8	36.10	10
AA-3	15 5	1903	Dusk	20	18.7	36.50	6
AA-4	15 5	1850	Day	26	19.6	36.70	8
AA-5	15 5	1616	Day	30	21.7	37.40	11
AA-6	15 5	1337	Day	39	22.0	36.70	7
AA-7	15 5	1111	Day	175	23.3	36.60	2
BB-1	14 5	2226	Night	13	20.2	35.30	-
BB-2	14 5	2329	Night	12	20.2	35.40	3
BB-3	15 5	0054	Night	19	19.9	35.70	1
BB-4	15 5	0223	Night	27	20.9	36.60	5
BB-5	15 5	0352	Night	28	21.8	36.80	6
BB-6	15 5	0549	Dawn	157	24.2	36.70	4
CC-1	14 5	1806	Day	10	20.8	37.60	3
CC-2	14 5	1715	Day	13	20.5	35.60	-
CC-3	14 5	1620	Day	17	20.9	35.70	5
CC-4	14 5	1501	Day	20	21.1	35.80	7
CC-5	14 5	1337	Day	25	21.3	36.40	9
CC-6	14 5	1058	Day	31	21.6	36.80	10
CC-7	14 5	0853	Day	124	21.3	37.20	15
DD-1	13 5	2103	Dusk	10	21.7	33.90	7
DD-2	13 5	2201	Night	13	20.8	35.80	5
DD-3	13 5	2335	Night	16	20.9	35.70	7
DD-4	14 5	0108	Night	28	22.1	36.70	4
DD-5	14 5	0230	Night	34	21.9	37.90	8
DD-6	14 5	0457	Dawn	160	22.2	37.80	14
EE-1	13 5	0409	Night	11	21.3	35.20	6
EE-2	13 5	0307	Night	13	21.2	35.60	2
EE-3	13 5	0206	Night	16	20.9	35.70	4
EE-4	13 5	0040	Night	25	21.1	36.70	6
EE-5	13 5	1149	Day	37	21.5	37.40	8
EE-6	13 5	1431	Day	108	22.1	37.30	12
FF-1	12 5	1830	Day	11	23.3	31.00	6
FF-2	12 5	1711	Day	16	22.3	36.00	6
FF-3	12 5	1534	Day	22	21.8	36.60	8
FF-4	12 5	1406	Day	29	21.3	37.40	10
FF-5	12 5	1111	Day	42	21.3	37.60	5
FF-6	12 5	0849	Day	139	21.7	37.80	4
GG-1	11 5	1728	Day	9	22.9	35.10	-
GG-2	11 5	1839	Day	13	22.7	35.30	-
GG-3	11 5	1947	Dusk	16	22.1	35.40	-
GG-4	11 5	2125	Night	25	22.3	35.88	2
GG-5	11 5	2321	Night	32	22.3	36.15	7
GG-6	12 5	0200	Night	39	22.5	37.63	6
GG-7	12 5	0433	Night	157	24.6	38.00	3
HH-1	10 5	1353	Day	13	23.4	34.96	1
HH-2	10 5	1252	Day	17	23.2	35.58	10
HH-3	10 5	1158	Day	21	23.3	35.97	2
HH-4	10 5	1033	Day	26	22.2	36.31	12
HH-5	10 5	0910	Day	31	22.3	36.49	13
HH-6	10 5	0642	Dawn	36	22.5	36.88	7
HH-7	10 5	0349	Night	113	24.6	37.70	8
JJ-1	9 5	1518	Day	15	23.9	37.15	4
JJ-2	9 5	1619	Day	17	23.9	37.32	3
JJ-3	9 5	1713	Day	19	23.9	37.33	12
JJ-4	9 5	1930	Dusk	19	23.9	37.20	6
JJ-5	9 5	2134	Night	36	23.2	36.96	7
JJ-6	10 5	0020	Night	183	25.4	37.25	6
KK-1	9 5	1050	Day	16	23.9	37.25	5
KK-2	9 5	0942	Day	17	23.8	37.15	6
KK-3	9 5	0810	Day	20	23.9	36.88	8
KK-4	9 5	0643	Dawn	26	22.4	39.40	2
KK-5	9 5	0414	Night	40	23.7	37.70	5
KK-6	9 5	0122	Night	102	25.3	37.70	6
LL-1	8 5	1516	Day	12	24.2	37.50	6
LL-2	8 5	1610	Day	14	25.2	37.40	13
LL-3	8 5	1705	Day	21	24.5	37.00	5
LL-4	8 5	1822	Day	42	24.4	38.00	10
LL-5	8 5	2040	Dusk	42	25.8	36.90	19
