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CEPHALOPODS COLLECTED IN THE STRAITS OF FLORIDA BY THE R/V GERDA

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ABSTRACT

Fifty species of cephalopods are identified from the Straits of Florida from the 698 specimens collected by the R/V GERDA. This raises the total number of species known from the Straits from 49 to 64. Four are new records for the Western Atlantic: *Pterygioteuthis gemmata, Abraliopsis pfefferi, Corynoma speculator* and *Helicocranchia pfefferi*. Two others, *Rossia bullisi* and *Abraliopsis atlantica*, are reported for the second time in the literature. The male of *Abralia redfieldi* is described for the first time. The first mature specimen of *Danoctopus schmidti* is reported with drawings of its radula and ligula.

Pelagic distributions are analyzed with respect to mean depth of capture and concentration in particular geographic regions of the Straits. Benthic distributions are analyzed regarding bottom type and concentration in geographic regions of the Straits. Diel migration is discussed for several species. The zoogeography of all species reported in the Straits is discussed.

The hydrography of the Straits of Florida is a unique system in which a major ocean current is funneled into a shoaling channel creating profound climatological and biological effects on the waters of the southeastern United States. The northward-flowing waters of the Straits, dominated by the fast-moving Florida Current, are part of a transient system which derives its properties from the eastern Gulf of Mexico, Caribbean Current and ultimately from the North Equatorial Current which feeds the Caribbean Sea. The energy of the Florida Current results from a hydrostatic head developed in the Gulf of Mexico; the difference in level between Cedar Keys, West Coast and St. Augustine, East Coast is 19 cm (Montgomery, 1938). This "oceanic jet stream" which attains surface speeds of 180 cm/second has a significant effect on the distribution of pelagic larvae and midwater organisms along the eastern coast of the United States.

The Straits of Florida also lies in an important zoogeographic area for the benthic shelf fauna. Miami is considered by some to be the northern limit of the tropical fauna with a warm temperate or transitional area to the North. There is considerable disagreement from other zoogeographers regarding the placement and nature of this border (Briggs, 1974). Because of these zoogeographic and unique hydrographic features certain groups of the Straits have been investigated in detail: benthic fish (Staiger, 1970), lantern fish (Devany, 1969), brachyura (Soto, dissertation in preparation), hydroids (Bogle, 1975), crinoids (Messing, 1975) and gastropods (Quinn, thesis in preparation). All of these studies, including the present one, were based on material collected by the R/V GERDA during her ten years of operation (May 1962-May 1972) in the Deep-Sea Biology Program. The GERDA performed 1348 stations, predominantly in the Straits; 698 cephalopods were collected at 198 stations, making possible the first comprehensive account of the cephalopods of this unique area.

The Straits can be divided into three geographic regions (Fig. 1) based on bathymetry: Western, Cay Sal and Northern (Wennekens, 1959). No discrete boundaries occur to separate these three regions,

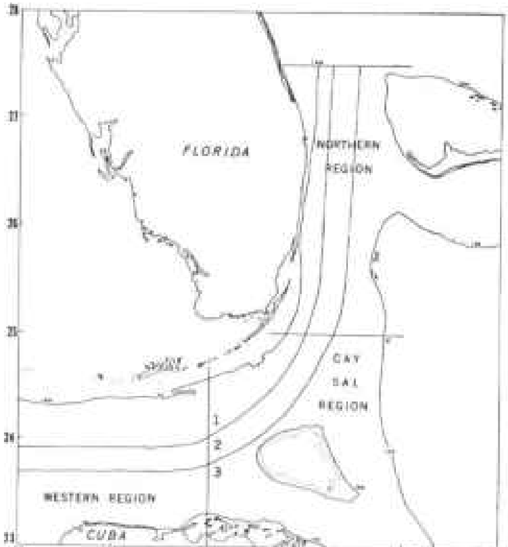

Figure 1. Geographic division of the Straits by regions and water masses: (1) Continental Zone, (2) Transitional Zone, (3) Yucatan Zone.

rather the Cay Sal Region acts as a transitional area separating the Northern and Western Regions which differ with regard to axial gradient and maximum depth of the valley. These bathymetric divisions are used in this paper as convenient distributional indicators. Malloy and Hurley (1970) should be consulted for a more detailed account of the bathymetry and geomorphology of the Straits.

Hydrographically, the Straits can also be divided into three water masses: Continental, Transitional and Yucatan (Fig. 1). Wennekens (1959) clearly showed that the insular Yucatan water, flowing directly from the Yucatan Channel to the Straits, could be easily distinguished from Continental Edge water (Caribbean water that is modified in the northeastern Gulf of Mexico) by its T-S characteristics. Devany (1969) further refined Wennekens's boundaries and defined a third water mass, the Transitional water, to account for the latitudinal meandering of the boundaries of the Continental and Yucatan water masses and the consequent intermediate hydrographic nature resulting from their mixture. Below 300 meters the T-S characteristics of all three water masses merge into a single narrow envelope.

Within the Florida Current the mass distribution must adjust itself so that the lighter (warmer) water is on the east side and the denser (colder) water is on the west side, resulting in the sea surface rising toward the east (Sverdrup, Johnson, & Fleming, 1942). Because of these tilted cross-stream isopycnals it is impossible to use a standard depth to designate the 10°C isotherm dividing the meso- and bathypelagic zones. Instead, the depth of the tilted 10°C isotherm was determined for each water mass of each region from data obtained by Wüst (1924) and Clausner (1967) and summarized by Devany (1969). In the Western and Cay Sal Regions this depth is considered to lie

Table 1. Discrete depth, non-discrete depth sampling (Roper, Gibbs, and Aron, 1970) and GERDA ranges for two common mesopelagic squid (Numbers in parentheses were the numbers of specimens available for analysis and depths in meters)

		Pyroteuthis margaritifera			*Pterygioteuthis giardi*	
		Depth	No.		Depth	No.
Discrete Depth Sampling	Day	250–*415*–550	(40)	Day	300–*383*–500	(13)
	Nt.	50–*140*–250	(39)	Nt.	0–*102*–250	(28)
Non-Discrete Depth Sampling	Day	200–*463*–1000	(29)	Day	200–*400*–500	(14)
	Nt.	0–*205*–600	(33)	Nt.	0–*159*–400	(23)
GERDA ranges (open nets)	Day	310–*401*–595	(8)	Day	256–*297*–375	(5)
	Nt.	18– *69*–154	(5)	Nt.	45–*156*–389	(12)

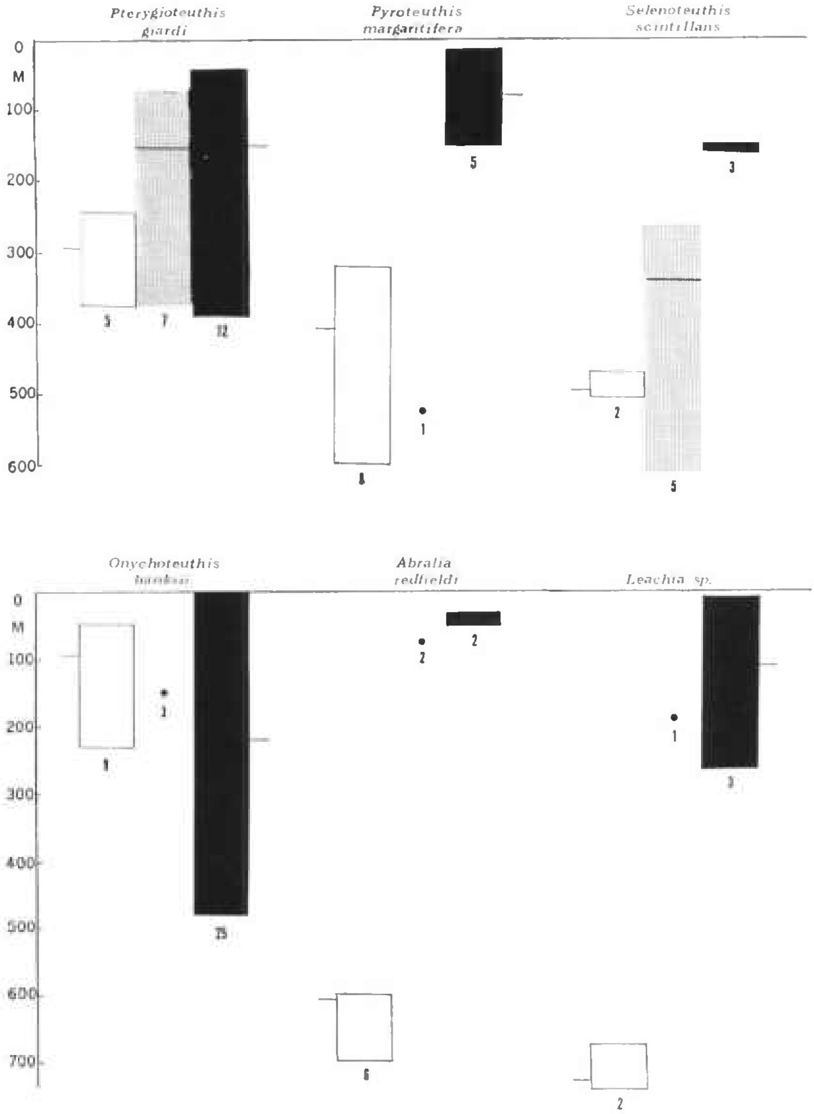

Figure 2. Bathymetric ranges of the six most common species of pelagic squid from the GERDA collections in the Straits of Florida. Open bar—daytime range; hatched bar—twilight range; solid bar—nighttime range. Cross bars indicate respective levels of weighted average depths. Numbers below bars indicate the number of GERDA specimens available for analysis.

at 400 m in Continental water, 500 m in Transitional water and 600 m in Yucatan water. For the Northern Straits the 10°C isotherm is 300 m in Continental water, 450 m in Transitional water, and 600 m in Yucatan water.

MATERIAL AND METHODS

A detailed account of the GERDA and her equipment can be found in Devany (1969) and Staiger (1970). Most of the GERDA cephalopods were captured with a ten-foot otter trawl or a 6-foot Isaacs-Kidd Mid-

Table 2. Geographic summary of the fishing efforts of the IKMT tows made by the R/V GERDA by Straits regions and ecological zones of the midwaters (minutes are converted to hundredths of an hour)

		WATER MASSES							
		Continental		Transitional		Yucatan		Total	
STRAITS REGION	ZONE	No. tows	Hr. fished	No. tows	Hr. fished	No. tows	Hr. fished	No. tows	Hr. fished
NORTH	Epi.	30	34.20	15	27.80	17	19.00	62	81.00
	Meso.	1	1.96	23	46.90	28	62.50	52	111.36
	Bathy.	1	.50	5	16.30	0	1.80	6	18.60
	TOTAL	32	36.66	43	91.00	45	83.30	120	210.96
CAY SAL	Epi.	2	1.25	1	.67	9	4.20	12	6.12
	Meso.	0	0	0	0	4	6.52	4	6.52
	Bathy.	0	0	1	4.02	0	0	1	4.02
	TOTAL	2	1.25	2	4.69	13	10.72	17	16.66
WEST	Epi.	2	2.81	1	0	0	0	3	2.81
	Meso.	4	10.06	1	2.00	0	0	5	12.06
	Bathy.	2	6.15	10	31.90	3	9.90	15	47.95
	TOTAL	8	19.02	12	33.90	3	9.90	23	62.82
TOTAL	Epi.	34	38.26	17	28.47	26	23.20	77	89.93
	Meso.	5	12.02	25	48.90	32	69.02	62	129.94
	Bathy.	3	6.65	15	52.22	3	11.70	21	70.57
	TOTAL	42	56.93	57	129.59	61	103.92	160	290.44

Abbreviations of vertical zones: Epi.—epipelagic; Meso.—mesopelagic; Bathy.—bathypelagic.

water Trawl, both of which were non-discrete samplers, open both when paid out and hauled in. Bruun (1943), Pickford (1946) and Thore (1949) have used a statistical method to increase depth reliability of non-closing net tows and Voss (1967) has discussed the problem of contamination in non-closing nets. Most recently a direct comparison of discrete depth sampling and non-closing net sampling has been published by Roper, Gibbs, and Aron (1970). Table 1 presents diel ranges for two species obtained by discrete depth sampling, non-discrete depth sampling, and for comparison, the GERDA data for non-discrete depth sampling. Although the ranges of the non-discrete captures are broader, the mean depths of capture and magnitudes of diel migration are similar.

Two methods were used to analyze the distribution of the common midwater cephalopods. First, the arithmetic mean of depth of capture was obtained for each species for each diel period: day, night, and twilight. (A twilight tow is defined as any tow in the water at 0600 hours or at 1800 hours.) The mean depth was obtained for each diel period by summing the depths of capture of each specimen (regardless of the number of specimens taken in one haul) and dividing by the total number of specimens caught in the same period. Even with the use of open nets this procedure indicates the weighted maximum concentration of individuals at those periods. The results of this analysis for the six most common mid-water cephalopods are illustrated in Figure 2.

A second method was used to compensate for the uneven fishing efforts of the GERDA at particular depths and Straits re-

Table 3. Geographic summary of otter trawl tows by Straits regions and depth

STRAITS REGION	DEPTH RANGE (meters)						
	0–200	201–400	401–600	601–800	801–1000	> 1000	Total
NORTH	59	99	87	44	28	10	327
CAY SAL	29	28	19	11	13	2	102
WEST	48	21	21	11	14	27	142
TOTAL	136	148	127	66	55	39	571

gions. The actual fishing time at depth in hours and minutes was calculated for the 160 GERDA IKMT tows and then segregated as to Straits region (N, CS, W), water mass (C, T, Y) and depth (epi-, meso-, bathypelagic), resulting in 27 categories (Table 2). The total number of specimens for a species for each category could then be divided by the hours fished in that category to achieve a decimal expression of catch per unit fishing effort as specimens per hour fished at a given depth range, a given water mass and a given Straits region.

Two methods of distributional analysis were also used for the common benthic cephalopods. First, the substrate at the capture site was determined by using a combination of methods including remarks from the deck log of the GERDA, observation of debris from capture sites and associations with other benthic animals of known habit preference that were captured in the same tow. It was hoped that several independent observations at one station might correlate and strengthen the likelihood of a true determination of the substrate. Also, a combination of substrate types for all stations of a particular species tended to correspond and supplement each other.

The second method of distributional analysis for the benthic species resulted in frequency of capture at a certain depth range and zone of the Straits. The 571 GERDA otter trawl stations made in the Straits of Florida were divided with regard to the depth of capture (0-200 m, 201-400 m, 401-600 m, 601-800 m, 801-1000 m, and over 1000 m) and the Straits region, resulting in 18 subdivisions (Table 3). The total number of stations at which a species was captured in a particular subdivision could then be divided by the total number of otter trawls made in that subdivision to obtain a percentage indicating the frequency of capture at a certain depth and zone in the Straits.

Standard cephalopod measurements and abbreviations are employed in this paper as listed by Voss (1956, 1963). Other abbreviations used in this paper include:

TL—tentacle length: total length of the tentacles and club; Fin angle—angle that the straight posterior border of one fin makes with the longitudinal axis of the body; FL/FW—fin length/fin width ratio; EI—eye diameter index: eye diameter expressed as a percentage of ML; OGI—oviducal gland index: in female octopods, the diameter of oviducal gland expressed as a percentage of ML; G—R/V GERDA; WH—R/V WALTER HERWIG; USNM—United States National Museum; RSMAS—Rosenstiel School of Marine and Atmospheric Science; OT—10-foot (3 m) Otter Trawl; IKMT—6-foot (1.8 m) Isaacs-Kidd Midwater Trawl; DN—Dip Net station; PN—Plankton Net; UMML 31.XXX—University of Miami Marine Lab (RSMAS) accession number; C—Continental water (zone); T—Transitional water (zone); Y—Yucatan water (zone); N—Northern Straits Region; CS—Cay Sal Region of Straits; and W—Western Straits Region.

The synonymies given in the SPECIES ACCOUNT are regional, covering only the Straits of Florida plus the original description.

CHECKLIST OF CEPHALOPODS FROM THE STRAITS OF FLORIDA

The cephalopods of the Straits of Florida have never been reviewed, but a search of the scattered literature of this area reveals that 49 species have been reported, the majority since 1949. Important systematic cephalopod papers pertinent to this area are those of Voss (1954, 1955, 1956, 1956a). As a result of the present study, 15 new records can be added to the Straits cephalopod fauna (indicated by an asterisk). This increases the total number of cephalopod species reported in the Straits to 64.

Class Cephalopoda
Order Sepioidea
Family Spirulidae

Spirula spirula (Linnaeus, 1758)

Family Sepiolidae

Semirossia tenera (Verrill, 1880)
Semirossia equalis (Voss, 1950)
**Rossia bullisi* Voss, 1956
Rossia antillensis Voss, 1955
Rossia tortugaensis Voss, 1956
**Stoloteuthis leucoptera* (Verrill, 1878)
Nectoteuthis pourtalesi Verrill, 1883

Order Teuthoidea
Family Pickfordiateuthidae

Pickfordiateuthis pulchella Voss, 1953

Family Loliginidae

Loligo pealei Lesueur, 1821
Loligo A LaRoe, 1967
Doryteuthis plei (Blainville, 1823)
Lolliguncula brevis (Blainville, 1823)
Sepioteuthis sepioidea (Blainville, 1823)

Family Lycoteuthidae

Lycoteuthis diadema (Chun, 1900)
**Selenoteuthis scintillans* Voss, 1958

Family Enoploteuthidae

Abralia veranyi (Rüppell, 1844)
Abralia redfieldi Voss, 1955
Abralia grimpei Voss, 1958
**Abraliopsis pfefferi* Joubin, 1896
**Abraliopsis* sp.
Pyroteuthis margaritifera (Rüppell, 1844)
Pterygioteuthis giardi Fischer, 1895
**Pterygioteuthis gemmata* Chun, 1908
**Enoploteuthis anapsis* Roper, 1964
Enoploteuthis leptura (Leach, 1817)
Thelidioteuthis alessandrini (Verany, 1851)

Family Octopoteuthidae

Octopoteuthis megaptera (Verrill, 1885)

Family Onychoteuthidae

Onychoteuthis banksii (Leach, 1817)
Onykia carriboea Lesueur, 1821

Family Histioteuthidae

Histioteuthis dofleini (Pfeffer, 1912)
Histioteuthis corona corona (Voss & Voss, 1962)

Family Ctenopterygidae

**Ctenopteryx sicula* (Verany, 1851)

Family Architeuthidae

Architeuthis princeps Verrill, 1875

Family Ommastrephidae

Illex coindetii (Verany, 1837)
Illex oxygonius Roper, Lu & Mangold, 1969
Ommastrephes pteropus (Steenstrup, 1855)

Family Mastigoteuthidae

**Mastigoteuthis grimaldii* (Joubin, 1895)

Family Grimalditeuthidae

**Grimalditeuthis bomplandii* (Verany, 1837)

Family Cranchiidae

Cranchia scabra Leach, 1817
Liocranchia reinhardti (Steenstrup, 1856)
**Leachia* sp.
Egea inermis Joubin, 1933
**Helicocranchia pfefferi* Massy, 1907
**Galiteuthis armata* Joubin, 1898
**Corynoma speculator* Chun, 1906
**Bathothauma lyromma* Chun, 1906

Order Vampyromorpha

Vampyroteuthis infernalis Chun, 1903

Order Octopoda
Family Bolitaenidae

Japetella diaphana Hoyle, 1885

Family Octopoteuthidae

Octopus vulgaris Cuvier, 1797
Octopus hummelincki Adam, 1936
Octopus joubini Robson, 1929
Octopus briareus (Robson, 1929)
Octopus burryi Voss, 1950
Octopus macropus Risso, 1826
Octopus defilippi Verany, 1851
Danoctopus schmidti Joubin, 1933
Scaeurgus unicirrhus (d'Orbigny, 1840)
Pteroctopus tetracirrhus (Delle Chiaje, 1830)
Bathypolypus arcticus (Prosch, 1849)
Tetracheledone spinicirrus Voss, 1955

Family Tremoctopodidae

Tremoctopus violaceus Delle Chiaje, 1830

Family Argonautidae

Argonauta argo Linnaeus, 1758
Argonauta hians Solander, 1786

Species Account
Class CEPHALOPODA
Order SEPIOIDEA
Family SPIRULIDAE Owen, 1836

Spirula spirula (Linnaeus, 1758)

Nautilus spirula Linnaeus, 1758: 710.
Spirula spirula, Bruun, 1943: 39 (Western and Cay Sal Yucatan waters).—McGinty, 1955: 35 (Boynton Beach).

