

# Food of Whales

(In the Adjacent Waters of Japan)

By

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## Introduction

Biological investigations of whales have been made in the last three years since the end of the War,—1946, 1947 and 1948 — in each landstation of the coastal whaling in Japan. Based on the records of such investigations, we are here going to make a report of the stomach contents of whales. The records consist of four items; — food contained or empty, quantity, species and degree of digestion. Of these, we will not refer to the degree of digestion in the present piece. Suffice it to say that our material is confined to the contents of the first room only, though the stomach of whales is divided into four rooms.

Table 1 shows the numbers of the catches of these three years according to the species. (The results of the factory whaling in the Bonin Islands sea area are excluded from the number.) In Table 2 are shown the total numbers of the catches of the three years of the various sea area and the whaling seasons according to the sea areas. These two tables will give readers a brief idea of the catches of our coastal whaling. The biological investigations before mentioned were made of all the whales posted in these tables.

Table 1

Whale species Year	Right	Blue	Fin	Sei	Hump- back	Sperm	Total
1946	0	8	232	545	8	957	1750
1947	0	30	257	383	8	964	1642
1948	1	49	176	533	8	823	1590
Total	1	87	665	1461	24	2744	4982

Table 2

Whale species Sea-area	Right		Blue		Fin		Sei		Hump- back		Sperm		Total
	No.	Whalling	No.	W.S.	No.	W.S.	No.	W.S.	No.	W.S.	No.	W.S.	
Hokkaido- Okhotsk	0		0		411	Jul. -Aug.	18	Jul. -Aug.	4	Jun. -Aug.	75	Aug.	508
Hokkaido- Pacific	0		58	Oct.	128	Oct.	442	Sep. -Oct.	7	Oct.	649	Sep. -Oct.	1284

Sanriku	1	Jan.	28	May -Jun.	86	May -Aug.	946	May -Aug.	6	May	1944	May -Dec.	3011
Kinan	0		0		0		2	Apr. -Jun.	1	May	54	Apr. -May	57
Goto- Tsushima	0		1	May	40	Mar. & Aug.	53	Jul. Aug.	6	Jan.	22	May	122
Total	1		87		665		1461		24		2744		4982

*Food Contained on Empty, and Quantity*

Whether food is contained in the first room of the stomach or it is empty, and the quantity of food, if any, are shown according to the species in Tables 3 — 9.

Table 3

Blue whales - Stomach contents

Food (quantity)	Contained					Empty	No. of stomachs examined
	R	rrr	rr	r	Total		
Sea area							
Hokkaido -Okhotsk							
Hokkaido -Pacific	1	8	6	20	35	23	58
Sanriku		3	3	11	17	11	28
Kinan							
Goto-Tsushima						1	1
Total	1	11	9	31	52	35	87

Table 4

Fin whales - Stomach contents

Food (quantity)	Contained					Empty	No. of stomachs examined
	R	rrr	rr	r	Total		
Sea area							
Hokkaido-Okhotsk	1	61	24	181	267	144	411
Hokkaido-Pacific		16	18	60	94	34	128
Sanriku		8	16	21	45	41	86
Kinan							
Goto-Tsushima		6	3	3	12	28	40
Total	1	91	61	265	418	247	665

Table 5

Sei whales - Stomach contents

Food (quantity) Sea area	Contained					Empty	No. of stomachs examined
	R	rrr	rr	r	Total		
Hokkaido-Okhotsk	R	4	2	3	9	9	18
Hokkaido -Pacific		42	66	180	297	145	442
Sanriku	9	27	58	310	399	547	946
Kinan	4	1			1	1	2
Goto-Tsushima	4	6	10	11	31	22	53
Total	17	80	35	504	737	724	1461

Table 6

Hump-back whales - Stomach contents

Food (quantity) Sea area	Contained					Empty	No. of stomachs examined
	R	rrr	rr	r	Total		
Hokkaido -Okhotsk			1	2	3	1	4
Hokkaido -Pacific				1	1	6	7
Sanriku		1	1	1	2	4	6
Kinan				1	1		1
Goto-Tsushima						6	6
Total		1	2	4	7	17	24