MM-1	8 5	0657	Dawn	12	22.4	37.00	6
MM-2	8 5	0746	Day	14	21.6	37.00	3
MM-3	8 5	0842	Day	22	23.1	37.00	6
MM-4	8 5	0227	Night	155	25.6	37.20	6
NN-1	7 5	1903	Dusk	12	25.4	37.30	3
NN-2	7 5	1757	Day	55	25.2	37.50	12
NN-3	7 5	1650	Day	175	25.7	37.00	21
NN-4	7 5	1550	Day	305	25.4	37.10	22
PP-1	7 5	0858	Day	64	25.0	36.80	9
PP-2	7 5	1105	Day	227	25.3	37.60	10
PP-3	7 5	1305	Day	338	26.1	37.40	-

Cruise 0-67-8

Station	Date 1967 D M	Tow Start Time (EDST)	Light Condition	Water Depth (M)	Surface Temp (°C)	Surface Sal (°/oo)	Number of Categories Caught
AA-1	1 8	1154	Day	13	25.5	34.90	1
AA-2	1 8	1243	Day	16	25.7	35.32	-
AA-3	1 8	1340	Day	21	25.8	34.84	-
AA-4	1 8	0627	Dawn	27	26.6	34.95	3
AA-5	1 8	0501	Dawn	32	26.8	34.93	4
AA-6	1 8	0057	Night	41	25.5	35.07	3
AA-7	31 7	2308	Night	158	28.5	35.76	11
BB-1	31 7	0703	Dawn	13	27.0	34.24	1
BB-2	31 7	0617	Dawn	14	25.6	34.92	-
BB-3	31 7	1112	Day	19	25.7	34.55	1
BB-4	31 7	1234	Day	27	25.7	33.84	6
BB-5	31 7	1454	Day	31	27.5	35.14	10
BB-6	31 7	1642	Day	159	28.0	35.51	13
CC-1	31 7	0130	Night	12	25.6	35.03	1
CC-2	31 7	0217	Night	15	24.5	35.07	-
CC-3	31 7	0305	Night	17	24.7	34.85	3
CC-4	30 7	2006	Dusk	19	25.2	34.60	2
CC-5	30 7	1840	Day	25	25.1	34.64	3
CC-6	30 7	1655	Day	32	27.5	35.84	12
CC-7	30 7	1516	Day	124	28.7	36.10	3
DD-1	30 7	0253	Night	11	24.8	35.06	3
DD-2	30 7	0346	Night	15	23.2	35.32	3
DD-3	30 7	0439	Night	15	24.4	34.72	4
DD-4	30 7	0600	Dawn	27	27.1	33.94	2
DD-5	30 7	0933	Day	33	27.1	34.66	-
DD-6	30 7	1145	Day	75	27.9	35.97	10
EE-1	29 7	1350	Day	14	28.2	32.96	-
EE-2	29 7	1451	Day	15	26.7	34.60	-
EE-3	29 7	1542	Day	18	26.8	34.55	-
EE-4	28 7	1442	Day	26	27.5	34.22	3
EE-5	28 7	1317	Day	37	27.7	34.48	6
EE-6	28 7	1128	Day	105	27.2	35.05	2
FF-1	27 7	2054	Dusk	12	28.1	31.91	1
FF-2	27 7	2212	Night	15	27.9	34.46	7
FF-3	28 7	0200	Night	21	27.2	34.50	1
FF-4	28 7	0336	Night	31	27.2	35.19	5
FF-5	28 7	0526	Dawn	40	27.7	35.43	6
FF-6	28 7	0722	Dawn	111	26.8	35.46	10
GG-1	27 7	1311	Day	13	27.3	34.03	-
GG-2	27 7	1208	Day	14	26.2	34.88	-
GG-3	27 7	1114	Day	17	25.5	34.70	-
GG-4	27 7	0814	Day	25	26.8	34.99	2
GG-5	27 7	0620	Dawn	30	26.8	35.39	4
GG-6	27 7	0431	Night	38	26.4	35.49	15
GG-7	27 7	0231	Night	146	27.2	35.52	13
HH-1	26 7	1053	Day	12	25.1	33.54	-
HH-2	26 7	0958	Day	15	25.8	34.50	-
HH-3	26 7	0907	Day	18	25.8	35.07	-
HH-4	26 7	1526	Day	25	26.5	34.02	-
HH-5	26 7	1655	Day	31	26.5	34.84	3
HH-6	26 7	2103	Dusk	36	27.1	35.82	1
HH-7	26 7	2318	Night	126	27.3	35.63	8