Material examined.—1 juvenile, ML 14.5 mm, G-72.—1 juvenile, ML 8.5 mm, G-208.

Type-locality.—"America."

Discussion.—The family Spirulidae contains only one, easily recognized species, *S. spirula.* Bruun (1943) could find no specific or geographic variation in this species.

Distribution.—*S. spirula* is cosmopolitan in tropical and subtropical seas dependent on bottom depths between 1000-2000 m (Bruun, 1943, 1955). Live *Spirula* were first reported from the Straits by Bruun (1943); shells had been reported earlier by Calkins (1878) and Simpson (1887).

Bruun (1943) placed the lower limit of distribution at 1750 m, the pressure at which the shell would implode, and considered that eggs were deposited on the bottom, explaining the abundance of captures near continental slopes and island shelves. He gave the vertical ranges as 200-1750 m. Clarke (1969), using closing nets, detected a diurnal migration for specimens larger than ML 6.7 mm (night range 100-300 m; day range 500-700 m). Both GERDA juveniles were captured during the day at 458 and 675-777 m.

Family SEPIOLIDAE Keferstein, 1866
Subfamily ROSSIINAE Appellöf, 1898

Semirossia tenera (Verrill, 1880)

Heteroteuthis tenera Verrill, 1880: 392.
Rossia (*Semirossia*) *tenera*, Voss, 1950: 76 (off Looe Key, Sombrero Light); 1956: 99 (off Palm Beach, Fla.); 1956a: 276 (off Palm Beach, Miami, Dry Tortugas).
Semirossia tenera Boletzky, 1970: 386 (off Miami, Key West).

Material examined.—1 female, ML 28.0 mm, G-1009.—1 male, ML 23.5 mm, G-898.—1 male, ML 23.0 mm, G-589.—5 males, ML 22.0-10.0 mm, G-855.—1 male, ML 21.0 mm, G-853.—5 males, ML 21.0-12.0 mm, 3 females, ML 14.0-12.0 mm, G-1024.—1 male, ML 21.0 mm, G-830.—5 females, ML 19.5-12.0 mm, 1 male, ML 18.0 mm, G-1035.—13 males, ML 19.0-11.0 mm, 2 females, 16.0-14.0 mm, 1 juvenile, 9.0 mm, G-1028.—30 females, ML 18.0-10.0 mm, 5 males, ML 17.0-11.0 mm, 1 juvenile, ML 7.5 mm, G-1319.—2 females, ML 18.0-9.0 mm, 2 males, ML 11.0 mm, G-760.—2 males, ML 18.0-15.5 mm, G-1081.—2 females, ML 17.0-12.5 mm, 1 male, ML 16.0 mm, G-834.—1 male, ML 16.0 mm, 1 female, ML 16.0 mm, 3 juveniles, ML 10.0-6.2 mm, G-456.—1 male, ML 13.0 mm, G-29.—1 male, ML 11.0 mm, G-414.—1 female, ML 11.0 mm, G-413.

Type-locality.—Off Newport, Rhode Island.

Discussion.—Boletzky (1971) raised *Semirossia* to generic status upon the discovery of light organs on the ink sac. *S. tenera* can be distinguished from its sympatric relative, *S. equalis*, by possession of two rows of marginal club suckers with diameters three to four times greater than those of the contiguous rows.

Distribution.—*S. tenera* is a common benthic sepiolid ranging from New England to Brazil, including the Gulf of Mexico and Caribbean Sea. GERDA took specimens at 15 locations from Palm Beach to Key West, and from the Yucatan Channel and Cay Sal Bank.

It is found on a muddy or sandy bottom in fairly deep water (Voss, 1956). Depths of capture (Voss, 1956a) were 73-230 m and 33-460 m (Verrill, 1882). Depths of GERDA stations range from 82-*230*-345 m. Available data indicated a predominantly soft, muddy bottom.

Semirossia equalis (Voss, 1950)

Rossia (*Semirossia*) *equalis* Voss, 1950: 73 (off Pelican Shoal and Sombrero Light).

Material examined.—2 males, ML 22.0-20.0 mm, G-1038.—1 male, ML 20.0 mm, G-894.—1 female, ML 19.0 mm, G-897.—1 female, ML 17.0 mm, G-877.—3 females, ML 15.0-13.0 mm, 1 male, ML 11.0 mm, G-997.—1 male, ML 12.0 mm, G-794.—1 male, ML 11.0 mm, G-1286.—1 male, ML 11.0 mm, G-855.—1 male, ML 9.5 mm, G-522.—1 female, ML 9.0 mm, G-857.

Type-locality.—Off Pelican Shoal, Florida; 183 m.

Distribution.—Besides the type-locality, this species has been taken from the vicinity of Sombrero Light (Voss, 1950), the Gulf of Mexico (Voss, 1956), the Caribbean (Boletzky, 1970) and off the Georgia coast (Kraeuter and Thomas, 1975). The GERDA took five specimens from localities in the Straits from St. Lucie to Key Largo, one in the Santaren Channel, one in Northeast Providence Channel and three in the Yucatan Channel.

Semirossia equalis, like its sympatric relative, *S. tenera*, is found in fairly deep water on muddy or sandy bottoms (Voss, 1956).

Voss reported it from 51-320 m. Boletzky (1970) gave one Caribbean record from 460 m. The GERDA capture depths range from 42-229-344 m, almost exactly the same as calculated for the GERDA *tenera*. The data indicate a predominantly muddy bottom habitat with some evidence of shell rubble.

Rossia (Allorossia) bullisi Voss, 1956

Rossia (Allorossia) bullisi Voss, 1956: 101.

Material examined.—1 male, ML 14.0 mm, G-76.—2 males, ML 14.0-13.0 mm, G-66.

Type-locality.—27°51'N, 91°32'W (Upper Gulf of Mexico); 402 m, mud bottom.

Discussion.—There are four recognized Atlantic species in the subgenus *Allorossia*, all having both dorsal arms of the male hectocotylized and a well-developed ink sac with no associated light organs (Boletzky, 1971). *R. bullisi* can be distinguished from *R. glaucopis* Loven, 1845, *megaptera* Verrill, 1881 and *tortugaensis* Voss, 1956 by its much smaller tentacular suckers. Other differences are listed by Voss (1956: 103) and Mangold-Wirz (1963).

Distribution.—*R. bullisi* has been reported only once (Voss, 1956) from the upper Gulf of Mexico both east and west of the Mississippi River Delta from 356-480 m on a mud bottom. The GERDA specimens are the first records for the Straits and are from depths of 366-346 m on a sandy bottom. An additional specimen (UMML 31.57) was taken at a depth of 503 m in the upper Gulf. It is tempting to speculate that *R. bullisi* might replace *S. tenera* and *equalis* at greater depths since the upper range for *bullisi* (346 m) is virtually the same as the lower limit of the GERDA *tenera* and *equalis* (345 m and 344 m).

Stoloteuthis leucoptera (Verrill, 1878)

Sepiola leucoptera Verrill, 1878: 378.

Material examined.—1 male, ML 16.0 mm, G-88.

Type-locality.—Gulf of Maine, 48 km east from Cape Ann; 201 m, muddy bottom.

Discussion.—*Stoloteuthis* can be distinguished from the other four genera in the Heteroteuthinae by these characteristics: dorsal mantle margin united with head, fins large but not projecting beyond the posterior tip of the mantle, and ventral mantle margin only slightly projected.

Distribution.—The only specific distributional records for *S. leucoptera* are from the Gulf of Maine, off Cape Cod and off Martha's Vineyard at depths ranging from 172-710 m (Verrill, 1882). The GERDA specimen is the first record for the Straits and the southernmost record for this species. It was captured in an IKMT tow between 338-389 m over a bottom depth of 610 m at twilight.

Order TEUTHOIDEA

Family LOLIGINIDAE Steenstrup, 1861

Loligo pealei Lesueur, 1821

Loligo pealeii Lesueur, 1821: 92.
Loligo pealei, Voss, 1956a: 277 (off Miami, Key West, Dry Tortugas).—LaRoe, 1967: 28 (off Miami, Key Largo).

Material examined.—1 male, ML 234.0 mm, G-795.—1 male, ML 153.0 mm, G-467.—1 male, ML 127.0 mm, 1 female, ML 110.0 mm, G-110.—1 male, ML 123.0 mm, G-1034.—1 female, ML 104.0 mm, G-452.—4 females, ML 75.0-67.0 mm, G-570.—4 females, ML 66.0-54.0 mm, G-657.—1 female, ML 43.0 mm, G-280.

Type-locality.—Off coast of South Carolina.

Discussion.—The two most abundant neritic loliginids of the Western Atlantic, *L. pealei* and *Doryteuthis plei*, are not readily separable when young (LaRoe, 1967). In fact, there is a considerable overlap between these two species in most adult characteristics; however, LaRoe (1967) has established adequate criteria for separation.

Distribution.—LaRoe (1967) stated that *L. pealei* was found in coastal waters from Massachusetts Bay (42°N) to Colombia (6°N) but regarded it as a temperate water species, most abundant between Massachusetts and South Carolina, replaced by *Doryteuthis plei* to the south but again abundant off Colombia. The GERDA took specimens from eight Strait stations.

LaRoe (1967) reported an average depth

of capture of 63 m for 35 *L. pealei* south of Jacksonville, Fla. Summers (1969) recorded winter depths of capture of 28-366 m off New England with a concentration at 110-183 m. This species was taken once by night-lighting off the GERDA and seven times with an otter trawl ranging in depth from 66-*185*-360 m.

Doryteuthis plei (Blainville, 1823)

Loligo plei Blainville, 1823: 132.—LaRoe, 1967: 51 (off Miami, Alligator Reef).
Doryteuthis plei, Voss, 1952: 48 (Bear Cut, off Miami, Dry Tortugas); 1956a: 277 (off Florida Keys).

Material examined.—15 females, ML 93.0-35.0 mm, 12 males, ML 90.0-41.5 mm, G-735.—3 females, ML 89.5-65.5 mm, 1 male, ML 89.5 mm, G-539.—5 females, ML 84.0-47.0 mm, 1 male, ML 63.0 mm, G-1013.—4 females, ML 70.0-50.5 mm, 4 males, ML 56.0-52.0 mm, G-498.—3 males, ML 61.5-51.0 mm, G-529.

Type-locality.—Martinique.

Distribution.—*D. plei* ranges from Cape Hatteras, North Carolina to Recife, Brazil, including the Greater and Lesser Antilles. It is common on both sides of the Straits of Florida but rare in the northern Gulf of Mexico (LaRoe, 1967). The five GERDA records came from Northwest Providence Channel, Northeast Providence Channel, and Santaren Channel.

LaRoe (1967) reported that 69% of his specimens were caught by night-lighting. The other 31% were most common at 36-50 m; however, *D. plei* has been taken as deep as 180 m (LaRoe, 1967: 50). All the GERDA specimens were captured at the surface by night-lighting.

Sepioteuthis sepioidea (Blainville, 1823)

Loligo sepioidea Blainville, 1823: 133.
Sepioteuthis sepioidea, Verrill, 1882: 374 (off Key West).—Voss, 1952: 26 (off Key Largo, Miami); 1954: 477 (off Lower Florida Keys); 1955: 97 (east Florida coast); 1956: 115 (off Miami to Dry Tortugas); 1956a: 277 (Biscayne Bay).—LaRoe, 1967: 70 (off Lower Matecombe Key).

Material examined.—3 females, ML 140.0-99.0 mm, G-546.—1 male, ML 117.0 mm, G-987.

Type-locality.—Martinique.

Discussion.—*S. sepioidea* is the most distinctive loliginid in the tropical Western Atlantic, easily recognized by its fins which occupy almost the entire length of the mantle.

Distribution.—*S. sepioidea* is a shallow water, inshore species most common in waters of 3-7 m depth, although divers have reported it from 20 m (LaRoe, 1967). It is common from the Dry Tortugas to Miami and throughout the Bahamas. Its range extends from Cape Canaveral to Venezuela, but it has not been taken in the Gulf of Mexico (LaRoe, 1967). LaRoe explained its absence from the Gulf as due to the lack of coral reefs with which it is strongly associated. The GERDA records are from Cay Sal Bank and Northeast Providence Channel.

Family LYCOTEUTHIDAE Pfeffer, 1908
Subfamily LYCOTEUTHINAE Pfeffer, 1908

?*Lycoteuthis diadema* (Chun, 1900)

Enoploteuthis diadema Chun, 1900: 532.
Lycoteuthis diadema, Voss, 1958: 374 (Straits of Florida off Delray Beach, Florida); 1962: 277 (same location, monographic treatment).

Material examined.—1 juvenile, ML 6.8 mm, G-331.—1 juvenile, ML 6.2 mm, G-71.

Type-locality.—West Wind Drift south of Africa, 40°31'S, 15°06'W; vertical net to 1500 m.

Discussion.—Because of their small size and mangled condition these specimens are questionably assigned to *L. diadema*.

Distribution.—*L. diadema* has been reported from the West Wind Drift (Chun, 1900), off South Africa (Robson, 1924), the west coast of South America, the Indian Ocean (Pfeffer, 1900) and the Gulf of Mexico (Voss, 1956). It was first reported in the Straits (Voss, 1958) from two juveniles from 57 m. Adults have been captured with open nets between 366-589 m and juveniles have been taken between 46-57 m (Voss, 1962). Voss (1962: 273) has suggested that *L. diadema* is a mesopelagic squid and that "their larvae are found near the surface, moving downward with age."

Selenoteuthis scintillans Voss, 1958

Selenoteuthis scintillans Voss, 1958: 370.

Material examined.—1 female, ML 24.0 mm, G-225.—1 female, ML 22.0 mm, G-352.—3 females, ML 17.0-10.8 mm, 1 juvenile, ML 13.1 mm, G-327.—1 female, ML 13.1 mm, G-200.—1 female, ML 10.8 mm, G-287.—1 female, ML 10.7 mm, G-195.—1 female, ML 10.0 mm, G-72.—1 juvenile, ML 6.2 mm, G-201.

Type-locality.—East of Little Bahama Bank, 26°22'N, 76°10'W; 46 m.

Discussion.—*Selenoteuthis* closely resembles *Lycoteuthis* with only two major exceptions: an additional terminal photophore on the mantle and terminal photophores on arms II and III of the male. The terminal mantle photophore can distinguish these two species at a mantle length as small as 5 mm.

Remarks.—Only four *S. scintillans* have been reported previously. Two of the GERDA specimens were immature and the other nine were females.

Distribution.—*S. scintillans* has been reported twice: the type-locality (Voss, 1958) and 25°11'N, 89°50'W (Voss, 1962: central Gulf of Mexico). It was also taken in the Caribbean by the R/V GILLISS in 1972. Most of the GERDA records are from mesopelagic Northern Transitional waters but it was also taken from the Cay Sal and Western Regions. No specimens were taken in Continental waters.

Voss's holotype was captured at night at a depth of 46 m; the other three recorded specimens were caught in an open net fished to 3290 m. Nevertheless, Voss (1962) considered it to be an upper bathypelagic squid. The depth range of the GERDA specimens was day: 458-*472*-485 m; night: 137-*148*-154 m and twilight: 324 m (Fig. 2). *S. scintillans* thus seems to be an upper bathypelagic to lower mesopelagic species that migrates diurnally to the epipelagic zone at night.

Family ENOPLOTEUTHIDAE Pfeffer, 1900
Subfamily ENOPLOTEUTHINAE Pfeffer, 1912

Enoploteuthis leptura (Leach, 1817)

Loligo leptura Leach, 1817: 141.
Enoploteuthis leptura, Roper, 1966: 2 (GERDA Sta. 120, 23°32'N, 82°21'W).

Material from GERDA.—1 male, ML 79.0 mm, G-120, UMML 31.483.

Type-locality.—1°08'N, 7°26'E, Gulf of Guinea.

Discussion.—Of the four other nominal species of *Enoploteuthis* only one, *E. anapsis* Roper, 1964, is recorded in the Atlantic. *E. leptura* can be distinguished from *E. anapsis* by possession of seven distinct rows of light organs on the ventral mantle, not four as in *E. anapsis*.

Distribution.—Roper (1966: 14) described *E. leptura* as "a tropical Atlantic mesopelagic cephalopod." It has been reported from Madeira, the Cape Verde Islands, the Gulf of Guinea and in the Western Yucatan waters of the Straits of Florida. The GERDA specimen is the only record from the Western Atlantic. Since few specimens have been captured, an accurate evaluation of its bathymetric distribution is not feasible.

Enoploteuthis anapsis Roper, 1964

Enoploteuthis anapsis Roper, 1964: 140.

Material examined.—1 male, ML 18.0 mm, G-318, from stomach of black-finned tuna.—1 juvenile, ML 7.7 mm, G-346.

Type-locality.—16°55'N, 81°10'W.

Distribution.—*E. anapsis* ranges from the Gulf of Mexico and the Caribbean Sea across the North Atlantic to Madeira and as far south as St. Helena (19°16'S, 1°48'W). It has also been taken from the Tongue of the Ocean, Bahamas.

Roper (1966) listed time and depth of capture for 21 specimens. Sixteen were caught at night between 0-100 m, the rest at twilight. The juvenile GERDA specimen was caught at night at 181 m. A diel migration cannot be implied with the available data.

Abralia (Asteroteuthis) veranyi (Rüppell, 1844)

Enoploteuthis veranyi Rüppell, 1844: 3.
Abralia veranyi, Voss, 1956a: 277 (off Key West).

Material examined.—1 female, ML 39.5 mm, G-546.

Type-locality.—Messina, Italy.

Discussion.—*A. veranyi* is placed in the subgenus *Asteroteuthis* on the basis of its possession of 9-10 indistinct rows of photophores on the ventrum of the head.

Distribution.—*A. veranyi* has been reported from the Mediterranean and both sides of the Atlantic from the Bay of Funchal, Madeira, to off the Congo River in the Eastern Atlantic, and in the Western Atlantic in the Gulf of Mexico, off Cuba and off Key West (Voss, 1956a). Depths of capture have ranged between the surface and 550 m.

