A REVIEW OF SPERM WHALE FOOD

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ABSTRACT

Papers on the food of sperm whales caught in various parts of the world hitherto published were reviewed, and the outline of the informations obtained are as follows:

The composition of the items in the sperm whale food is various according to region, season, year, etc., depending on the composition of the food animals inhabiting the area. The most important food items are squids, followed by fishes.

Among squids, numerically important species are histioteuthids, gonatids, onychoteuthids and octopoteuthids. In addition to these squids, cranchiids are also very important in some regions. Seeing their importance from the view point of weight, the important species are octopoteuthids and histioteuthids nearly all over the world except some regions, and onychoteuthids, architeuthids and ommastrephids are important in some regions.

Though the species of fishes in the food of sperm whales are various, they are less important than squids. They are rather important in the northeastern part of the North Pacific, New Zealand waters and the northern part of the North Atlantic.

The important fishes as the food of sperm whales are rock fishes, cod, sharks, rag fish, skate, dory-type fish, ling, lumpsucker, etc., though the degree of the importance of them are different according to region.

Sperm whales sometimes attack and catch large squids, e.g. *Architeuthis* sp. and *Moroteuthis robusta* of 2–3 m in mantle length, and also large fishes of 1–3 m in total length such as sharks *Cetorhinus maximus*, *Somniosus* sp. etc., *Dissostichus mawsoni*, etc.

The amount of the stomach contents of sperm whales has been considered less than 300 kg, and the foods consumed in a day have been considered differently by person as 2–3 tons or 1 ton. And also there is another estimate: 300 kg and 200 kg for average-sized male and female sperm whale respectively. The total weight of squids eaten by sperm whales in a year has been estimated to be 110–320 million tons.

INTRODUCTION

The sperm whale (*Physeter macrocephalus* Linnaeus) has 20–28 teeth in each side of the lower mandible, the diameters of which attain 10 cm (Nishiwaki 1965). These teeth have the function to attract and catch cephalopods, particularly the large squids, which are the staple food of the sperm whales. Fishes are, as Clarke, R. (1956) said, subsidiary, but not negligible, items of food.

The foods of sperm whales in various regions have long been studied by many

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TABLE 1. OCCURRENCES OF SQUIDS AND FISHES IN THE STOMACHS

Locality	Number stomachs observed	Number stomachs with food	Number and percent (of the stomachs			
			Squid		Octopus	
			No.	%	No.	%
Japan	555	338	323*	96	10	3
Japan	1365	809	725	90	16	2
	1379	818	788	96	3	0
	2744	1627	1513	93	19	1
Japan	65	65	65	100	—	—
Kuriles	360?	360?	>250*	>69	—	—
Kuriles (Okhotsk)				13–100		
(Pacific)				4– 97		
Kamchatka		21				
Bering Sea						
(Komandorskiye)	67	67	66 (50)	99 (75)		
(Aleutorskiye)	29	26	21 (14)	81 (54)		
(Northern)	14	14	10 (5)	71 (36)		
(Total)	110	107	97 (69)	91 (64)		
Bering Sea and Aleutian coast						
(–180°)		256	240	94		
		148	129	8		
(180°–160°W)		612	434	71		
		125	116	93		
Coast of Alaskan Gulf						
(160°–130°W)		139	45	32		
British Columbia	50	≦50	35	≧70		
Central California	128	54	52	96	6	11
New Zealand	133	118	95	81		
Iceland	57	49	27	55		
Azores	39	28	28?	100?		
Antarctic		56				
„	129	115				
South Georgia and South Africa	74	63	63	100		

scientists. A detailed review of their results was made by Berzin in 1971. Since then the several researches on this problem have been made, especially on squids (Clarke, M. R. 1972, 1977; Clarke, M. R. *et al.*, 1974, 1976; Kawakami, 1976; Okutani *et al.*, 1976, 1978). Recently the taxonomic studies of squids by beaks have been developed by Clarke, M. R. *et al.* and the studies on the food of sperm whales have advanced with a lot of beak samples removed from the stomachs of sperm whales caught in various parts of the world, and their results were summed up (Clarke, M. R., 1977, 1980).

I have again reviewed the published reports on the foods of sperm whales in

OF SPERM WHALES TAKEN FROM DIFFERENT PARTS OF THE WORLD

with food) stomachs with				Number and percent (of the stomachs observed) empty stomachs		Remarks	Source
Fish		Others					
No.	%	No.	%	No.	%		
5	1	—	—	217	39		Omura 1950
68	8	—	—	556	41	Males	Mizue 1951
25	3	2	0	561	41	Females	
93	6	2	0	1117	41	Total	
—	—	—	—	0	0		Kawakami 1976
110**	30	—	—	0?	0?	*: Only squid	Betesheva and Akimushkin 1955
						**: Including squid remainders	
	57-100						Tarasevich 1963
	13- 50						
4	19						Tomilin 1957
17 (1)	25 (1)			—	—	In parentheses, for only squids or fishes	Berzin 1959
12 (5)	46 (19)			3	10		
9 (4)	64 (29)			—	—		
38 (10)	36 (9)			3	3		
16	7					1960	Okutani and Nemoto 1964
19	13					1963	
178	29					1960	
9	7					1963	
94	68					1963	„
≦45	90?						Pike 1950
33	61	1	2				Rice 1963
93	79			15	11		Gaskin and Cawthorn 1967
48	98	8	14	8	14	Males	Roe 1969
4	14	0?	0?	11	28	Both sexes	Clarke, R. 1956
7	13					Males	„
6	5			14	11	Males	Korabelnikov 1959
7	11	—	—	11	15	Both sexes	Matthews 1938

various regions, and summarised them. But I could not fully refer to Dr Clarke's latest paper (1980) as I could get it only after the completion of this manuscrpt.

RELATIVE IMPORTANCE OF SPECIES IN THE FOOD OF SPERM WHALES

The frequencies of occurrence of various food items of sperm whales are different according to the region, season, year, etc., and also it may be varied by sex, age, or body length, but various species of cephalopods predominate almost always and

TABLE 2. RATIO OF OCCURRENCE OF SQUIDS AND FISHES IN THE STOMACHS OF SPERM WHALES TAKEN FROM DIFFERENT PARTS OF THE WORLD

Locality	Ratio of occurrence in percentage		Sex of whales	Year observed
	Squid	Fish		
Japan	98	2		1948–49
Japan	91	9	Males	1946–48
	97	3	Females	"
	94	6	Total	"
Japan	100	0		1772
Kulile Islands	69	31		1951–52?
Bering Sea				
(Komandorskiye)	80	20		1957
(Aleutorskiye)	64	36		"
(Northern)	53	47		"
(Total)	72	28		"
Bering Sea and Aleutian Coast				
(–180°)	94	6		1960
	87	13		1963
(180–160°W)	71	29		1960
	93	7		1963
Coast of Alascan Gulf				
(160–130°W)	32	68		1963
British Columbia	≧44	56≧		1948–49
Central California	61	39		1959–62
New Zealand	51	49		1963–64
Iceland	36	64	Males	1967
Azores	87≧	≦13	Both sexes	1949
South Georgia and South Africa	90	10	Both sexes	1932–35

Notes: 1) The ratios were calculated with the numbers of stomachs having squid and fish.
2) Sources are the same as those in Table 1.

everywhere.