JJ-1	26 7	0333	Night	17	22.3	34.94	2
JJ-2	26 7	0423	Night	18	24.2	36.00	2
JJ-3	26 7	0513	Dawn	21	25.5	35.06	2
JJ-4	25 7	2139	Night	25	25.6	35.36	5
JJ-5	25 7	1952	Dusk	36	25.6	35.30	13
JJ-6	26 7	1713	Day	189	28.5	35.00	10
KK-1	22 7	1514	Day	17	26.6	34.30	-
KK-2	22 7	1637	Day	19	27.0	34.43	-
KK-3	22 7	1749	Day	21	26.4	33.69	-
KK-4	22 7	1917	Dusk	24	27.2	35.41	3
KK-5	22 7	2045	Dusk	36	27.7	35.53	16
KK-6	22 7	2309	Night	105	28.2	35.68	19
LL-1	23 7	1545	Day	12	27.3	33.52	-
LL-2	23 7	1018	Day	13	26.2	34.70	1
LL-3	23 7	0910	Day	23	25.5	34.61	5
LL-4	23 7	0700	Dawn	45	26.5	35.53	11
LL-5	23 7	0539	Dawn	170	26.6	35.53	21
MM-1	23 7	2233	Night	12	25.5	35.40	6
MM-2	23 7	2146	Night	13	26.9	35.13	14
MM-3	23 7	2022	Dusk	23	28.2	35.65	11
MM-4	24 7	0455	Night	162	29.1	36.12	7
NN-1	24 7	1027	Day	13	28.2	34.77	8
NN-2	24 7	1123	Day	39	27.8	35.33	17
NN-3	24 7	1238	Day	92	29.4	35.44	15
NN-4	24 7	1411	Day	300	29.3	34.54	6
PP-1	24 7	2204	Night	70	28.5	35.32	7
PP-2	24 7	2308	Night	243	29.4	35.76	4
PP-3	25 7	0443	Night	346	29.2	35.50	9

Cruise D-67-18

Station	Date 1967 D M	Tow Start Time (EDST)	Light Condition	Water Depth (M)	Surface Temp (°C)	Surface Sal (°/oo)	Number of Categories Caught
AA-1	19 10	1045	Day	11	21.3	33.89	-
AA-2	19 10	1212	Day	17	21.7	35.82	2
AA-3	19 10	1314	Day	21	22.2	34.50	1
AA-4	19 10	1439	Day	27	22.9	35.00	4
AA-5	19 10	1613	Day	32	24.2	35.23	6
AA-6	19 10	1848	Dusk	38	24.5	35.53	5
AA-7	19 10	2136	Night	167	26.2	35.35	6
BB-1	20 10	1158	Day	13	20.8	34.29	3
BB-2	20 10	1101	Day	12	20.8	34.68	1
BB-3	20 10	0938	Day	18	20.9	34.94	-
BB-4	20 10	0806	Dawn	27	23.1	35.35	2
BB-5	20 10	0638	Dawn	30	24.1	35.91	1
BB-6	20 10	0313	Night	175	24.9	35.63	-
CC-1	20 10	1541	Day	10	20.9	34.52	1
CC-2	20 10	1639	Day	13	21.2	34.74	2
CC-3	20 10	1744	Dusk	16	21.7	35.28	1
CC-4	20 10	1910	Dusk	20	21.9	35.92	2
CC-5	20 10	2038	Night	25	22.5	35.41	5
CC-6	20 10	2257	Night	31	23.3	35.96	5
CC-7	21 10	0104	Night	134	24.6	35.88	6
DD-1	21 10	1355	Day	9	20.9	34.17	1
DD-2	21 10	1253	Day	13	21.2	34.30	3
DD-3	21 10	1152	Day	16	21.7	34.88	2
DD-4	21 10	1023	Day	27	23.5	35.23	7
DD-5	21 10	0856	Day	33	24.3	36.28	8
DD-6	21 10	0544	Night	164	24.6	35.58	8
EE-1	21 10	1900	Dusk	11	20.8	30.80	1
EE-2	21 10	2008	Night	15	21.6	34.11	5
EE-3	21 10	2108	Night	17	21.9	34.35	2
EE-4	21 10	2337	Night	25	23.1	35.75	-
EE-5	22 10	0101	Night	37	24.6	35.56	3
EE-6	22 10	0340	Night	108	26.0	35.30	9
FF-1	22 10	1953	Night	12	21.4	33.10	1