Only one specimen was captured by the GERDA, a gravid female dip-netted at the surface in Northwest Providence Channel, north of Andros Island. Two other gravid females taken at the surface were reported at Corrientes, Cuba (Voss, 1955).

Abralia (Asteroteuthis) redfieldi Voss, 1955
Figures 3A, B

Abralia redfieldi Voss, 1955: 99; 1956a: 277.

Material examined.—1 male, ML 19.0 mm, 1 juvenile, ML 9.2 mm, G-101.—1 male, ML 16.0 mm, G-351.—5 juveniles, ML 10.0-6.2 mm, G-286.—1 juvenile, ML 9.2 mm, G-115.—1 juvenile, ML 6.2 mm, G-284.

Type-locality.—Off Gun Cay, Bahamas; surface.

Discussion.—Adult *A. redfieldi* are distinguished from the other two Atlantic species, *A. veranyi* and *A. grimpei* Voss, 1958, by their five round ocular photophores and only two rows of suckers on the tips of the sessile arms.

Remarks.—No male specimen of *A. redfieldi* has been described; therefore, a description of the hectocotylus and a figure of both the hectocotylus and spermatophore

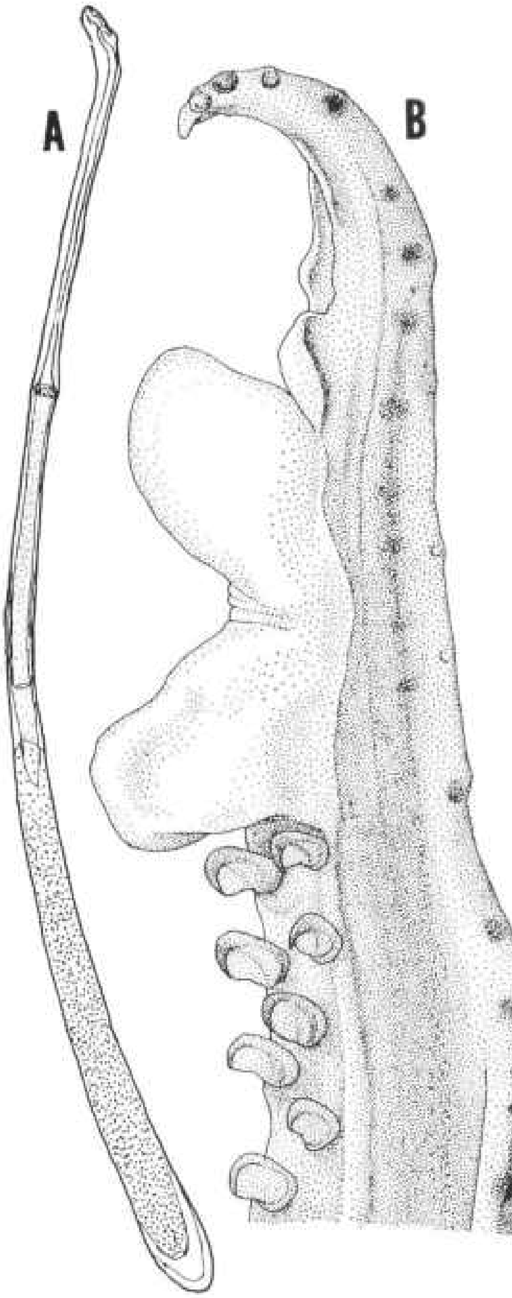

Figure 3. *Abralia redfieldi*, G-101, ML 19 mm: A, Spermatophore; B, Hectocotylus.

are provided (Figs. 3A, B). Of the four species in the subgenus *Asteroteuthis*, the hectocotylus is known for only two plus one of their subspecies. In all three cases the left ventral arm is hectocotylized by a semi-circular ventral membrane, a smaller dorsal membrane, and the absence of hooks distal to the dorsal membrane. Two males were taken by the GERDA: the larger with a mantle length of 19.0 mm (G-101) with mature spermatophores, and the smaller (ML 16.0 mm, G-351) with a penis but no spermatophores. The larger specimen has the right ventral arm hectocotylized by a large bilobed ventral membrane originating at the last arm hook (ninth) and extending over halfway to the tip of the arm. A much smaller ventral flap lies distal to this bilobate membrane. No dorsal flap, suckers or hooks occur distal to the origin of the ventral flap. The smaller specimen also has the right ventral arm hectocotylized. Its ventral flap is not as distinctly bilobate; however, there is a constriction in the middle of the flap. There is no additional ventral membrane but a small dorsal flap is present. Fourteen biserially arranged suckers extend beyond the flaps to the tip of the arm.

The hectocotylization of the right ventral arm also occurs in *A.* (*Abralia*) *armata* and *A.* (*Astrabralia*) *euides*, but this is the first time observed in the subgenus *Asteroteuthis*. Also, the peculiar bilobate ventral flap, the additional small ventral flap of the larger specimen, and suckers on the hectocotylized arm tip of the smaller specimen have not been reported before in the genus *Abralia*. Males are known in only four of the 13 valid species (Voss, in manuscript).

Distribution.—Only two specimens of *A. redfieldi* from two locations have been reported: the type-locality off Gun Cay and the location of one female off Caibarien, Cuba (Voss, 1955). The GERDA took ten specimens from five locations in the Straits, distributed in all three water masses and regions.

The two previously recorded specimens were caught from 446 m to the surface. The GERDA specimens had an average night depth of 55 m and a day average of 611 m (Fig. 2).

Abraliopsis (*Abraliopsis*) *pfefferi* Joubin, 1896
Figures 4A, B

Abraliopsis pfefferi Joubin, 1896: 19.

Material examined.—1 female, ML 29.0 mm, G-181.—1 male, ML 21.5 mm, G-304.—1 male, ML 18.0 mm, G-99.—1 female, ML 16.9 mm, G-352.

Type-locality.—Villefranche-sur-Mer, Mediterranean Sea.

Discussion.—*A. pfefferi* is in the subgenus *Abraliopsis*, characterized by the possession of irregularly scattered photophores on the ventral surface of the head and mantle, not arranged in rows as in the subgenus *Micrabralia*. It is the only Atlantic representative of the subgenus.

Remarks.—Voss (1967a) reported a male of *A. pfefferi* from the Indian Ocean but did not describe it. Young (1972: 21) described the hectocotylus from two Indian Ocean specimens, however, he neither illustrated the hectocotylus nor mentioned the spermatophore. The GERDA material contained four specimens, two of which were males of ML 21.5 and 18.0 mm. The larger specimen possesses a hectocotylus and spermatophores, which are illustrated in Figures 4A, B.

The hectocotylus of the GERDA specimen agrees with Young's description. The ventral flap of the right ventral arm begins at the tenth hook and extends a millimeter past the last (14th) hook. It is a low ridge with several folds, perhaps due to the preserving fluid. The dorsal membrane originates at the level of the last hook and is about half as long and tall as the ventral membrane. No suckers lie distal to the dorsal flap. Hooks 7 and 8 are undeveloped, smaller and lacking a chitinous hard part. A similar condition is found in *A.* (*Micrabralia*) *affinis* in which the hooks in the center of the hectocotylized arm are smaller. The left arm is unmodified. Males of all three species of the subgenus *Abraliopsis* are now known to have hectocotylized right ventral arms and unmodified left arms.

Distribution.—*A. pfefferi* is known from the Mediterranean (Joubin, 1896), the northeastern Atlantic (Joubin, 1920, 1924) and the Indian Ocean SSE of Natal (Voss, 1967a). Three adult specimens were taken from the Straits in Northern Yucatan and Transitional waters. The other specimen was captured north of Little Bahama Bank. This is the first record of *A. pfefferi* from the Western Atlantic.

Two of the three GERDA specimens were captured during the day at an average depth of 640 m; the other was captured at night at 52 m.

Abraliopsis (*Micrabralia*) sp.

Material examined.—1 male, ML 19.5 mm, G-285.—1 juvenile, ML 8.4 mm, G-106.

Type-locality.—5°09′N, 4°04′E, Gulf of Guinea; 500-740 m.

Discussion.—The subgenus *Micrabralia* is characterized by four to five distinct rows of photophores on the ventral surface of the head. Only this species is known from the Western Atlantic.

Distribution.—This species has been reported only from the Gulf of Guinea and the Gulf of Mexico (Voss, 1975). The GERDA produced two records in the Continental and Transitional waters of the Cay Sal and Northern Regions. One specimen was captured between 400-596 m during the day and the other between 97-104 m at night. There are not enough data to prove a diurnal migration.

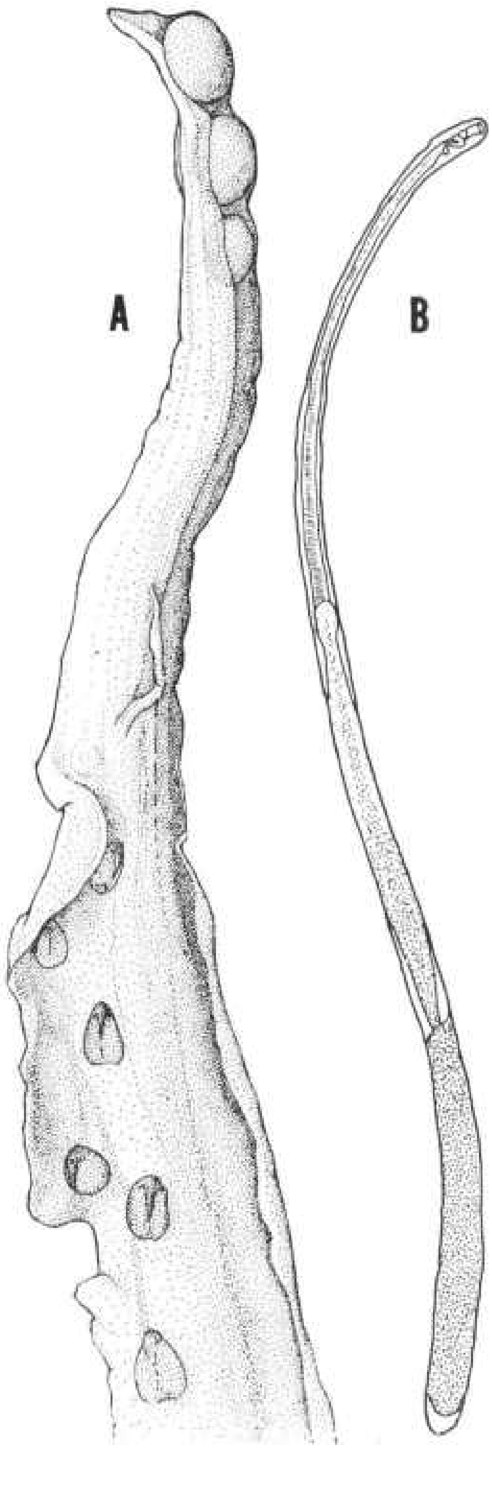

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Figure 4. *Abraliopsis pfefferi*, G-304, ML 21.5 mm: A, Hectocotylus; B, Spermatophore.

Subfamily PYROTEUTHINAE Pfeffer, 1912

Pyroteuthis margaritifera (Rüppell, 1844)

Enoploteuthis margaritifera Rüppell, 1844: 2. *Pyroteuthis margaritifera*, Voss, 1954: 477 (Gulf Stream off Miami); 1956a: 278 (Florida Current off Miami); 1958: 381 (off Delray Beach, Fla.).

Material examined.—1 female, ML 36.0 mm, G-358.—1 female, ML 36.0 mm, G-11.—1 male, ML 32.0 mm, G-72.—2 females, ML 12.5-10.0 mm, 2 juveniles, ML 7.7-6.2 mm, G-199.—1 male, ML 12.3 mm, G-159.—1 female, ML 10.9 mm, G-286.—1 female, ML 10.8 mm, G-339.—1 juvenile, ML 7.0 mm, G-201.—1 juvenile, ML 6.2 mm, G-530.—1 juvenile, ML 6.1 mm, G-356.—2 juveniles, ML 4.6-3.7 mm, G-497.

Discussion.—The Pyroteuthinae contains two genera, each with two species. *Pyroteuthis* is distinguished from *Pterygioteuthis* by hooks on the tentacular club, hectocotylization of the right ventral arm instead of the left ventral, 12 ocular photophores instead of 14 or 15 and broad fin insertion.

Distribution.—*P. margaritifera* has been reported from both sides of the North Atlantic, the Mediterranean, off Amboina (Hoyle, 1886), the Central Pacific (0°33′S, 151°34′E; Hoyle, 1886), the Indian Ocean (Voss, 1967a) and the Straits of Florida (Voss, 1954) off Miami.

Sixteen specimens were captured from 11 stations mainly in the Transitional and Yucatan Northern mesopelagic zone. No specimens were taken from Continental waters. Highest catch/effort was found in the mesopelagic Western Transitional waters, .50 specimen/hour, and the mesopelagic Northern Transitional waters, .12 specimen/hour.

Roper, Gibbs and Aron (1970), based on 79 specimens collected with closing nets off Bermuda, reported a day and night range of 250-*415*-550 m and 50-*140*-250 m respectively. The GERDA specimens had a corresponding range of 310-*401*-595 m and 18-*69*-154 m (Fig. 2). There was no change in depth with increase of size.

Pterygioteuthis giardi Fischer, 1895

Pterygioteuthis giardi Fischer, 1895: 205.—Voss, 1954: 477 (Gulf Stream off Miami, Lower Florida Keys); 1956a: 278 (Florida current off Miami); 1958: 381 (off West Palm Beach).

Material examined.—1 female, ML 15.5 mm, G-323.—2 males, ML 15.4-13.0 mm, G-92.—1 female, ML 15.4 mm, G-88.—3 females, ML 14.6-10.0 mm, 1 male, ML 9.3 mm, 2 juveniles, ML 8.5-5.4 mm, G-351.—1 male, ML 14.0 mm, G-37.—1 male, ML 12.3 mm, G-333.—1 male, ML 12.3 mm, 2 females, ML 11.5-10.0 mm, G-101.—1 male, ML 11.5 mm, G-58.—1 male, ML 10.9 mm, G-284.—1 male, ML 10.8 mm, 1 female, ML 10.0 mm, G-90.—1 male, ML 10.7 mm, 1 female, ML 9.2 mm, G-97.—2 females, ML 8.5-8.0 mm, G-331.—1 juvenile, ML 7.7 mm, G-196.—1 juvenile, ML 5.3 mm, G-314.

Type-locality.—Off the coast of Morocco (*see* Berry, 1912).

Discussion.—There are two Atlantic species of *Pterygioteuthis* in the literature: *P. giardi* Fischer, 1895 and *P. gemmata* Chun, 1908. *P. giardi* can be distinguished by hooks on both dorsal and ventral rows of arms I-III, fifteen ocular photophores, and the absence of suckers and hooks on arms IV (Berry, 1912: 334). Most of the GERDA specimens were small and often the arm hooks were missing, not yet formed, or difficult to distinguish. The number and position of the ocular photophores served to identify specimens as small as 7.7 mm ML.

Distribution.—This small squid has been reported from both sides of the Atlantic, New South Wales, South Africa, the Indian Ocean, the East Indies, New Zealand, off the Galapagos Islands, the eastern Pacific Ocean and southern South America. It was the second most abundant pelagic cephalopod collected by the GERDA in the Straits, caught at fourteen stations for a total of 25 specimens. No specimens were caught in the Western Region or Continental waters. Most of the specimens were captured in the epi- and mesopelagic zones of the Transitional and Yucatan waters of the Northern Region. Notable maxima of catch/effort were .32 specimen/hour in the epipelagic Northern Yucatan waters and .19 specimen/hour in the mesopelagic Northern Transitional waters.

Roper, Gibbs and Aron (1970) reported

a day and night range of 300-*383*-500 m and 0-*102*-250 m respectively for 41 specimens captured with closing nets off Bermuda. The GERDA specimens had a day depth range of 256-*297*-375 m, a twilight range of 70-*159*-365 m, and a night range of 45-*156*-389 m (Fig. 2).

Pterygioteuthis gemmata Chun, 1908

Pterygioteuthis gemmata Chun, 1908: 86.

Material examined.—1 female, ML 23.0 mm, G-333.—1 female, ML 23.0 mm, G-559.—1 female, ML 12.3 mm, 1 juvenile, ML 6.9 mm, G-1251.—1 female?, ML 12.3 mm, G-1259.—2 females, ML 11.5-10.8 mm, 6 juveniles, ML 8.5-4.6 mm, G-107.—1 female, ML 10.0 mm, G-108.—1 juvenile, ML 6.2 mm, G-545.

Type-locality.—South Atlantic Ocean.

Distribution.—Until recently *P. gemmata* was considered a "southern" form, reported only from the South Atlantic and equatorial North Atlantic (Chun, 1910; Thiele, 1921). Then Voss (1967a) reported *gemmata* from the Indian Ocean and Young (1972) reported it from the South Pacific and the coast of California. Young concluded that this species is worldwide but occurred primarily in warmer waters. The occurrence of *gemmata* in the Western Atlantic is therefore logical.

Fifteen specimens of *P. gemmata* were collected at seven stations in the Straits including Continental, Transitional and Yucatan waters. It was most abundant in the Continental Northern area with a catch/effort value of .31 specimen/hour. These specimens have an average nighttime depth of 99 m and one twilight record at 121 m.

Family OCTOPOTEUTHIDAE Berry, 1912

Octopoteuthis sp.

Material examined.—1 juvenile, ML 25.0 mm, G-89.—1 juvenile, ML 12.5 mm, G-106.—1 juvenile, ML 12.0 mm, G-321.

Discussion.—These three specimens, all juvenile and in poor condition, could be identified only to genus. The systematics of *Octopoteuthis* is confused owing to the paucity of specific systematic characters, ignorance of individual variation, and incomplete earlier descriptions. Young (1972) listed the four nominal species of *Octopoteuthis* known from the Atlantic and provided a review of the systematics.

Family ONYCHOTEUTHIDAE Gray, 1849

Onychoteuthis banksii (Leach, 1817)

Loligo banksii Leach, 1817: 141.
Onychoteuthis bartlingii, Calkins, 1878: 233 (Gulf Stream).
Onychoteuthis banksii, Voss, 1955: 278 (between Cat Cay and Miami); 1956a: 278 (off Miami, Key West, Dry Tortugas).

Material examined.—8 males, ML 84.0-65.0 mm, 9 females, ML 83.5-61.0 mm, G-215.—23 females, ML 82.0-57.0 mm, 12 males, 80.0-63.0 mm, G-75.—12 females, ML 78.0-65.0 mm, 8 males, ML 74.0-64.0 mm, 3 sex indet., ML 56.0-47.0 mm, G-40.—7 males, ML 78.0-69.0 mm, 10 females, ML 77.0-68.0 mm, G-1006.—1 female, ML 77.5 mm, G-70.—1 male, ML 72.0 mm, G-119.—3 females, ML 68.0-57.0 mm, 1 male, ML 59.0 mm, G-4A.—2 juveniles, ML 18.7-10.8 mm, G-86.—5 juveniles, ML 14.6-6.2 mm, G-105.—3 juveniles, ML 12.9-9.2 mm, G-10.—3 juveniles, ML 12.8-8.3 mm, G-82.—1 juvenile, ML 11.5 mm, G-46.—1 juvenile, ML 8.5 mm, G-26.—1 juvenile, ML 8.5 mm, G-207.—5 juveniles, ML 7.9-6.1 mm, G-196.—1 juvenile, ML 7.0 mm, G-80.—2 juveniles, ML 6.9-6.4 mm, G-326.—2 juveniles, ML 6.9-5.4 mm, G-195.—1 juvenile, ML 6.9 mm, G-69.—1 juveniles, ML 6.9 mm, G-83.—2 juveniles, ML 6.2-6.1 mm, G-11.—1 juvenile, ML 5.5 mm, G-332.—1 juvenile, ML 5.3 mm, G-331.—2 juveniles, ML 4.6-4.5 mm, G-353.—1 juvenile, ML 4.6 mm, G-337.—1 juvenile, ML 4.0 mm, G-100.—1 juvenile, ML 3.9 mm, G-343.—4 juveniles, ML 3.3-1.8 mm, G-717.—1 juvenile, ML 2.3 mm, G-726.

