## 14.

# Preliminary List of Bermuda Deep-sea Fish.1

Based on the Collections from Fifteen Hundred Metre-net Hauls, Made in an Eight-mile Circle South of Nonsuch Island, Bermuda.

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In the course of the oceanographic work of the Department of Tropical Research of the New York Zoological Society during the last nine years off the southern coast of Bermuda, we have concentrated our investigations on an eight-mile circle, the center of which is at 32° 12′ North Latitude, and 64° 36′ West Longitude, and nine miles south-southeast of Nonsuch Island.

In this circle Net Number 1 was drawn at a depth of 400 fathoms on April 3, 1929. Since that time on all possible occasions intensive trawling has been carried on in this same locality from the surface to a depth of 1,400 fathoms. More than 1,500 metre-net hauls have been made, besides 16 descents in the bathysphere from 250 to 3,028 feet.

Only about half of the captured fish have been monographed, but the work is progressing rapidly. We have often been asked for a general list or résumé of the deep-sea fish thus far taken within this circle, so without waiting for completion of study of all the forms I have compiled a preliminary check-list of names and numbers. The hundred-odd pelagic species have not been considered in this catalogue, and so far no attempt has been made to do any dredging on the bottom, so that our list excludes all strictly surface forms as well as abyssal flounders, bottom-living macrurids, etc.

A single sentence will show the value of this concentrated research: The volume of this eight-mile circle is one five-millionth of the volume of the seas of the world, while in it we have taken more than one-third of all the corresponding abyssal fish so far known to science. More specifically, from this extreme, y limited area we have brought up fishes representing at least 10 Orders, 46 Families, 65 Genera, 220 Species and 115,747 Individuals, almost all from depths below 300 or 400 fathoms, in strictly abyssal habitats. Thirty-one of these species have been described as new.

While it is not my intention at present to make any comparative study between these deep-sea fish and surface or shore forms, or between those taken at various depths, yet a few facts will help to make more real the fish fauna of this area. Members of the genus *Cyclothone* of the family Gonostomidae are among the smallest and the most delicate of all abyssal fish, and within our circle they are far and away the most abundant. If we consider only two species, *C. microdon* and *C. braueri*, which thus comprise less than 1%

<sup>&</sup>lt;sup>1</sup> Contribution No. 529, Department of Tropical Research, New York Zoological Society. Contribution from the Bermuda Biological Station for Research, Inc.

of the whole, we find that in total numbers they compose four-fifths or 82% (94,684) of all the other deep-sea individual fish together.

Myctophidae or lantern-fish come next in abundance but with wholly different relative proportions. The 57 species of this family compose one-quarter of the whole, and their numbers amount to 10%. Still a third different ratio of factors is shown by Melanostomiatidae, which, with 36 species (16%), can show only 247 individuals, or a mere two-tenths of one per-cent.

The drastic effect on physical characters of fish entering and living under the conditions of darkness, great pressure and frigidity of the abysses of ocean is evident when we realize that out of the 46 families, only 5 contain true surface-living members. These are Anguillidae, Gadidae, Trichiuridae, Brotulidae and Ogcocephalidae.

Considering abundance of individuals the following 10 families are in the lead: Gonostomatidae, Myctophidae, Sternoptychidae, Melamphaeidae, Chauliodontidae, Paralepidae, Maurolicidae, Melanostomiatidae, Aceratiidae and Serrivomeridae. With the species of these 10 families amounting to only 60% of all, we find that the individual count comes to 98.8% of all the fish taken.

Luminosity is present as follows: in 50% of the orders, 39% of the families, 81% of the genera, 66% of the species and (thanks again to Cyclothone and Myctophidae) to 96.5% of all individuals.