The composition of the food items in sperm whale depends on the composition of the food animals inhabiting the area where the whales take food (Berzin 1971), but it does not always represent the fauna of the area. This may be thinkable from the fact that species composition of the families is different between net samples and whales' stomach contents, and many of those taken by nets are smaller species and not young specimens of the large species sampled by whales (Clarke, M. R., 1977).

The most important food items of sperm whales are cephalopods, followed by fishes as are shown in Tables 1 and 2. In addition to cephalopods and fishes, crabs, shrimps, krill, lobsters, colonial tunicates, jelly-fishes, sponges, starfishes, sea cucumbers, vibrissae, gorgonians, etc. were reported from the stomachs of sperm whales (Mizue 1950, Clarke, R. 1956, Tarasevich 1963), but these are not considered to be the normal food items.

The families and species of cephalopods and fishes reported as the food of sperm whales by many scientists are summarised in Appendix Tables I and II.

Cephalopods as the food of sperm whales

As are shown in Appendix Table I, the cephalopods consist of 36 genera (about 56 species) belonging to 19 families, of which only 5 genera (about 6–7 species) belonging to 4 families are octopods and vampyromorph, and the other 31 genera (about 50 species) belonging to 15 families are decapods. Thus squids are of far greater impotance than octopods almost everywhere. But in the littoral waters, the significance of octopods for sperm whales is sometimes greater, especially of those which have a pelagic mode of life, e. g. *Amphitretus* sp. and *Alloposus mollis*. They are sometimes found in 50% of the total number of stomachs examined (Berzin, 1971).

Most decapods in Appendix Table I are pelagic species except *Loligo* sp. which is the littoral species and was found in the stomachs of sperm whales in the northeastern part of the Atlantic (Clarke, R., 1956). This may be a very rare example. *Octopus* spp. are also littoral species and were reported from the stomachs of sperm whales caught in the littoral waters of the North Pacific (Berzin, 1971).

It is noteworthy, as Berzin (1971) stated, that some of the species inhabiting the surface waters in some regions, e. g. *Todarodes pacificus* which is the widespread and abundant species in the western part of the North Pacific and serves as food for the most varied pelagic animals (including baleen whales), do not form a part of the sperm whales' diet.

The data on the compositions in numerical and weight percentages of families of cephalopod constituents in sperm whale food are available in the waters around Japan, Kurile Islands, California, New Zealand, Peru and Chile, Iceland, Azores, Vigo and Madeira as are shown in Table 3.

The numerically important species of cephalopods are as follows: In the Japanese waters, *Histioteuthis dofleini* is the most important and *Octopoteuthis* sp., *Moroteuthis robusta* and *Ommastrephes bartrami* are also important (Omura, 1950; Mizue, 1951; Berzin, 1971; Kawakami, 1976; Okutani *et al.*, 1976, 1978). In the Kurile Islands waters, the species belonging to Gonatidae such as *Gonatopsis borealis*, *Gonatus magister* and *Gonatus fabricii*, *Galiteuthis armata* and *Histioteuthis* sp. are important (Betesheva and Akimushkin, 1955; Berzin, 1959, 1971; Tarasevich, 1963). In the Okhotsk Sea, *Gonatus fabricii* is important (Tarasevich, 1963; Berzin, 1971). In the Bering Sea and the adjacent waters, *Moroteuthis robusta*, the species belonging to Gonatidae such as *Gonatopsis borealis*, *Gonatopsis makko*, *Gonatus magister* and *Gonatus fabricii*, and *Galiteuthis armata* are important (Berzin, 1959, 1971; Okutani and Nemoto 1964). Off British Columbia and California, *Moroteuthis robusta*, *Gonatopsis borealis* and *Gonatus fabricii* are important (Pike, 1950; Rice, 1963; Berzin, 1971; Fiscus and Rice, 1974; Clarke, M. R., 1979). In the Tasmanian and New Zealand waters, *Moroteuthis* sp. and *Onychoteuthis* sp. are important (Gaskin and Cawthorn, 1967; Berzin, 1971; Clarke, M. R., 1977). Off Peru and Chile, *Histioteuthis* sp., *Chiroteuthis* spp., *Octopoteuthis* sp. and *Dosidicus gigas* are important (Berzin, 1971; Clarke, M. R. *et al.*, 1976; Clarke, M. R., 1977). In the eastern North Atlantic, *Histioteuthis bonelli* is the most important and followed by *Taningia danae* (Clarke, R., 1955, 1956; Clarke, M. R., 1962, 1977; Keil, 1963; Roe, 1969; Berzin, 1971;

TABLE 3. COMPARISON IN NUMERICAL AND WEIGHT PERCENTAGE BY

Family	Japan		Kurile Ialands			California
	(1976)	(1977)	(Okhotsk)	(Pacific)		
Enoploteuthidae	0.1	—	—	—	—	—
Octopoteuthidae	11.1	19.9	—	3.4	1.5	—
Onychoteuthidae	11.4	3.9	3.2	8.4	8.8	42.9
Cycloteuthidae	—	—	—	—	—	—
Gonatidae	1.3	4.0	64.5	50.2	59.5	17.9
Psychroteuthidae	—	—	—	—	—	—
Lepidoteuthidae	0.1	—	—	—	—	—
Architeuthidoe	0.2	—	6.8	3.1	3.8	—
Histioteuthidae	30.4	38.2	1.0	10.9	4.4	—
Ommastrephidae	14.5	0.5	—	0.1	—	—
Chiroteuthidae	—	1.3	—	2.1	5.0	—
Cranchiidae	3.7	5.6	8.7	25.2	11.2	—
Pholidoteuthidae	—	—	—	—	—	—
Unidentified squid	27.0	26.5	—	—	1.5	39.3
Vampyroteuthidae	—	—	—	—	—	—
Octopodidae	—	—	2.0	0.9	0.5	—
Alloposidae	—	—	—	—	1.6	—
Amphitretidae	—	—	—	—	1.5	—
Others	—	—	—	—	0.7	—
Total	100.0	100.0	86.2*	114.3*	100.0	100.0
Source**	(1)	(2)	(3)	(3)	(4)	(5)

Notes 1) The values in parentheses are the percentage by weight.
2) *: These values are calculated by the present author in the same way as the original author did.

