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NORTH AMERICAN HYDROMEDUSAE FROM BEAUFORT, NORTH CAROLINA

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Few studies have been made of the hydromedusae from the Atlantic coast of the United States. In view of the need for investigations of western Atlantic species, this study was undertaken to record the occurrence of hydromedusae at Beaufort, North Carolina. Collections were made throughout the year so that records of seasonal occurrence and abundance could be kept. It is hoped that such information will be useful in hydrozoan life cycle studies and establishment of more complete distribution records.

In spite of the considerable amount of biological research at Beaufort, N.C. and elsewhere along the United States eastern coast, few biologists have recorded hydromedusa species from the north-western Atlantic. The only previous attempt to study the Beaufort medusae was made by W.K. Brooks in 1882. From the summer collections of 1881 and 1882 Brooks lists 24 hydromedusa species. Of these, 5 were considered to be new species, and many have since been revised.

One of the earliest and most valuable papers dealing with North American hydromedusae was that of McCrady (1857) who studied and described many medusa species from Charleston, South Carolina. Shortly after McCrady's paper appeared, Louis Agassiz (1860, 1862) published several volumes dealing with medusae, siphonophores and ctenophores and containing descriptions of new species. The other major work including medusae of the United States eastern coast was Mayer's *Medusae of the World* (1910). The papers of C.W. Hargitt (1901, 1902) and H.B. Bigelow (1915, 1918) also contain useful, although incomplete, information on some American hydromedusae. Of course, several of Kramp's publications (1959, 1961) are invaluable aids to any study of western Atlantic species, and many of his other papers are most helpful.

I wish to thank Dr. I.E. Gray (Duke University, Durham, N.C.) for helpful suggestions offered throughout the duration of this project. I am especially grateful to Dr. K. W. Petersen (Zoological Museum, Copenhagen, Denmark) for considerable help with identifications and for valuable comments given during the preparation of this manuscript. Several collections used in this study were made by Thomas Myers of Duke University; the Institute of Fisheries Research

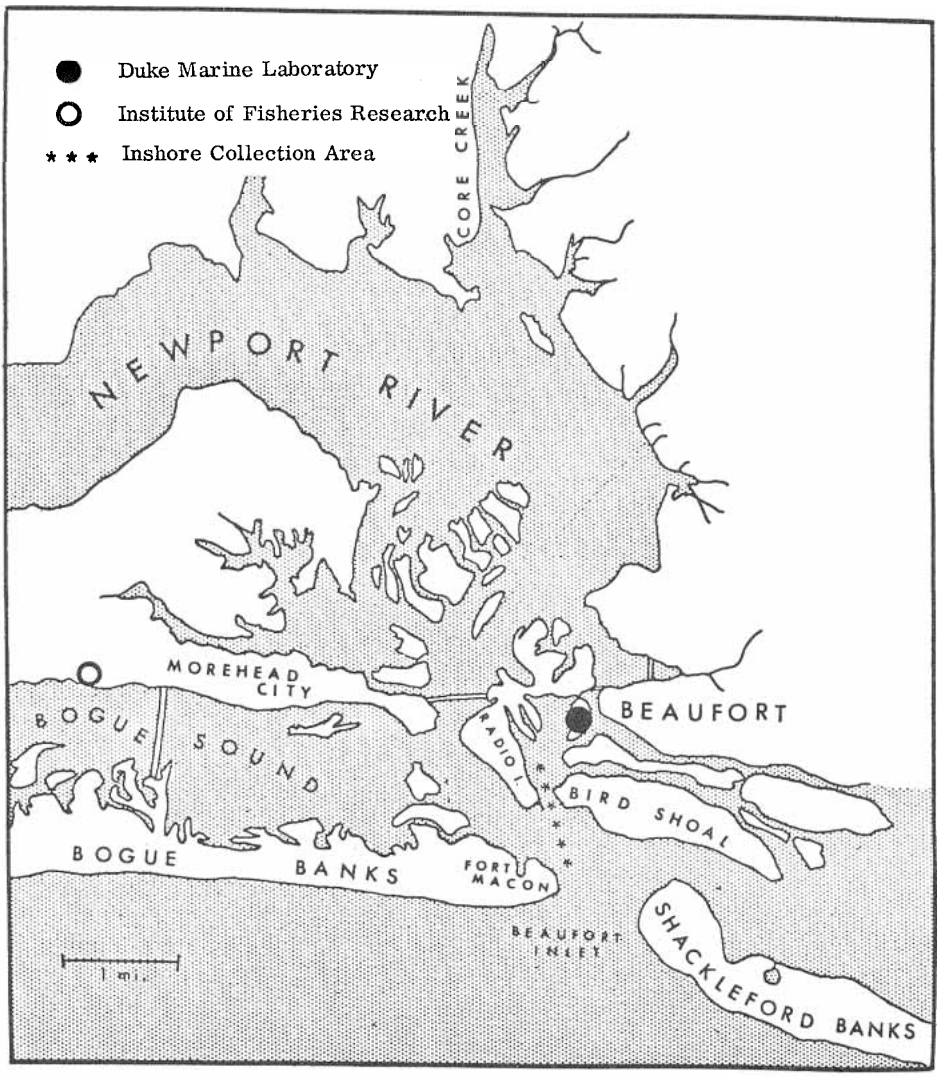

Fig. 1. Beaufort, North Carolina and inshore collection site.

collections were made available to me by Dr. Austin Williams and Dr. William Wood. I thank these individuals for allowing me to use materials from their collections.

The final revision and species descriptions for this paper were completed at the Zoological Museum, University of Copenhagen during the tenure of a Danish Government Grant and a Fulbright Foundation Travel Grant. This assistance and the cooperation of Museum personnel are gratefully acknowledged. The type specimens of new species described in this paper are in the Zoological Museum of the University, Copenhagen.