Discussion.—There are now two recognized species of *Onychoteuthis*, however Young (1972) considered that the *O. banksii* "complex" from Florida waters will eventually be split into at least two groups. Juveniles of *O. banksii* are distinguished from all other cephalopod juveniles by their short, fat bodies, the line of chromatophores on the mid-dorsal surface, and the sharp, projecting end of the gladius (Voss, 1958). These features are visible to 2.3 mm ML.

Distribution.—This species is cosmopolitan in warm and temperate seas and has been reported as far north as the Barents Sea and as far south as Cape Horn (Clarke, 1966: 141).

O. banksii was the most numerous species collected by the GERDA. They fall into two size groups: seven stations with 97 adults and 22 stations with 36 juveniles. The adults all have a ML ⩾ 47.0 mm and the juveniles are all ⩽ 18.7 mm ML, creating a sizeable gap in ML range. This gap can be explained by the fact that all adults were captured at night by dip-netting and never by an IKMT. Adult *O. banksii* are apparently too swift to be caught by an IKMT.

O. banksii has been captured at the surface in all three regions of the Straits and in all three water masses. The juveniles were mainly in epi- and mesopelagic Northern Continental and Transitional waters. Notable maxima of catch/effort occur in Northern mesopelagic Continental waters (1.53 specimens/hour) and Northern epipelagic Transitional waters (.36 specimen/hour). The juveniles had a day range of 51-*93*-231 m and a night range of 0-*226*-475 m (Fig. 2). These data imply a daytime concentration in the epipelagic zone and a nighttime random dispersal ranging from the surface to lower mesopelagic depths.

Onykia carriboea Lesueur, 1821

Onykia carriboea Lesueur, 1821: 98.
Onykia caribaea, Voss, 1954: 477 (Gulf Stream off Miami); 1956a: 278 (off Miami).

Material examined.—1 female, ML 18.0 mm, G-1295.—1 female, ML 17.0 mm, G-1294.—1 juvenile, ML 10.8 mm, G-206.—1 juvenile, ML 10.0 mm, G-542.—1 juvenile, ML 6.2 mm, G-1298.—1 juvenile, ML 6.2 mm, G-89.

Type-locality.—Not traced.

Discussion.—Until the genus *Onykia* has been revised the number of species and their diagnostic differences will remain uncertain. Juveniles can be recognized by the presence of club hooks, a distinctive chromatophore pattern and body shape. Pfeffer presented an excellent developmental series of drawings of *O. carriboea* from ML 3.5-13.5 mm and another series of drawings of the development of the club (Pfeffer, 1912: pl. 1, figs. 20-26 and figs. 12-18).

Distribution.—Six specimens from six stations were collected by the GERDA in all three regions and water masses. Clarke (1966) stated that it is the only species of pelagic squid the adults of which are normally caught at the surface during the daylight hours. The two GERDA specimens taken in trawls at deeper fishing depths were undoubtedly caught when the net was near the surface.

Family CTENOPTERYGIDAE Grimpe, 1922

Ctenopteryx sicula (Verany, 1851)

Sepioteuthis sicula Verany, 1851: 51.

Material examined.—1 juvenile, ML 10.0 mm, G-92.

Type-locality.—Off Messina, Italy.

Discussion.—The single genus of the family Ctenopterygidae is polytypic; however, due to the confused state of their systematics, all forms have been lumped under the name *C. sicula* (Roper, Young and Voss, 1969). Rancurel (1970) added *C. sepioloidea* from the southwest Pacific. Members of this genus are easily recognized, even in juvenile stages, by the peculiar comb-like structure of the fins. The GERDA specimen of 10 mm ML possesses fin trabeculae for about 25% of the mantle length.

Distribution.—*C. sicula* is cosmopolitan, having been reported from the North and South Atlantic, Mediterranean, Pacific, and off southeast Africa (Voss, 1967a); there are no records for the Gulf-Caribbean region. The single juvenile captured in Northern Transitional waters is the first record for the Straits.

Family HISTIOTEUTHIDAE Verrill, 1881

Histioteuthis corona corona (Voss & Voss, 1962)

Calliteuthis reversa, G. Voss, 1956: 139 (Western Continental waters, 24°16'N, 83°22'W); 1956a: 278 (from stomach of *Coryphaena*, off Miami, bathypelagic).
Calliteuthis corona, Voss & Voss 1962: 191 (Western Continental waters, 24°11'N, 83°21'W).
Histioteuthis corona corona, N. Voss, 1969: 773 (monographic treatment, GERDA Sta. 88, 25°02'N, 79°48'W).

Material examined.—1 juvenile, ML 17.0 mm, G-88.

Type-locality.—Gulf of Mexico, 29°10'N, 88°00'W; 521 m.

Discussion.—The genus *Histioteuthis* contains 13 recognized species, including seven from the North Atlantic. *H. corona* can be distinguished from all other histioteuthids by a combination of characters: 17 large photophores around the right eyelid, no enlarged photophores on the mantle or arm tips, and swollen arms of the dorsal funnel organ (N. Voss, 1969: 777).

Distribution.— *H. c. corona* is known from the Gulf-Caribbean area, the North Atlantic, eastern South Atlantic and the Indian Ocean off the African coast. It was first reported from the Straits (Voss, 1956) in Western Continental waters.

Only *H. heteropsis* is definitely known to migrate diurnally (Young, 1972), but N. Voss (1969) implied that diel vertical migrations are a characteristic of most, if not all, species of this family. She stated that *H. c. corona* is primarily a mesopelagic squid concentrating at depths between 200-1000 m. The GERDA specimen was caught at twilight at 350 m.

Histioteuthis dofleini (Pfeffer, 1912)

Stigmatoteuthis Dofleini Pfeffer, 1912: 288.
Histioteuthis dofleini, Voss, N., 1969: 784 (monographic treatment; off Miami, from stomach of *Alepisaurus* sp.).

Material examined.—1 male, ML 43.0 mm, G-331.—2 females, ML 16.0-14.5 mm, G-686.—1 juvenile, ML 12.0 mm, G-313.

Type-locality.—Sagami Bay, Japan; surface.

Discussion.—*H. dofleini* can be distinguished from other species of *Histioteuthis* by a combination of characters: 17 large photophores around the right eyelid, no enlarged photophores on the mantle or arm tips and the expansion of the distal median ridge of the arms of the dorsal pad of the funnel organ into a distinct flap (N. Voss, 1969: 738).

Distribution.—*H. dofleini* is primarily a tropical-subtropical species found in both the Atlantic and Pacific Oceans. It has been reported from the Gulf of Mexico, North Atlantic, North Pacific off Baja California, Hawaii, the east coast of Japan and in the vicinity of the Seychelles in the Indian Ocean (N. Voss, 1969). The only record from the Straits was from an unspecified location off Miami from the stomach of an *Alepisaurus*. The GERDA specimens yielded two more records off Miami in Transitional and Yucatan waters and another record in Northwest Providence Channel. N. Voss (1969) stated that *H. dofleini* appeared to concentrate in the upper 700-800 m. The GERDA specimens were all captured at night between 250-450 m.

Family OMMASTREPHIDAE Steenstrup, 1857

?*Illex coindetii* (Verany, 1837)

Loligo coindetii Verany, 1837: 94.
?*Illex illecebrosus*, Voss, 1955: 103 (off Matanzas, Cuba); 1956a: 279 (off Dry Tortugas).
Illex coindetii, Roper, Lu and Mangold, 1969 (off Palm Beach, Dry Tortugas).

Material examined.—2 females, ML 239.0-226.0 mm, G-435.—1 male, ML 191.0 mm, G-43.—1 female, ML 170.0 mm, G-646.—2 females, ML 152.0-137.0 mm, 2 males, ML 124.0-123.0 mm, G-997.

Type-locality.—Mediterranean near Nice.

Discussion.—Before 1912 two nominal species of *Illex* were recognized in the Atlantic: *Illex illecebrosus* (Lesueur, 1821) in the Western Atlantic from Brazil to Newfoundland and distributed across European waters to the Bristol Channel, and *Illex coindetii*

Table 4. Measurements of the GERDA *Illex* specimens

Sex	G-435 female	G-435 female	G-43 male	G-646 female	G-997 male	G-997 male	G-997 female	G-997 female
ML	239	226	191	170	124	123	152	137
MW	61	59	42	41	28	25	27.5	25
HW	49	47	40	45.5	24	23	21.5	25
FL	109	104	81	76	49	49	62	54
FW	141	133	105	107	70	69	81	75
HWI	20.5	20.8	20.9	26.8	19.8	18.7	14.1	18.2
MWI	25.4	26.1	21.9	24.1	22.6	20.4	18.1	18.4
FL/FW	1:1.30	1:1.32	1:1.30	1:1.4	1:1.43	1:1.41	1:1.31	1:1.39
Fin angle	54°	51°	56°	54°	57°	58°	56.5°	54°
HcLI	—	—	missing	—	36.0	32.6	—	—

(Verany, 1837) from the British Isles south to the African coast at Angola. In 1912, Pfeffer designated them as subspecies, an idea which did not gain full acceptance. Adam (1952) employed the subspecific designation in his study of *Illex* from the Atlantic and decided it was premature to call these subspecies or full species until more material was analyzed. Castellanos (1960) established *Illex argentinus* but later made it a subspecies of *Illex illecebrosus* (Castellanos, 1964). In 1969, Roper, Lu and Mangold established another species, *Illex oxygonius*, raised the remaining three subspecies to full specific status and reviewed the genus. The GERDA specimens possess characteristics of both *I. illecebrosus* and *coindetii*. For this reason their measurements are provided (Table 4) and they are questionably assigned to *coindetii*.

Distribution.—*I. coindetii* is known from the Eastern Atlantic as far north as the North Sea, the Mediterranean (Mangold, 1963a), along the coast of Portugal and to 14°S off West Africa (Adam, 1952). It was first reported from the Western Atlantic in the Caribbean, Gulf of Mexico, and the Straits off the Dry Tortugas by Roper, Lu and Mangold (1969). The northern limits of *coindetii* and *oxygonius* and the southern limits of *illecebrosus* are still unclear (Roper, *et al*., 1969). All three species may exist in the Straits of Florida. More material needs to be examined, especially off the Atlantic Coast of Florida, to resolve the distributional and systematic problems of this genus (Roper, *et al*., 1969).

Both Adam (1952) and Mangold-Wirz (1963a) reported *I. coindetii* from 40-500 m. Seven of the GERDA *Illex* were captured between 183-531 m with an otter trawl during the day and one was captured between 89-139 m with an IKMT at night over a bottom depth of 367-585 m. The species appears to be associated with the bottom during the day, dispersing into mid-depths at night.

Ommastrephes pteropus (Steenstrup, 1855)

Ommatostrephes pteropus Steenstrup, 1855: 200.

Ommastrephes pteropus, Voss, 1956a: 279 (off Palm Beach, Miami, Dry Tortugas).

Material examined.—1 female, ML 93.5 mm, G-75.—2 females, ML 90.5-57.0 mm, G-64.—1 female, ML 61.0 mm, G-40.

Type-locality.—Atlantic Ocean.

Discussion.—All three species of *Ommastrephes* are found in the Atlantic, but *O. pteropus* can be distinguished by possession of ⩽ 2 suckers on the tentacular stalk proximal to the last knob of the carpal cluster.

Distribution.—The known distribution of *O. pteropus* ranges from Nova Scotia to the

Caribbean, the Cape Verde Islands, and the west coast of Africa to 13°25′S (Adam, 1952). It was first reported in the Straits from three locations by Voss (1956a). The three GERDA locations are all in Northern Transitional waters. All GERDA specimens were dip-netted from the surface at night.

Family CHIROTEUTHIDAE Gray, 1849

Chiroteuthis sp. (*Doratopsis* stage) Figure 5

Material examined.—1 juvenile, ML 21.0 mm, G-1046.

Discussion.—The *Doratopsis* juvenile stage of the chiroteuthids undergoes great ontogenetic change. Before this was known several of these doratopsiform juveniles were given specific status in the genus *Doratopsis*. This genus is now a useful repository for any larval forms which cannot be related to an adult *Chiroteuthis*. No attempt is made to relate the GERDA specimen to any juvenile or adult species, but measurements and a figure are provided.

Remarks.—This specimen is transparent with the exception of the liver and the eyeballs which are orange. Both eyes have small light organs on their ventral surface (Fig. 5). Arm suckers are biserial. The tentacular club is unexpanded and has four rows of suckers which extend 40% of the tentacle length in four neat rows, gradually decreasing in size proximally.

Distribution.—No adult or juvenile chiroteuthid has been reported in the Straits; the GERDA specimen was captured in Northeast Providence Channel. The only adult chiroteuthid reported from the West Indies was *Chiroteuthis lacertosa* Verrill, 1881 (Voss, 1956).

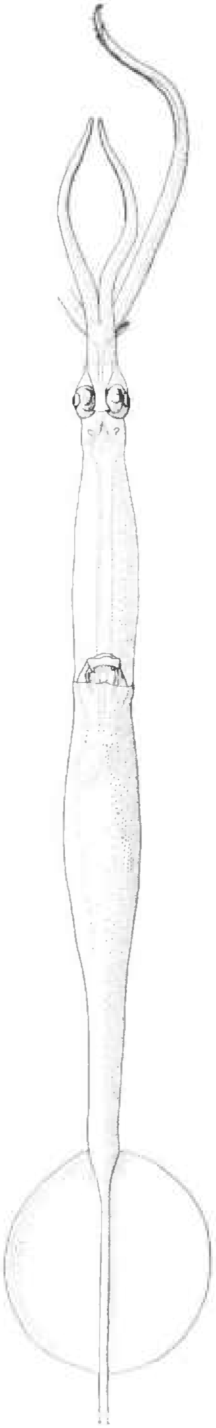

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Figure 5. *Chiroteuthis* sp. (*Doratopsis* larva), G-1046, ML 21.0 mm. Ventral view of partially reconstructed specimen. Funnel cut open.

Family MASTIGOTEUTHIDAE Verrill, 1881

?*Mastigoteuthis grimaldii* (Joubin, 1895)

Chiroteuthis grimaldii Joubin, 1895: 38.

Material examined.—1 male, ML 74.0 mm, G-212.—1 juvenile, ML 35.0 mm, G-143.

Type-locality.—39°43′N, 33°22′W (Azores); 1445 m.

Discussion.—The systematics of *Mastigoteuthis* is very confused and in great need of revision, partially as a result of the description and naming of new species from small and mutilated specimens. These bathypelagic animals are soft and delicate and therefore often come up without tentacles and without the epidermis and associated light organs (Young, 1972: 65). Until a revision of the genus is accomplished and type specimens examined, identification of species will remain tentative. Young (1972) has provided a capsulized summary of the 15 species now assigned to this genus. The following table presents measurements of the two GERDA specimens.

Distribution.—*M. grimaldii* was reported by Joubin (1895) from the Azores and again by Joubin (1924) at 10 different locations ranging from the coast of Spain to as far west as 59°W in the North Atlantic. It has also been reported in the North Atlantic by Adam (1960), Fischer and Joubin (1906; near the Azores) and Chun (1913). Rancurel (1971) reported specimens from 26 stations in the Gulf of Guinea ranging from 300-800 m depth.

Only two specimens of *Mastigoteuthis* have been reported from the Gulf-Caribbean area, both unidentifiable to species. One (Voss, 1956) was reported in the Gulf of Mexico south of Louisiana at 1100 m and the other (Voss, 1958) was reported north of the Virgin Islands in 565 m. The GERDA material contained two ?*M. grimaldii*, both from Transitional waters in the Western and Cay Sal Regions, which are new records for the Straits.

Table 5. Measurements of GERDA mastigoteuthids

	G-212 ?*grimaldii*	G-143 ?*grimaldii*
Sex	male	juv.
ML	74	35
FL	41	17
FW	45	21
TL	265	153
CL	150	90
ED	9.5	5.5
DSt	.160	.105
FLI	55.5	48.5
FWI	61.0	60.0
TLI	358	437
CLI	57.5	58.5
EDI	12.8	15.7
SIt	.216	.300

Family GRIMALDITEUTHIDAE Pfeffer, 1900

Grimalditeuthis bomplandii (Verany, 1837)

Loligopsis Bomplandii Verany, 1837a: 99.

Material examined.—1 male, ML 56.0 mm, G-225.—1 juvenile, ML 47.0 mm, G-82.

Type-locality.—29°N, 39°W, North Atlantic; surface.

Discussion.—The two nominal species in the Grimalditeuthidae, *G. bomplandii* (Verany, 1837) and *G. richardi* (Joubin, 1898) were synonymized by Pfeffer (1912). Young (1972) described a specimen of 89 mm ML which lacked both photophores and suckers at the arm tips. *G. bomplandii* is known to have photophores at the tips of all arms. The GERDA specimens of a smaller ML also lacked distal arm photophores but had pedicellated suckers to the tips of the arm. Young (1972: 76) implied that the addition of arm photophores is an ontogenetic change which is preceded by the loss of distal arm suckers.

Distribution.—*G. bomplandii* has been reported from the Northeast Atlantic (Verany, 1837a; Joubin, 1898a; Chun, 1913), the upper Gulf of Mexico (Voss, 1956), the South Atlantic (Pfeffer, 1912), off South Africa (Massy, 1925), and Santa Catalina Basin (Young, 1972). The GERDA specimens from Cay Sal and Northern Transitional waters are the first records for the Straits.

Family CRANCHIIDAE Prosch, 1849
Subfamily CRANCHIINAE Pfeffer, 1912

Cranchia scabra Leach, 1817

Cranchia scabra Leach, 1817: 140.—Voss, 1955: 104 (off Miami); 1956: 154 (off Miami in Florida Current); 1956a: 279 (off Miami and Key West).

Material examined.—1 female, ML 55 mm, G-106.—1 juvenile, ML 17.0 mm, G-104.—1 juvenile, ML 6.0 mm, G-89.

Type-locality.—Off West Africa.

Discussion.—*Cranchia* is one of five recognized genera in the subfamily Cranchiinae. Members of this subfamily are separable from those in the other subfamily, Taoniinae, by the possession of two or more cartilaginous strips extending posteriorly on the mantle from the points of the funnel-mantle fusions and a funnel that in the adult stage, fuses laterally to the ventral surface of the head (Young, 1972: 78). *Cranchia* is easly recognized by its complex cartilaginous tubercles completely covering the mantle and fins.

Distribution.— *C. scabra* is known from all temperate and tropical seas between 35°N and 37°S (Clarke, 1966: 218). It has been reported in the Straits three times by Voss (1955, 1956, 1956a) in the Northern and Western Regions and now from three additional locations by the GERDA in Northern Continental and Cay Sal Yucatan waters.