FAMILY OF THE CEPHALOPOD CONSTITUENTS IN SPERM WHALE FOOD

New Zealand	Peru, Chile	Iceland		Azores	Vigo	Madeira
		Complete collection	Mixed sample			
—	5.5	0.2	0.3	—	2.9	1.0
(—)	(2.6)	(0.1)			(0.3)	(0.3)
—	9.2	3.4	6.8	39.1	14.3	0.5
(—)	(1.9)	(25.3)			(83.0)	(14.2)
70.7	0.1	0.8	3.3	1.8	—	—
(89.7)	(0.1)	(5.9)			(—)	(—)
—	—	0.6	0.7	—	—	—
(—)	(—)	(0.4)			(—)	(—)
—	3.2	0.3	12.9	—	—	—
(—)	(1.4)	(0.1)			(—)	(—)
—	0.1	0.1	0.2	—	—	—
(—)	(0.1)	(0.0)			(—)	(—)
—	—	—	1.0	—	5.7	1.3
(—)	(—)	(—)			(2.3)	(4.0)
—	—	0.2	0.3	—	1.4	1.7
(—)	(—)	(3.4)			(6.6)	(40.6)
13.3	50.3	73.9	60.5	59.1	67.2	88.3
(1.0)	(56.3)	(46.5)			(5.6)	(36.1)
8.0	4.1	0.1	0.3	—	—	—
(5.6)	(31.7)	(0.0)			(—)	(—)
—	16.1	0.1	—	—	—	—
(—)	(1.0)	(0.0)			(—)	(—)
—	0.8	1.9	3.3	—	5.7	—
(—)	(0.5)	(0.6)			(0.1)	(—)
—	—	0.1	0.7	—	—	—
(—)	(—)	(0.0)			(—)	(—)
8.0	7.6	15.8	7.0	—	—	—
(3.7)	(1.1)	(10.1)			(—)	(—)
—	3.2	—	—	—	—	—
(—)	(3.3)	(—)			(—)	(—)
—	—	—	2.6	—	—	—
(—)	(—)	(—)			(—)	(—)
—	—	2.8	—	—	2.9	0.8
(—)	(—)	(7.5)			(2.1)	(1.5)
—	—	—	—	—	—	—
(—)	(—)	(—)			(—)	(—)
—	—	—	—	—	—	—
(—)	(—)	(—)			(—)	(3.4)
100.0	100.0	100.0	100.0	100.0	100.0	100.0
(100.0)	(100.0)	(100.0)			(100.0)	(100.0)
(6)	(7)	(8)	(8)	(9)	(10)	(11)

3) **: (1) Okukani *et al.* 1976 (2) Okutani and Satake 1978 (3) Tarasevich 1963 (4) Betesheva and Akimushkin 1955 (5) Rice 1963 (6) Gaskin and Cawthorn 1967 (7) Clarke, M. R. *et al.* 1976 (8) Clarke, M. R. and MacLeod 1976 (9) Clarke, R. 1956 (10) Clarke, M. R. and MacLeod 1974 (11) Clarke M. R. 1962, amended by Clarke, M. R. 1974.

Clarke, M. R. and MacLeod, 1974). In the Indian Ocean, histioteuthids are the most important (Matthews, 1938; Berzin, 1971; Clarke, M. R., 1972, 1977). In the Antarctic, onychoteuthids and cranchiids are very important (Matthews, 1938; Korabelnikov, 1959; Berzin, 1971; Clarke, M. R., 1977).

The data on the amount of squids as the food of sperm whales are rather numerous (Clarke, M. R., 1962; Clarke, M. R. and MacLeod, 1974, 1976; Clarke, M. R. *et al.*, 1976), but most of them have not been treated quantitatively (Table 3).

According to Clarke, M. R. (1977) who reported the quantitatively important squid families estimated by the beaks removed from the stomachs of sperm whales, octopoteuthids, including the large *Taningia danae*, are important in all regions except the Antarctic and off Peru and Chile, and histioteuthids, including several species, are important everywhere expect the Antarctic. In addition to them, onychoteuthids, architeuthids, ommastrephids such as *Dosidicus gigas*, *Todarodes* sp., *Ancistrocheirus* of enoploteuthid, and pholidoteuthids are also important in some regions.

Fishes as the food of sperm whales

Though the species of fishes obtained from the stomachs of sperm whales are various as are shown in Appendix Table II, namely 55 genera (about 68 or more species) belonging to 49 families, the occurrence prortion of fishes in the food is not so large as squids, and is different by region and year like cephalopods as are shown in Table 1. The ratios of occurrence of squids to fishes in the food of sperm whales by region are shown in Table 2. In the North Pacific the fish occurrence is between 1% and 68% of the stomachs having fishes and/or squids in them (Omura, 1950; Pike, 1950; Mizue, 1951; Betesheva and Akimushkin, 1955; Tomilin, 1957; Tarasevich, 1963; Rice, 1963; Okutani and Nemoto, 1964). It is only 1–9% in the Japanese waters, 31% in the Kurile Islands waters, 6–47% in the western part of the Bering Sea and Aleutian coast west of 180°, 7–29% in the Bering Sea and Aleutian coast between 180° and 160°W, 68% off the coast of Alaskan Gulf, not less than 56% off British Columbia and 39% off California. In the Bering Sea and Aleutian coast west of 180° it is, as is shown in Table 2, 6–13% according to Okutani and Nemoto (1963), but it is 20%, 36% and 47% in the waters of Komandorskiye, Aleutorskiye and northern part of the Bering Sea respectively according to Berzin (1959). Thus fishes as the food of the sperm whales mostly predominate in the eastern waters along the Alsakan Gulf and the east Bering Sea as was stated by Okutani and Nemoto (1964), and in the northern part of the both sides of the North Pacific.

In the New Zealand waters the sperm whales take squids and fishes in nearly the same ratio, but about one third of them feed both fishes and squids, and the ratio of fishes to squids by weight was 1: 1.69 (Gaskin and Cawthorn, 1967).

In the Iceland waters of the Atlantic, fishes occur in 98% of the sperm whale stomachs with food, in which 54% contain both squids and fishes (Roe, 1969), and the occurrence ratio of squids to fishes is 36: 64. In the Azores waters fishes occur in 13% or less (Clarke, R. 1956). For the sperm whales in the North Atlantic, fishes are more important in the northern part of the Ocean.