FF-2	22 10	1834	Dusk	15	22.2	34.37	1
FF-3	22 10	1659	Day	19	22.1	34.57	1
FF-4	22 10	1530	Day	30	24.0	35.24	3
FF-5	22 10	1156	Day	42	24.5	35.18	14
FF-6	22 10	0915	Day	103	26.3	35.11	9
GG-1	23 10	0150	Night	11	21.7	32.78	-
GG-2	23 10	0250	Night	15	22.1	33.62	-
GG-3	23 10	0442	Night	17	22.4	34.45	2
GG-4	23 10	0615	Dawn	23	22.9	34.77	5
GG-5	23 10	0821	Dawn	30	24.1	35.28	8
GG-6	23 10	1115	Day	38	25.4	35.13	4
GG-7	23 10	1433	Day	132	26.0	35.02	4
HH-1	24 10	0630	Dawn	12	22.1	30.25	-
HH-2	24 10	0528	Night	14	22.6	33.93	2
HH-3	24 10	0428	Night	18	22.2	34.57	4
HH-4	24 10	0301	Night	26	23.6	35.38	5
HH-5	24 10	0133	Night	32	24.1	35.34	-
HH-6	23 10	2234	Night	38	25.3	35.25	20
HH-7	23 10	2002	Night	178	25.7	35.21	15
JJ-1	24 10	1117	Day	15	22.7	33.00	2
JJ-2	24 10	1215	Day	19	23.2	34.07	6
JJ-3	24 10	1329	Day	22	23.3	34.40	4
JJ-4	24 10	1500	Day	24	24.0	35.22	5
JJ-5	24 10	1700	Day	37	24.7	35.19	5
JJ-6	24 10	1921	Dusk	202	26.8	35.16	8
KK-1	25 10	0926	Day	17	23.4	33.30	6
KK-2	25 10	0808	Dawn	16	23.6	34.03	4
KK-3	25 10	0707	Dawn	19	23.5	34.16	6
KK-4	25 10	0543	Night	24	23.9	34.40	3
KK-5	25 10	0313	Night	38	25.9	35.31	18
KK-6	25 10	0136	Night	97	26.0	35.02	12
LL-1	25 10	2157	Night	12	24.7	34.70	6
LL-2	25 10	2103	Night	137	25.1	34.76	4
LL-3	25 10	1940	Dusk	20	25.5	35.11	16
LL-4	25 10	1754	Dusk	47	26.9	35.30	11
LL-5	25 10	1545	Day	169	27.6	35.19	10
MM-1	26 10	0212	Night	12	24.4	34.17	7
MM-2	26 10	0307	Night	15	24.9	34.49	11
MM-3	26 10	0407	Night	23	25.8	35.12	9
MM-4	26 10	0541	Night	149	27.2	35.29	8
NN-1	26 10	1041	Day	11	24.8	32.69	6
NN-2	26 10	1141	Day	46	25.5	33.51	13
NN-3	26 10	1340	Day	151	27.0	35.09	14
NN-4	26 10	1615	Day	308	27.5	35.10	3
PP-1	26 10	2345	Night	80	26.9	34.04	20
PP-2	26 10	2143	Night	247	27.5	35.08	3
PP-3	26 10	1953	Night	348	27.5	35.07	16

Cruise D-68-1

Station	Date 1967 D M	Tow Start Time (EDST)	Light Condition	Water Depth (M)	Surface Temp (°C)	Surface Sal (°/oo)	Number of Categories Caught
AA-1	27 1	0434	Night	11	7.8	34.13	2
AA-2	27 1	0540	Night	17	11.3	35.98	7
AA-3	27 1	0650	Dawn	20	12.8	36.02	4
AA-4	27 1	0817	Dawn	27	13.5	36.12	9
AA-5	27 1	0948	Day	31	17.9	36.65	8
AA-6	27 1	1320	Day	39	19.9	36.96	-
AA-7	27 1	1527	Day	151	22.8	36.75	15
BB-1	28 1	0858	Dawn	13	8.0	30.99	5
BB-2	28 1	0806	Dawn	13	8.0	33.85	5
BB-3	28 1	0640	Dawn	19	11.0	36.21	5
BB-4	28 1	0320	Night	27	15.5	36.41	5
BB-5	28 1	0138	Night	29	18.1	36.38	4
BB-6	27 1	2313	Night	149	23.0	36.45	-
CC-1	28 1	1647	Day	10	9.4	31.35	3