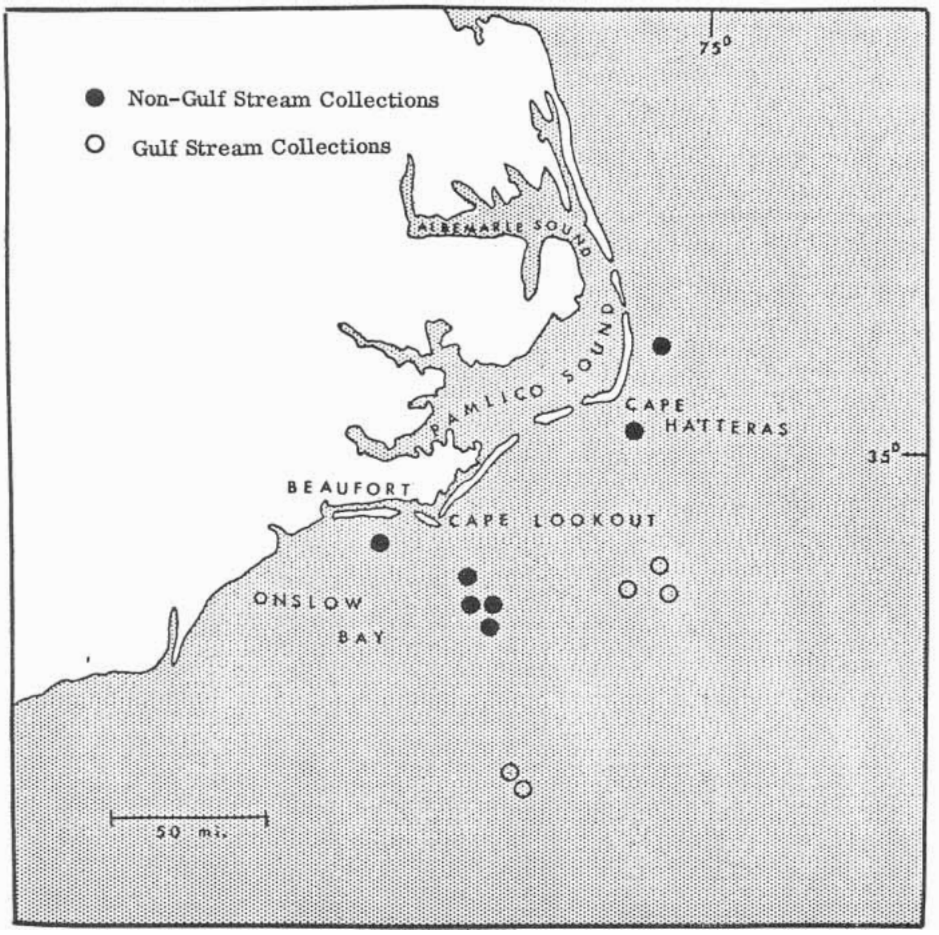

Fig. 2. North Carolina coast and offshore collection sites.

MATERIALS AND METHODS

Inshore plankton tows were made over a 15 month period from June, 1964 through August, 1965. With the exception of the winter months, when weather conditions made sampling difficult and thus interfered with the regular schedule, collections were taken at weekly intervals. Figure 1 indicates the location of these collections from Shark Shoal jetty on Radio Island to the inlet waters east of Fort Macon, N.C. The plankton tows were made at high tide in the Beaufort Inlet ship channel, which has an average depth of 12 meters. To maintain this depth, the channel is dredged at regular intervals. During the summers of 1964 and 1965, dredging operations were being completed in Beaufort channel. It is not known to what extent this affects planktonic forms, but the increased turbidity of the water may influence their abundance and/or distribution.

A Clarke-Bumpus plankton sampler with a # 2 net (aperture size – 0.366 mm) was towed for 10 or 20 minute periods about 2.5 meters below the water surface. Samples were preserved in 5-10 % formalin immediately upon recovery of the sampling apparatus, in order to prevent excessive deterioration and distortion of the medusae. Water temperature and salinity readings were recorded for each collection from September 1964-August 1965. Air temperatures used in this paper were calculated from data supplied by the Atlantic Beach Police Department, Carteret County, N.C.

The Institute of Fisheries Research data were obtained from semi-monthly collections taken at the IFR pier in Morehead City, N.C. (see Fig. 1.) from 1957 through 1965. These were used for comparison with seasonal distribution of species found by the author. It is quite probable that many smaller medusae were overlooked by their staff sorters, so the data are probably incomplete for IFR seasonal occurrence.

In August 1964, November 1964, February 1965 and May 1965 offshore collections were made from the Duke University research vessel, EASTWARD. A one meter zooplankton net (aperture size – 526 mu) was towed from the stern of the vessel for 10-20 minutes at a speed less than one knot. These collections were taken for qualitative comparison of inshore with oceanic species; quantitative determinations were not made. Figure 2 gives the locations of the offshore tows, indicating Gulf Stream and non-Gulf Stream collections.

RESULTS

Since the primary concentration of this study deals with inshore hydromedusae, the correlation between species abundance, seasonal occurrence and temperature data is given only for inshore collections. Records of species taken in offshore collections are included in Table 1.

Figure 3 shows bimonthly air temperatures, which gradually declined from a maximum high of 35.5°C in July and August 1964 to a low of –6.5°C at the end of January 1965. In the spring of 1965 there was a rather rapid rise in air temperature to the late June peak of 36.5°C. Water temperatures from September 1964 through August 1965 are also shown in Figure 3. As one would expect, the water temperature dropped more slowly than the average air temperature, remained somewhat higher than average air temperature during the winter and increased slowly during the spring months.

Calculations for over-all comparison among collections were made according to number of animals per thousand liters of sea water passing through the Clarke-Bumpus sampler. Figure 4 provides a comparison of total numbers of medusae taken in inshore plankton tows throughout the study. The early summer 1964 collections yielded less than 200 medusae per thousand liters with a tremendous increase during late summer collections. By mid-September the number of in-

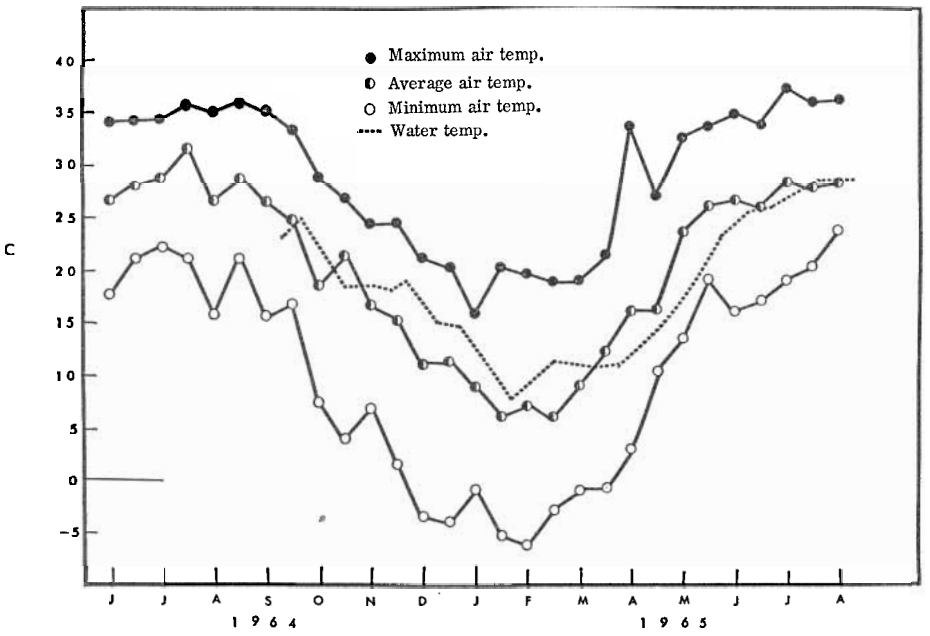

Fig. 3. Air and water temperatures June 1964-August 1965.