The use of a submarine automatically recording pressure gauge has made the exact depths of the long hauls certain. The consistent and long-continued trawls of hundreds of nets at corresponding levels have established a very accurate basis for estimating upper and lower life levels of species, and the level of maximum abundance. Also very sound data have been obtained on relative abundance and rarity. Three examples will suffice. Cyclothone microdon and C. pallida are very closely related, and yet their totals are 57,512 and 505 respectively; two eels, Serrivomer beanii and S. brevidentatus are distinguished with difficulty and yet they show the inexplicable difference in numbers of 155 and 7; Myctophum laternatum and M. fibulatum bear the same extremely close relationship, and they in turn tally at 2,853 and 8 respectively. The value of figures such as these is confirmed by net to net and year to year catches. The Myctophum case will illustrate this. The captures during the three years 1929, 1930 and 1931 of M. laternatum were 1,047, 877 and 905, while the corresponding years yielded 4, 2 and 2 individuals of M. fibulatum.

I have appended a list of the published papers dealing directly with this collection of fish.

	Number of Specimens.	Number in Single Nets.	Size Range (mm.).	Depth Range (fathoms).
ALEPOCEPHALIDAE				
Anomalopterus megalops Beebe, 1933	1	1	31	700
Bathytroctes drakei Beebe, 1929	27	1-2	10-22	400-900
Bathytroctes rostratus Günther, 1878	89	1-4	9.5-56	500-1,000
Dolichopteryx binocularis Beebe, 1932	2	1	53-85	200-400
Dolichopteryx longipes (Vaillant), 1888	4	1	23-85	600-800

	Number of Specimens.	Number in Single Nets.	Size Range (mm.).	Depth Range (fathoms).
Macromastax gymnos Beebe, 1933	. 1	1	35	1,000
Photostylus pycnopterus Beebe, 1933	1	1	64	800
Xenodermichthys copei (Gill), 1884	3	1	27-34	600-700
BATHYLAGIDAE				
Bathylagus benedicti Goode & Bean, 1895	20	1-2	18-91	400-1,000
Bathylagus glacialis Regan, 1913	99	1-3	24-135	500-1,000
STOMIATIDAE				
Macrostomias calosoma Beebe, 1933	1	1	430	600
Stomias brevibarbatus Ege, 1918	22	1	19-225	400-1,000
Stomias ferox Reinhardt, 1842	96	1-6	23-90	300-1,000
MELANOSTOMIATIDAE				
Bathophilus altipinnis Beebe, 1933	1	1	63	800
Bathophilus brevis Regan & Trewavas, 1930	4	1	13-26	300-900
Bathophilus chironema Regan & Trewavas, 1930	1	1	34	1,000
Bathophilus longipinnis (Pappenheim), 1914	2	1	48-61	400-900
Bathophilus metallicus (Welsh), 1923	22	1-2	25-105	300-900
Bathysphaera intacta Beebe, 1932	2		1829	350
Chirostomias pliopterus Regan & Trewavas, 1930 (= C. lucidimanus Beebe, 1932).	8	1	19-225	300-700
Echiostoma tanneri (Gill), 1883	13	1	61-375	500-900
Eustomias bibulbosus Parr, 1927	8	1	42-123	500-900
Eustomias bigelowi Welsh, 1923	1	1	108	700
Eustomias fissibarbis (Pappenheim), 1914	1	1	130	800
Eustomias frondosus Regan & Trewayas, 1930	1	1	43	500
Eustomias lipochirus Regan & Trewavas, 1930	1	1	50	500
Eustomias obscurus Vailliant, 1888	5	1	51-98	500-700
Eustomias paucifilis Parr, 1927	1	1	134	800
Eustomias satterleei Beebe, 1933	1	1	140	1,000

