FOOD OF *STENELLA CAERULEOALBA*

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ABSTRACT

Food contents of 27 stomachs of *Stenella caeruleoalba* taken from two schools were examined. In total, 5410 fishes were identified by otolith and 1,448 fishes by facial bones. Four species from 3 genera and 3 families were identified by otolith and 31 species from 14 genera and 11 families by facial bones. Two species from 2 genera and 2 families were observed in 35 squids contained and 4 species from 4 genera and 3 families in 1,971 shrimps. Myctophid fishes and *Bentheogennema borealis* were dominant in number in the food components. All species identified are pelagic or semipelagic. The estimated body length of fishes, the mantle length of squids, and the total length of shrimps are in the range of 60–300 mm, 95–190 mm, and 38–130 mm, respectively. The number of specimens of food components with luminous organs amounted to 74% of the total number of all specimens identified.

INTRODUCTION

Schools of blue white dolphin, *Stenella caeruleoalba* are found around the coast of Oshima Island mostly from southeast to north (Tobayama, 1969) and several thousands individuals of this animal are caught commercially in Sagami Bay throughout autumn and early winter (Tobayama, 1969; Kasuya, 1972). Accordingly, this animal is considered to migrate into Sagami Bay in autumn and early winter.

The study of the food and the food habits of this population may be important for recognizing the behavior and a cycle of ecosystem to which this animal belongs.

In the present paper, species, numbers and sizes of the food specimens in the stomach contents of 27 blue white dolphins from two schools were studied.

MATERIAL AND METHOD

In this study, contents of the first stomach were examined. The dolphins were chosen randomly from 13 and 14 individuals of schools A and B respectively. Both schools were found in Sagami Bay (Fig. 1) and driven into Kawana harbor by fishermen. Biological examination suggests that school A is considered to be a breeding school consisted of sexually maturged animals and their calves, and school B to be a nonbreeding school consisted of sexually immatured animals. Other

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TABLE 1. BIOLOGICAL INFORMATION OF SCHOOLS A AND B, *STENELLA CAERULEOALBA.*

Items			School A	School B
Time of found			09 : 00 2 Dec. 1970	06 : 30 10 Dec. 1970
Position of found			34°49′N 139°24′E	34°49′N 139°25′E
Time of expire			13 : 00 2 Dec. 1970	09 : 00 10 Dec. 1970
School size			256	88
No. of individuals examined			255	77
No. of stomachs collected			13	14
Range of body length			108–250 cm	182–245 cm
School composition	M	female	54	0
		male	56	16
	IM	female	59	16
		male	86	45

M and IM indicate mature and immature respectively.

information is shown in Table 1.

The samples were taken to the laboratory after they had been freezed to −20°C. In the laboratory, specimens were separated into three groups, fishes, squids and shrimps, then their species were identified.

As it has been formerly done (Kusaka, 1969, 1970; Kusaka and Thuc, 1972), fish species were used to be identified mostly by facial bones mainly by the urohyals, and partly by the otoliths. The number of specimens was counted by urohyals and otoliths. All otoliths refered in this report were sagittae. The body length of fish specimens was estimated from the size of the urohyal. Squid species were identified only by the half digested body and not by the beaks. The number of specimens, however, was counted by the beaks. Shrimp species were identified by the half digested individuals by the help of Dr. Y. Aizawa, and the number of specimens was also counted.

RESULT

1. The weight of stomach content

The weight of stomach contents of 26 dolphins is shown in Table 2. The average weight of those from school A is almost similar to those from school B.

2. Fish

In 27 stomachs of the dolphins 1,448 fishes found, were identified by facial bones and 31 species from 14 genera and 11 families were detected (Table 3). Among these fishes, 1,234 fishes of 13 species were found in both schools, 210 fishes of 15 species, were found only in school B and 4 fishes of 3 species, were found only in school A (Table 3).

Myctophid fishes are dominant in number amounting to 63.9% of the total number.

Myctophidae spp., *Polyipnus spinosus*, Gonostomatidae sp. and Chauliodontidae spp. have luminous organs.