TABLE 4. COMPARISON IN NUMERICAL PERCENTAGE OF THE FISHES IN SPERM WHALE FOOD

Fishes	Japan	Japan	British Columbia	California	New Zealand	Iceland
Lamprey	—	—	2.2	—	—	—
Shark	—	3.2	—	25.0	6.9	6.3
Skate	—	—	20.0	54.2	—	3.1
Rag fish	—	—	35.6	—	—	—
Sardine	—	4.3	—	—	—	—
Salmon-like fish	—	—	6.7	—	—	—
Lanternfish	—	—	—	4.2	1.7	—
Conger eel	—	—	—	—	13.8	—
Saury	—	6.5	—	—	—	—
Dory-types	—	—	—	—	29.3	—
South kingfish	—	—	—	—	12.1	—
Groper	—	—	—	—	15.5	—
Anarrhichus minor	—	—	—	—	—	3.1
Ling	—	—	—	—	20.7	—
Rock fish	80.0	55.9	35.6	—	—	25.0
Sablefish	—	—	—	8.3	—	—
Lingcod	—	—	—	8.3	—	—
Lumpsucker	—	—	—	—	—	31.3
Cod	20.0	30.1	—	—	—	18.8
Angler fish	—	—	—	—	—	12.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
Source	Omura 1950	Mizue 1951	Pike 1950	Rice 1963	Gaskin and Cawthorn 1967	Roe 1969

Note: The percentages were calculated with the numbers of stomachs in which the fish were found by the present author.

In the waters of South Georgia and South Africa, the fishes occur in 11% of the sperm whales' stomachs with food (Matthews, 1938), and in the Antarctic, in 5–13% (Clarke, R., 1956; Korabelnikov, 1959) (Table 1).

Thus, generally speaking, the occurrence proportion of fishes is not so large as squids, and in many cases fishes are found mixed with squids. These conditions are various according to the region, and the regions where fishes are rather important are the northern and the northeastern parts of the North Pacific, the New Zealand waters and the northern part of the North Atlantic.

The data on the composition in numerical percentage of fish constituents in sperm whale food are available in the waters of Japan, British Columbia, California, New Zealand and Iceland as are shown in Table 4. The important fishes in each region are rock fish and cod for the Japanese waters, rock fish and rag fish for the British Columbian waters, skate and shark for Californian waters, dory-type fish and ling for the New Zealand waters, and lumpsucker and rock fish for the Iceland waters.

THE FEEDING TIME OF SPERM WHALES

It may be thinkable that sperm whales actively feed during night when squids come up to the surface, and do not move about so actively in the daytime, judging from the catch data of the Antarctic whaling (Matsushita 1955), but Okutani and Nemoto (1964) and Clarke, M. R. (1980) found no evidence for special feeding time in the North Pacific and off Durban respectively.

THE SIZE OF FOOD ANIMALS EATEN BY SPERM WHALES

Squids

Though the size of cephalopods usually eaten by sperm whales does not appear so large, sperm whales are considered to attack sometimes the gigantic squids. This is considerable from the large scars up to 20 cm in diameter on the skin of sperm whales caused by large suckers of squids, and also from the reports of huge fragments of squids vomitted by dying whales or recovered among the stomach contents, although Roe (1969), who recorded the sucker scars of 1.7–11.5 cm in diameter, doubted whether the very large scars such as 11.5 cm in diameter had been, in fact, caused by squids, and considered it was possible that they were old sucker scars which had stretched as the whale had grown (Matthews, 1938; Roe, 1969; Berzin, 1971).

TABLE 5. SIZES OF SQUIDS FROM STOMACHS OF SPERM WHALES EXAMINED AT HORTA IN 1949 (Quoted from Clarke, R., 1956)

Sizes of squids Length group	Standard length	Male whales		Female whales	
		No. of squids	%	No. of suids	%
Small	0.6 to 0.9 m	41	59	28	67
Medium	0.9 to 1.5	26	37	13	31
Medium-large	1.5 to 1.8	2	3	0	0
Large	1.8 to 2.4	1	1	1	2
Total		70	100	42	100
Average size of squids		0.95 m		0.92 m	

Kondakov (1940) considered that the suckers as large as 20 cm in diameter might belong to *Architeuthis* of 18 m in total length. The large *Architeuthis* whose total length and weight were 10.5 m (mantle length was 2 m), 184 kg, and 12 m, 200 kg were actually removed from the stomachs of sperm whales from the Azores in 1955 and from the Antarctic in 1964 respectively (Clarke, M. R., 1955; Berzin, 1971). An architeuthid 2.4 m in mantle length was obtained from the stomach of the sperm whale in the Azores waters (Keil 1963). In addition to these architeuthids, *Moroteuthis robusta* of 2.9 m, 2.4 m and 2.4 m long were reported from the stomachs of the sperm whales caught off Kommandorskiye Islands, off British Columbia and in the Antarctic respectively (Pike, 1950; Clarke, R., 1956; Berzin, 1971).

As the large scars and scratches are usually found on the head of male whales, and females are smaller in body length than males, it is often considered that male

sperm whales take larger squids than females (Matthews, 1938). Clarke, M. R. (1980) also considered that males favour larger species than females by a χ^2 test of the data of the sperm whales off Durban. But there is also another opinion that males and females take food of the same size as shown in Table 5 (Clarke, R. 1956).

The size of the food items in the diet may be different according to the ground, and an example of the difference was shown by Clarke, R. (1956) as follows: The average standard length of squids from the sperm whales caught in the Azores was 0.94 m and that of the Antarctic (*Moroteuthis ingens*) was 1.3 m.

Fishes

Fishes are, as stated above, generally not so important food for sperm whales as squids, but sometimes large fishes 1–3 m in body length have been removed from the stomachs of sperm whales as follows: a 3 meter shark, the species of which was unidentified, was reported off South Africa (Chabb, 1918; fido Berzin 1971), a basking shark *Cetorhinus maximus* 2.5 m long, at the Azores (Clarke, R., 1956), a green shark *Somniosus* sp. 2.1 m long, another shark *Squalus acanthias* 1.3 m long, and *Alepisaurus aesculopius* 1.3 m long, in the Kurile waters (Betesheva, 1961; fido Berzin 1971), fishes belonging to Notothenidae up to 1.5 m long and a ray *Raja griseocandata* 1.1 m long, near Tierra del Fuego (Semskii, 1962, fido Berzin 1971), *Dissostichus mawsoni* up to 1.7 m long (as a rule 1.2–1.4 m), near the Balleny Island (Berzin, 1971), fantailed ragfish *Icosteus aenigmaticus* 1.3 m long, off British Columbia (Pike, 1950).

THE WEIGHT OF DOOD OF SPERM WHALES

The weight of food in a stomach of sperm whales

The weight of food in a stomach of sperm whales may be different according to the size of whales, and is generally considered to be less than 300 kg. According to Betesheva and Akimushkin (1955) and Betesheva (1961), it did not exceed 200 kg. Other data showed that stomachs contained 201–500 squid (*Gonatus fabricii*) (Berzin, 1971), the weight of which may be calculated as 80–200 kg, supposing the average weight of this squid is 400 g. The weight of fresh food of the sperm whales in the Cook Strait region of New Zealand was reported to have varied from 12.7 to 105 kg (Gaskin and Cawthorn, 1967).