	Number of Specimens.	Number in Single Nets.	Size Range (mm.).	Depth Range (fathoms),
Evotomino coli C				
Eustomias schiffi Beebe, 1932	3	1	43-115	600
Eustomias schmidti Regan & Trewavas, 1930	2	1	55-118	700-800
Eustomias simplex Regan & Trewavas, 1930	1	1	91	600
Flagellostomias boureei (Zugmayer), 1913	10	1	7-97	0-1,000
Lamprotoxus angulifer Beebe, 1932	4	1	34-145	400-700
Lamprotoxus flagellibarba Holt & Byrne, 1910	3	1	29-206	500-700
Leptostomias bermudensis Beebe, 1932	1	1	285	500
Leptostomias ramosus Regan & Trewavas, 1930	20	1-2	12-52	50-1,000
Melanostomias bulbosus Beebe, 1933	1	1	222	700
Melanostomias spilorhynchus Regan & Trewavas, 1930	54	1-3	17-240	400-1,000
Pachystomias atlanticus Regan & Trewavas, 1930	1	1	38	500
Photonectes bifilifer Beebe, 1933	1	1	245	800
Photonectes braueri (Zugmayer), 1913	1	1	62	900
Photonectes cornutus Beebe, 1933	1	1	19	600
Photonectes dinema Regan & Trewavas, 1930	26	1-2	24-51	1,000
Photonectes intermedius Parr, 1927	4	1	49-70	400-800
Photonectes leucospilus Regan & Trewavas, 1930	15	1	25-33	300-1,000
Photonectes margarita (Goode & Bean), 1895	6	1	245-300	500-1,000
Photonectes mirabilis Parr, 1927	3	1	18-28	600
Photonectes parvimanus Regan & Trewavas, 1930	10	1	14-44	0-800
MALACOSTEIDAE				
Aristostomias photodactylus Beebe, 1933	1	1	84	700
Aristostomias tittmanni Welsh, 1923	14	1	30-62	500-1,000
Malacosteus niger Ayres, 1849	26	1-2	20-206	500-1,000
Photostomias guernei Collet, 1889	99	1-3	23-145	500-1,000
Ultimostomias mirabilis Beebe, 1933	1	1	40	900
ASTRONESTHIDAE				
Astronesthes gemmifer Goode & Bean, 1895	7	1	21-26	400-700

	Number of Specimens.	Number in Single Nets.	Size Range (mm.).	Depth Range (fathoms).
Astronesthes niger Richardson, 1845	47	1-2	24-35	300-1,000
Neonesthes nicholsi Beebe, 1933	8	1	26-156	500-1,000
CHAULIODONTIDAE				10.57
Chauliodus danae Regan & Trewavas, 1930	380	1-8	8-113	300-1,000
Chauliodus sloanei Bloch & Schneider, 1801	413	1-9	16-245	300-1,000
GONOSTOMATIDAE				
Bonapartia pedaliota Goode & Bean, 1895	6	1-2	15-55	200-800
Cyclothone microdon (Günther), 1878	57,512	1-268	10-62	300-1,000
Cyclothone braueri Jespersen & Taning, 1926	37,172	1-471	10-25	100-1,000
Cyclothone pallida Brauer, 1906	505	1-10	20-45	300-1,000
Gonostoma bathyphilum (Vaillant), 1884	5	1	56-165	700-1,000
Gonostoma elongatum Günther, 1878	40	1-2	21-270	400-1,000
Photichthys nonsuchi Beebe, 1932	1	1	89	600
Yarrella blackfordi Goode & Bean, 1895	5	1	16-33	400-1,000
DIACANTHIDAE				
Idiacanthus fasciola Peters, 1876	129	1-8	16-270	100-1,000
Maurolicidae		00		
Diplophos taenia Günther, 1873	1	1	35	600
Ichthyococcus ovatus (Cocco), 1838	198	1-5	9.3-31	300-1,000
Maurolicus muelleri (Gmelin), 1789	2	1	7-8	500-800
Valenciennellus tripunctulatus (Lütken), 1870	6	1-2	9-27	100-1,000
Vinciguerria attenuata (Cocco), 1838	219	1-5	7-19	300-1,000
Vinciguerria nimbraria (Jordan & Williams), 1896	4	1-2	14-30	400-800
PISTHOPROCTIDAE				
Opisthoproctis soleatus Vaillant, 1888	1	1	51	450
STERNOPTYCHIDAE			1 11 12	
Argyropelecus aculeatus Cuvier & Valenciennes, 1849	139	1-12	6-55	300-1,000
Argyropelecus affinis Garman, 1899	2	2	44-48	400