C. scabra is common in the epipelagic zone and has been captured at the surface and in open nets in the mesopelagic zone. GERDA records range from 97-259 m with no indication of diurnal migration.

Liocranchia reinhardti (Steenstrup, 1856)

Leachia Reinhardti Steenstrup, 1856: 200.
Liocranchia reinhardti, Voss, 1955: 104 (off Matanzas, Cuba).

Material examined.—1 juvenile, ML 22.0 mm, G-329.—1 juvenile, ML 20.0 mm, G-206.—1 juvenile, ML 17.0 mm, G-932.—2 juveniles, ML 11.5-5.5 mm, G-545.

Type-locality.—Azores.

Discussion.—The genus *Liocranchia* is a member of the subfamily Cranchiinae and is distinguished from the other four genera in this subfamily by its lack of tubercles covering the mantle and fins and its two V-shaped lines of cartilage with tubercles extending posteriorly from the points of the funnel-mantle fusion (Sasaki, 1929: 332). *L. reinhardti* is distinguished from the other two nominal species in this genus by its dorsal median line of tubercles on the mantle and normal arm tips. The V-shaped cartilage lines, and the median dorsal line of tubercles are distinguishable to a mantle length of 5.5 mm.

Remarks.—Sasaki (1929) reported 15 ocular photophores from a specimen with ML 77.0 mm. Voss (1963) consistently reported 14 photophores from specimens with a ML of 157.0 mm (largest known specimen) and "smaller specimens from the Florida Current." Voss (1963: 149) also stated that the number of photophores varies with age. An adult *L. reinhardti* (ML 110 mm, USNM 574883) possessed the 14 ocular photophores as described by Voss, six in a proximal series and eight larger photophores in a distal series on the inner surface of the periphery of the eyeball. The two largest GERDA specimens (ML 22, 20 mm) were missing both eyes, but the right eye of the 17.0 mm ML specimen possessed six ocular photophores in the distal series and four buried in transparent tissue in the proximal series. The left eye was mutilated. The 11.5 mm specimen had one to two irregular swellings on the ventral surface of each eye.

Distribution.—*L. reinhardti* is cosmopolitan in tropical and temperate seas (Clarke, 1966: 220). It has been reported in the Straits off Matanzas, Cuba (Voss, 1955) from an open net fished from 256-430 m. The GERDA material provided three more locations in the Straits and one in Northeast Providence Channel.

Clarke (1966) reported that most specimens of *L. reinhardti* were caught from 500 m to the surface. From an examination of numerous specimens captured from 310-520 m, Voss (1963) theorized that the adults belong to the bathypelagic fauna and probably leave the more passive planktonic stage at ML 50-60 mm. The GERDA specimens captured from 0-907 m were all planktonic juveniles.

Leachia sp. (*Pyrgopsis* stage)

Material examined.—1 male, juvenile, ML 52.0 mm, G-207.—1 juvenile, ML 7.0 mm, G-351.—1 juvenile, ML 7.0 mm, G-199.—1 juvenile, ML 6.0 mm, G-8.—1 juvenile, ML 5.0 mm, G-37.

Discussion.—Young (1972: 82) stated in reference to *Leachia* that, "There is probably no genus in the Oegopsida that is more systematically confused. Of the eight species previously recognized, none can be presently identified with any certainty." *Leachia* and *Pyrgopsis* both belong to the subfamily Cranchiinae and can be distinguished from the other four genera of this subfamily by a longitudinal row of tubercles on the mantle from the funnel-mantle fusion of each side (Young, 1972: 80). The genera *Pyrgopsis* and *Leachia* have customarily been separated on the basis of size and position of eyes and ocular photophores; *Pyrgopsis* were generally smaller with stalked eyes and fewer ocular photophores. However, if one assumes that all *Leachia* pass through a "pyrgopsis" stage of development possessing juvenile stalked eyes, confusion will result in identifying smaller specimens. Young (1972) made this assumption, based on a complete series of growth stages of *L. dislocata*, resulting in a synonymy of these two genera. Even with this assumption, the eight nominal species that would now compose the genus *Leachia* are indistinguishable because of dubious descriptions, improper emphasis of specific characters in the past and descriptions of new species involving only one juvenile specimen in poor condition (Young, 1972: 82-83). Until a revision of the Cranchiidae is completed, these GERDA specimens must remain identified only to the generic level.

Distribution.—Of the eight nominal species of *Leachia*, only two have been recorded in the Western Atlantic from three locations: two gravid females of *L. cyclura* Lesueur, 1821, 45 and 55 mm ML from 1050 m near Bermuda (Voss, 1960); the 32 mm ML holotype of *Pyrgopsis lemur* (Berry, 1920) from the surface at 35°27′N, 73°14′W (East of Cape Hatteras); and a 21 mm ML specimen of *P.* (= *Leachia*) *lemur* from 46 m at 18°43′N, 65°10′W (North of the Virgin Islands; Voss, 1958). Four records of *Leachia* sp. resulted from the GERDA material in the Straits: three from Western Transitional waters, one from Northern Yucatan waters and an additional record from Northwest Providence Channel.

Two of the GERDA specimens were captured during the day between 675-777 m, three at night between 18-259 m and one at twilight at 200 m.

Egea inermis Joubin, 1933

Egea inermis Joubin, 1933: 43; N. Voss, 1974: 941.

Material examined.—1 juvenile, ML 29.0 mm, G-106.—1 juvenile, ML 22.0 mm, G-328.—1 juvenile, ML 22.0 mm, G-54.—1 juvenile, ML 17.0 mm, G-195.—1 juvenile, ML 17.0 mm, G-47.

Type-locality.—33°51′N, 66°43′W (northwest of Bermuda); 0-50 m.

Discussion.—The monotypic genus *Egea* can be distinguished from other cranchiid genera by its two non-tuberculated V-shaped lines extending posteriorly from the funnel-mantle fusion (Joubin, 1933). *Egea* also possesses two delicate, elongated flaps on both arms of the dorsal funnel organ.

Distribution.—This poorly known squid, previously known from only the type-locality, was reviewed by N. Voss (1974) based on over 60 additional specimens from 31 localities. She concluded that it was a tropical-subtropical species found in the East and West Atlantic, Indian and West Pacific Oceans. Also, it was found only in shallow water (35-125 m) and showed no tendency to migrate vertically. The five juvenile GERDA specimens were taken off Miami in all three water masses at depths of 97-230 m.

Subfamily TAONIINAE Pfeffer, 1912

Helicocranchia pfefferi Massy, 1907

Helicocranchia pfefferi Massy, 1907: 382.

Material examined.—1 juvenile, ML 17.0 mm, G-206.—1 juvenile, ML 13.0 mm, G-344.—1 juvenile, ML 10.0 mm, G-333.

Type-locality.—51°54′N, 11°57′W, near Ireland.

Discussion.—*H. pfefferi* belongs to the subfamily Taoniinae characterized by the absence of cartilaginous strips on the mantle and a funnel that is laterally free from the head in the adult (Young, 1972: 84). The genus *Helicocranchia* is characterized by its very large funnel and pedunculate fins attached to a gladius which rises free from the mantle shortly in advance of the mantle tip. Of the two Atlantic species, *H. pfefferi* can be distinguished from *H. papillata* (Voss, 1960) by its absence of small papillae covering the mantle and funnel.

Distribution.—*H. pfefferi* has been reported from southwest of Ireland (Massy, 1907), the Bay of Biscay (Bouxin and Legendre, 1936), the Canary Islands (Clarke, 1969), the Pacific Ocean off the coast of California (Okutani and McGowan, 1969; Young, 1972), and off the southern Colombian coast (Fields and Gauley, 1972). The three GERDA locations in the Straits are the first record of this species in the Western Atlantic Ocean.

?*Galiteuthis armata* Joubin, 1898

Galiteuthis armata Joubin, 1898: 279.

Material examined.—1 juvenile, ML 39.0 mm, G-323.

Type-locality.—Mediterranean Sea.

Discussion.—*Galiteuthis* can be distinguished from other genera in the subfamily Taoniinae by its possession of hooks on adult tentacular clubs (Sasaki, 1929: 316). Of the four species presently recognized only one is known from the Atlantic.

Remarks.—Juvenile *Galiteuthis* lack the diagnostic club hooks and are consequently often identified in other "larval genera." The GERDA specimen of ML 39 mm shows a precocious development of club hooks, seven on each club (four in the dorsal row and three in the ventral row). Sasaki (1929) indicated that adult *G. armata* possess 12-14 club hooks. Examination of a specimen of ML 212 mm (USNM 332926) revealed 12 club hooks on the right club and 13 on the left.

Distribution.—Clarke (1966: 239) summarized the distribution of *G. armata* as: the Mediterranean, North Atlantic, off South Africa, East Pacific coast, off Japan and the Kurile region. The GERDA specimen is the first galiteuthid reported from the Straits and Gulf-Caribbean area. Voss (1960) suggested that *G. armata* is a bathypelagic species that lives between 700-1000 m.

Corynoma speculator Chun, 1906

Corynoma speculator Chun, 1906: 85.

Material examined.—2 juveniles, ML 19.0-16.0 mm, G-545.—3 juveniles, ML 15.0-9.0 mm, G-105.—1 juvenile, ML 13.0 mm, G-8.—1 juvenile, ML 10.0 mm, G-350.—1 juvenile, 6.5 mm, G-69.—1 juvenile, ML 5.0 mm, G-345.

Type-locality.—North Atlantic and Indian Oceans.

Discussion.—*Corynoma* is a "larval genus" and probably undergoes considerable ontogenetic change. Voss stated that *C. speculator* might be a juvenile *Carynoteuthis* *oceanica* Voss, 1960. Both possess a light organ on the liver but differ with respect to the funnel organ and presence of a funnel valve. Clarke (1962) synonymized *Carynoteuthis* within *Phasmatopsis* Rochebrune, 1884, based on the similarity of their ventral ocular light organs, the light organs on the ink sac, the presence of a funnel valve, and the lappets on the funnel organ. Voss (1963a: 82) agreed but cautioned "that it is still premature to diagnose these genera [*Carynoteuthis*, *Phasmatopsis*, *Taonius*] as Clarke [1962] has done, and in my opinion both the generic and specific affinities of these groups are still indefinite."

Remarks.—Little can be added to the qualitative description provided by Chun's illustrations (1910, pl. 55) but some quantitative measurements can be provided based primarily on the 19 mm ML specimen (G-545). The body is stout with a MWI of 50. The arms are very short, 10% of the mantle length and sub-equal. The tentacles are exactly as long as the mantle and bear four longitudinal rows of suckers on an unexpanded club. Four rows of suckers extend about 31% of the TL where they grade off into a biserial arrangement for another 26% of the TL; the remaining 43% of the tentacle is bare. Dactyler suckers are strongly pedicillated. The largest suckers on the manus possess 5-6 sharp, slender teeth covering one half of the sucker ring. The FLI is 19 and the FWI is 32.

Distribution.—Until the systematics of this genus is resolved, the geographic distribution of the species is uncertain. In addition to Chun's type-localities, Massy (1925) also reported it from off South Africa. *Corynoma* has not previously been reported from the Western Atlantic.

Juvenile *C. speculator* have been taken from the surface and in open nets fished to 2000 m. The GERDA specimens were all captured from the epipelagic zone, between 36-146 m, with no evidence of diel migration.

Bathothauma lyromma Chun, 1906

Bathothauma lyromma Chun, 1906: 86.

Material examined.—1 sex indeterminate, ML 55.0 mm, G-68.

Type-locality.—West of Cape Verde, West Africa.

Discussion.—*Bathothauma* is noted for its retention of many larval features even at a large size. It is characterized by strongly stalked eyes with one large ventral ocular photophore, a "rostrum" or elongation of the head region between the eyes and the tentacular crown, small, broadly-spaced fins, and a gladius which extends laterally at the posterior end to serve as a support for the fin-attachment (Voss, 1963).

Distribution.—*B. lyromma* has been captured in the North Atlantic, East Pacific, off Tasmania (Allan, 1940) and the Philippines (Voss, 1963). It was also reported in the Western Atlantic near Bermuda (Voss, 1960). It is now first recorded for the Straits and Gulf-Caribbean area, captured in Northern Transitional waters off Miami.

Allan (1940) reported a juvenile *B. lyromma* taken at the surface and Voss (1960) recorded a juvenile taken at 200 m. All other records are from open nets fished in excess of 520 m.

Order VAMPYROMORPHA
Family VAMPYROTEUTHIDAE
Thiele, 1915

Vampyroteuthis infernalis Chun, 1903

Vampyroteuthis infernalis Chun, 1903: 88.—Pickford, 1946: 8 (24°17'N, 83°17'W, Western Continental waters).

Material examined.—1 sex indeterminate, ML 60 mm, G-222.

Type-locality.—Off the Cameroons-Congo River; 1200 m.

Discussion.—*Vampyroteuthis infernalis*, the sole member of the order Vampyromorpha, is distinguished from other recent cephalopods by its possession of eight arms and two long filaments unlike tentacles. It also bears a gladius distinct from any other recent cephalopod. Pickford (1946) noticed no geographic variation in this species, explaining this conformity as due to its free communication in all oceans and its essentially uniform environment.

Distribution.—Pickford (1946) stated that *V. infernalis* inhabits all tropical and subtropical oceans between the 40th parallels of latitude. She (Pickford, 1952) also reported it to be stenothermal (2-10°C), stenohaline (34.4-35.4 ‰), oligoaerobic (1-4 ml/l O_2) and that it preferred waters with a σ_t range of 27.0-27.9.

Pickford (1946) reported the only *V. infernalis* taken in the Straits at a calculated depth of 1000 m. The GERDA took only one specimen in Transitional Cay Sal waters with a temperature of 6-8°C, 34.9 ‰ salinity and 3.5 ml/l O_2.

Order OCTOPODA
Family BOLITAENIDAE Chun, 1911

Japetella diaphana Hoyle, 1885

Japetella diaphana Hoyle, 1885: 232.—Joubin, 1937: 27 (Western Straits).—Thore, 1949: 1 (monographic treatment, Western Straits).

Material examined.—1 male, ML 44.0 mm, G-205.—1 juvenile, ML 23.0 mm, G-213.

Type-locality.—0°42'S, 147°E (North of New Guinea); surface.

Discussion.—Since Thore's (1949) monograph of the pelagic octopods of the DANA, the genera *Japetella* and *Eledonella* are now easily distinguished. *Japetella* has larger eyes (consequently a larger HWI) and crowded arm suckers, not well-spaced as in *Eledonella.*

Distribution.—In 1949, Thore examined the morphology and distribution of *J. diaphana* and concluded that it was a worldwide species bounded by the 200 m 10°C isotherm. He also reported ontogenetic descent in this species; the juveniles (25 mm) were found between 100-300 m while the adults were concentrated between 1750-2500 m. The two GERDA specimens were captured between 777-1022 m, corresponding to a water temperature of 5-9°C.

Family OCTOPODIDAE Orbigny, 1845
Subfamily OCTOPODINAE Grimpe, 1921

Octopus vulgaris Cuvier, 1797

Octopus vulgaris Cuvier, 1797: 380.—Simpson, 1887: 49 (off Long Key).—Robson, 1929: 58 (off Dry Tortugas, monographic treatment).—Adam, 1937: 71 (off east coast of Florida).—Pickford, 1945: 708 (off Lake Worth, Sand Key, Dry Tortugas).—Voss, 1956a: 280 (off Miami Beach, Teatable Key, and others).
Octopus rugosus, Simpson, 1887: 49 (off Florida Keys).—Robson, 1931: 368, specimen #1 (off Dry Tortugas).

Material examined.—1 female, ML 64.0 mm, G-602.—1 female, ML 50.0 mm, G-566.—1 female, ML 40 mm, G-834.—1 female, ML 38.0 mm, G-765.—1 female, ML 32.0 mm, G-769.—1 male, ML 29.0 mm, G-833.—1 juvenile female, ML 11.5 mm, G-584.—3 juveniles, ML 9.3-8.0 mm, G-1033.

Type-locality.—Mediterranean Sea?

Discussion.—*O. vulgaris* is a moderate to large species with small eggs (< 3.0 mm), a LLI ≤ 2.5, and symmetrical arms without a marked enlargement of arms II and III (Voss, 1956). It is similar to *O. briareus*; however, males can be distinguished by a smaller LLI, penial diverticle, and arms III and IV; a larger calamus; and the absence of transverse grooves on the ligula. Female *O. vulgaris* have: 1) a smaller AWI (13-*22*-28) compared to 21-*31*-37 of *O. briareus*; 2) a smaller SIn (9-*11*-18) compared to 14-*17*-20; 3) a smaller OGI (5-9) compared to 12-14; and 4) smaller eggs (≤ 3 mm) compared to 12-14 mm. Descriptions of this species can be found in Pickford (1945) and Voss (1956).

Distribution.—*O. vulgaris* ranges from the coastal waters of the English Channel to the Cape of Good Hope in the Eastern Atlantic (Rees, 1950) and from New York to Brazil in the Western Atlantic (Voss, 1956). It is common in the Mediterranean and Red Seas and has been reported in t

Indian Ocean and off Japan (Sasaki, 1929). The GERDA material provided eight records in Continental waters from the Dry Tortugas to off Miami. It was captured in five out of 59 (8.5%) otter trawls made in the Northern Straits in 0-200 m.

According to Robson (1929: 60), *O. vulgaris* is "strictly a littoral form" with very few records deeper than 180 m. Voss (1968) indicated that it is found on sand and mud bottoms as were the present specimens which were from depths of 33-99-149 m.

Octopus hummelincki Adam, 1936

Octopus hummelincki Adam, 1936: 1.—Voss, 1949: 3 (off French Reef, Key Largo); 1953: 73 (off Long Reef); 1956a: 279 (off Molasses Reef).—Burgess, 1966: 762 (off Florida Keys and various localities in Bahamas adjacent to the Straits).

Material examined.—1 female, ML 38.0 mm, G-1052.

Type-locality.—Bonaire; 1-1.5 m.

Discussion.—Burgess (1966) reviewed the literature and undertook a morphometric analysis of *hummelincki*, discussing its affinity with other ocellated species in the Atlantic and Pacific.

Distribution.—This species is widely distributed in the warm waters of the Western Atlantic and Caribbean occurring from Bahia, Brazil to the south, the Bahamas to the north and Grand Cayman Island to the west (Burgess, 1966: 807, distributional map). It is known from the Greater Antilles and Voss (1949, 1953, 1956a) has reported it from the Straits of Florida. The single GERDA specimen came from the Great Bahama Bank near Northeast Providence Channel.

Burgess stated that this species is rarely caught by conventional methods but is usually obtained by using full-strength fish poison. Its habitat is usually a coral reef overgrown with *Sargassum* and *Dictyota* in shallow waters (1-17 m). The GERDA specimen was captured floating on the surface after poisoning in three meters of water.

Octopus joubini Robson, 1929

Octopus joubini Robson, 1929: 50, 161.—Voss, 1956: 160 (off Florida Keys); 1956a: 279 (Biscayne Bay, off Soldier Key).
Octopus mercatoris Adam, 1937: 76 (off Dry Tortugas).
Paroctopus joubini, Pickford, 1945: 757 (off Palmetto Key).