Table 7

Sperm (males) - Stomach contents

Food (quantity) Sea area	Contained					Empty	No. of stomachs examined
	R	rrr	rr	r	Total		
Hokkaido -Okhotsk		10		20	30	45	75
Hokkaido -Pacific	1	13	25	198	237	123	360
Sanriku		17	54	425	496	379	875
Kinan		1	8	32	41	6	47
Goto-Tsushima				5	5	3	8
Total	1	41	87	680	809	556	1365

Table 8

Sperm (females) - Stomach contents

Food (quantity) Sea area	Contained					Empty	No. of stomachs examined
	R	rrr	rr	r	Total		
Hokkaido-Okhotsk							
Hokkaido-Pacific		14	18	150	182	107	289
Sanriku		13	51	557	621	448	1069
Kinan				7	7		7
Goto-Tsushima	1		1	6	8	6	14
Total	1	27	70	720	818	561	1379

Table 9

Sperm (Males and Females) - Stomach contents

Food (quantity) Sea area	Contained					Empty	No. of Stomachs examined
	R	rrr	rr	r	Total		
Hokkaido-Okhotsk		10		20	30	45	75
Hokkaido-Pacific	1	27	43	348	419	230	649
Sanriku		30	105	982	1.117	827	1.944
Kinan		1	8	39	48	6	54
Goto-Tsushima	1		1	11	13	9	22
Total	2	68	157	1.400	1.627	1.117	2.744

Remarks -- Shown by the Quantity

R = The Number with very much food

rrr = The Number with much food

rr = The Number with moderate food

r = The Number with little food

From these seven tables we know that the best grounds of our coastal whaling are the Sanriku and the Hokkaido-Pacific sea areas. Next to these ranks the Hokkaido-Okhotsk sea area, grounds for fin whales. In point of the quantity of the food for whales, the Hokkaido-Pacific sea area is by far the best. The comparison between the two best whaling grounds, the Hokkaido-Pacific and the Sanriku sea areas shows that the former surpasses the latter in the quantity of food for every

species of whales. This fact as well as the differences of the whaling seasons between the two sea areas and some other points justifies the assumption that whales make migrations from off the coast of Sanriku to the Hokkaido-Pacific sea area in search of food. The Antarctic Ocean is a vast breeding place for the food of whales and in point of quantity it is unsurpassed by any place on earth. Yet according to Mr. Ohmura who made reports on board a Japanese factory ship in the Antarctic Ocean in the season 1940-1941, 30% of the blue whales and 40% of the fin whales captured then were found hungry, that is, their stomachs were quite empty of food when dissected. Our adjacent waters with abundant food for whales are qualified for excellent whaling grounds. Especially, the Hokkaido-Pacific sea area where female sperm whales have the destinations of their northern migrations,—the former species go as far as the neighbouring waters of Etorohu Island, 45° N and the latter the Nemuro Peninsula, 43° 30' N.—is, in point of the quantity of food, comparable with the Antarctic Ocean, though on a smaller scale. Also, the Hokkaido-Okhotsk sea area where catch is confined to fin whales and male sperm whales, is plentiful in the material for the food of whales. As far the Kinan and the Goto-Tsushima sea area the catch is too small to draw a definite conclusion; yet comparatively few animals go hungry there. Especially the percentage of the hungry sperm whales in the Kinan sea area is low. In short, our adjacent waters make good whaling grounds with abundant food.

There is hardly any variation found between the stomach contents of the two sexes of all the species except sperm whales. The size and the number of the catch of sperm whales differ greatly according to the sexes. Females are generally found in Harem while some males, so-called "Old Bulls" live unaccompanied and go far into the cold water area of the north. Due to these differences we consider it necessary to treat the whales of this species separately according to the sexes. As far the quantity of food, however, no difference is discernible between the sexes.

### *Species of Food*

The following tables will show the species of food according to the sea areas.