On the difference of the quantity of food for male and female sperm whales, there are two different opinions. The quantity of food of sperm whales in the Japanese waters was not different between males and females (Mizue, 1950), but the uncomplete data from the Azores suggested (not concluded) that females were feeding rather less heavily than males, and this might be explained as follows: females are hampered to feed heavily by calves which cannot dive deep (Clarke, R., 1956).

The amount of sperm whale food consumed in a day and in a year

The food of sperm whales consumed in a day was considered to be at least 2–

3 tons of squids for a sperm whale 13–14 m long by Sleptsov (1952), and one ton a day by Berzin (1971).

Clarke, M. R. (1977) considered the amount of food consumed in a day by sperm whales would be 2–4% of their body weight and calculated as 300 kg and 200 kg for males and females respectively, supposing the average body weights were 15 tons and 5 tons for males and females respectively. As he stated that the weight of sperm whales is between 8 and 50 tons, if the largest whale is considered, the amount of food consumed in a day will be one ton.

The total weight of cephalopods eaten by sperm whales each year has been estimated by Clarke, M. R. (1977) to be over 110 million tons on the basis of the data on estimated number of whales and estimated weight of food consumed by whales, and also as a muximum figure the amount of cephalopods eaten was estimated to be 320 million tons, accepting a value of 15 tons for the average whale and a consumption of 3.5% of body weight per day as well as an average calorific value of 75% of that for mascular squids.

NUTRIENT DISPERSAL BY SPERM WHALES

This problem has scarecely been studied. Sperm whales seem to eat food actively near the surface during night as stated above, but it may be true that they certainly eat several midwater species and also eat species in spawning condition on the bottom. Therefore, it could be considerable that sperm whales probably carry nutrient upwards by eating deepsea squid and defaecating near the surface as Clarke, M. R. (1977) stated.

Many families of cephalopods are said to have large amount of ammonia in their tissues and coelom, and 53–78% of the number of cephalopods consumed by sperm whales are said to be ammonical squid (Clarke, M. R., 1977), which are probably not good for human food as they are.

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APPENDIX TABLE I. THE CEPHALOPODS FOUND IN THE STOMACHS OF SPERM WHALES BY AREA*

Family Genus Species	Pacific					Atlantic			Indian	Antarctic				Off S. Afr.[8]
	NW[1]	N[2]	NE[3]	SW[4]	SE[5]	NE[3]	SW[4]	SE[5]	S[6]	Pac	Atl	Ind	Ant[7]	
Loliginidae	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Loligo forbesi	−	−	−	−	−	+	−	−	−	−	−	−	−	−
Enoploteuthidae	−	−	−	+	−	−	+	+	+	−	−	−	−	−
Ancistrocheirus lesueuri	+	−	−	−	+	+	−	+	+	−	−	−	−	−
Octopoteuthidae	−	−	−	+	+	+	+	+	+	−	−	−	+	−
Octopoteuthis longiptera	+	−	+	−	−	−	+	−	−	−	−	−	−	−
O. spp.	+	−	−	−	+	+	−	−	−	−	−	−	−	−
Taningia danae	+	−	−	−	+	+	−	−	−	−	−	−	−	−
=*Cucioteuthis unguiculata*	−	−	−	−	−	+	−	−	−	−	−	−	−	−
Onychoteuthidae	+	+	+	+	−	−	−	+	+	−	−	−	+	−
Onychoteuthis banksii	+	+	+	−	−	+	−	−	−	−	+	−	+	−
O. spp.	+	−	+	+	−	−	−	−	−	−	−	−	−	−
Moroteuthis robusta	+	+	+	−	−	−	−	−	+	+	−	−	−	+
M. lönbergii	+	−	−	−	−	−	−	−	−	−	−	−	−	−
M. ingens	−	−	−	−	−	−	−	−	+	−	−	+	−	−
M. robsoni	−	−	−	−	−	+	−	−	−	−	−	−	−	−
M. knipovitchi	−	−	−	−	−	−	−	−	−	−	−	−	+	−
M. sp.	−	−	−	+	+	−	−	−	+	−	−	−	−	−
Tetronychoteuthis dussumierii	−	−	−	−	−	+	−	−	−	−	−	−	−	−
T. sp.	−	−	−	−	−	+	−	−	−	−	−	−	−	−
Kondakovia longimana	−	−	−	−	−	+	−	−	−	−	−	−	−	−
K. sp.	−	−	−	−	−	−	−	−	−	−	−	−	+	−
Cycloteuthidae	−	−	−	+	−	−	+	−	+	−	−	−	−	−
Cycloteuthis akimushkini	−	−	−	−	−	+	−	−	−	−	−	−	−	−
C. sp.	−	−	−	−	+	−	−	−	−	−	−	−	−	−
Gonatidae	+	+	+	−	+	+	−	−	−	−	−	−	+	−
Gonatus fabricii	+	+	+	−	−	+	−	−	−	−	−	−	−	−
G. berryi	+	−	−	−	−	−	−	−	−	−	−	−	−	−
G. antarcticus	−	−	−	−	+	−	−	−	+	−	−	−	−	−
G. sp.	+	−	−	−	−	−	−	−	−	−	−	−	−	−
Berryteuthis magister	+	−	−	−	−	−	−	−	−	−	−	−	−	−
=*Gonatus magister*	+	+	+	−	−	−	−	−	−	−	−	−	−	−
Gonatopsis borealis	+	+	+	−	−	−	−	−	−	−	−	−	−	−
G. makko	+	+	−	−	−	−	−	−	−	−	−	−	−	−
G. octopedatus	+	−	−	−	−	−	−	−	−	−	−	−	−	−
Mesonychoteuthis hamiltoni	−	−	−	−	−	−	−	−	+	−	−	−	−	−
Psychoteuthidae	−	−	−	+	−	−	−	−	−	−	−	−	−	−
Psychoteuthis sp.	−	−	−	−	+	−	−	−	−	−	−	−	−	−
Lepidoteuthidae	−	−	−	+	−	+	+	−	−	−	−	−	−	−
Lepidoteuthis grimaldii	+	−	−	−	−	+	−	−	−	−	−	−	−	−
L. sp.	−	−	−	−	−	+	−	−	−	−	−	−	−	−
Architeuthidae	−	−	−	+	−	+	−	+	−	−	+	−	−	+
Architeuthis japonica	+	−	+	−	−	−	−	−	−	−	−	−	−	−

Continued . . .

APPENDIX TABLE I. Continued.