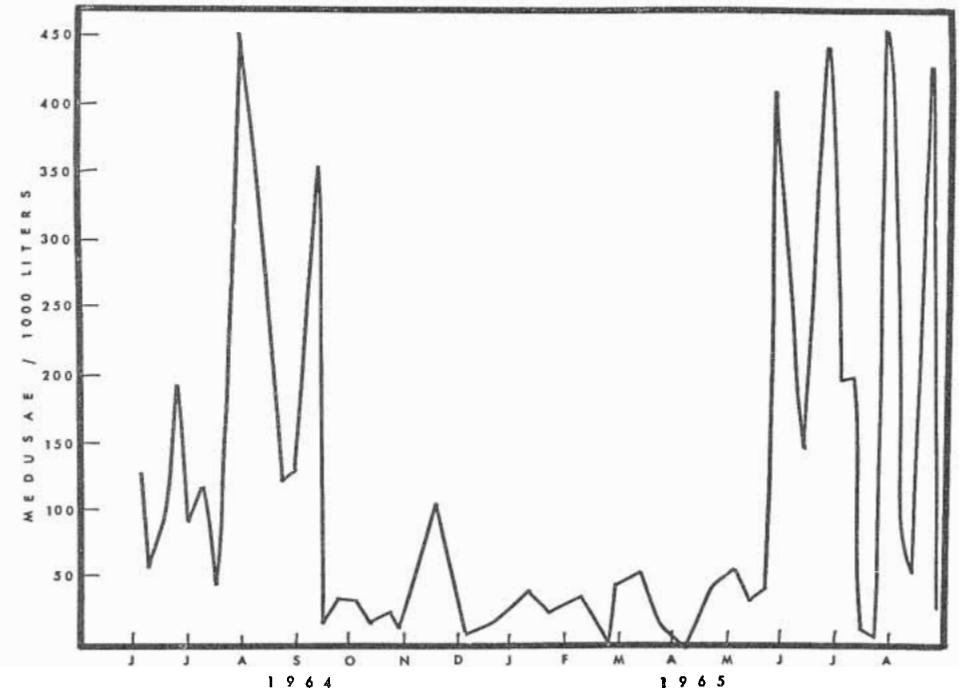

Fig. 4. Seasonal abundance of medusae June 1964-August 1965.

Table 1. Medusae of 1964-1965 inshore and offshore collections.

Species	Inshore	Offshore	Nearest previous record	Present U.S.A. distribution
Anthomedusae				
Amphinema australis (Mayer 1900)		×	Florida	Beaufort-Florida
Amphinema dinema (Peron & Lesueur 1809)	×		Beaufort, N.C.	Cape Cod-Florida
Amphinema rugosum (Mayer 1900)		×*	South Carolina	Cape Cod-Florida
Amphinema turrida (Mayer 1900)		×	Florida	Beaufort-Florida
Bougainvillia carolinensis (McCrady 1857)	×		Beaufort, N.C.	Cape Cod-Florida
Bougainvillia ramosa (van Beneden 1844)	×	×	Block I. Sound (Chesapeake?)	Cape Cod-Beaufort
Bougainvillia rugosa Clarke 1882	×		South Carolina	Cape Cod-Florida
Cnidotiara gotoi Uchida 1927		×	Bet. Azores & U.S.A.	Beaufort, N.C.
Cytaeis tetrastyla Eschscholtz 1829		×*	Bermuda	Beaufort, N.C.
Dipurena strangulata McCrady 1857	×		Beaufort, N.C.	Cape Cod-Florida
Ectopleura dumortieri (van Beneden 1844)		×	Beaufort, N.C.	Cape Cod-Florida
Euphysilla peterseni n.sp.	×		None	Beaufort, N.C.
Euphysora gracilis (Brooks 1882)	×	×	Beaufort, N.C.	Cape Cod-Beaufort
Halitiara formosa Fewkes 1882	×	×	Florida	Beaufort-Florida
Heterotiara sp.		×*	Bermuda	Beaufort, N.C.
Hybocodon forbesi Mayer 1894		×	Florida	Beaufort-Florida
Lizzia blondina Forbes 1848	×		Europe	Beaufort, N.C.
Margelopsis gibbesi (McCrady 1857)	×		North Carolina	North South Carolina
Nemopsis bachei L. Agassiz 1849	×		Beaufort, N.C.	Cape Cod-Florida
Pennaria tiarella (Ayres 1852)	×		Beaufort, N.C.	Cape Cod-Florida
Podocoryne minima (Trinci 1903)**	×		England (Brazil?)	Beaufort, N.C.
Podocoryne minuta (Mayer 1900)	×	×	Florida	Beaufort-Florida
Turritopsis nutricula McCrady 1856	×		Beaufort, N.C.	Cape Cod-Florida
Leptomedusae				
Aequorea aequorea (Forskål 1775)		×*	Florida; Chesapeake Bay	Cape Cod-Florida
Aequorea macrodactyla (Brandt 1835)		×*	West Indies	Beaufort, N.C.
Cirrholovenia tetranema Kramp 1959		×	Mediterranean Sea	Beaufort, N.C.
Eirene gibbosa (McCrady 1857)?	×		Beaufort, N.C.	Cape Cod-S. Carolina
Eirene pyramidalis (L. Agassiz 1862)	×		Florida	Beaufort-Florida
Eucheilota duodecimalis A. Agassiz 1862	×	×	Beaufort, N.C.	Cape Cod-Florida

Eutima suzannae n.sp.	×		None	Beaufort, N.C.
Eutima gegenbauri (Haeckel 1864)	×		Europe	Beaufort, N.C.
Eutima mira McCrady 1857	×	×	Beaufort, N.C.	Cape Cod-Florida
Eutima variabilis McCrady 1857	×	×	South Carolina	Beaufort-Florida
Helgicirrha schulzei Hartlaub 1909		×	Europe	Beaufort, N.C.
Helgicirrha weaveri n.sp.	×	×	None	Beaufort, N.C.
Laodicea undulata (Forbes & Goodsir 1853)	×	×*	Cape Cod-Florida	Cape Cod-Florida
Laodicea brevigona n.sp.		×	None	Beaufort, N.C.
Lovenella bermudensis (Fewkes 1883)	×		Florida	Beaufort-Florida
Obelia spp.	×	×	Beaufort, N.C.	Cape Cod-Florida
Orchistomella tentaculata (Mayer 1900)?		×	NE of Bermuda	Cape Cod-Bermuda
Phialidium discoidum (Mayer 1900)?	×		Florida	Beaufort-Florida
Phialidium gelatinosum (Mayer 1900)?	×		Florida	Beaufort-Florida
Phialidium globosum (Mayer 1900)	×		Florida	Beaufort-Florida
Phialidium languidum (A. Agassiz 1862)	×	×	South Carolina	Cape Cod-Florida
Limnomedusae				
Proboscidactyla ornata (McCrady 1857)	×	×	Beaufort, N.C.	Cape Cod-Florida
Narcomedusae				
Cunina sp.	×	×		
Cunina octonaria McCrady 1857	×	×	Beaufort, N.C.	Cape Cod-Florida
Cunina peregrina Bigelow 1909		×	North of Bahamas	Beaufort, N.C.
Solmaris sp.**	×		N. & Tropical Atlantic	Beaufort, N.C.
Solmundella bitentaculata (Quoy & Gaimard 1833)		×*	Florida	Beaufort-Florida
Trachymedusae				
Aglaura hemistoma Peron & Lesueur 1809		×*	Florida; Chesapeake Bay	Cape Cod-Florida
Liriope tetraphylla (Chamisso & Eysenhardt 1821)	×	×*	Beaufort, N.C.	Cape Cod-Florida
Persa incolorata McCrady 1857	×	×	Beaufort, N.C.	Beaufort-Florida
Rhopalonema velatum Gegenbaur 1856		×*	Florida; Chesapeake Bay	Cape Cod-Florida