Number of Specimens.	Number in Single Nets.	Size Range (mm.).	Depth Range (fathoms).
295	1-9	5-35	300-1,000
691	1-26	6-12	100-1,000
1,337	1-9	5-41	0-1,000
1	1	155	900
26	1-2	20-50	100-1,000
19	1	30-63	500-1,000
11	1-2	63-88	500-900
18	1	55-268	500-1,000
4			
21	1-2	26-166	400-1,000
155	1-5	55-440	50-1,000
7	1	73-512	500-800
22	1	18-178	100-1,000
7	1-2	31-488	50-1,000
45	1-2	40-360	50-1,000
1	1	498	1,000
3	1	200-470	500-1,000
4	1	50-105	800-1,000
84	1-3	30-506	500-1,000
1	1	1,400	900
	of Specimens.  295 691 1,337  1 26 19 11 18 21 155 7 22 7 45 1 3 4 84	of Specimens.         Single Nets.           295         1-9           691         1-26           1,337         1-9           1         1           26         1-2           19         1           11         1-2           18         1           21         1-2           155         1-5           7         1           22         1           7         1-2           45         1-2           1         1           3         1           4         1           84         1-3	of Specimens.         Single Nets.         Range (mm.).           295         1-9         5-35           691         1-26         6-12           1,337         1-9         5-41           1         1         155           26         1-2         20-50           19         1         30-63           11         1-2         63-88           18         1         55-268           21         1-2         26-166           155         1-5         55-440           7         1         73-512           22         1         18-178           7         1-2         31-488           45         1-2         40-360           1         1         498           3         1         200-470           4         1         50-105           84         1-3         30-506

	Number of Specimens.	Number in Single Nets.	Size Range (mm.).	Depth Range (fathoms).
PARALEPIDAE		7		
Luciosudis sp.	3	1	32-35	500-1,000
Macroparalepis intermedius Ege, 1933	1	ī	130	500
Macroparalepis sp.	19	1	8-87	100-900
Paralepis brevirostris (Parr), 1928	60	1-2	8-50	300-1,000
Paralepis brevis Zugmayer, 1911	662	1-7	9-87	300-1,000
Paralepis bronsoni (Parr), 1928	1	1	90	800
Paralepis speciosus? Bellotti, 1877	7	1-2	18-90	500-900
Мусторнідає				
Diaphus agassizi Gilbert, 1908	2	1	27-34	500-900
Diaphus dofleini Zugmayer, 1911	192	1-12	9-29	300-1,000
Diaphus dumerili (Bleeker), 1856	7	7	54-66	0
Diaphus effulgens (Goode & Bean), 1895	6	1	10-43	500-900
Diaphus fulgens (Brauer), 1904	93	1-9	9-16	300-1,000
Diaphus garmani Gilbert, 1906	1	1	48	0
Diaphus gemellari (Cocco), 1838	27	1-4	10-28	300-1,000
Diaphus hypolucens Parr, 1928	5	1-2	10-12	400-1,000
Diaphus lucidus (Goode & Bean), 1895	4	1	9-11	500-900
Diaphus lutkeni (Brauer), 1904	1	1	42	1,000
Diaphus macrophus Parr, 1928	294	1-14	9-45	300-1,000
Diaphus metopoclampus (Cocco), 1829	13	1	20-80	300-1,000
Diaphus rafinesquei (Cocco), 1820	134	1-9	9-70	400-1,000
Diaphus splendidus (Brauer), 1904	1 -	1	13	600
Diaphus young (Not yet studied)	122	1-20	8-13	300-1,000
Lampadena anomala Parr, 1928	10	1-3	17-26	500-800
Lampadena bathyphila Taning, 1928	21	1	17-61	600-1,000
Lampadena braueri Zugmayer, 1914	54	1-3	10-32	300-1,000
Lampadena chavesi (Collet), 1905	9	1	20-27	500-1,000
Lampadena minima Taning, 1928	5	1	26-40	500-1,000