Material examined.—1 male, ML 13.0 mm, G-1033.

Type-locality.—St. Thomas, British West Indies; 15 m.

Discussion.—This species can be distinguished from the other shallow-water *Octopus* in the Western Atlantic by the following characters. It is small with large eggs, 5-7 gill filaments/demibranch, a LLI of 4-7, prominent eyes, enlarged suckers on the arms of the male and short, sub-equal, symmetrical arms (Voss, 1968).

Remarks.—*O. joubini* becomes sexually mature at a small size. Robson's (1929) holotype was a 16 mm ML gravid female. Adam's (1937) *mercatoris* was a male of 17 mm ML with spermatophores. The GERDA specimen, with a ML of 13 mm, possesses spermatophores and hectocotylus.

Enlarged suckers were not reported on a male of ML 13 mm (Pickford, 1945) but were found consistently in larger specimens in an irregular arrangement. The GERDA specimen had sucker indices of: SIn = 11.5 and SIe = 19.2. The eighth sucker was enlarged on both first arms and the second right arm. The eighth and ninth suckers were enlarged on the remaining five arms.

Distribution.—*O. joubini* inhabits shallow, inshore waters on sand and mud bottoms. It has been reported from St. Thomas, the eastern Gulf of Mexico, off the Islas de San Bernardo, Colombia, and the Florida Keys. Only one specimen was captured off Sombrero Key by the GERDA on a sand-shell substrate at 42 m.

Danoctopus schmidti Joubin, 1933
Figures 6A, B

Danoctopus schmidti Joubin, 1933: 4.

Material examined.—1 male, ML 38.0 mm, G-388.

Type-locality.—25°50'N, 76°55'W; 1200 m.

Discussion.—This rare octopus has been reported only twice before; once by Joubin (1933) and again by Voss (1956). Both of these specimens had mantle lengths of 20 mm and were considered to be immature. The GERDA specimen is twice as large and has a well-formed hectocotylus. It agrees well with both previous descriptions with the exception of the form of the funnel and the funnel organ. The funnels of the two smaller specimens had their edges rolled inward with a round, button-like orifice and their funnel organs were described as two widely spaced V's. The GERDA specimen did not have a "button-like orifice" and its funnel organ was composed of two V's, but closely adjacent. These differences may be due to the greater size and maturity of the GERDA specimen.

The radula of this species was not examined by either Joubin (1933) or Voss (1956). The GERDA specimen has a radula with a B 5-6 seriation (Fig. 6A). The ligula is blunt and spade-shaped, occupying 7.8% of the hectocotylized third right arm with a CLI of 27 (Fig. 6B).

Distribution.—The two specimens reported in the literature were captured off Abaco, Bahamas (25°50'N, 76°55'W) at 1200 m, and off the Dry Tortugas in 517 m. The GERDA specimen was captured in the Northern Straits near the Little Bahama Bank at 320 m.

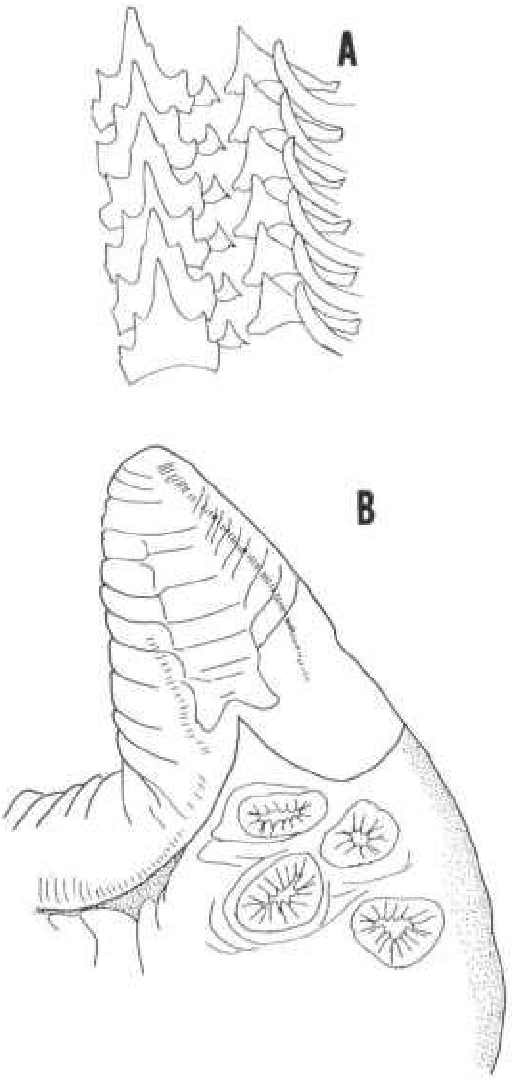

Figure 6. *Danoctopus schmidti*, G-388, ML 38 mm: A, Radula; B, Ligula.

Scaeurgus unicirrhus (d'Orbigny, 1840)

Octopus unicirrhus d'Orbigny, 1840: 70.
Polypus scorpio Berry, 1920: 295 (off Key Biscayne).
Scaeurgus unicirrhus, Voss, 1951: 65 (off Sombrero Light and Palm Beach); 1954: 477 (Lower Florida Keys); 1955: 111 (off Matanzas, Cuba); 1956a: 280 (off Palm Beach to Key West).

Material examined.—1 gravid female, ML 56.0 mm, G-432.—1 gravid female, ML 50.0 mm, G-456.—1 male, ML 45.0 mm, G-462.—1 male, ML 42.0 mm, G-1319.—1 male, ML 26.0 mm, G-624.—1 female, ML 22.0 mm, G-280.

Type-locality.—Not traced.

Discussion.—*Scaeurgus* can be distinguished from all other genera in the subfamily Octopodinae by a combination of the following characters: third left arm hectocotylized, large ligula and calamus and long penial diverticulum (Robson, 1931). It can be differentiated from the closely related *Pteroctopus*, another sinistrally hectocotylized genus, on the basis of a comparison of their funnel organ, hectocotylus and penial diverticulum (Robson, 1931: 197; Jatta, 1896: pl. 25).

Remarks.—The ovary and egg mass of the 50.0 mm gravid female comprised at least half of the visceral mass. The eggs were small (1.0-1.5 mm), oblong, randomly oriented, and densely packed, having the appearance of rice grains.

Distribution.—*S. unicirrhus* is a littoral octopod with a worldwide distribution in the Mediterranean Sea, North Atlantic, Pacific and Indian Oceans. It was first reported in the Western Atlantic in the lower Florida Keys (Voss, 1951). It is now known from off Brazil (Voss, 1964a), Matanzas, Cuba, Palm Beach and as far north as Georgia (Kraeuter and Thomas, 1975). The GERDA distributional records include the Continental waters in all three regions of the Straits and one record in Northern Yucatan waters (off Bimini).

Voss (1955) described *S. unicirrhus* as a benthic species from moderate depths and (1956a) listed depths of capture ranging from 73-366 m. The GERDA specimens ranged from 119-*168*-255 m. It has been recorded from sand and mud bottoms (Jatta, 1896; Voss, 1951); this is confirmed by the previous data.

Macrotritopus stage

Material examined.—1 juvenile, ML 10.0 mm, G-92.—1 juvenile, ML 3.8 mm, G-741.

Discussion.—In 1954, Rees reanalyzed most of the type-material of the nominal *Macrotritopus* species and subsequently synonymized them all. The two GERDA specimens clearly fall into this category.

Rees considered four possible adults for *Macrotritopus*: *O. vulgaris*, *O. macropus*, *Scaeurgus unicirrhus* and *Pteroctopus tetracirrhus*, all of which have planktonic larvae. He eliminated *O. vulgaris* and *macropus* as their larval stages were already known. *Scaeurgus* and *Pteroctopus* were considered because Rees (1954: 78) observed an "egg-shaped structure with a finely pointed tip" on the third left arm of Degner's (1925) largest specimen (VML = 6.0 mm). Both genera have a symmetrical seriation of the rachidian, as does *Macrotritopus* (A3-4), but the radula of *Pteroctopus* differs from that of *Macrotritopus* with regard to the first and second laterals. Also, at that time *Pteroctopus* was not known from the Western Atlantic. Rees therefore logically chose *Scaeurgus unicirrhus* as the adult of all Atlantic *Macrotritopus*.

Later in the same year Voss (1954) reported the first *Pteroctopus* from the Western Atlantic and in 1964 reported the first record of *O. defilippi* from the Western Atlantic. *O. defilippi* has a pelagic larva, an unknown ontogeny and an A3-4 seriation. The second and third laterals fit the description of *Macrotritopus*, the first lateral to a lesser extent. *O. defilippi* has 9-11 gill filaments and an adult arm order of 3.4.2.1. *Macrotritopus* has 9-12 gill filaments and common arm orders of 3.2.4.1, 3.4.2.1 and 3.2.1.4. Except for a dubious report of the left ventral hectocotylization, *O. defilippi* would have equal claim to the *Macrotritopus* larva. Juvenile records of *Scaeurgus* and *O. defilippi* should clarify the "*Macrotritopus* problem."

Distribution.—*Macrotritopus* stages have been recorded from the Mediterranean, off West Africa, the Canary Islands, off Guiana, western Cuba, Biscayne Bay and Nova Scotia; the last location is probably the result of expatriation. Rees (1954) stated that the larvae are usually found in the upper 200 m. The GERDA material adds two more records to the Straits, both in Northern Transitional waters captured at depths of 157 and 23 m.

Pteroctopus tetracirrhus (Delle Chiaje, 1830)

Octopus tetracirrhus Delle Chiaje, 1830: pl. 72.
Pteroctopus tetracirrhus, Voss, 1955: 111 (Bahia de Cardenas); 1956: 166 (Western Yucatan waters of Straits); 1956a: 280 (off Palm Beach).

Material examined.—1 male, ML 36.5 mm, G-464.

Type-locality.—Mediterranean Sea (Naples?).

Discussion.—The single GERDA specimen can be placed in *Pteroctopus* and eliminated from the closely related *Scaeurgus* by the following characteristics: 1) the hectocotylus is short and lacks inrolled sides, 2) it lacks the mantle ridge characteristic of *Scaeurgus*, 3) it has an open, short (CLI = 28%) calamus, 4) it has eight lamellae on each demibranch, not 13-14 as in *Scaeurgus*, 5) the first lateral tooth of the radula has a wider base (Jatta, 1896: pl. 25; Adam, 1952: fig. 55), and 6) it lacks the long penial diverticulum of *Scaeurgus*. This specimen differs from typical *Pteroctopus* in three notable characters. First, the LLI is 7.2 which is above the range given by Robson (1929) of 3-4. However, Voss (1956) and Adam (1952) record LLI's of 6.2 and 6.7 which are very close to that of the GERDA specimen. Second, the SIn of the GERDA specimen is about 12, whereas Robson described the arm suckers as very small (SIn = 5-5.8) and deeply embedded in swollen skin. Again, Voss (1956: 167) noted that the suckers were "not as deeply set into the arms as suggested by Robson." Third, *P. tetracirrhus*, as its name implies, possesses two distinct pairs of ocular cirri. The GERDA specimen has only one indistinct cirrhus over each eye.

The GERDA specimen differs from Robson's Mediterranean material and even Voss's description from the Gulf of Mexico material. Voss (1956: 167) implied that closer examination of specimens from both sides of the Atlantic may reveal subspecific differences, which might be the case for the GERDA specimen.

Remarks.—The strong connection between the fauna of the Mediterranean Sea and the Gulf-Caribbean region is well-exemplified by the three species: *Scaeurgus unicirrhus*, *Pteroctopus tetracirrhus*, and *Octopus defilippi*. For a long time these three species were known only from the Mediterranean, but are now known to be common in the Western Atlantic. Their long-lived pelagic larvae are probably carried by the North Equatorial Current into the Caribbean, and thence into the Gulf of Mexico and Straits of Florida.

Distribution.—*P. tetracirrhus* is known from the Cape Verde Islands, West Africa (Adam, 1952), the Gulf of Mexico (Voss, 1954) and the Straits of Florida from the Dry Tortugas to Palm Beach. The single GERDA record is from Western Continental waters.

P. tetracirrhus has been captured from 26 m (Voss, 1956) to 677-1097 m (Voss, 1955) on mud and shell bottoms. The GERDA specimen was captured between 357-370 m on a fine mud bottom.

Subfamily BATHYPOLYPODINAE Robson, 1929

Bathypolypus arcticus (Prosch, 1849)

Octopus arcticus Prosch, 1849: 59.
Bathypolypus arcticus, Boone, 1939: 360 (off Fowey Rock).—Voss, 1956a: 280 (off Delray Beach).

Material examined.—7 females, ML 40.0-25.0 mm, 5 males, ML 39.0-29.0 mm, G-655.—2 males, ML 39.0-28.0 mm, G-175.—2 females, ML 38.5-24.5 mm, 2 males, ML 30.0-27.0 mm, G-654.—7 females, ML 37.0-21.0 mm, 2 males, ML 33.0-31.0 mm, G-29.—3 males, ML 36.5-32.0 mm, G-857.—12 females, ML 36.0-21.5 mm, 16 males, ML 35.0-22.5 mm, G-997.—4 females, ML 36.0-26.0 mm, 8 males, ML 35.0-23.0 mm, G-855.—10 males, ML 35.0-20.0 mm, 7 females, ML 30.0-16.0 mm, G-998.—5 females, ML 35.0-12.0 mm, 2 males, ML 28.0-27.5 mm, G-66.—1 male, ML 35.0 mm, G-77.—1 male, ML 34.0 mm, G-15.—1 male, ML 34.0 mm, G-197.—4 males, ML 33.0-23.0 mm, 1 female, ML 27.0 mm, 1 juvenile, ML 20.5 mm, G-658.—1 male, ML 32.0 mm, G-61.—1 male, ML 32.0 mm, 2 females, ML 21.0-20.0 mm, G-266.—1 female, ML 31.0 mm, G-256.—3 males, ML 31.0-14.5 mm, 1 female, ML 22.0 mm, 1 juvenile, ML 9.0 mm, G-845.—4 males, ML 30.5-

22.0 mm, G-76.—1 female, ML 26.0 mm, G-146.—1 female, ML 25.0 mm, G-179.—1 male, ML 25.0 mm, G-853.—1 female, ML 25.0 mm, G-4.—1 male, ML 24.0 mm, 1 female, ML 20.0 mm, G-659.—1 male, ML 20.5 mm, G-652.—1 male, ML 20.0 mm, 1 juvenile, ML 13.0 mm, G-650.—2 females, ML 19.0 mm, G-161.—1 juvenile, ML 8.5 mm, G-228.

Type-locality.—Off Greenland.

Discussion.—*Bathypolypus* can be distinguished from the other genera in the family Octopodidae by a combination of: biserial suckers, lack of an ink sac and lack of ectocones on the rachidian of the radula. Before 1958 there were eight nominal species of *Bathypolypus*. Kumpf (1958) synonymized most of the Atlantic species: *B. bairdii*, *lentus*, *obesus* and *faeroensis* as *B. arcticus*. *B. salebrosus* (Sasaki, 1920) is known from only two specimens from Japan and *B. valdiviae* (Thiele, 1915) is common only to South Africa. Both the latter species and *B. sponsalis* (P. & H. Fischer, 1892), can be distinguished from *arcticus* by their larger eyes, fewer gill filaments and differently shaped funnel organs. Kumpf (1958) could find no geographic subspeciation of *B. arcticus* north and south of an arbitrary boundary at 39°N. Muus (1962) named a new species, *B. proschi*, from specimens off Greenland which may prove identical to *arcticus*.

Distribution.—*B. arcticus* is common on continental shelves and upper slopes of the North Atlantic. It extends from Ireland to Iceland, both coasts of Greenland and along the east coast of America to Fowey Rock (Kumpf, 1958: 118, distributional map). It has previously been reported from the Straits off Delray and Fowey Rock, and was found to be the most common cephalopod taken by the GERDA: 133 specimens from 27 stations. The male taken at G-146 (24°45′N, 80°09′W) is the southernmost record for this species. It is common in Northern Continental waters, and extends across the channel in the upper Straits to a depth of 550 m. Only two records were noted from the Cay Sal region and none from the Western.

Kumpf (1958) reported that it ranged from 20-1540 m with an average depth of capture of about 340 m. The depth range of the GERDA stations is 190-*345*-674 m. Of the 99 otter trawl tows made by the GERDA in the Northern Region between 200-400 m, 19 produced *B. arcticus*. It is also interesting to note that the deepest GERDA record (G-146; 674 m) was also the southernmost. Substrate data implied a predominantly muddy bottom with several indications of sand.

Tetracheledone spinicirrus Voss, 1955

Tetracheledone spinicirrus Voss, 1955: 107 (off Matanzas, Cuba); 1956a: 157 (Western Continental waters).

Material examined.—1 gravid female, ML 72.0 mm, G-1016.—1 female, ML 61.0 mm, G-15.—1 female, ML 49.0 mm, 3 males, ML 42.0-33.0 mm, G-29.—1 male, ML 33.0 mm, G-716.

Type-locality.—Off Matanzas, Cuba; 261-347 m.

Discussion.—*Tetracheledone* is diagnosed by the following features: uniserial suckers, stellate warts on the mantle, two cirri over each eye, a well-developed ink sac and a four-parted funnel organ (Voss, 1953). It is probably the most easily recognized octopod in the Straits.

Distribution.—The distribution of *T. spinicirrus*, based on past records, includes the northern and southern coasts of Cuba, the eastern Gulf of Mexico and off Jacksonville, Florida (Voss, 1956). Specimens in the RSMAS museum (R/V COMBAT, SILVER BAY, OREGON) represent an additional 18 locations: 11 off Jacksonville, Florida, 4 in the western approach to the Straits, 2 off Georgia and 1 off North Carolina (34°N, 75°W), the northernmost record. GERDA specimens were from Northern Continental and Yucatan waters and Santaren Channel.

Voss (1956) reported depths of capture from 192-540 m. The 18 additional RSMAS captures ranged from 274-411 m. The four GERDA locations ranged from 183 to 544 m.

Family ARGONAUTIDAE Naef, 1912

Argonauta argo Linnaeus, 1758

Argonauta argo Linnaeus, 1758: 708.—Anonymous, 1893: 47 (off Palm Beach); 1894: 83 (Palm Beach).—Smith, 1945: 149 (off Florida east coast).—Voss, 1954: 477 (off Miami in Gulf Stream); 1956a: 281 (off Palm Beach to Bear Cut).

Material examined.—1 gravid female, ML 109.5 mm, G-40.—1 gravid female, ML 99.0 mm, G-75.—1 juvenile female, ML 6.0 mm, G-203.—1 juvenile female, ML 4.6 mm, 2 juvenile males, ML 4.4-3.1 mm, G-106.

Type-locality.—"Pelago, M. Indico, Mediterraneo."

Discussion.—Adult female *A. argo* can be distinguished from *A. hians*, the other argonautid found in the Straits, by the following features: ventral arms shorter than the laterals, a wider keel of about 24% of the aperture and 10 gill filaments (Robson, 1931). The males of *A. argo*, which show extreme sexual dimorphism, attain a length of 15 mm according to Naef (1923), 35 mm according to Voss (1956).

Juvenile female argonautids can be recognized by the thickening and membranous expansion of the first arms which eventually secrete the shell. Juvenile males can be diagnosed by their autonomous hectocotylus on the third left arm, which at this stage is contained in a sac between the second and fourth arms.