* – Gulf Stream.

** – Note added in proof: These species re recorded for St. Andrews Bay, Florida by T. L. Hopkins, August 1961. See Hopkins, T. L. 1966, Publ. Inst. Mar. Seig Texas. **11**: 12-64.

dividuals dropped considerably and remained low until May 1965. Only one collection, in November, yielded more than 75 per thousand liters during winter months. By late May the number rose sharply, and during the following months hit several peaks well over 400. Note that in mid-July 1965 there was a two step drop with two collections yielding less than 10 medusae per thousand liters of water.

The 55 species found during this study are listed in Table I, which also indicates their inshore and/or offshore occurrence and nearest previous collection site. Of 37 species taken on inshore tows, 21 were only found inshore; of 34 collected offshore, 18 were offshore only; 16 species occurred in both offshore and inshore samples.

Table 1 also gives the site of the nearest previous collection for each species. Seventeen species were previously recorded for Beaufort, N.C. The last column of the table indicates for each species the apparent present distribution along the eastern United States coast. The distributions have been determined from previous records cited by Kramp (1959, 1961) and the new records noted in this study. If a species is found south of Beaufort, one would expect it to occur to Florida; and those found at Cape Cod and Beaufort probably can be found elsewhere on the eastern U.S. coast between these localities. Where the present study gives the only record of a species being found on this coast, Beaufort, N.C. is given as its U.S. distribution. Further collections will have to be made to determine the actual range of these species. No species of the genera *Heterotiara* and *Solmaris* have been recorded for the Atlantic coast of the United States so occurrence of these is noted even though the species could not be determined. Please note that any reference to "Beaufort", on this table or elsewhere, indicates Beaufort, North Carolina *not* Beaufort, South Carolina.

The seasonal distribution for each inshore species is indicated in Table 2. Species are listed according to the number of months they were represented in the plankton, beginning with predominant species and ending with the listing of those found only in one month's collections.

Liriope tetraphylla, the most abundant hydromedusa of both inshore and offshore collections, was found every month except April and also occurred frequently in the IFR (Institute of Fisheries Research) collections. Much of the time this species comprised the bulk of the sample. In July 1964, May 1965 and July 1965 there were collections containing more than 350 *Liriope* per thousand liters of sea water.

Although *Bougainvillia ramosa* was found nine months of the year, it did not occur in the same large quantities as *Liriope. Bougainvillia ramosa* never was found to have a density greater than 94 per thousand liters, with the greatest numbers occurring in June 1965.

Since it is impossible to separate the medusoid species of *Obelia,* they are treated as one species, *Obelia* spp., in this study. *Obelia* was never represented in large numbers, always less than 10 per thousand liters, but did appear in collec-

Table 2. Seasonal occurrence of inshore medusae.

ies	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
tylla	×*	×	×		×	×*	×*	×*	×*	×	×*	×
amosa	×	×	×		×	×	×*	×*	×*			×
	×	×			×	×	×	×	×	×		
Turritopsis nutricula							×	×*	×*	×*	×	
Eucheilota duodecimalis					×	×	×	×		×		
Euphysora gracilis						×		×		×	×	
Eutima mira					*	×	×*	*	×*	×		
Nemopsis bachei	×*	*	×*	×*	*	*			*	×*	*	*
Phialidium languidum						×	×		×	×		
Amphinema dinema							×		×	×		
Bougainvillia rugosa						×	×	×				
Cunina octonaria						×		×	×			
Lovenella bermudensis					×	×	×					
Pennaria tiarella							×	×	×*			
Podocoryne minima				×	×	×						
Bougainvillia carolinensis						×	×					
Eutima variabilis						×	×					
Eirene pyramidalis							×	×				
Halitiara formosa						×		×				
Margelopsis gibbesi			×	×				*				
Podocoryne minuta				×								
Dipurena strangulata					×							
Lizzia blondina					×							
Eutima suzannae n. sp.						×						
Eucheilota paradoxica						×			*			
Eucheilota ventricularis						×						
Euphysilla peterseni n. sp.						×						
Phialidium globosum						×						
Phialidium discoidum?						×						
Helgicirrha weaveri n. sp.						×						
Solmaris sp.						×						
Cunina frugifera?							×					
Eirene gibbosa?							×					
Phialidium gelatinosum?							×					
Laodicea undulata									×			
Proboscidactyla ornata								×				
Eutima gegenbauri									*			
Persa incolorata												×

* – From Institute Fisheries Research Collections.

tions eight months of the year. Density varied from 2.6 to 17.2 per thousand liters with the latter figure applying to an August 1965 collection.

The following species all occurred during the summer and fall months: *Turritopsis nutricula, Eucheilota duodecimalis, Euphysora gracilis,* and *Eutima mira. Turritopsis* reached its peak in September 1964 with 204 animals per thousand liters. The peak for *Euphysora* was in November with 117 per thousand liters. Both

Eucheilota duodecimalis and *Eutima mira* were less abundant and never present in densities greather than 12 per thousand liters.

Nemopsis bachei appears to be primarily a winter species; and although it was taken only four months of the year in the present study, comparison with the IFR collections shows that it may occur as many as 10 months of the year. The peak of abundance for *Nemopsis* was in March when it was collected in large numbers during this project and at IFR in Morehead City.

Most of the remaining species on Table 2 are summer forms, or at least were collected only during the summer months. *Podocoryne minima, Margelopsis gibbesi, Podocoryne minuta, Lizzia blondina* and *Dipurena strangulata,* all occurring in the spring, are exceptions. *Persa incolorata* was found in December and presents the only other notable exception.