Family Genus Species	Pacific					Atlantic			Indian	Antarctic				Off S. Afr.[8]
	NW[1]	N[2]	NE[3]	SW[4]	SE[5]	NE[3]	SW[4]	SE[5]	S[6]	Pac	Atl	Ind	Ant[7]	
A. physeteris	−	−	−	−	−	+	−	−	−	−	−	−	−	−
=*Dubioteuthis physeteris*	−	−	−	−	−	+	−	−	−	−	−	−	−	−
A. sp.	−	−	−	+	−	+	−	−	+	−	+	−	−	−
Histioteuthidae	+	−	+	+	+	+	+	+	+	−	−	−	+	−
Histioteuthis dofleini	+	−	−	−	−	+	−	−	−	−	−	−	−	−
=*Stigmateuthis dofleini*	−	−	+	−	−	−	−	−	−	−	−	−	−	−
H. sp.	−	−	−	−	+	+	−	−	−	−	−	−	−	−
=*S.* sp.	−	+	−	−	−	−	−	−	−	−	−	−	−	−
=*Calliteuthis* sp.	−	−	−	−	−	+	−	−	−	−	−	−	−	−
H. meleagroteuthis	−	−	−	−	−	−	−	−	−	−	−	−	−	−
=*Meleagroteuthis separata*	+	+	+	−	−	−	−	−	−	−	−	−	−	−
H. bonelliana	−	−	−	+	−	+	−	−	+	−	−	−	−	−
H. bonellii	−	−	−	−	−	+	−	−	−	−	−	−	−	−
H. cookiana	−	−	−	+	−	−	−	−	−	−	−	−	−	−
Ommastrephidae	−	−	+	+	+	−	−	−	+	−	−	−	+	−
Todarodes sagittatus	−	−	−	−	−	+	−	−	−	−	−	−	−	−
T. sp.	−	−	−	−	−	−	−	−	+	−	−	−	−	−
Nototodarus sloani	−	−	−	+	−	−	−	−	−	−	−	−	−	−
Ommastrephes bartrami	+	−	−	−	−	−	−	−	−	−	−	−	−	−
=*Stenoteuthis bartrami*	+	−	−	+	−	−	−	−	+	−	−	−	−	−
Dosidicus gigas	−	−	−	−	+	−	−	−	−	−	−	−	−	−
=*Ommastrephes gigas*	−	−	−	−	+	−	−	−	−	−	−	−	−	−
Symplectoteuthis sp.	−	−	−	−	+	−	−	−	−	−	−	−	−	−
Chiroteuthidae	−	−	+	+	+	−	−	−	+	−	−	−	−	−
Chiroteuthis calyx	+	−	−	−	−	−	−	−	−	−	−	−	−	−
C. veranyi	+	+	+	−	−	−	−	−	−	−	−	−	−	−
C. spp.	−	−	−	−	+	+	−	−	−	−	−	−	−	−
Mastigoteuthidae	−	−	−	+	−	−	−	−	−	−	−	−	+	−
Mastigoteuthis sp.	−	+	−	−	−	−	−	−	−	−	−	−	−	−
Cranchiidae	−	−	+	+	+	+	−	+	+	−	−	−	+	−
Cranchia scabra	+	−	−	−	−	−	−	−	−	−	−	−	−	−
Taonius pavo	+	+	+	−	−	+	−	−	−	−	−	−	−	−
T. megalops	−	−	−	−	+	+	−	−	−	−	−	−	−	−
T. spp.	+	−	−	−	−	−	−	−	−	−	−	−	−	+
Galiteuthis armata	+	+	+	−	−	+	−	−	−	−	−	−	−	−
G. sp.	+	−	−	−	−	−	−	−	−	−	−	−	−	−
Phasmatopsis cymoctypus	−	−	−	−	−	+	−	−	−	−	−	−	−	−
P. sp.	−	−	−	−	+	−	−	−	−	−	−	−	−	+
Mesonychoteuthis hamiltony	−	−	−	−	+	−	−	−	−	−	−	−	+	−
Pholidoteuthidae	−	−	−	+	−	−	−	+	+	−	−	−	−	−
Pholidoteuthis sp.	−	−	−	−	−	+	−	−	+	−	−	−	−	−
P. ? *boschmai*	−	−	−	−	−	+	−	−	−	−	−	−	−	−
Vampyroteuthidae	−	−	+	−	+	−	−	−	−	−	−	−	−	−
Vampyroteuthis infernalis	−	−	−	−	+	−	−	−	−	−	−	−	−	−

Continued . . .

APPENDIX TABLE I. Continued.

Family Genus Species	Pacific					Atlantic			Indian	Antarctic				Off S. Afr.[8]
	NW[1]	N[2]	NE[3]	SW[4]	SE[5]	NE[3]	SW[4]	SE[5]	S[6]	Pac	Atl	Ind	Ant[7]	
Vampyroteuthis sp.	−	−	−	−	+	−	−	−	−	−	−	−	−	−
Octopodidae	+	−	+	+	+	+	−	−	+	−	−	−	−	−
Octopus vulgaris	+	−	−	−	−	−	−	−	−	−	−	−	−	−
O. gilbertianus	+	−	+	−	−	−	−	−	−	−	−	−	−	−
O. sp.	−	−	+	−	−	−	−	−	−	−	−	−	−	−
Paroctopus gilbertianus	+	−	−	−	−	−	−	−	−	−	−	−	−	−
Alloposidae	−	−	−	−	−	+	−	−	−	−	−	−	+	−
Alloposus mollis	+	−	+	−	−	+	−	−	−	−	−	−	−	−
A. sp.	−	−	−	−	−	+	−	−	−	−	−	−	−	−
Amphitretidae	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Amphitretus sp.	+	−	−	−	−	−	−	−	−	−	−	−	−	−

Notes:

* The list has been drawn up on the basis of data from the works listed in the chapter "REFERENCE." The bar in the table only shows that the shecimen was not reported by this name.

1) Northwestern part of the Ocean.
2) Northern part of the Ocean.
3) Northeastern part of the Ocean.
4) Southwestern part of the Ocean.
5) Southeastern part of the Ocean.
6) Southern part of the Ocean.
7) The part of the Ocean was not reported.
8) Off South Africa.