Table 10

Blue Whales - Stomach contents

Food (Species) Sea area	Contained				Empty	No. of stomachs examined
	Kri.	Sar.	Sj.	Total		
Hokkaido-Okhotsk						

Hokkaido-Pacific	34		1	35	23	58
Sanriku	16	1		17	11	28
Kinan						
Goto-Tsushima					1	1
Total	50	1	1	35	35	87

Table 11

## Fin Whales - Stomach contents

Food (Species) Sea area	Contained						Empty	No. of Stomachs exa- mined
	Kri.	Mac.	Sq.	Sar.	San.	Total		
Hokkaido-Okhotsk	267					267	144	411
Hokkaido-Pacific	90		2	1	1	94	34	128
Sanriku	43	1		1		45	41	86
Kinan								
Goto-Tsushima	10	1		1		12	28	40
Total	410	2	2	3	1	418	245	665

Table 12

## Sei Whales - Stomach contents

Food (Species) Sea area	Contained								Emp- ty	No. of stomachs examined
	Kri.	Sq.	Sar.	San.	Mac.	Men.	Oct.	Total.		
Hokkaido-Okhotsk	9							9	9	18
Hokkaido-Pacific	103	135	32	16	10		1	297	145	422
Sanriku	253	10	107	25	1	2	1	399	547	946
Kinan	1							1	1	2
Goto-Tsushima	1		29		1			31	22	53
Total	367	145	168	41	12	2	2	737	724	1,461

Table 13

## Hump-back Whales - Stomach contents

Food (Species) Sea area	Contained			Empty	No. of stomachs examined
	Kri.	Sar.	Total		
Hokkaido-Okhotsk	3		3	1	4
Hokkaido-Pacific		1	1	6	7
Sanriku	2		2	4	6
Kinan			1		1
Goto-Tsushima	1			6	6
Total	6	1	7	17	24

Remarks — Shown by the food species

Kri.	=	The number, eater Krill
Sar.	=	" Sardine
Mar.	=	" Mackerel
San.	=	" Sanma
Men.	=	" Menuke
Oct.	=	" Octopus
Sha.	=	" Shark
Sq.	=	" Squid
Cod.	=	" Codfish

The data contained in Tables 10—13 are concerned exclusively with baleen whales and they make it clear that the larger the sizes of the whales are, the fewer the varieties of food they eat. In other words, the whales having large sized baleen eat more homogenous food consisting only of small food. All the blue whales in Table 10 eat "Krill" except two which have sardines and squids respectively in their stomachs. Most fin whales eat "Krill" but some sardines, mackerels and sanmas, showing they take greater varieties of food than blue whales. As for sei whales, they are arrant gross feeders. Besides "Krill", they eat sardines, squids and other kinds of food shown in Table 12. Most sei whales caught in the Goto-Tsushima sea area have sardines in their stomachs.—sei whales are called "Iwashi-whale" in Japanese, "Iwashi" meaning sardine. The name is derived from their staple food in this sea area—Also in the Sanriku sea area sardines are eaten by a considerable number of sei whales. In the Hokkaido-Pacific sea area, however, it is often the case that squids make their stomach

contents rather than "Krill". All the species of whales eat, besides "Krill", squids, the proper food for sperm whales, in this sea area. We cannot arrive at any definite conclusion regarding the catch of any species of the Kinan sea area as the number of the catch there is so small with only one land station at Oshima. So is the case with humpback whales whose catch are so scanty in our adjacent waters.

Now we are going to deal with the food of sperm whales, the only large sized species of Odontoceti.

Table 14

## Sperm Whales (Males) - Stomach contents

Food (Species) Sea area	Contained									Em- pty	No. of stomachs examined
	Sq.	Kri.	Oct.	Cod.	Sha.	Men.	Sar.	San.	Total		
Hokkaido-Okhotsk	28					2			30	45	75
Hokkaido-Pacific	210		5	4	1	10	1	6	237	123	360
Sanriku	441		11	18	2	23	1		496	379	875
Kinan	41								41	6	47
Goto-Tsushima	5								5	3	8
Total	725		16	22	3	35	2	6	809	556	1,365