DISCUSSION

There are apparently two major factors influencing the seasonal occurrence of hydromedusae at Beaufort, N.C. Comparison of Figures 3 and 4 gives a good indication of the relationship of temperature to seasonal abundance. With the September temperature decline, there was also a marked decrease in hydromedusa numbers. Through the winter months, extremely low counts were taken. In late May, when a sharp increase in hydromedusae occurred, the water temperature had risen to 23° C. This was only a few degrees lower than the temperature recorded at the time of the September decline.

The second important factor in seasonal occurrence, the hydrozoan life cycle, is directly influenced by temperature. While the number of hydromedusae in a given species may vary from year to year, the medusae of the species are generally released during the same months and are in the plankton for approximately the same period each year. The variability in numbers and flexibility in time range is due mainly to temperature. There are apparently optimal temperatures for each species which trigger medusa formation and release. The other factors which contribute to the special physiological condition necessary for the temperature trigger to be effective are physiological problems beyond the scope of this study.

Since Brooks' (1882) study of Beaufort medusae included 24 species of hydromedusae, it is worthwhile to compare the results of his work with that of the 1964-65 collections. Table 3 lists the species found by Brooks with indications of changes in nomenclature since 1882. Of Brooks' species, 19 were found in this study. Several of the species listed in the first column are dubious: *Cunina discoides* Fewkes, *Eucopa obliqua* Brooks and *Eutima cuculata* Brooks. From Brooks' comments it is impossible to identify the medusa of *Eucopa obliqua.* He briefly describes the hydroid and indicates that the medusa at time of discharge is "2/1000 inch across the disc, with 2 otocysts and 6 or 7 tentacles in each quadrant". *Eutima cuculata* is more completely described; Kramp (1961) does include it in his synopsis but notes that it is a doubtful species. Comparing Brooks' description with *Eutima*

Table 3.

Brooks' list	Present name	1964-65 study
Foveola octonaria A. Agassiz	*Cunina octonaria* McCrady	×
Cunina discoides Fewkes	?	
Persa incolorata McCrady	*Persa incolorata* McCrady	×
Liriope scutigera McCrady	*Liriope tetraphylla*	×
Liriope scutigera A. Agassiz.....	(Chamisso & Eysenhardt)	
Epenthesis folliata McCrady	*Phialidium folleatum* (McCrady)	
Eucheilota ventricularis McCrady	*Eucheilota ventricularis* McCrady	×
Dipleuron parvum Brooks	*Eucheilota duodecimalis* A. Agassiz	×
Eucopa obliqua Brooks.....	?	
Obelia commisuralis McCrady	*Obelia* spp.	×
Eirene gibbosa Agassiz.....	*Eirene gibbosa* McCrady	×
Eutima mira McCrady	*Eutima mira* McCrady	×
Entima cuculata Brooks.....	Young *Eutima mira* McCrady	
Eutima emarginata Brooks	*Eutima mira* McCrady	×
Margelis carolinensis Agassiz	*Bougainvillia carolinensis* (McCrady)	×
Nemopsis bachei Agassiz	*Nemopsis bachei* Agassiz	×
Turritopsis nutricula McCrady	*Turritopsis nutricula* McCrady	×
Stomotoca apicata McCrady	*Amphinema dinema* (Peron & Lesueur)	×
Willia ornata McCrady	*Proboscydactyla ornata* (McCrady)	×
Dipurena strangulata McCrady	*Dipurena strangulata* McCrady	×
Corynetis agassizii McCrady.....	*Linvillea agassizi* (McCrady)	
Pennaria tiarella McCrady	*Pennaria tiarella* (Ayres)	×
Ectopleura ochracea A. Agassiz	*Ectopleura dumortieri* (Van Beneden)	×
Steenstrupia gracilis Brooks	*Euphysora gracilis* (Brooks)	×

mira specimens taken during the 1964-1965 study, the *E. cuculata* of Brooks appears to be incompletely developed *E. mira*. The only difference between the two species is the lack of gonad development on the manubrium; in immature *E. mira* this incomplete gonad development is also apparent.

Dipleuron parvum Brooks has since been synonomized with *Eucheilota duodecimalis* A. Agassiz and is considered to be variety *parvum* of *E. duodecimalis*. Both "*parvum*" and "*typicum*" varieties were found in the 1964-1965 study.

Both the *Obelia* "*lucifera*" and *Obelia* "*nigra*" types (Russell, 1953) were collected at Beaufort in the present study. The former was found in the inshore plankton throughout the year and was somewhat more abundant during the summer. Offshore plankton contained both *O.* "*lucifera*" and *O.* "*nigra*".

At least 22 species found in this study represent an extension of their known ranges. Eleven of these were previously recorded from Florida (see Table 1) but not as far north as North Carolina on the western Atlantic coast. *Cunina peregrina* Bigelow was reported north of the Bahamas (Bigelow, 1918) so the Beaufort offshore specimens represent a northern range extension. Cowles (1930) reported *Bougainvillia* ramosa from Chesapeake Bay; however, this idenfication may not have been accurate. If Cowles' specimens were not *B. ramosa*, the Beaufort collec-

tion represents an even greater range extension, from Block Island Sound, R.I. (Deevey, 1952). The known range of *Aequorea macrodactyla* has been extended northward from the West Indies (Kramp, 1961) by this study. With species which have previously been reported from both Chesapeake Bay and Florida, one can assume that these may be found along the United States coast between these two regions. Beaufort specimens, therefore, represent a verification of this in the case of *Aequorea aequorea, Laodicea undulata, Aglaura hemistoma* and *Rhopalonema velatum.*

The remaining new distribution records are more important than those discussed above. Descriptions and previous distributions are given for these in the following section. The new species found near Beaufort during this study are also described.

Lizzia blondina Forbes, 1848

Material: May 2, 1965. Beaufort Inlet, Beaufort, N.C. One mature specimen.

Description: 1.4 mm wide; with thick apex. Gastric peduncle short and difficult to see; short manubrium, about 2/3 the subumbrellar length. 4 short oral tentacles, one at each corner of the quadrate mouth; oral tentacles with terminal nematocyst knob. 7 marginal tentacle bulbs, 2 perradial bulbs with 2 tentacles each; other bulbs with only 1 tentacle; tentacles long. No medusa buds on stomach; gonad circular around stomach.

Distribution: This species has previously been reported from the northeastern Atlantic: Denmark, England, Norway, Scotland, Ireland, Germany and Iceland. There are no published records of *L. blondina* for the northwestern Atlantic; but it has been collected at Woods Hole, Massachusetts (K.W. Petersen, Personal Communication).

Podocoryne minima (Trinci, 1903)

Material: June 5, 1965. Beaufort Inlet, Beaufort, N.C. One specimen.

Description: 0.7 mm high. Several medusa buds on stomach; stomach slightly more than half the bell height; 4 simple knobbed mouth arms; peduncle very short. 4 marginal tentacles with relatively large basal bulbs.