APPENDIX TABLE II. THE FISHES FOUND IN THE STOMACHS OF SPERM WHALES BY AREA*

English name	Family Genus Species	Pacific						Atl.	Ind.	Antarctic			
		NW[1]	N[2]	NE[3]	SW[4]	SE[5]	Pac[6]	NE[3]	S[7]	Pac	Atl	Ind	Ant
Lamprey	Petromyzonidae	−	+	+	−	−	−	−	−	−	−	−	−
Pacific lamprey	*Entophenus tridentatus*	−	+	−	−	−	−	−	−	−	−	−	−
	Scyliorhinidae	−	−	−	−	−	−	−	−	−	−	−	−
Brown cat shark	*Apristurus brunneus*	−	−	+	−	−	−	−	−	−	−	−	−
	Cetorhinidae	−	−	−	−	−	−	−	−	−	−	−	−
Basking shark	*Cetorhinus maximus*	−	−	−	+	−	−	+	−	−	−	−	−
	C. sp.	−	−	−	−	−	−	+	−	−	−	−	−
Blue shark	Carchariidae	−	−	−	−	−	−	−	−	−	−	−	−
	Carcharias glaucus	−	−	−	−	−	−	+	−	−	−	−	−
Shark	Squalidae	+	−	−	−	−	+	−	−	−	−	−	−
Spined dog fish	*Squalus acanthias*	+	+	−	−	−	−	−	−	−	−	−	−
	=*Koinga kirki*	−	−	−	+	−	−	−	−	−	−	−	−
	Dalatiidae	−	−	−	−	−	−	−	−	−	−	−	−
Green shark	*Somniosus* sp.	+	−	−	−	−	−	−	−	−	−	−	−
Greenland shark	*S. microcephalus*	−	−	−	−	−	−	+	−	−	−	−	−
Black shark	*Dalatias licha*	−	−	−	−	−	−	+	−	−	−	−	−
	D. sp.	−	−	−	+	−	−	−	−	−	−	−	−
Shark	Echinorhinidae	−	−	−	−	−	−	−	−	−	−	−	−
	Echinorhinus cooki	−	−	−	+	−	−	−	−	−	−	−	−
	E. sp.	−	−	−	+	−	−	−	−	−	−	−	−

Continued . . .

APPENDIX TABLE II. Continued.

English name	Family Genus Species	Pacific						Atl.	Ind.	Antarctic			
		NW[1]	N[2]	NE[3]	SW[4]	SE[5]	Pac[6]	NE[3]	S[7]	Pac	Atl	Ind	Ant
Shark, Pacifice angel shark	Squatinidae	−	−	−	−	−	+	−	−	−	−	−	−
	Squatina californica	−	−	+	−	−	−	−	−	−	−	−	−
Shark		+	−	−	−	−	−	+	−	−	−	−	−
Ray, Long nose skate	Rajidae	−	+	+	−	−	−	−	−	−	−	−	−
	Raja smirnovi	+	−	−	−	−	−	−	−	−	−	−	−
	R. rhina	−	−	+	−	−	−	−	−	−	−	−	−
	R. griseocaudata	−	−	−	−	−	−	−	−	−	+	−	−
	R. sp.	+	+	−	+	−	−	+	−	−	−	−	−
	Chimaeridae	−	−	−	+	−	−	−	−	−	−	−	−
Round-herring	Dussumieridae	−	−	−	−	−	−	−	−	−	−	−	−
	Etrumeus micropus	+	−	−	−	−	−	−	−	−	−	−	−
	Clupeidae	−	−	−	−	−	−	−	−	−	−	−	−
Sardine	*Sardinops melanosticta*	+	−	−	−	−	−	−	−	−	−	−	−
	Engraulidae	−	−	−	−	−	−	−	−	−	−	−	−
	Engraulis japonicus	+	−	−	−	−	−	−	−	−	−	−	−
Salmon	Salmonidae	−	−	−	−	−	−	−	−	−	−	−	−
	Onchorhynchus gorbusha	+	−	−	−	−	−	−	−	−	−	−	−
Salmon like fish		−	−	+	−	−	−	−	−	−	−	−	−
Lantern fish	Myctophidae	−	−	−	−	−	−	−	−	−	−	−	−
	Myctophum humboldti	−	−	−	+	−	−	−	−	−	−	−	−
	Tarletonbeania crenularis	−	−	+	−	−	−	−	−	−	−	−	−
	Alepisauridae	−	+	−	−	−	−	−	−	−	−	−	−
	=Plagiodontidae	−	+	−	−	−	−	−	−	−	−	−	−
	Alepisaurus aesculapius	+	+	−	−	−	−	−	−	−	−	−	−
	=Plagyodus aesculapius	−	+	−	−	−	−	−	−	−	−	−	−
	A. spp.	−	−	−	−	−	−	+	−	−	−	−	−
Large eel	Anguillidae	−	−	−	−	−	−	−	−	−	−	−	−
	Anguilla sp.	−	−	−	−	−	−	+	−	−	−	−	−
Conger eel	Congridae	−	−	−	+	−	−	−	−	−	−	−	−
Eel		−	−	−	+	−	−	−	−	−	−	−	−
	Scombresocidae	−	−	−	−	−	−	−	−	−	−	−	−
Saury	*Cololabis saira*	+	+	−	−	−	−	−	−	−	−	−	−
Dory-like fish	Trachichthidae	−	−	−	−	−	−	−	−	−	−	−	−
	Hoplostethus sp.	−	−	−	+	−	−	−	−	−	−	−	−
John Dory	Zeidae	−	−	−	−	−	−	−	−	−	−	−	−
	Zeus faber	−	−	−	+	−	−	−	−	−	−	−	−
Porcupine fish	Diodontidae	−	−	−	−	−	−	−	−	−	−	−	−
	Diodon sp.	−	−	−	−	−	−	−	+	−	−	−	−
Mackrel	Scombridae	−	−	−	−	−	−	−	−	−	−	−	−
	Scomber japonicus	+	−	−	−	−	−	−	−	−	−	−	−
	S. tapeinocephalus	+	−	−	−	−	−	−	−	−	−	−	−
	=S. japonicus tapeinocephalus	+	−	−	−	−	−	−	−	−	−	−	−

Continued . . .

APPENDIX TABLE II. Continued.