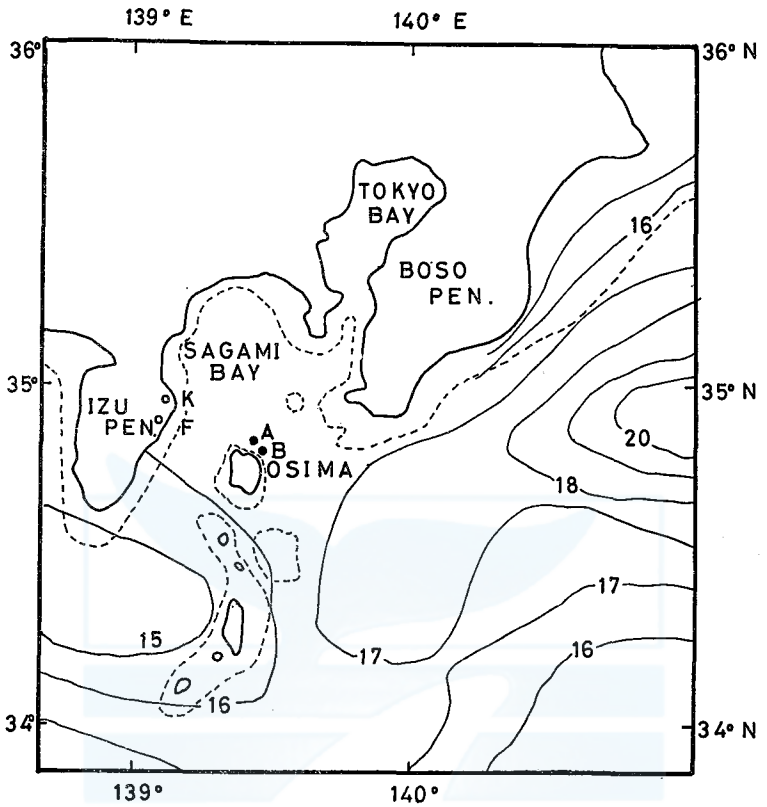

Fig. 1. Surface isothermal line around Sagami Bay in Dec. 1970 (Japanese Maritime Safety Agency, 1970), with the position of finding of the schools A and B. Broken line indicates 200 m contour line of the depth. K and F indicate Kawana and Futo.

The ranges of estimated body length of fish species are shown in Fig. 3.

By the otoliths 5,410 fishes were identified and represented 4 species belong to 3 genera and 3 families. These four species are *Diaphus elucens*, *Polyipnus spinosus*, *Diaphus coeruleus* and *Argentina semifasciata*.

The average number of fishes in the stomachs counted by the number of otoliths is higher than that counted by the number of urohyals (Table 2, Fig. 2). This difference in number may indicate the fact that otoliths remain in the first stomach longer than urohyals. Possibly, the process of digestion is more proceeded in the stomachs from school A than in those from school B, because the ratio of the number of urohyals to that of otoliths is lower in the stomachs from school A.

3. Squid

Thirty five squids found in 19 stomachs were identified by the half digested specimens and represented 2 species from 2 genera and 2 families (Table 4).

The number of individuals and the mantle length frequency of these two

TABLE 2. THE CONTENT OF FIRST STOMACHS OF *STENELLA CAERULEOALBA*.

School	Serial Number	Weight of Stomach content (g)	Fish			Squid		Shrimp
			No. Otoliths/2	No. Urohyals	No. H.D.I.	No. Beaks	No. H.D.I.	No. H.D.I.
A	2	1500	116	57	10	47	2	154
	3	—	124	39		31	3	120
	4	1150	178	35	1	37	3	85
	5	660	105	23		31		173
	21	1380	133	35		42	3	58
	29	885	209	12		42	1	189
	30	1245	265	11		29	4	21
	31	440	135	13		35		6
	32	410	283	12		8		13
	33	1310	135	23	8	47	2	86
	34	500	309	9		46		93
	35	965	129	19		38	3	106
	36	1285	49	27		13	1	140
	Total	11730	2170	315	19	456	22	1244
	Ave.	978	167	24		35		96
	S.D.	392	77	14		13		60
B	1	2095	235	189		139		67
	15	1010	149	90		89	1	34
	16	285	175	55		75		25
	17	1000	308	81		128	2	20
	18	1465	304	30	3	27	1	208
	19	1595	117	25	14	27	1	167
	20	1650	302	140		94	1	48
	22	910	172	97	1	108	2	9
	23	1135	189	54	1	98		14
	24	935	172	51	1	43	1	62
	25	1095	199	98		156	1	17
	26	1110	371	100		121		4
	27	1140	192	75		70	1	36
	28	790	355	48		174	2	16
	Total	16215	3240	1133	30	1349	13	727
	Ave.	1158	231	81		96		52
	S.D.	434	81	44		50		61

H.D.I. : indicates half digested individuals.

species are shown in Fig. 4.

Todarodes pacificus is found in both schools. *Symplectoteuthis luminosa* is found only in school B.

The number of beaks is higher in school B than in school A (Table 2, Fig. 2).