Distribution: This species was first described from Naples, Italy and has since been found at Plymouth, England and off the coast of China. *Podocoryne minima* may have been found in Brazilian waters (Vannucci, 1957), but its occurrence there is questionable. If this species is identical with *P. simplex* Kramp 1928, as Kramp speculates (1959, 1961), its distribution records include Japan. If *P. minuta* = *P. mimima,* the occurrence of this medusa at Beaufort would not seem unusual since *P. minuta* has been found near Florida (Mayer, 1900) and in the present study at Beaufort. However, at the present time, it is generally agreed that the two should be treated as separate species.

Cirrholovenia tetranema Kramp, 1959

Material: February 6, 1965. Eastward Cruise E-8-65. 34°28.5'N, 76°13.7'W. One mature specimen.

Description: 2.8 mm wide, width and height about equal; dome-shaped; jelly thin; velum narrow. 4 perradial tentacles with large basal bulbs; 6-8 curled marginal cirri in each quadrant; 4 large interradial marginal vesicles. Stomach small and cross-shaped with short, simple lips surrounding the mouth. Gonads large, thick, extending from stomach base almost to the bell margin; each gonad divided into two portions by the radial canal.

Distribution: *Cirrholovenia tetranema* has previously been recorded for the Mediterranean; Strait of Malacca; Gulf of Siam; Philippines; Bali; Solomon Islands. Since it has not been recorded from Atlantic waters, the Beaufort specimen represents a considerable extension of range. The life cycle of this species has been described by Brinckmann (1965) and the hydroid designated as a member of the genus *Cuspidella* Hincks.

Eutima (Octorchis) gegenbauri (Haeckel, 1864)

Material: September 21, 1961. Institute of Fisheries Research, Morehead City, N.C. Two mature specimens.

Description: 8.2 mm and 19.6 mm wide; jelly thin. Long narrow peduncle; stomach short with short folded lips; 4 short gonads on distal 1/3 of peduncles near stomach; 4 gonads on subumbrella from bell margin, extending 3/4 of the distance to the peduncle base. 8 thick, hollow tentacles, some with small lateral cirri. 8 marginal vesicles; 32 marginal warts with lateral cirri and adaxial papillae. Both specimens are remarkably similar in structure, although differing in size. The gonads on the larger specimen are more fully developed and more conspicuous, but the gonad length is proportionately the same.

Distribution: Although no specimens of *E. gegenbauri* were found in the 1964-1965 study, the specimens from the IFR 1961 collection do indicate the occurrence of this species on the North Carolina coast. It is previously recorded from the Mediterranean and northwestern European waters.

Helgicirrha schulzei Hartlaub, 1909

Material: May 23, 1965. Eastward cruise E-28-65. 34°29.5'N, 76°20.5'W. Six badly torn specimens.

Description: Most of the specimens were in poor condition when caught and did not preserve well. Width about 30 mm; jelly thin. Long, fairly narrow peduncle; small stomach with 4 short crenulated lips. Gonads linear or wavy along radial canals from near base of peduncle almost to bell margin. Up to 45 tentacles with conical bulbs, some with lateral cirri; numerous rudimentary bulbs with lateral cirri; many marginal vesicles.

Distribution: This species has previously been recorded from the North Sea, Adriatic Sea, Mediterranean and eastern Atlantic Ocean from the British Isles to Congo, W. Africa. The specimens collected at Beaufort are most probably *H. schulzei,* but this new distribution record must be regarded as tentative until verified by later collections.

NEW SPECIES

Genus *Euphysilla* Kramp, 1955

Tubulariid medusae without exumbrellar nematocyst tracts; with 4 equally developed hollow perradial marginal tentacles provided with clasps (adaxial or abaxial clusters, not knobs; see Figs. 5a, b) of nematocysts; with broad stomach and a simple, quadrate mouth without lips; without stomachal peduncle.

Euphysilla peterseni n.sp.

Material: June 19, 1965. Beaufort Inlet, Beaufort, N.C. One mature specimen. (Fig. 5c).

Diagnosis: 0.78 mm high and almost as wide; bluntly rounded apex. Large manubrium extending just beyond bell margin; mouth small, without lips, surrounded by nematocysts. Gonad circular around stomach. 4 short perradial tentacles, each with about 8 transverse nematocyst clasps on abaxial side and with prominent terminal knob of nematocysts; 4 broad, flat tentacle bulbs.

Description: Umbrella about as wide as high, 0.78 mm high and 0.74 mm wide, with bluntly rounded apex. No apical canal. Manubrium large, filling most of bell cavity and extending slightly beyond bell margin; quadrate base of stomach attached to subumbrella along a cross-shaped perradial region; manubrium widest just below base, tapering gradually toward mouth. Small mouth without lips, almost tubular but with a slight indication of cross shape. Distal end of manubrium around mouth is covered with conspicuous nematocyst batteries. Gonad appears to be circular around stomach, not divided into interradial or perradial portions.

Velum narrow; radial canals and ring canal extremely narrow. 4 short perradial tentacles, each with about 8 transverse clasps of nematocysts on abaxial side and with a prominent spherical terminal knob. Tentacle bulbs are broad and flat with one tentacle originating from the central abaxial portion of the bulb. On the specimen collected, 2 adjoining tentacles are whole and appear as described; the other 2 are somewhat damaged but show presence of nematocyst clasps; one retains part of the terminal knob.

Discussion: *Euphysilla peterseni* resembles *Euphysomma brevia* (Uchida, 1947) in several respects. The size is almost the same; both have abaxial nematocyst concentrations on the 4 tentacles and a terminal knob of tentacular nematocysts. The nematocyst concentrations are arranged in 4 knobs on each tentacle in *Euphysomma* and are in 6-9 transverse clasps on the tentacles of the species of