Distribution.—*A. argo* is cosmopolitan in warm and temperate seas (Robson, 1931); there have been numerous reports of both live specimens and shells of *A. argo* in the Straits. The first report of a live specimen was of a 15 cm specimen stranded at Palm Beach (anonymous, 1893). The GERDA took gravid females in Northern Transitional waters and juveniles from Continental Western and Northern waters. The two gravid females were dip-netted at the surface and the juveniles were captured at depths of 97-104 m and 518 m, the latter record probably the result of contamination.

ZOOGEOGRAPHY

A discussion of the geographic distribution of the cephalopods of the Straits of Florida is premature as any cephalopod zoogeographic analysis would be at this time. Systematic collecting is absent in too many areas to adequately define boundaries for species. Even with the extensive collecting of the GERDA, over 1300 stations in the Straits, the mid-water zone of the Cay Sal Region was poorly sampled and much of the littoral border of the Straits has been neglected. Nevertheless, it is possible to show certain components of Straits fauna, keeping in mind that further collecting will require some modification.

The 64 cephalopod species reported from the Straits of Florida can be divided into six faunal components: Circumtropical, Tropical Western Atlantic, Temperate Western Atlantic, Amphi-Atlantic, Amphi-Atlantic plus Indian Ocean, and North Atlantic. The largest component is the Circumtropical, amounting to 34% of the total, or 22 species.

List of Circumtropical Cephalopoda

Spirula spirula
Onychoteuthis banksii
Pyroteuthis margaritifera
Pterygioteuthis gemmata
Pterygioteuthis giardi
Lycoteuthis diadema
Thelidioteuthis alessandrini
Ctenopteryx sicula
Histioteuthis dofleini
Bathothauma lyromma
Cranchia scabra
Helicocranchia pfefferi
Liocranchia reinhardti
Grimalditeuthis bomplandii
Octopus macropus
Octopus vulgaris
Scaeurgus unicirrhus
Japetella diaphana
Tremoctopus violaceus
Argonauta argo
Argonauta hians
Vampyroteuthis infernalis

The second largest component is the Tropical Western Atlantic, bounded to the south by Rio de Janeiro and including the lower Gulf of Mexico, Caribbean, Bahamas, Straits and Bermuda. The Straits lies fully within the tropical region, although it is bordered by a warm temperate area directly to the north. Therefore the Straits possesses a strong element of a tropical fauna (28%)

but also a considerable mixture of a temperate fauna (9.5%). The Tropical Western Atlantic component represents 28% of the total, of 18 species:

List of Tropical Western Atlantic Cephalopoda

***Abralia grimpei*
Pickfordiateuthis pulchella
Nectoteuthis pourtalesi
Semirossia equalis
Rossia antillensis
Rossia bullisi
Rossia tortugaensis
Loligo A
Doryteuthis plei
Septoteuthis sepioidea
Selenoteuthis scintillans
Abralia redfieldi
Egea inermis
Octopus briareus
Octopus hummelincki
Octopus joubini
Danoctopus schmidti
Tetracheledone spinicirrus

The Amphi-Atlantic component is represented by nine species, or 14% of the total.

List of Amphi-Atlantic Cephalopoda

†*Abralia veranyi*
Abraliopsis sp.
Enoploteuthis anapsis
Enoploteuthis leptura
Illex coindetii
Ommastrephes pteropus
Mastigoteuthis grimaldii
Octopus burryi
Pteroctopus tetracirrhus

The fourth faunal component is the Temperate Western Atlantic containing species more abundant in the temperate coastal waters of the eastern United States but also commonly found in the Straits and Gulf of Mexico. This component is represented by six species, or 9.5 % of the total.

List of Temperate Western Atlantic Cephalopoda

Loligo pealei
Lolliguncula brevis
Stoloteuthis leucoptera
Semirossia tenera
Illex oxygonius
Octopoteuthis megaptera

* Known only from the Straits at this time.
† Also known from the Mediterranean Sea.

Three species represent an Amphi-Atlantic plus Indian Ocean component: *Histioteuthis corona corona*, *Abraliopsis pfefferi* and *Octopus defilippi*. If these are added to the other Amphi-Atlantic species, a considerable Amphi-Atlantic faunistic component results (18.5%).

Finally, one species, *Bathypolypus arcticus*, is relegated to a North Atlantic component since it is found on continental shelves and slopes from Ireland to the Cay Sal Region, including Spitzenberg, Greenland and the northeast coast of America.

Five of the 64 species were not placed in zoogeographic categories due to uncertain identifications of the confused state of their taxonomy: *Architeuthis princeps*, *Onykia carriboea*, *Leachia* sp., *Galiteuthis armata*, and *Corynoma speculator*.

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Literature Cited

Adam, W. 1936. Notes sur les Céphalopodes. VI.—Une nouvelle espèce d'Octopus (*Octopus hummelincki* sp. nov.) des Indes Occidentales Néerlandaises. Bull. Mus. r. Hist. nat. Belg. 12: 1-30.

———. 1937. Résults scientifiques des croisières du navire-école Belge "Mercator." IV. Cepha-

lopoda. Mém. Mus. r. Hist. nat. Belg. 9: 43-82.
———. 1952. Résultats scientifiques des expéditions océanographiques belges dan les eaux côtières africaines de l'Atlantique Sud. (1948-1949). Céphalopodes. Résult. scient. Expéd. océanogr. Belg. (1948-1949) 3: 1-142.
———. 1960. Les céphalopodes de l'Institute Francais d'Afrique Noire. Bull. Inst. fr. Afr. noire, Sér. A. 22: 465-511.
Allan, J. 1940. A rare stalk-eyed squid (*Bathothauma lyromma* Chun) new to Australian waters. Rec. Aust. Mus. 20: 320-324.
Anonymous. 1893. *Argonauta* found alive. Nautilus 7: 47.
Anonymous. 1894. *Argonauta argo* on the East Florida coast. Nautilus 8: 83.
Berry, S. S. 1912. The cephalopoda of the Hawaiian Islands. Bull. Bur. Fish. Wash. 32: 255-362.
———. 1920. Preliminary diagnoses of new cephalopods from Western Atlantic. Proc. U.S. natn. Mus. 58: 293-300.
Blainville, M. H. de. 1823. Memoire sur les especes du genre calmar (*Loligo* Lamarck). J. Physiol. Paris 96: 116-135.
Bogle, M. A. 1975. A preliminary revision of the tropical Western Atlantic Aglaopheniinae (Coelenterate, Hydroida). M.S. Thesis, Univ. of Miami.
Boletzky, S. von. 1970. On the presence of light organs in *Semirossia* Steenstrup, 1887 (Mollusca: Cephalopoda) Bull. mar. Sci. 20: 374-388.
———. 1971. *Neorossia* N. G. pro *Rossia (Allorossia) caroli* Joubin, 1902, with remarks on the generic status of *Semirossia* Steenstrup, 1887 (Mollusca: Cephalopoda). Bull. mar. Sci. 21: 964-969.
Boone, L. 1939. Scientific results of the world cruises of the yachts "Eagle" and "Ara," 1928-1929, and "Alva" 1931-1932, "Alva" Mediterranean cruise, 1933, and "Alva" South American cruise, 1935. VI. Mollusca. Bull. Vanderbilt mar. Mus. 7: 285-361.
Bouxin, J., and R. Legendre. 1936. La Fauna pelagique de l'Atlantique recueillie dans des estomacs de germons au large du Golfe de Gascogne. Deuxieme Partie: Cephalopodes. Annls. Inst. océanogr., Monaco 16: 1-99.
Briggs, J. C. 1974. Marine Zoogeography. McGraw-Hill Book Co., New York. 475 pp.
Bruun, A. F. 1943. The biology of *Spirula spirula* (L.) Dana Rep. No. 24: 1-44.
———. 1955. New light on the biology of *Spirula*, a mesopelagic cephalopod. Pages 61-72 *in* Essays in the natural sciences in honor of Captain Allan Hancock. Univ. of Calif. Press, Los Angeles.
Burgess, L. A. 1966. A study of the morphology and biology of *Octopus hummelincki* Adam, 1936 (Mollusca: Cephalopoda). Bull. mar. Sci. 16: 762-813.
Calkins, W. W. 1878. Catalogue of the marine shells of Florida, with notes and descriptions of several new species. Proc. Davenport Acad. Sci. 2: 232-252.
Castellanos, Z. J. A. 1960. Una neuva especie de calamar Argentino *Ommastrephes argentinus* sp. nov. (Mollusca: Cephalopoda). Neotropica 6: 55-58.
———. 1964. Contribution al conocimiento biologico del calamar Argentino *Illex illecebrosus argentinus*. Bol. Inst. Biol. Mar. Mar del Plata 8: 1-37.
Chun, C. 1900. Die Tiefe des Weltmeeres. Jena: Gustav Fischer. 549 pp.
———. 1906. Systemder Cranchien. Zool. Anz. 31: 82-86.
———. 1908. Ueber Cephalopoden der Deutschen Tiefsee-Expedition. Zool. Anz. 33: 86-89.
———. 1910. Die Cephalopoden. Wiss. Ergebn. dt. Tiefsee-Exped. "Valdivia" 18: 1-552.
———. 1913. Cephalopoda from the "Michael Sars" North Atlantic Deep-Sea Expedition, 1910. Rep. scient. Results Michael Sars N. Atlant. Deep-Sea Exped. 3: 1-21.
Clarke, M. R. 1962. A large member of the squid family Cranchiidae *Phasmatopsis cymoctypus* de Rochebrune, 1884. Proc. malac. Soc. Lond. 35: 27-42.
———. 1966. A review of the systematics and ecology of oceanic squids. Advances in Marine Biology 4: 91-300.
———. 1969. Cephalopods of the SOND cruise. J. mar biol. Ass. U.K. 49: 961-976.
Clausner, E. 1967. Characteristics of the Florida Current. M.S. Thesis, Univ. of Miami. 55 pp.
Cuvier, G. L. C. 1797. Tableau élémentaire de l'histoire naturelle des animaux. Paris, xvi and 710 pp.
Degner, E. 1925. Cephalopoda. Oceanogrl. Rep. "Dana" Exped. 2: 1-94.
Delle Chiaje, S. 1830. Memorie sulla storia e notomia degli animali senza vertebre del regno di Napoli. Vol. 4. Naples.
Devany, T. 1969. Ecological interpretation of distribution of the Lanternfishes (Myctophidae) in the Straits of Florida. Ph.D. Dissertation, Univ. of Miami. 431 pp.
Fields, W. G., and V. A. Gauley. 1972. A report on cephalopods collected by Stanford Oceanographic Expedition 20 to the Eastern Tropical Pacific Ocean Sept.-Nov., 1968. Veliger 15: 113-118.
Fischer, H. 1895. Note préliminaire sur le *Ptergioteuthis giardi*, céphalopode nouveau

recueilli dans le cours de l'Expédition scientifique du Talisman (1883). J. Conch., Paris 43: 205-211.

Fischer, H., and L. Joubin. 1906. Notes sur les céphalopodes captures au cours des expédition du "Travailleur" et du "Talisman." Bull. Mus. Hist. nat., Paris 12: 202-205.

Hoyle, W. E. 1885. Diagnoses of new species of cephalopoda collected during the cruise of the H.M.S. "Challenger" Part 1. The Octopoda. Ann. Mag. nat. Hist., Ser. 5, 15: 222-236.

———. 1886. Report on the Cephalopoda. Rep. scient. Results H. M. S. "Challenger" (1873-76), Zoology 16: 1-245.

———. 1904. Reports on the Cephalopoda. Bull. Mus. comp. Zool. Harv. 43: 1-71.

Jatta, G. 1896. I cefalopodi viventi nel Golfo di Napoli (Sistematica). Fauna Flora Golf. Neapel 23: 1-268.

Joubin, L. 1895. Céphalopodes. Résult. Camp. scient. Prince Albert I 9: 3-63.

———. 1896. Observations sur divers céphalopodes. 1. *Abraliopsis pfefferi* (nov. gen. et sp.). Bull. Soc. scient. méd. Ouest 5: 19-35.

———. 1898. Note sur une nouvelle famille de céphalopodes. Annls. Sci. nat., sér. 8, Zool. 6: 279-292.

———. 1898a. Observations sur divers céphalopodes. 4. *Grimalditeuthis richardi*. Bull. Soc. zool. Fr. 23: 101-113.

———. 1920. Céphalopodes provenant des campagnes de la "Princesse Alice" (1898-1916). Résult. Camp. scient. Prince Albert I 54: 1-95.

———. 1924. Contribution à l'étude des céphalopodes de l'Atlantique Nord. Résult. Camp. scient. Prince Albert I 67: 1-113.

———. 1933. Notes préliminaires sur les céphalopodes des croisières du Dana (1921-1922). Annls. Inst. océanogr. Monaco 13: 1-49.

———. 1937. Les octopodes da la croisière du Dana (1921-1922). Dana Rep. 11: 1-49.

Kraeuter, J. N., and R. F. Thomas. 1975. Cephalopod mollusks from the waters off Georgia, U.S.A. Bull. mar. Sci. 25: 301-303.

Kumpf, H. E. 1958. A study of the *Bathypolypus arcticus-bairdii-lentus-obesus* complex of the North Atlantic. M.S. Thesis, Univ. of Miami. 135 pp.

LaRoe, E. T. 1967. A contribution to the biology of the Loliginidae (Cephalopoda: Myopsida) of the tropical Western Atlantic. M.S. Thesis, Univ. of Miami. 220 pp.

Leach, W. E. 1817. Synopsis of the orders, families and genera of the class Cephalopoda. *In*: "Zoological Miscellany" 3: 137-141. London.

Lesueur, C. A. 1821. Descriptions of several new species of cuttlefish. J. Acad. nat. Sci. Philad. 2: 86-101.

Linnaeus, C. 1758. Systema naturae. 10th edition, vol. I.

McGinty, T. L. 1955. *Spirula spirula* Linne, a remarkable find. Nautilus 69: 35.

Malloy, R. J., and R. J. Hurley. 1970. Geomorphology and geologic structure: Straits of Florida. Bull. geol. Soc. Am. 81: 1947-1972.

Mangold-Wirz, K. 1963. Contribution a l'etude de *Rossia carolina* Joubin. Vie Milieu 14: 205-224.

———. 1963a. Dimensions et croissance relatives de quelques ommastrephides Mediterraneens. Rapp. P.-v. Reun. comm. int. Explor. scient. Mer Mediterr. 17: 387.

Massy, A. L. 1907. Preliminary notice of new and remarkable cephalopods from the south-west coast of Ireland. Ann. Mag. nat. Hist. Ser. 7, 20: 377-384.

———. 1925. On the Cephalopoda of the Natal museum. Ann. Natal Mus. 5: 201-229.

Messing, C. G. 1975. The systematics of the Crinoidea Comatulida (exclusive of the Macrophraetina) collected by the R/V GERDA in the Straits of Florida and adjacent waters. M.S. Thesis, Univ. of Miami. 285 pp.

Montgomery, R. B. 1938. Fluctuations in monthly sea level on Eastern U.S. coast as related to dynamics of western North Atlantic Ocean. Jour. Mar. Res. 1: 165-185.

Muus, B. J. 1962. Cephalopoda. Meddr. Gronland 81: 4-21.

Naef, A. 1923. Die Cephalopoden. Fauna flora Golf. Naepel, Monograph 35: 1-863.

Okutani, T., and J. A. McGowan. 1969. Systematics, distribution, and abundance of the epiplanktonic squid (Cephalopoda, Decapoda) larvae of the California Current April, 1954-March, 1957. Bull. Scripps Instn. Oceanogr. 14: 1-90.

Orbigny, A. d'. 1839. *In*: Mm. de Férussac and A. d'Orbigny 1835-1848. Histoire naturelle générale et particulière des céphalopodes acétabuliferes, vivants et fossiles. Paris. 361 pp.

Pfeffer, G. 1900. Synopsis der oegopsiden Cephalopoden. Mitt. naturh. Mus. Hamb. 17: 147-198.

———. 1912. Die Cephalopoden der plankton-expedition. Zugleich eine monographische ubersicht der oegopsiden Cephalopoden. Ergebn. der Plankton-Exped. Humboldt-Stiftung 2: 1-815.

Pickford, G. E. 1945. Le poulpe Américain: a study of the littoral Octopoda of the Western Atlantic. Trans. Conn. Acad. Arts Sci. 36: 701-811.

———. 1946. *Vampyroteuthis infernalis* Chun, an archaic dibranchiate cephalopod. I. Natural history and distribution. Dana Rep. 29: 1-40.

———. 1952. The Vampyromorpha of the Discovery expeditions. "Discovery" Rep. 26: 197-210.

Prosch, V. 1849. Nogle nye Cephalopoder. K. danske Vidensk. Selsk. Skr. Ser. 2, 1: 53-72.

Rancurel, P. 1970. Les contenus stomacaux d'*Alepisaurus ferox* dans le Sud-Ouest Pacifique (Cephalopodes). Cah. ORSTOM, Ser. Oceanogr. 8: 3-87.

———. 1971. *Mastigoteuthis grimaldii* (Joubin, 1895) Chiroteuthidae pue connu de l'Atlantique tropical (Cephalopoda: Oegopsida). Cah. ORSTOM, Ser. Océanogr. 9: 125-145.

Rees, W. J. 1950. The distribution of *Octopus vulgaris* Lamarck in British waters. J. mar. biol. Ass. U.K. 29: 361-378.

———. 1954. The *Macrotritopus* problem. Bull. Br. Mus. nat. Hist., Zool. 2: 69-99.

Robson, G. C. 1924. On the Cephalopoda obtained in South African waters by Dr. J. D. F. Gilchrist in 1920-1921. Proc. zool. Soc. Lond. 589-686.

———. 1929. A monograph of the recent Cephalopoda. Part I. Octopodinae. British Museum. 236 pp.

———. 1931. A monograph of the recent Cephalopoda. Part II. The Octopoda (excluding the Octopodinae). British Museum. 359 pp.

Roper, C. F. E. 1964. *Enoploteuthis anapsis*, a new species of enoploteuthid squid (Cephalopoda: Oegopsida) from the Atlantic Ocean. Bull. mar. Sci. Gulf & Carib. 14: 140-148.

———. 1966. A study of the genus *Enoploteuthis* (Cephalopoda: Oegopsida) in the Atlantic Ocean with a redescription of the type species, *E. leptura* (Leach, 1817). Dana Rep. 66: 1-46.

———, R. J. Gibbs, and W. Aron. 1970. Ocean Acre: An interim report. Report to the U.S. Navy Underwater Sound Lab, Contr. #N00140-69-C-1066. 32 pp.

———, C. C. Lu, and K. Mangold. 1969. A new species of *Illex* from the Western Atlantic and distributional aspects of other *Illex* species (Cephalopoda: Oegopsida). Proc. biol. Soc. Wash. 82: 295-322.

———, R. E. Young, and G. L. Voss. 1969. An illustrated key to the families of the order Teuthoidea (Cephalopoda). Smithson. Contr. Zool. No. 13: 1-32.

Rüppell, E. 1844. Intorno ad alcuni cefalopodi del mare di Messina. Giornale del Gablnetto di Messina 26: 1-7.

Sasaki, M. 1929. A monograph of the dibranchiate cephalopods of the Japanese and adjacent waters. J. Coll. Agric. Sapporo, Suppl. No. 20: 1-357.