CC-2	28 1	1559	Day	14	9.1	34.51	3
CC-3	28 1	1505	Day	17	9.9	35.77	5
CC-4	28 1	2017	Night	20	14.3	36.59	4
CC-5	28 1	2254	Night	24	16.7	36.52	2
CC-6	29 1	0035	Night	32	16.1	36.37	3
CC-7	29 1	0432	Night	111	23.0	36.40	-
DD-1	29 1	1715	Dusk	11	7.4	16.68	5
DD-2	29 1	1624	Day	13	8.2	28.35	5
DD-3	29 1	1533	Day	15	11.6	33.15	4
DD-4	29 1	1320	Day	28	16.8	36.31	2
DD-5	29 1	1144	Day	33	20.1	36.00	8
DD-6	29 1	0800	Dawn	142	22.8	36.13	18
EE-1	30 1	0102	Night	11	8.4	29.37	5
EE-2	29 1	2359	Night	13	9.7	34.36	5
EE-3	29 1	2302	Night	16	15.2	36.06	4
EE-4	30 1	0455	Night	24	17.9	36.41	8
EE-5	30 1	0625	Night	37	21.8	36.21	7
EE-6	30 1	1005	Day	100	23.0	36.35	5
FF-1	31 1	0210	Night	13	10.4	33.89	2
FF-2	30 1	2303	Night	17	11.6	35.17	3
FF-3	30 1	2139	Night	20	15.6	36.28	3
FF-4	30 1	2016	Night	32	17.9	36.00	3
FF-5	30 1	1754	Dusk	41	19.9	35.91	13
FF-6	30 1	1422	Day	141	21.5	35.57	4
GG-1	31 1	0918	Day	11	10.5	31.05	3
GG-2	31 1	0831	Dawn	12	10.7	33.66	6
GG-3	31 1	0743	Dawn	16	11.1	34.42	4
GG-4	31 1	1329	Day	25	14.6	36.24	3
GG-5	31 1	1510	Day	30	18.5	36.18	7
GG-6	31 1	1849	Dusk	38	20.6	36.01	7
GG-7	31 1	2102	Night	134	23.0	36.00	4
HH-1	1 2	1158	Day	14	12.1	32.66	4
HH-2	1 2	1052	Day	17	12.4	34.35	2
HH-3	1 2	1000	Day	20	12.8	34.59	4
HH-4	1 2	0853	Dawn	26	15.2	35.90	7
HH-5	1 2	0541	Night	32	19.2	36.18	9
HH-6	1 2	0357	Night	36	20.0	36.29	1
HH-7	1 2	0220	Night	100	22.1	36.10	-
JJ-1	1 2	1840	Dusk	15	14.1	33.92	-
JJ-2	1 2	1932	Dusk	19	13.4	34.40	2
JJ-3	1 2	2024	Night	20	14.6	35.27	4
JJ-4	2 2	0107	Night	24	18.5	37.14	8
JJ-5	2 2	0324	Night	34	20.4	36.22	10
JJ-6	2 2	0512	Night	157	23.1	35.95	5
KK-1	2 2	1324	Day	18	14.4	33.67	-
KK-2	2 2	1414	Day	19	14.6	34.07	-
KK-3	2 2	1503	Day	20	14.8	34.49	1
KK-4	2 2	1620	Day	26	19.8	35.74	4
KK-5	2 2	1831	Dusk	37	21.2	36.10	11
KK-6	2 2	1957	Dusk	110	23.2	35.96	3
LL-1	3 2	0715	Dawn	14	15.7	34.57	4
LL-2	3 2	0624	Night	15	15.8	34.26	5
LL-3	3 2	0531	Night	21	15.8	34.23	8
LL-4	3 2	0353	Night	45	21.7	35.86	1
LL-5	3 2	0239	Night	154	22.4	36.05	10
MM-1	3 2	1547	Day	13	17.9	35.22	3
MM-2	3 2	1453	Day	16	18.5	35.47	1
MM-3	3 2	1352	Day	26	20.0	35.99	9
MM-4	3 2	2014	Night	136	23.4	36.04	12
NN-1	4 2	0420	Night	14	22.7	36.14	6
NN-2	4 2	0251	Night	60	23.2	36.22	6
NN-3	4 2	0147	Night	153	24.4	35.88	3
NN-4	4 2	0030	Night	316	24.4	36.11	5
PP-1	4 2	1130	Day	77	23.4	36.47	7
PP-2	4 2	0816	Dawn	219	24.2	35.75	20
PP-3	4 2	0929	Day	334	24.7	36.03	12

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