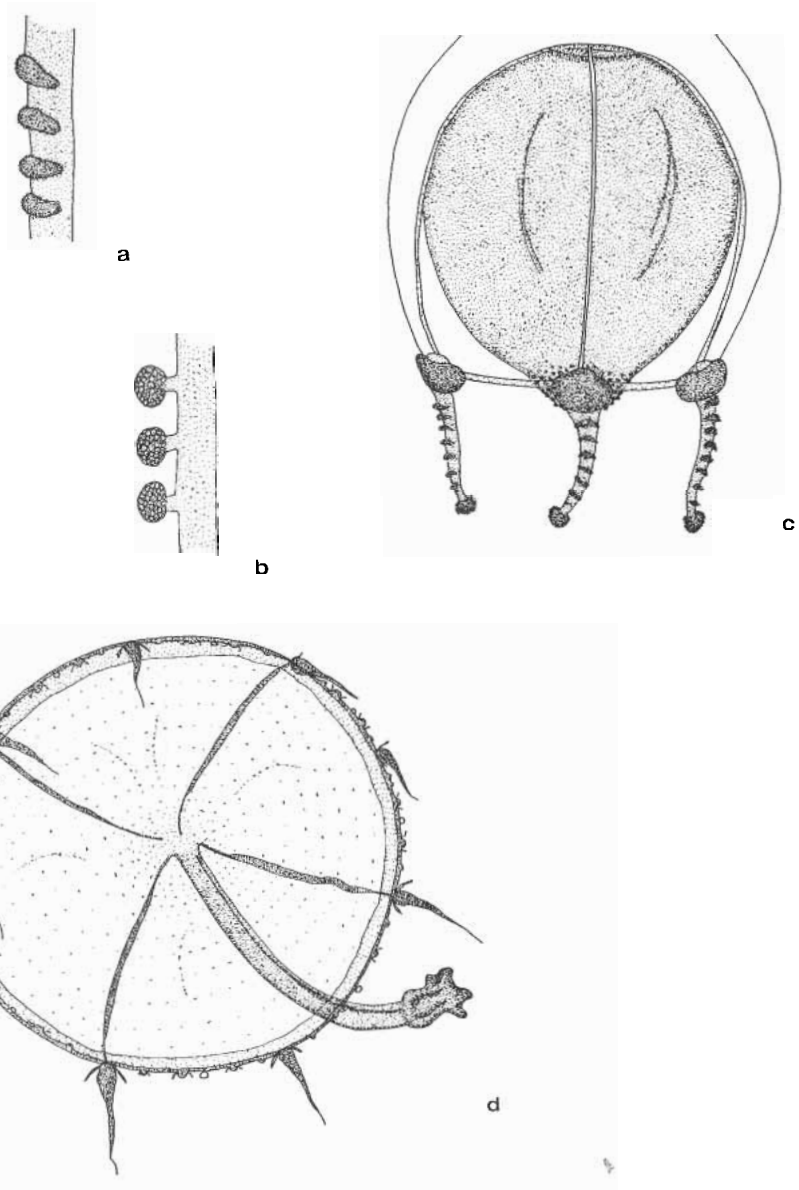

Fig. 5. a. Portion of *Euphysilla peterseni* tentacle showing nematocyst clasps. b. Portion of *Euphysomma brevia* tentacle with nematocyst knobs. c. *Euphysilla peterseni* n.sp. d. *Eutima suzannae* n.sp.

Euphysilla (Plate I, Figs. a and b). This structural difference is a major characteristic for differentiating the two genera. *Euphysilla* does not have the aboral region of the manubrium devoid of gonad, with a distinctly glandular region at the stomach base, as *Euphysomma* does.

Euphysilla peterseni differs from *Euphysilla pyramidalis* Kramp in several important characters. The size of the latter is at least twice that of *E. peterseni*. The nematocyst clasps on the tentacles are different in number, position and prominence. *Euphysilla peterseni* has about 8 abaxial nematocyst clusters on each tentacle and a large, distinct terminal knob, while *E. pyramidalis* has 5-7 less conspicuous adaxial nematocyst clasps per tentacle and a rather inconspicuous terminal knob.

Genus *Eutima* McCrady, 1857

Eutimidae with eight (rarely 12) marginal vesicles; with lateral cirri and with marginal warts; with 2-32 tentacles.

Eutima (Octorchis) suzannae n.sp.

Material: June 22, 1965. Beaufort Inlet, Beaufort, N.C. One mature specimen. Fig. 5d).

Diagnosis: Umbrella 5.7 mm wide, flat; peduncle slender, about $\frac{1}{2}$ bell diameter. 4 narrow gonads, on subumbrellar portions of the 4 radial canals. 8 tentacles, all of same size, with lateral cirri; 8 marginal vesicles; 4 marginal warts in each octant, with adaxial papillae and lateral cirri.

Description: Umbrella broader than high, measuring 5.7 mm in diameter; jelly thicker in center than at periphery but not exceptionally thick even in center. Peduncle slender with a narrow base, about $\frac{1}{2}$ the length of the bell diameter. Stomach small, almost square, with 4 short, slightly recurved lips. Four gonads located on the subumbrella and extend $\frac{2}{3}$-$\frac{3}{4}$ the length of the subumbrellar radial canals, situated closer to the bell margin than to the peduncle base; gonads narrow, divided into 2 longitudinal parts. The specimen found was a female with fairly large eggs visible in the gonads.

Eight tentacles of equal size, 4 perradial and 4 interradial. The 8 marginal vesicles are located approximately halfway between successive tentacles; 4 marginal warts appear to be present in each octant, although some of these were partially destroyed; the 2 middle warts of an octant are larger than the 2 outer ones and have lateral cirri; marginal warts have small adaxial papillae with nematocysts, making *E. suzannae* a member of the subgenus *Octorchis*.

Discussion: *Eutima suzannae* resembles *E. japonica* Uchida (1925) in general shape, tentacle number, marginal wart number and arrangement, and peduncle length. However, the two species differ in two important respects: *E. japonica* has large sac-like gonads on the subumbrellar part of the radial canals, extending onto the peduncle, whereas *E. suzannae* has rather small, narrow gonads located