Simpson, C. T. 1887. Contribution to the mollusca of Florida. Proc. Davenport Acad. Sci. 5: 45-72.

Smith, M. 1945. East Coast Marine Shells. Ann Arbor.

Staiger, J. C. 1970. The distribution of the benthic fishes found below two hundred meters in the Straits of Florida. Ph.D. Dissertation, Univ. of Miami. 219 pp.

Steenstrup, J. 1855. On the jaws of a giant cuttlefish (*O. pteropus*). Overs. danske Vidensk. Selsk. Forh., 1855. Pages 199-200 *in* The Cephalopod papers of Japetus Steenstrup. Danish Science Press, Copenhagen.

———. 1856. Hectocotyldannedsen hos Octopodslägterne *Argonauta* og *Tremoctopus* oplyst ved Jagttagelse of ligmende Dannelsen hos Blacksprutternes in Almindelighed. Dansk. Vid. Selsk. Afh. 4: 187-216.

Summers, W. E. 1969. Winter population of *Loligo pealei* in the mid-Atlantic Bight. Biol. Bull. mar. biol. Lab., Woods Hole 137: 202-216.

Sverdrup, H. V., M. W. Johnson, and R. H. Fleming. 1942. The oceans. Prentice-Hall Inc. Englewood Cliffs, N. J. 1087 pp.

Thiele, J. 1921. Die Cephalopoden der Deutsch Sudpolar-Expedition 1901-1903. Dt. Sudpol. Exped. 16 (Zool. Bd. 8): 433-465.

Thore, S. 1949. Investigations on the "Dana" octopods: Part I. Bolitaenidae, Amphitretidae, Vitreledonellidae, and Alloposidae. Dana Rep. 33: 1-85.

Verany, J. B. 1837. Mémoire sur six nouvelles espèces de céphalopodes trouvées dans la Méditerranée à Nice. Mem. Acc. Sci. Torino, Sér. 2, 1: 91-98.

———. 1837a. Mémoire sur deux nouvelles espèces de céphalopodes trouvées dans l'ocean. Mem. Acc. Sci. Torino, Sér. 2, 1: 99-101.

———. 1851. Mollusques Méditerranéens. I. Céphalopodes. 132 pp. Gènes.

Verrill, A. E. 1878. Notice of recent additions to the marine fauna of the eastern coast of North America. Am. J. Sci., Ser. 3, *16* (1, 2): 207-215, 371-378.

———. 1880. Notice of the remarkable marine fauna occupying the outer banks of the southern coast of New England. Am. J. Sci., Ser. 3, 20: 390-403.

———. 1882. Report on the cephalopods of the northeastern coast of America. Rep. U.S. Commnr. Fish. 1879 7: 211-450.

Voss, G. L. 1949. Notes on a specimen of *Octopus hummelincki* Adam from the Florida Keys. Revta Soc. malac. Carlos de la Torre 7: 3-5.

———. 1950. Two new species of cephalopods from the Florida Keys. Revta Soc. malac. Carlos de la Torre 7: 73-79.

———. 1951. The first record of *Scaeurgus unicirrhus* from the Western Atlantic. Bull. mar. Sci. Gulf & Carib. 1: 64-71.

———. 1952. A revision of the Loliginid squids of the Western Atlantic. M.S. Thesis, Univ. of Miami. 83 pp.

———. 1953. Observations on a living species of *Octopus hummelincki* Adam. Nautilus 66: 73-76.

———. 1954. Cephalopoda of the Gulf of Mexico. Fishery Bull. Fish Wild. Serv. U.S. 55: 475-478.

———. 1955. The Cephalopoda obtained by the Harvard-Havana expedition off the coast of Cuba in 1938-39. Bull. mar. Sci. Gulf & Carib. 5: 81-115.

———. 1956. A review of the cephalopods of the Gulf of Mexico. Bull. mar. Sci. Gulf & Carib. 6: 85-178.

———. 1956a. A checklist of the cephalopods of Florida. Q. Jl. Fla. Acad. Sci. 19: 274-282.

———. 1958. The cephalopods collected by the R/V ATLANTIS during the West Indian cruise of 1954. Bull. mar. Sci. Gulf & Carib. 8: 369-389.

———. 1960. Bermudan cephalopods. Fieldiana, Zool. 39: 419-446.

———. 1962. A monograph of the Cephalopoda of the North Atlantic. 1. The family Lycoteuthidae. Bull. mar. Sci. Gulf & Carib. 12: 264-305.

———. 1963. Cephalopods of the Philippine Islands. Bull. U.S. natn. Mus. 234:1-180.

———. 1963a. A new species of cranchiid squid *Phasmatopsis lucifer*, from the Gulf of Mexico. Bull. mar. Sci. Gulf & Carib. 13: 77-83.

———. 1964. *Octopus defilippi*, an addition to the cephalopod fauna of the Western Atlantic. Bull. mar. Sci. Gulf & Carib. 14: 554-560.

———. 1964a. A note on some cephalopods from Brazil with a description of a new species of octopod, *Eledone massyae*. Bull. mar. Sci. Gulf & Carib. 14: 511-516.

———. 1967. The biology and bathymetric distribution of deep sea cephalopods. Studies in in Tropical Oceanography 5: 511-538.

———. 1967a. Some bathypelagic cephalopods from South African waters. Ann. S. Afr. Mus. 50: 61-88.

———. 1968. Octopods from the R/V PILLSBURY Southwestern Caribbean cruise, 1966, with a description of a new species, *Octopus zonatus*. Bull. mar. Sci. 18: 645-659.

Voss, N. A. 1969. A monograph of the Cephalopoda of the North Atlantic. The family Histioteuthidae. Bull. mar. Sci. 19: 713-867.

———. 1974. Studies on the cephalopod family Cranchiidae. A redescription of *Egea inermis* Joubin, 1933. Bull. mar. Sci. 24: 939-956.

———, and G. L. Voss. 1962. Two new species of squid of the genus *Calliteuthis* from the Western Atlantic with a redescription of *Calliteuthis reversa* Verrill. Bull. mar. Sci. Gulf & Carib. 12: 169-200.

Wennekens, M. P. 1959. Water mass properties of the Straits of Florida and related waters. Bull. mar. Sci. Gulf & Carib. 9: 1-52.

Wüst, G. 1924. Florida- und Antillenstrom eine hydrodynamische untersuchung. Veroff. Inst. Meeresk. Univ. Berlin, N.F., Reihe A, 12: 1-48. Translation by W. von Dunser, RSMAS, 1967.

Young, R. E. 1972. The systematics and areal distribution of pelagic cephalopods from the seas off Southern California. Smithson. Contr. Zool. 97: 1-157.

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APPENDIX 1

R/V GERDA STATION DATA

GERDA Sta.	Date	North latitude	West longitude	Depth (meters)	Gear
4	May 4, 1962	25°49′	80°00′	256	OT
4A	May 4	25°49′	80°00′	sfc.	DN
8	May 25	25°43′	80°04′	35.5	IKMT
10	May 25	25°43′	80°00′	78	IKMT
11	May 26	25°41′	79°50′	155–104	IKMT
15	May 30	25°45′	80°00′	270–302	OT
24	June 20	25°33′	79°43′	300–260	IKMT
25	June 20	25°35′	79°46′	104–130	IKMT
26	June 21	25°31′	79°50′	100–52	IKMT
29	June 21	25°41′	80°02′	183–247	OT
37	June 22	25°33′	79°39′	250–209	IKMT
40	June 22	25°20′	79°42′	sfc.	DN
43	July 20	25°39′	80°02′	87–139	IKMT
46	Aug. 21	25°39′	79°58′	87	IKMT
47	Aug. 21	25°39′	79°40′	162	IKMT
54	Aug. 28	25°31′	79°32′	230–200	IKMT
61	Aug. 29	25°14′	80°02′	256	OT
64	Aug. 29	25°20′	80°00′	sfc.	DN
66	Sept. 26	25°25′	79°59′	366	OT
68	Sept. 26	25°37′	79°57′	363–287	IKMT
69	Sept. 26	25°28′	79°41′	78	IKMT
70	Sept. 27	25°23′	79°41′	sfc.	DN
71	Sept. 27	25°33′	79°38′	300	IKMT
72	Sept. 27	25°28′	79°43′	458	IKMT
75	Sept. 27	25°21′	79°41′	sfc.	DN
76	Sept. 28	25°28′	80°00′	344–348	OT
77	Sept. 28	25°29′	79°54′	329–339	OT
80	Dec. 20	25°39′	80°03′	99–90	IKMT
82	Dec. 20	25°32′	80°03′	154	IKMT
83	Dec. 20	25°47′	79°50′	147–133	IKMT
86	Dec. 21	25°39′	79°46′	126–140	IKMT
88	Mar. 8, 1963	25°02′	79°48′	389–338	IKMT
89	Mar. 8	24°57′	79°57′	259–208	IKMT
90	Apr. 18	25°35′	79°45′	389–363	IKMT
92	Apr. 19	25°10′	79°41′	157	IKMT
95	Apr. 19	25°08′	79°44′	sfc.	DN
97	May 9	25°31′	79°51′	208–259	IKMT
99	May 9	25°21′	79°50′	52	IKMT
100	May 9	25°18′	79°50′	24–26	IKMT
101	May 10	25°19′	79°46′	62–78	IKMT
104	May 23	25°37′	80°03′	73–78	IKMT
105	May 23	25°36′	80°00′	61–91	IKMT
106	May 23	25°34′	80°01′	97–104	IKMT
107	May 23	25°32′	80°03′	113–130	IKMT
108	May 23	25°30′	79°56′	113–130	IKMT
110	June 17	24°21′	82°55′	183	OT
115	June 18	24°02′	82°55′	696	IKMT
119	June 19	23°32′	82°26′	1647	Dredge
120	June 19	23°32′	82°21′	0–1620	OT
143	June 22	24°28′	80°12′	805	OT
146	June 23	24°45′	80°09′	659–686	OT
159	June 25	26°36′	79°33′	733	OT

APPENDIX I

R/V GERDA STATION DATA (continued)

GERDA Sta.	Date	North latitude	West longitude	Depth (meters)	Gear
161	June 26	26°37′	79°50′	412–421	OT
175	June 30	27°19′	79°44′	430–421	OT
179	July 1	27°41′	79°11′	549–567	OT
181	July 2	27°57′	78°56′	779	OT
195	Sept. 9	25°45′	79°52′	137	IKMT
196	Sept. 9	25°35′	79°52′	259–342	IKMT
197	Sept. 10	25°30′	79°58′	329	OT
199	Sept. 10	25°47′	79°47′	209–410	IKMT
200	Sept. 10	25°43′	79°42′	104–205	IKMT
201	Sept. 10	25°40′	79°47′	104–205	IKMT
203	Jan. 10, 1964	24°01′	83°28′	518	IKMT
205	Jan. 18	23°20′	82°55′	907–1022	IKMT
206	Jan. 19	23°38′	83°06′	907	IKMT
207	Jan. 19	23°49′	82°52′	259	IKMT
208	Jan. 19	23°39′	82°38′	777–625	IKMT
211	Jan. 20	23°30′	82°31′	348–684	IKMT
212	Jan. 20	23°43′	82°31′	855–863	IKMT
213	Jan. 20	23°35′	82°40′	777	IKMT
215	Jan. 20	23°36′	82°46′	sfc.	DN
222	Jan. 22	24°23′	80°28′	824	OT
225	Jan. 23	24°24′	80°22′	805	OT
228	Jan. 24	25°04′	80°03′	320	OT
256	Feb. 6	27°37′	78°56′	494–467	OT
266	Mar. 29	25°39′	79°58′	338–332	OT
280	Apr. 1	25°37′	80°04′	110–128	OT
284	Apr. 2	24°09′	80°49′	65	IKMT
285	Apr. 2	24°09′	80°51′	400–596	IKMT
286	Apr. 2	24°03′	81°05′	595	IKMT
287	Apr. 2	23°57′	81°16′	595	IKMT
304	May 23	25°26′	79°23′	796	OT
313	May 24	25°37′	79°33′	450	IKMT
314	May 25	25°44′	79°34′	389	IKMT
318	May 25	25°40′	79°43′	sfc.	Hook & Line
321	May 25	25°47′	79°53′	200	IKMT
323	June 25	25°40′	79°51′	256	IKMT
326	June 26	25°41′	79°44′	256	IKMT
327	June 26	25°39′	79°44′	256	IKMT
328	June 26	25°29′	79°49′	256	IKMT
329	June 26	25°51′	79°41′	256	IKMT
331	June 26	25°26′	79°41′	256	IKMT
332	June 26	25°36′	79°44′	256	IKMT
333	June 27	25°31′	79°55′	256	IKMT
337	July 22	26°02′	79°48′	231	IKMT
339	July 23	26°01′	79°31′	375	IKMT
343	July 24	25°52′	79°20′	51	IKMT
344	July 24	26°05′	79°20′	137	IKMT
345	July 24	26°00′	79°28′	51	IKMT
346	July 25	26°01′	79°24′	181	IKMT
350	July 25	25°52′	79°24′	146	IKMT
351	July 25	25°40′	79°32′	45	IKMT
352	Aug. 23	25°36′	79°38′	450–520	IKMT
353	Aug. 23	25°41′	79°26′	450–500	IKMT

APPENDIX 1

R/V GERDA STATION DATA (continued)

GERDA Sta.	Date	North latitude	West longitude	Depth (meters)	Gear
356	Aug. 25	25°31′	79°28′	520–560	IKMT
358	Aug. 25	25°32′	79°31′	520	IKMT
388	Sept. 19	27°18′	79°12′	320	Dredge
413	Sept. 22	26°20′	80°00′	183	OT
414	Sept. 22	26°23′	80°01′	165–152	OT
432	Nov. 28	24°19′	82°29′	188–199	OT
435	Nov. 28	24°17′	82°26′	417–384	OT
452	Jan. 22, 1965	25°02′	80°12′	185	OT
456	Jan. 23	24°38′	80°48′	146–119	OT
462	Jan. 25	24°20′	82°46′	174–201	OT
463	Jan. 25	24°19′	82°43′	80–90	IKMT
464	Jan. 25	24°18′	83°00′	370–357	OT
467	Jan. 25	24°18′	82°56′	370–348	OT
497	Feb. 3	26°41′	79°00′	18	PN
498	Feb. 3	26°37′	78°56′	sfc.	DN
504	Feb. 4	26°30′	78°47′	27	OT
522	Mar. 3	26°05′	78°49′	322–366	OT
529	Mar. 3	26°29′	78°36′	sfc.	DN
530	Mar. 4	26°28′	78°36′	25–30	PN
539	Apr. 2	25°28′	78°06′	sfc.	DN
545	Apr. 2	25°24′	77°42′	104	PN
546	Apr. 2	25°23′	77°50′	sfc.	DN
559	Apr. 11	23°51′	83°04′	?	⅜″ line
566	Apr. 12	24°25′	82°56′	64	OT
570	Apr. 12	24°20′	82°50′	sfc.	DN
584	Apr. 14	24°32′	81°20′	37–33	Dredge
589	Apr. 14	24°40′	80°48′	150	OT
602	Apr. 15	25°05′	80°14′	95	OT
624	June 29	25°49′	79°19′	234–216	OT
646	July 1	25°49′	79°21′	439–531	OT
650	July 16	26°37′	79°45′	476–452	OT
652	July 16	27°07′	79°46′	403–393	OT
654	July 16	27°16′	79°49′	324	OT
655	July 16	27°00′	79°49′	287–262	OT
657	July 16	27°08′	79°49′	216–201	OT
658	July 16	27°15′	79°44′	320–310	OT
659	July 16	27°20′	79°40′	366	OT
686	July 21	25°55′	77°44′	388	IKMT
705	July 22	26°29′	78°41′	362–393	OT
716	Aug. 3	26°08′	79°24′	544	OT
717	Aug. 3	26°11′	79°25′	sfc.	PN
726	Aug. 3	26°03′	78°54′	201–194	Dredge
735	Sept. 1	26°39′	79°00′	sfc.	DN
741	Sept. 2	26°03′	79°54′	23	PN
746	Sept. 3	25°57′	80°04′	35–29	PN
760	Sept. 15	25°08′	80°11′	152–143	OT
765	Sept. 16	25°39′	80°04′	148–150	OT
769	Jan. 26, 1966	25°11′	80°10′	110–113	OT
794	Aug. 19	24°54′	80°15′	219–212	OT
795	Aug. 19	24°52′	80°20′	187–161	OT
815	June 22, 1967	24°08′	79°48′	618	OT
830	July 7	25°40′	79°59′	342	OT

APPENDIX 1

R/V GERDA STATION DATA (continued)

GERDA Sta.	Date	North latitude	West longitude	Depth (meters)	Gear
833	July 10	25°10′	80°10′	99–91	OT
834	July 10	25°15′	80°10′	86–79	OT
845	July 12	25°36′	80°01′	296–318	OT
853	Aug. 25	25°23′	80°02′	210–220	OT
855	Aug. 25	25°21′	80°01′	207–247	OT
857	Aug. 25	25°22′	80°03′	194–187	OT
877	Aug. 31	24°00′	79°47′	325–274	OT
894	Sept. 10	21°10′	86°19′	174–207	OT
897	Sept. 10	20°59′	86°24′	293–210	OT
898	Sept. 10	21°04′	86°19′	338–366	OT
924	Sept. 29	25°52′	78°27′	311–256	OT
932	Sept. 30	27°25′	79°10′	400–435	OT
958	Jan. 31, 1968	23°27′	82°47′	1913–1902	OT
987	Mar. 5	24°00′	80°10′	sfc.	DN
997	May 21	27°01′	79°51′	285–301	OT
998	May 21	27°10′	79°43′	366–375	OT
1001	May 21	27°07′	79°58′	60–62	OT
1006	June 13	24°35′	80°01′	sfc.	DN
1009	June 14	23°51′	79°39′	358–432	OT
1013	June 14	23°36′	79°31′	sfc.	DN
1016	June 15	23°34′	79°12′	528–543	OT
1024	Feb. 25, 1969	24°24′	81°29′	73–106	OT
1028	Feb. 25	24°28′	81°24′	135–146	OT
1033	Feb. 26	24°36′	81°06′	42	OT
1034	Feb. 26	24°35′	81°05′	66–68	OT
1035	Feb. 26	24°34′	80°58′	139–185	OT
1038	Feb. 26	24°51′	80°36′	40–44	OT
1043	Mar. 21	25°37′	77°36′	200	PN
1046	Mar. 21	25°32′	77°31′	330	PN
1052	Mar. 22	25°25′	77°37′	sfc.	Fish Poison
1069	Mar. 24	26°34′	79°01′	0–10	PN
1081	Apr. 26	24°24′	81°58′	110	OT
1251	Mar. 11, 1970	23°55′	80°33′	20	IKMT
1259	Mar. 12	25°27′	80°04′	70	IKMT
1286	Aug. 23	21°06′	86°28′	210–347	OT
1294	Mar. 25, 1971	25°31′	80°05′	sfc.	IKMT
1295	Mar. 25	25°33′	80°03′	sfc.	IKMT
1298	Mar. 26	24°51′	80°33′	20	IKMT
1300	Mar. 27	24°51′	80°35′	69	OT
1319	Apr. 1	26°51′	79°57′	161–154	OT
1329	Dec. 11	25°50′	78°22′	236–293	OT