3-0-0	Number of Specimens.	Number in Single Nets.	Size Range	Depth Range
	Specimens.	Single Nets.	(mm.).	(fathoms).
Lampanyctus ater Tàning, 1928	23	1-2	7-47	500-1,000
Lampanyctus crocodilus (Risso), 1810	95	1-6	15-32	300-1,000
Lampanyctus cuprarius Taning, 1928	208	1-6	9-101	50-1,000
Lampanyctus elongatus (Costa), 1844	11	1	13-30	400-1,000
Lampanyctus festivus Tàning, 1928	7	1-2	26-29	500-900
Lampanyctus gaussi (Brauer), 1906	2	1	12-23	400-600
Lampanyctus guntheri Goode & Bean, 1895	42	1-8	16-52	400-1,000
Lampanyctus intricarius Taning, 1928	1	1	32	700
Lampanyctus lineatus Taning, 1928	2	1	30-50	600
Lampanyctus longipes (Brauer), 1906	4	1	12-20	800-1,000
Lampanyctus micropterus (Brauer), 1906	2	1	19-21	500
Lampanyctus niger (Günther), 1887	1	1	37	900
Lampanyctus nobilis Täning, 1928	3	1-2	14-22	800-1,000
Lampanyctus photonotus Parr, 1928	1	1	14	500
Lampanyctus polyphotis Beebe, 1932	60	1-5	7-67	400-1,000
Lampanyctus photothorax Parr, 1928	891	1-20	9-37	300-1,000
Lampanyctus pusillus (Johnson), 1890	942	1-13	10-38	300-1,000
Lampanyctus resplendens Richardson, 1844-1848	14	1	23-37	600-1,000
Lampanyctus septilucis Beebe, 1932	3	1-2	28-31	700
Lampanyctus subpectoralis Parr, 1928	153	1-11	14-39	200-1,000
Lampanyctus supralateralis Parr, 1928	27	1-4	13-27	400-1,000
Lampanyctus taaningi Parr, 1929	350	1-7	13-58	500-1,000
Lampanyctus warmingi (Lütken), 1892	880	1-47	9-40	400-1,000
Myctophum affine (Lütken), 1892	37	1-2	13-25	400-1,000
Myctophum benoiti (Cocco), 1838	1,294	1-67	5-40	300-1,000
Myctophum coccoi (Cocco), 1829	165	1-3	7-26	300-1,000
Myctophum fibulatum Gilbert & Cramer, 1897	8	1-2	12-25	400-900

	Number of Specimens.	Number in Single Nets.	Size Range (mm.).	Depth Range (fathoms).
Myctophum glaciale (Reinhardt), 1837	2	1	26-28	700-900
Myctophum humboldti (Risso), 1810	2	2	21	1,000
Myctophum hygomi (Lütken), 1892	131	1-7	11-38	300-1,000
Myctophum imitator Parr, 1928	30	1-3	10-22	400-1,000
Myctophum laternatum Garman, 1899	2,853	1-43	9-22	100-1,000
Myctophum macrochir (Günther), 1864	170	1-5	10-44	300-1,000
Myctophum nigro-ocellatum (Günther), 1889	13	1-2	11-19	500-600
Myctophum rarum (Lütken), 1892	10	1	21-26	500-1,000
Myctophum reinhardti (Lütken), 1892	72	1-4	11-35	100-1,000
Myctophum rufinum Täning, 1928	6	1	20-28	600-700
Myctophum valdiviae Brauer, 1904	846	1-44	9-23	300-1,000
Myctophid young (Not yet studied)	1,646	1-67	7-16	0-1,000
Scopelarchus anale (Brauer), 1902	14	1	18-130	500-1,000
EVERMANNELLIDAE				
Evermannella atlantica Parr, 1928	1	1	35	500
Evermannella balbo (Risso), 1820	8	1	20-39	400-900
Evermannella melanoderma Parr, 1928	38	1	17-31	300-1,000
Omosudis lowii Günther, 1887	134	1-3	5-180	400-1,000
ALEPISAURIDAE  Alepisaurus ferox Lowe, 1833	122	1-4	7-190	500-1,000
RONDELETIIDAE  Rondeletia bicolor  Goode & Bean, 1895	2	1	97	600-1,000
CETOMIMIDAE		1.0	90.107	<b>500 1 000</b>
Genera & spp.  Bathyembryx istiophasma Beebe, 1934	11	1-2	30-105 600	700-1,000
Macruridae Macrurus spp.	5	1	64-68	500-1,000