English name	Family Genus Species	Pacific						Atl.	Ind.	Antarctic			
		NW[1]	N[2]	NE[3]	SW[4]	SE[5]	Pac[6]	NE[3]	S[7]	Pac	Atl	Ind	Ant
Tuna	Thunidae	–	–	–	–	–	–	–	–	–	–	–	–
Yellow fin tuna	*Thunus albacares*	–	–	–	–	–	–	+	–	–	–	–	–
	Sphyraenidae	–	–	–	–	–	–	–	–	–	–	–	–
Barracuda	*Sphyraena* sp.	–	–	–	–	–	–	+	+	–	–	–	–
	Acinaceidae	–	–	–	–	–	–	–	–	–	–	–	–
Southern king fish	*Rexea solandri*	–	–	–	–	–	–	–	–	–	–	–	–
	=*Jordanidia solandri*	–	–	–	+	–	–	–	–	–	–	–	–
	Histiopteridae	–	–	–	–	–	–	–	–	–	–	–	–
	Pseudopentaceros richardsoni	–	+	–	–	–	–	–	–	–	–	–	–
	Serranidae	–	–	–	–	–	–	–	–	–	–	–	–
Groper	*Polyprion oxygeneios*	–	–	–	+	–	–	–	–	–	–	–	–
	Anarrhichadidae	–	–	–	–	–	–	–	–	–	–	–	–
	Anarrhichas minor	–	–	–	–	–	–	+	–	–	–	–	–
	Ophidiidae	–	–	–	–	–	–	–	–	–	–	–	–
Ling	*Genypterus blacodes*	–	–	–	+	–	–	–	–	–	–	–	–
Rock fish	Scorpaenidae	+	+	+	+	–	–	–	–	–	–	–	–
Red fish	*Sebastes flammeus*	+	–	–	–	–	–	–	–	–	–	–	–
	S. iracundus	+	–	–	–	–	–	–	–	–	–	–	–
	S. alutus	–	+	–	–	–	–	–	–	–	–	–	–
	S. mentella	–	–	–	–	–	–	+	–	–	–	–	–
	S. marinus	–	–	–	–	–	–	+	–	–	–	–	–
	S. ruberrimus	–	–	+	–	–	–	–	–	–	–	–	–
Rock fish	*S. rober*	+	–	–	–	–	–	–	–	–	–	–	–
	=*Sebastodes rober*	–	–	–	–	–	–	–	–	–	–	–	–
	S. sp.	+	+	–	–	–	–	–	–	–	–	–	–
	Helicolenus papilosus	–	–	–	+	–	–	–	–	–	–	–	–
	Anoplopomidae	–	–	–	–	–	–	–	–	–	–	–	–
Sable fish, Black cod	*Anoplopoma fimbria*	–	–	+	–	–	–	–	–	–	–	–	–
	Hexagrammidae	–	–	–	–	–	–	–	–	–	–	–	–
	Pleurogrammus monopterigius	–	+	–	–	–	–	–	–	–	–	–	–
	P. sp.	+	–	–	–	–	–	–	–	–	–	–	–
Greeling, Ling cod	*Ophiodon elongatus*	–	–	+	–	–	–	–	–	–	–	–	–
Large gobies	Cottidae	+	+	–	–	–	–	–	–	–	–	–	–
	Myoxocephalus jaok	+	–	–	–	–	–	–	–	–	–	–	–
	M. verrucosus	+	+	–	–	–	–	–	–	–	–	–	–
	M. sp	–	+	–	–	–	–	–	–	–	–	–	–
	Agonidae	–	+	–	–	–	–	–	–	–	–	–	–
	Percis japonica	–	+	–	–	–	–	–	–	–	–	–	–
	Cyclopteridae	–	+	–	–	–	–	–	–	–	–	–	–
Lumpsucker	*Cyclopterus lumpus*	–	–	–	–	–	–	+	–	–	–	–	–
	Aptocyclus ventricosus	+	+	–	–	–	–	–	–	–	–	–	–
	Moridae	–	–	–	–	–	–	–	–	–	–	–	–
	Podonema longipes	+	–	–	–	–	–	–	–	–	–	–	–
Cod (fish)	Gadidae	+	–	+	–	–	–	–	–	–	–	–	–
	Gadus macrocephalus	+	–	–	–	–	–	–	–	–	–	–	–

Continued . . .

APPENDIX TABLE II. Continued.

English name	Family Genus Species	Pacific						Atl.	Ind.	Antarctic			
		NW[1]	N[2]	NE[3]	SW[4]	SE[5]	Pac[6]	NE[3]	S[7]	Pac	Atl	Ind	Ant
Pacific cod	=*G. morhua macrocephalus*	+	+	−	−	−	−	−	−	−	−	−	−
	G. morhua	−	−	−	−	−	−	+	−	−	−	−	−
	G. aeglefinus	−	−	−	−	−	−	+	−	−	−	−	−
	=Melanogrammus aeglefinus	−	−	−	−	−	−	+	−	−	−	−	−
	Pollachius virens	−	−	−	−	−	−	+	−	−	−	−	−
Walleye pollack	*Theragra chalcogramma*	+	−	−	−	−	−	−	−	−	−	−	−
	Eleginus gracilis	+	−	−	−	−	−	−	−	−	−	−	−
	E. gracilis navaga	+	−	−	−	−	−	−	−	−	−	−	−
Southern poutassou	Gadidae	−	−	−	−	−	−	−	−	−	−	−	−
	Micromesistius australis	−	−	−	−	−	−	−	−	−	+	−	−
	Notothenidae	−	−	−	−	−	−	−	−	−	−	−	−
	Dissostichus eleginoides	−	−	−	−	−	−	−	−	−	+	−	−
	D. mawsoni	−	−	−	−	−	−	−	−	+	−	−	−
Macrurid	Coryphaenoididae	−	−	−	−	−	−	−	−	−	−	−	−
	=Macruridae	−	+	−	−	−	−	−	−	−	−	−	−
	Coryphaenoides pectoralis	+	−	−	−	−	−	−	−	−	−	−	−
	=*Laemonema longipes*	−	+	−	−	−	−	−	−	−	−	−	−
	C. sp.	−	+	−	−	−	−	−	−	−	−	−	−
	=*Macrurns* sp.	−	+	−	−	−	−	−	−	−	−	−	−
	Hemimacrurus acrolepis	+	−	−	−	−	−	−	−	−	−	−	−
	Icosteidae	−	−	−	−	−	−	−	−	−	−	−	−
Fan-tailed rag-fish	*Icosteus aenigmaticus*	−	−	+	−	−	−	−	−	−	−	−	−
Brown ragfish	*Acrotus willoughbyi*	−	−	+	−	−	−	−	−	−	−	−	−
Angler fish	Lophiidae	−	−	−	−	−	−	−	−	−	−	−	−
	Lophius piscatorius	−	−	−	−	−	−	+	−	−	−	−	−
Large (bathy pelagic) angler fish	Ceratiidae	−	−	−	−	−	−	−	+	−	−	−	−
	Ceratias holboelli	−	−	−	−	−	−	+	−	−	+	+	−
	Himantolophidae	−	−	−	−	−	−	−	−	−	−	−	−
	Himantolophus groenlandicus	−	−	−	−	−	−	+	−	−	−	−	−
	Oneirodidae	−	−	−	−	−	−	−	−	−	−	−	−
Angler fish	*Oneirodes* sp.	+	−	−	−	−	−	−	−	−	−	−	−

Notes:

* The list has been drawn up on the basis of data from the works listed in the chapter "REFERENCE." The bar in the table only shows that the specimen was not reported by this name.

1) Northeastern part of the Ocean.
2) Northern part of the Ocean.
3) Northeastern part of the Ocean.
4) Southwestern part of the Ocean.
5) Southeastern part of the Ocean.
6) The part of the Ocean was not reported.
7) Southern part of the Ocean.