4. Shrimp

In 27 stomachs 1,971 shrimps found were identified by the half digested shrimps. Four species from 4 genera and 3 families were observed (Table 5). All individuals except one belong to 3 species. Only individual of 1 species is from school B.

Bentheogennema borealis is dominant in number which amounts to 85.6% of the

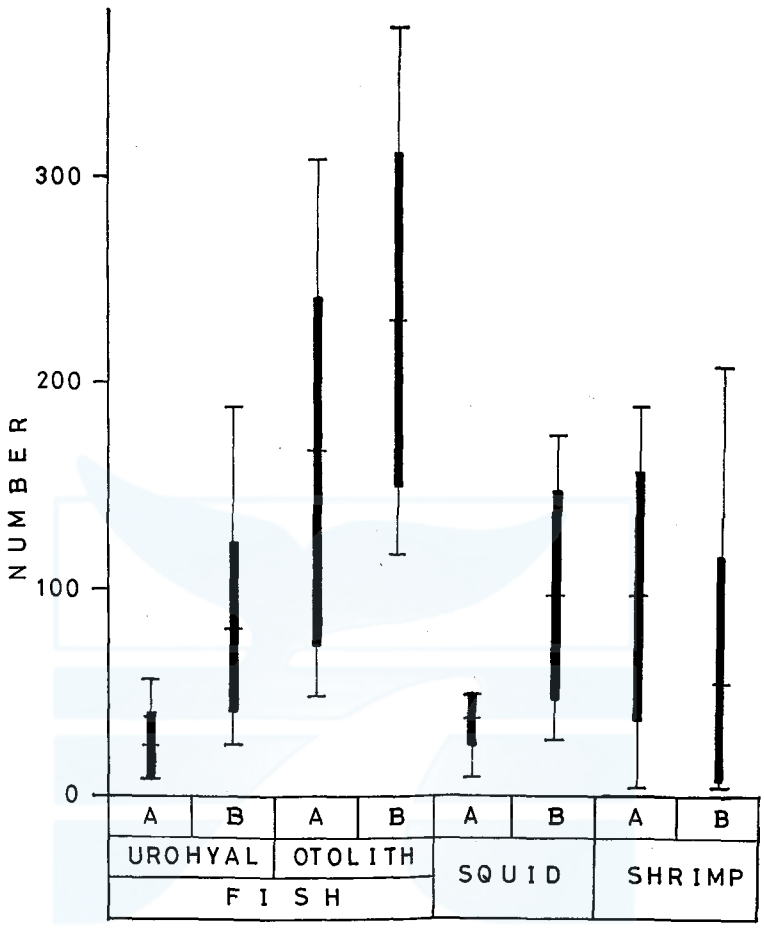

Fig. 2. Number of individuals eaten by *Stenella caeruleoalba* in schools A and B. Vertical line, range; box, range of a standard deviation; horizontal line in box, average.

total number of shrimps.

The ranges of the total length of *B. borealis* and *Pasiphaea* sp. are 38–68 mm and 110–130 mm, respectively.

The number of individuals found in school A is almost similar to that in school B (Table 2, Fig. 2).

DISCUSSION

The number of fish specimens is 59% of the total number of all specimens. It is considered that *Stenella caeruleoalba* feeds mainly on fish. Among fish species, Myctophids is the most dominant in number. The results are similar to those

TABLE 3. SPECIES AND NUMBERS OF FISHES IN

	School A													
Serial number →	2	3	4	5	21	29	30	31	32	33	34	35	36	Total
Species of fishes ↓														
Myctophidae														
Myctophum orientale														
Diaphus elucens	26	31	20	9	19	4	1		3	9	4	5	6	137
Diaphus coeruleus			1						1	1			1	4
Lampanyctus jordani														
Diaphus sp. A		1												1
Diaphus sp. B														
Nemichthyidae														
Nemichthys scolopaceus	9	3	6	6	5	2				4		2	3	40
Emmelichthyidae														
Erythrocles schlegeli	12	1	3	7	6	3	6	12	8	8	4	9	15	94
Erythrocles sp.														
Chauliodontidae														
Chauliodus sloani	1	2	1		1		3	1		1		1	1	12
Chauliodus sp.														
Paralepididae														
Lestidium sp. A	1		1								1			3
Lestidium sp. B	1			1	1	1						1		5
Lestidium sp. C	1													
Lestidium sp. D														
Lestidium sp. E													1	1
Lestidium sp. F														
Lestidium sp. G														
Lestidium sp. H														
Sternoptychidae														
Polyipnus spinosus														
Argyropelecus hemigymnus			1				1							2
Argentinidae														
Argentina semifasciata	6		1			2								9
Argentina sp.					1									1
Acinaceidae														
Acinacea sp. A		1	1		1									3
Acinacea sp. B												1		1
Acinacea sp. C					1									1
Acinacea sp. D														
Acinacea sp. E														
Lutjanidae														
Lutjanus sp.														
Priacanthidae														
Priacanthus sp.														
Gonostomatidae														
Gonostoma sp.														
Total species number	8	6	9	4	8	5	4	2	3	5	3	6	6	
Total individual number	57	39	35	23	35	12	11	13	12	23	9	19	27	315

THE STOMACHS OF *STENELLA CAERULEOALBA*.