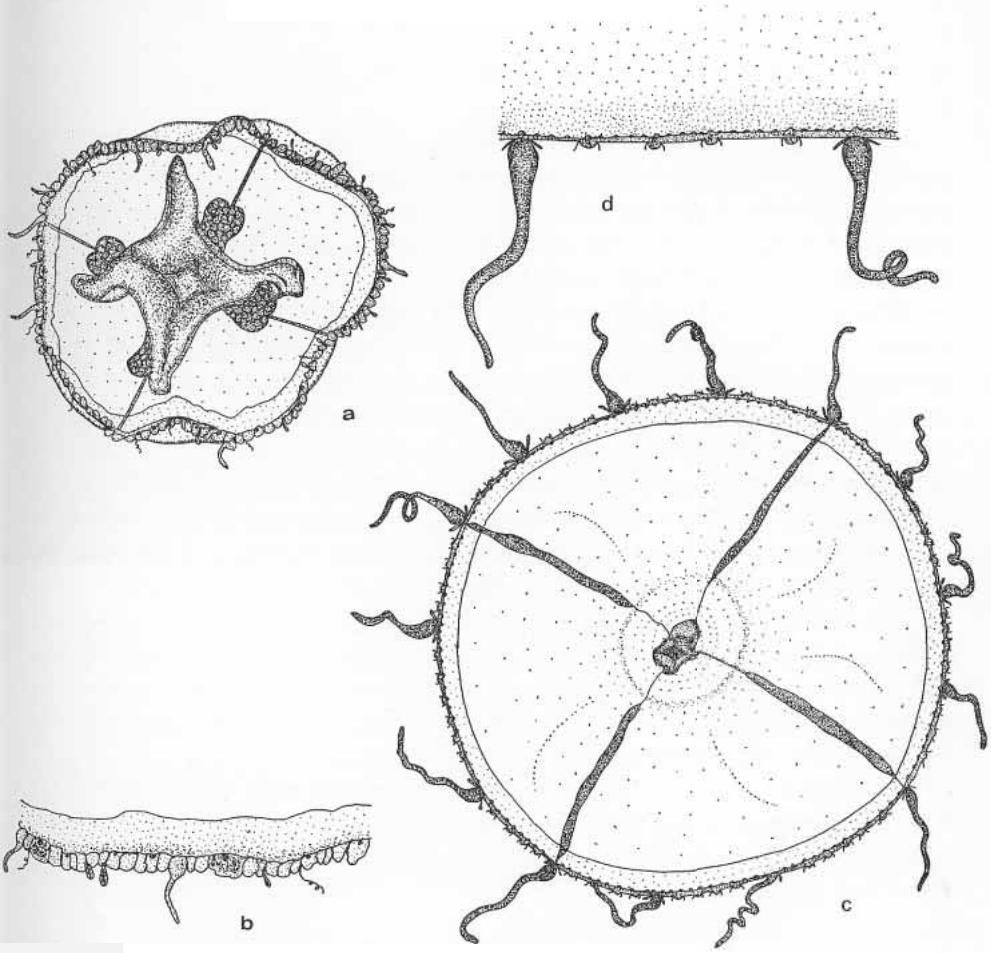

Fig. 6. a. *Laodicea brevigona* n.sp. b. Portion of the bell margin of *L. brevigona*. c. *Helgicirrha weaveri* n.sp. d. Portion of the bell margin of *H. weaveri*.

only on the subumbrella and not extending onto the peduncle. In the latter species all 8 tentacles are of the same size, and in *E. japonica* the perradial tentacles are larger than the interradial ones. Uchida refers to the occurrence of four "tentacle warts" between successive tentacles. He does not, however, give any indication that they ever become fully-developed tentacles. Assuming that these are the same as what are usually called "marginal warts", the arrangement of these is the same in the two species.

Genus *Laodicea* Lesson, 1843

Laodiceidae with four simple radial canals; with simple wavy gonads; with or without marginal cirri; with adaxial ocelli.

Laodicea brevigona n. sp.

Material: May 23, 1965. Eastward Cruise E-28-65. 34°29.5'N, 76°20.5'W. Two mature female specimens (Fig. 6a).

Diagnosis: 4 to 8 mm wide. 120-200 tentacles with dark adaxial ocelli at the base of every 2-5 tentacles; some tentacles with abaxial spurs. Cross-shaped mouth with large slightly folded lips. Four short gonads extending from the middle of each of the 4 radial canals to the stomach. With a few long curled cirri and many cordyli on the margin between tentacles.

Description: 4.5 and 7.6 mm wide, with about 120-200 tentacles, some with abaxial spurs. The mouth is cross-shaped with long, slightly folded lips; at the perradial corners the lips appear pointed so the cross shape is retained at the distal lip region. The 4 radial canals are moderately wide and easily seen toward the umbrella margin. On each radial canal and surrounding the canal on the subumbrellar surface, is a short thick gonad. The gonads extend from the middle of the canals to the stomach, are slightly folded, and in the specimens collected are filled with eggs. Dark abaxial ocelli occur at the base of every 2-5 tentacles; on some, there are two small pigmented ocelli; ocellus size varies considerably. Some tentacle bulbs have a light brownish-pink pigment dispersed over the adaxial surface of the bulb. In the larger specimen this pigment is not as conspicuous, although more of the tentacle bulbs are pigmented. Club-shaped cordyli are numerous, usually occurring between successive tentacles. Marginal cirri are few; where present, they are long and curled (Fig. 6b).

Discussion: *Laodicea brevigona,* as the name indicates, differs from other *Laodicea* species in having short thick gonads. Lower tentacle number, few marginal cirri and short gonads distinguish *L. brevigona* from *L. undulata,* which was also found in this study.

Genus *Helgicirrha* Hartlaub, 1909

Eirenidae with a distinct stomachal peduncle; with lateral cirri at the base of some or all of the tentacle bulbs; with excretory pores.

Helgicirrha weaveri n. sp.

Material: May 23, 1965. Eastward Cruise E-28-65. 34°29.5'N, 76°20.5'W. One mature specimen (Fig. 6c). June 22, 1965. Beaufort Inlet, Beaufort, N.C. Two immature specimens.

Diagnosis: Up to 25 mm wide, almost hemispherical. Peduncle short, conical; stomach small; mouth with short recurved lips. 4 radial canals. Gonads narrow, extending from near bell margin to peduncle base. Up to 14 tentacles with lateral cirri; 4-6 marginal warts with one or a pair of lateral cirri, one marginal vesicle and up to 15 adaxial excretory pores between successive tentacles. Adaxial excretory pores on tentacle bulbs and marginal warts.

Description: The mature specimen is 24.5 mm wide, almost hemispherical, with moderately thick jelly. The peduncle is quite short and conical; stomach, small and rectangular. Mouth square, surrounded by short recurved lips. Gonads narrow and straight, along each of the 4 radial canals, extending from a point near the umbrella margin to the peduncle base. One radial canal on the mature specimen was branched (assumed to be an abnormal condition) with the gonad also dividing. 14 hollow tentacles with fairly narrow, elongated bulbs, adaxial excretory pores and 1-3 pairs of lateral cirri. Between successive tentacles are one large marginal vesicle, 4-6 marginal warts with lateral cirri. On the adaxial side of the ring canal are numerous small warts with excretory pores, about 15 between successive tentacles (Fig. 6d).

The two immature specimens are 6.8 mm and 4.9 mm in diameter, with undeveloped gonads, remnants of 7 tentacles on one and only 2 remaining on the other. As many as 4 marginal warts are present between tentacles. The lateral cirri and marginal vesicles are generally torn off, but some remain. The ring canal is badly mangled and no adaxial excretory pores can be seen. The peduncle is short; stomach, small and quadratic; mouth square with short, slightly folded lips.

Discussion: Due to the presence of excretory pores and lateral cirri, these specimens must be referred to *Helgicirrha*. They do not, however, have the characteristics of any existing species of this genus. The peduncle is very short by comparison with other species; tentacle number is very low; there are fewer marginal vesicles. The presence of conspicuous and numerous excretory pores on the ring canal is also characteristic of this species.

SUMMARY

From June 1964 through August 1965 plankton tows containing hydromedusae were taken at Beaufort, North Carolina, U.S.A. Offshore collections for comparison with inshore samples were also made. A total of 55 species were collected: 21 inshore, 18 offshore and 16 from both areas of collection.

The inshore medusa species showed seasonal variation closely correlated with water temperature changes. Numbers of hydromedusae were consistently low October to April with high peaks occurring June through September.

Four new species are described: *Euphysilla peterseni* (Anthomedusae, Tubulariidae), *Eutima suzannae* (Leptomedusae, Eutimidae), *Helgicirrha weaveri* (Leptomedusae, Eirenidae) and *Laodicea brevigona* (Leptomedusae, Laodiceidae). New distribution records and United States eastern coast distributions are given for the 55 species.

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