Table 15

## Sperm Whales (Females) - Stomach contents

Food (Species) Sea area	Contained									Em- pty	No. of stomachs examined
	Sq.	Kri.	Oct.	Cod.	Sha.	Men.	Sar.	San.	Total		
Hokkaido-Okhotsk											
Hokkaido-Pacific	174	1		6		1			182	107	289
Sanriku	600	1	3			16	1		621	448	1,069
Kinan	7								7		7
Goto-Tsushima	7						1		8	6	14
Total	788	2	3	6		17	2		818	561	1,379



Table 16  
Sperm Whales (Males and Females) - Stomach contents

Food (Species) Sea area	Contained									Em- pty	No. of stomachs examin- ed
	Sq.	Kri.	Oct.	Cod.	Sha.	Men.	Sar.	San.	Total		
Hokkaido-Okhotsk	28					2			30	45	75
Hokkaido-Pacific	384	1	5	10	1	11	1	6	419	230	649
Sanriku	1,041	1	14	18	2	39	2		1,117	827	1,944
Kinan	48								48	6	54
Goto-Tsusima	12						1		13	9	22
Total	1,513	2	19	28	3	52	4	6	1,627	1,117	2,744

As is shown in these tables, most sperm whales live on squids but eat some other kinds of food too. For instance some considerable number caught in the Hokkaido-Pacific and the Sanriku sea areas contain "Menuke" in their stomachs and other noticeable number codfish. Although squids are the staple food for both the sexes of the sperm whales in these sea areas males take more miscellaneous food than females; of almost the same number of males and females with food in their stomachs, other food than squids are found in 84 males and 30 females.—Tables 14 and 15. Thus male sperm whales show a strong tendency to take various kinds of food. This may be due to the fact that males, mostly "Old Bulls", swim alone in search of food and go far into the north while the activities of females are restricted as composing numbers of Harem. These differences of environments will result in the differences of the stomach contents of the two sexes.

Octopuses are also found in the stomach contents of sperm whales. They are often found mixed with squids and as often overlooked. So the actual number of sperm whales which eat octopuses may be greater than what are shown in these tables. However, it is not certain to what species these octopuses belong. Nor are known the species of the squids and of the sharks sperm whales eat in our adjacent waters. A comparatively large number of sperm whales, mostly males, contain codfish, submarine fish, in their stomachs. In this case, they consist of both *Gadus macrocephalus* and *Theragra chalcogramma*. "Menuke" belong to the Family of Scorpaenidae and taste good, the species which make food for sperm whales are either *Sebastes flammeus* or *Se. iracundus*. "Sanma" is the Japanese name for *Cololabis saira* and lives in cold waters. Sardines here include *Sardinia melahosticta*, *Etrumeus micropus* and *Engraulis japonica*, and mackerels

both *Scomber japonicus* and *Sc. tapeinocephalus*.

Herrings are not found in the stomach contents of Sei whales in our adjacent waters. It is due to the fact that though the Hokkaido-Pacific sea area is the main fishing ground for herrings in Japan, whales in their migration do not arrive there during the fishing season for herrings.

Schizopoda is the most important food for all the whales of *Mystacoceti* and make the staple food for blue and fin whales. It is called "Krill" by European whalers. In the Antarctic Ocean, "Krill" means *Euphausia superba*, but in our adjacent waters the plankton belonging to *Copepoda*, for instance, *Calanus* sp., as well as *Euphausia* sp. are included in "Krill". *Calanus* sp. and *Euphausia* sp. are quite different species, so it is but proper to treat them separately in the future researches. In the adjacent waters of Japan, the *Euphausia* sp. mostly consists of *Eu. pellucida* and *Eu. splendens* but sometimes of *Eu. gibba* and *Mysis* sp. in the warm water area, and the *Calanus* sp. consists of *Ca. finmarchicus* of the cold current and *Ca. vulgaris* and *Ca. minor* of the warm current.

#### *Appendix*

The migration and the distribution of whales are much influenced by the material of their food, and the food, in its turn, is affected by the oceanological nature of the sea water. So the value of the whaling grounds depends upon the two factors, the material of the food for whales and the oceanological nature of the sea water. Therefore we consider it necessary to make more study of these two factors in their inseparable relations; for this purpose we are going to give out further study of the food of whales, and this statistic study of the same subject based on the data of the three years after the War should be the first of the series which will follow hereafter.

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