School B															Total
1	15	16	17	18	19	20	22	23	24	25	26	27	28	Total	
6	7	5	4			9	10	3	1	11	1	3	2	67	67
84	59	27	40	14	6	67	60	30	31	51	73	35	32	609	746
3	2					4		2	2	5	5			23	27
36	2	1	1		2	30		1	3	2	2			80	80
						2		1						3	4
	1							1						2	2
18	4	7	23	3	2	14	15	5	7	20	5	21	6	150	190
94	3		1		6	12		1						23	117
			1											1	1
6	9	8	5		1	4	5	6	2	5	9	11	6	77	89
4	1		4			2	1	3		1		3	2	21	21
	1					3		1	1			1		7	10
4										2				6	11
			1			2	3		1					7	8
1														1	1
															1
1														1	1
1														1	1
	1	1		1		1								4	4
14	1	1	2	1										19	19
															2
2				3	1									6	15
															1
	1	2	1				2	1	1	1				9	12
		1		1										2	3
				1										1	2
						1			1					2	2
									1					1	1
3	1				1							1		6	6
2														2	2
1						1								2	2
17	13	11	9	8	7	13	8	11	11	9	6	7	5		
189	90	55	81	30	25	140	97	54	51	98	100	75	48	1133	1448

TABLE 4. SPECIES AND NUMBERS OF SQUIDS IN

	School A													
Serial number →	2	3	4	5	21	29	30	31	32	33	34	35	36	Total
Species of squids ↓														
Todarodes pacificus	2	3	3		3	1	4			3		3	1	33
Symplectoteuthis luminosa														
Unidentified species	47	31	37	31	42	42	29	35	8	47	46	48	13	456
Total	49	34	40	31	45	43	33	35	8	49	46	51	14	478

TABLE 5. SPECIES AND NUMBERS OF SHRIMPS IN

	School A													
Serial number →	2	3	4	5	21	29	30	31	32	33	34	35	36	Total
Species of shrimps ↓														
Bentheogennema borealis	147	116	70	157	50	168	16	5	10	65	74	97	136	1111
Pasiphaea sp.	6		13	15	8	19	5	1	3	21	14	7	4	116
Acanthephyra sp.	1	4	2	1		2					5	2		17
Aristeinae sp.														
Total	154	120	85	173	58	189	21	6	13	86	93	106	140	1244

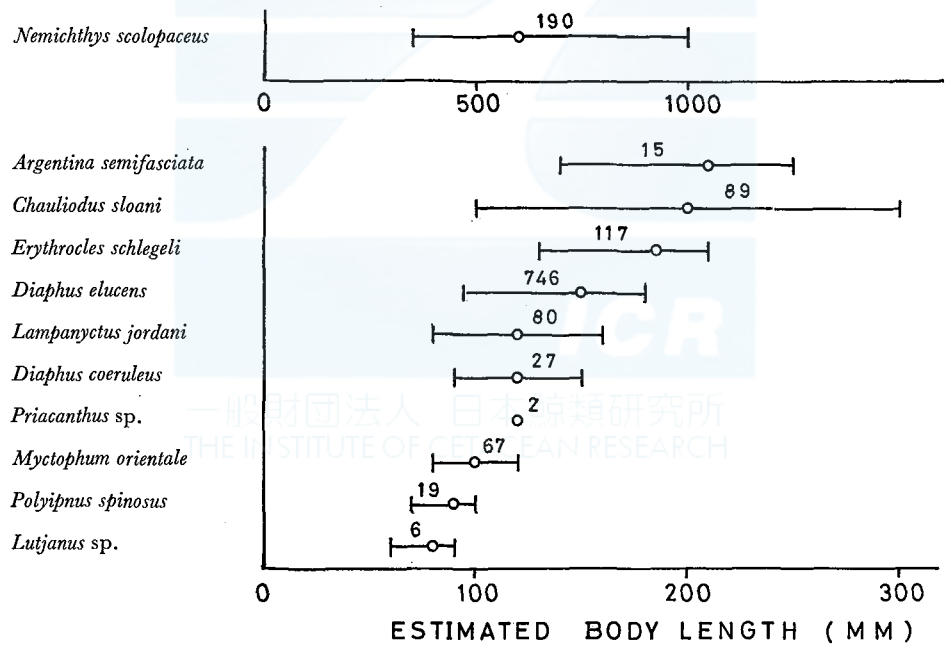

Fig. 3. Range and average (open circle) of the estimated body length of fishes eaten by *Stenella caeruleoalba* in schools A and B. Number indicates the number of individuals.