	Number of Specimens.	Number in Single Nets.	Size Range (mm.).	Depth Range (fathoms).
BREGMACEROTIDAE			SAME A	Territoria Swall
Bregmaceros atlanticus Goode & Bean, 1895	35	1-2	9-75	400-1,000
GADIDAE				
Laemonema barbatula Goode & Bean, 1883	1	1	72	900
Melanonus unipinnis Beebe, 1932	50	1-2	9-75	400-1,000
Physiculus kaupi Poey, 1865	1	1	35	100
MELAMPHAEIDAE				95 1 000
Anoplogaster cornutus (Cuvier & Valenciennes), 1833	22	1-2	4-48	25-1,000
Caulolepis longidens Gill, 1883	7	1	90-151	700,-1,000
Melamphaes cristiceps Gilbert, 1891	61	1	17-105	500-1,000
Melamphaes megalops Lütken, 1877	1	1	41	700
Melamphaes microps (Günther), 1878	989	1-18	9-36	300-1,000
Melamphaes mizolepis (Günther), 1878	65	1-2	8-56	300-1,000
Melamphaes nigrofulvus Garman, 1899	1	1	93	700
Melamphaes robustus Günther, 1887	306	1-4	13-42	100-1,000
Melamphaes typhlops (Lowe), 1843	5	1	13-52	400-1,000
Melamphaes young	600	1-14	6-13	300-1,000
TRICHIURIDAE	0	0	200-205	In stomach
Benthedesmus atlanticus Goode & Bean, 1895	2	2	200-203	of Para- thunnus at- lanticus
ACROPOMATIDAE	51	1-4	9-40	400-1,000
Oxyodon sp.	01	1.	0.10	100 1,000
Chigamadan and	27	1	8-220	500-1,000
Chiasmodon spp. Odontonema sp.	1	1	85	900
Pseudoscopelus stellatus Beebe, 1932	8	1-2	14-45	25-1,000
BROTULIDAE			The state of	
Brotula spp.	8	1	7-50	700-900
Parabrotula dentiens Beebe, 1932	1	1	28	800
Parabrotula sp.	3	1	30-31	700-1,000
Mixonus laticeps (Günther), 1878	1	1	43	700
LOPHIIDAE				
Lophius sp.	1	1	14	1,000

Number of Specimens.	Number in Single Nets.	Size Range (mm.).	Depth Range (fathoms).
	100		
4	1	25-28	600
5	1	1.3-31	600-800
2	1	26-33	700-900
2	1	23-30	900
3	1	11-18	700-1,000
			2011
1	1	17	500
1	1	18	600
1	1	42	1,000
2	1	17	500-600
1	1	40	700
2	1	27-42	900-1,000
3	1	14-17	600-900
1	1	38	600
45	1	10-47	600-1,000
12	1	9-86	0-1,000
	••••		411
24	1		0-1,000
1	1	17.5	900
1	1	19.6	1,000
91	1-3	3-19	500-1,000
128	1-2	8-36	25-1,000
1		152	316
	of Specimens.  4 5 2 2 3 1 1 1 2 3 1 45 12 1 24 1	of Specimens.     Single Nets.       4     1       5     1       2     1       2     1       3     1       1     1       2     1       1     1       2     1       3     1       1     1       45     1       12     1       1     1       1     1       1     1       1     1       1     1       1     1       1     1       1     1       24     1       1     1       91     1-3       1-2     1	of Specimens.     Single Nets.     Range (mm.).       4     1     25-28       5     1     1.3-31       2     1     26-33       2     1     23-30       3     1     11-18       1     1     17       1     1     18       1     1     18       1     1     42       2     1     17       1     1     40       2     1     27-42       3     1     14-17       1     1     38       45     1     10-47       12     1     9-86       1      152       24     1     10-28       1     1     17.5       1     1     19.6       91     1-3     3-19       1-2     8-36

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