THE STOMACHS OF *STENELLA CAERULEOALBA*.

School B														
1	15	16	17	18	19	20	22	23	24	25	26	27	28	Total
	1			1	1	1	1		1			1	2	9
			2				1			1				4
139	89	75	128	27	27	94	108	98	43	156	121	70	174	1349
139	90	75	130	28	28	95	110	98	44	157	121	71	176	1362

THE STOMACHS OF *STENELLA CAERULEOALBA*.

School B														
1	15	16	17	18	19	20	22	23	24	25	26	27	28	Total
63	25	17	9	194	164	39		5	58		1		1	576
4	9	7	11	12	3	9	8	8	4	17	3	34	15	145
		1		1			1	1				1		5
												1		1
67	34	25	20	208	167	48	9	14	62	17	4	36	16	727

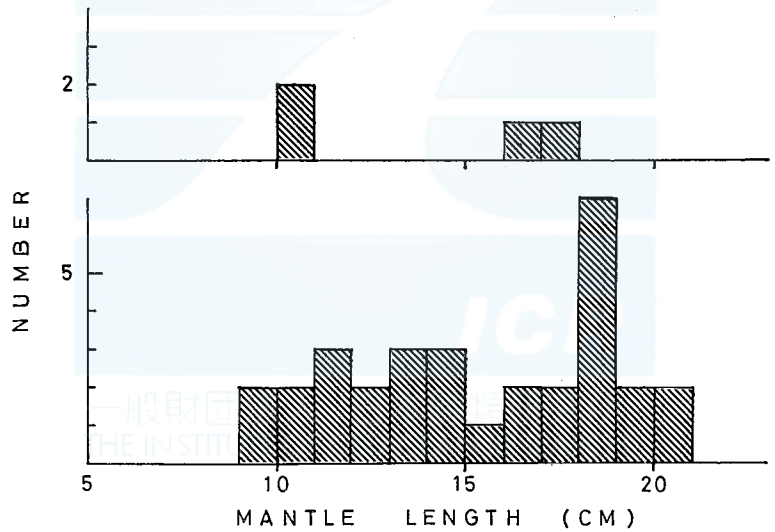

Fig. 4. Mantle length frequency of squids in the stomachs of *Stenella caeruleoalba*.
Top: *Symplectoteuthis luminosa*.
Bottom: *Todarodes pacificus*

formerly studied on *Stenella longirostris* and *Stenella graffmani* (Fitch and Brownell, 1968). Gonostomatidae spp. is commonly eaten by the above 3 *Stenella* species. Bathylagidae sp., Bregmacerotidae sp., Centrolophidae sp., Paralepididae sp. and Exocoetidae sp. have formerly been found in *S. longirostris* or *S. graffmani* (Fitch and Brownell, 1968). These species of fish inhabit in the adjacent waters of Japan, but they are not found from *S. caeruleoalba* in this study. The fish species which are found in *S. caeruleoalba* but neither in *S. longirostris* nor in *S. graffmani*, are 24 species belong to 9 genera and 9 families. Especially, *Chaulidus sloani*, *Nemichthys scolopaceus* and *Erythrocles schlegeli* are found abundantly from *S. caeruleoalba*.

The range of estimated body length of fishes from *S. caeruleoalba* is 60–300 mm. *Nemichthys scolopaceus* which is very slender (B. L. 350–1,000 mm), is an exception. The result is similar to that formerly studied on *S. longirostris* and *graffmani*.

Fish species of *Diaphus elucens*, *Nemichthys scolopaceus* and *Erythrocles schlegeli*, and shrimp species of *Bentheogennema borealis* and *Pasiphaea sp.* are found abundantly in most of the stomachs of the dolphins studied this time.

Fish species of Myctophidae spp., *Polyipnus spinosus*, Gonostomatidae sp. and Chauliodontidae spp. and squid species of *Symplectoteuthis luminosa* have luminous organs. The number of specimens of these species amounts to 74% of the total number of specimens identified in the present study.

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