OBSERVATION OF CETACEA DURING WHALE MARKING CRUISE IN THE WESTERN TROPICAL PACIFIC, 1976

NOBUYUKI MIYAZAKI

Department of Zoology, National Science Museum, Tokyo

AND

SHIRO WADA

Far Seas Fisheries Research Laboratory, Shimizu

ABSTRACT

From 20 January to 19 March 1976, the whale marking and sighting were carried out in the western tropical Pacific. During this survey 103 schools of 13 species from 11 genera were sighted, and 15 specimens of 5 species from 4 genera were collected. Observations of these 103 schools were made and the biology of these 15 specimens was studied.

INTRODUCTION

Distribution and biology of cetaceans in the western tropical Pacific have been almost not known till 1972. Recently Masaki (1972) and Wada (1975) carried out the tagging Investigation of cetacea in the western tropical Pacific. In Ogasawara and Mariana Islands Masaki (1972) found *Physeter catodon*, *Balaenoptera borealis*, *B. edeni*, *Stenella coeruleoalba*, *S. attenuata*, *Pseudorca crassidens*, *Globicephala macrorhynchus*, *Delphinus delphis*, *Ziphius cavirostris*. According to Wada (1975) *P. catodon*, *B. edeni*, *S. coeruleoalba*, *S. attenuata*, *G. macrorhynchus* were sighted in the southwest areas of the North Pacific. However, still little is known about thedistribution and biology of cetaceans in these areas. This paper reports biological investigations of cetaceans carried out during winter season in the western tropical Pacific.

MATERIALS AND METHODS

The vessel used was the *Miwa-marn*, 199.68 grosstons and maximum speed 11 knot. It was used from 20 January to 19 March 1976. The cruising course of this survey is shown in Fig. 1. The total cruising and sighting distance were 9,178 and 6,074 nautical miles, respectively. The total time of observation was 631.8 hours. Sightings were usually carried out by three persons at the foremast and two at the upper bridge except for in heavy rain.

Specimens were collected with shot gun and hand harpoon. The specimens were measured, photographed, and made on biological examinations as soon as

Sci. Rep. Whales Res. Inst.,
No. 30, 1978., 179-195

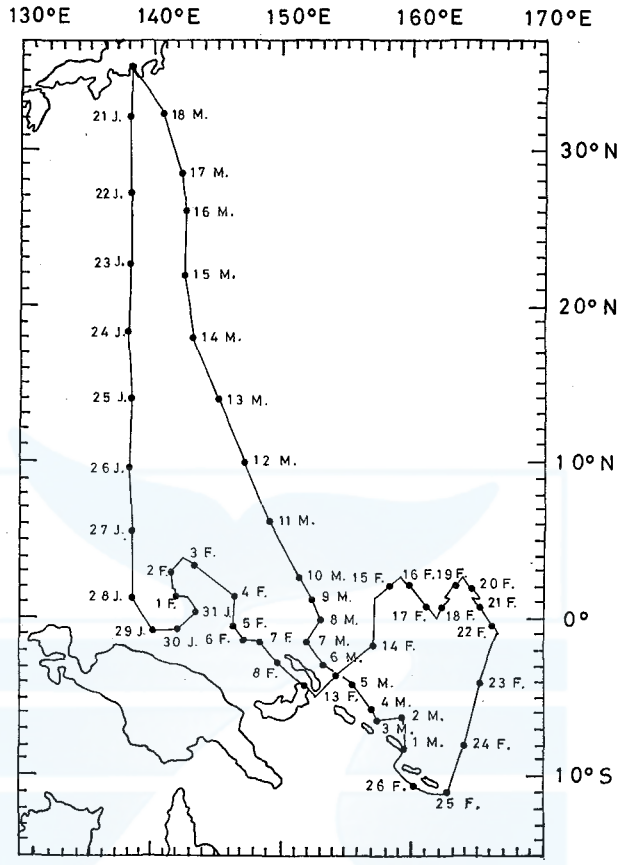


Fig. 1. The cruising course of *Miwa-maru* from 20 January to 19 March 1976. J., F., and M. mean January, February, and March, respectively. Numbers indicate dates.

possible after hauling them aboard the vessel. Testes and ovaries were collected and fixed with 10% formalin solution. In the laboratory testes and ovaries were weighed, the number of corpora counted, and the diameters of Graafian follicles measured. The testes of the specimens were histologically examined.

OBSERVATIONS AND BIOLOGICAL INFORMATIONS

During this survey 103 schools of 13 species from 11 genera were sighted, and 15 dolphins of 5 species from 4 genera were collected. Informations on the distribution, behavior, and biology of these species are given below.

Balaenoptera edeni

Bryde's whales, *Balaenoptera edeni*, are common in the western tropical Pacific (Masaki 1972, Wada 1975). As the research vessel could always approach to

Bryde's whales, it is easy for us to identify the species. Especially it is also possible to distinguish the species from the sei whale, *Balaenoptera borealis*, basing on the three ridges on the snout.

Fifty animals of 25 schools of Bryde's whale, and 4 females with calf in these schools were found (Table 1). Estimated body size of 4 calves, 4 females with calf, and the other animals were 7–8 m, 12–13 m, and 11–13 m, respectively. We could not find subadult animals between 8 and 11 m. According to Masaki (1972) and Wada (1975), they did not also find subadult animals in winter season of the western tropical Pacific. From these data it seems that the subadult of Bryde's whale geographically segregate from the adult in winter season of this area. In order to solve this problem it is necessary to accumulate more data in the future.

Bryde's whales were sighted mostly in the area of 0°–2°N latitude and 142°–144°E longitude, especially around Manus Islands, Solomon Islands, and Nauru Island (Fig. 2). Sea surface temperature at sighting positions ranged from 28.5°C to 30.0°C. School size ranged between 1 and 8 animals, but most of the groups had only one or two whales (Fig. 5). This suggests that Bryde's whales mostly distribute on solitary or pair, and sometime make small school less than 10 animals in winter season of the western tropical Pacific.

Six Bryde's whales of schools (sighting Nos 13, 14, 15, 22, 23, 24) were found together with bonito schools and many sea birds. Especially several animals of the school (sighting No. 14) chased the prey turning sideways with their mouths open and appeared to be feeding. This suggests that Bryde's whales take the prey in winter season. Many remoras (Echeneidae) were found on the back of one adult animal in a school (sighting No. 19).

Physeter catodon

Sperm whale, *Physeter catodon* is common in the western tropical Pacific (Masaki, 1972 ; Wada, 1975). Twelve schools with a total of 156 sperm whales were found. As shown in Fig. 2, sperm whales were often found around islands. The school size ranged from 1 to 28 animals (Fig. 5). Sea surface temperature at sighting positions ranged from 28.7°C to 29.7°C (Table 1).

Estimated body length of four sperm whales sighted separately (sighting Nos 33, 34, 35, 36) was between 12 and 14 m. These whales were probably solitary adult males. These animals were often observed to dive for 15 to 25 minutes. Four schools had female with calf (Table 1). These females and calves were often found slightly apart from other animals in the school. Estimated body size of these females and calves were 9–10 m and 4–5 m, respectively. Six schools were composed of the subadults or adults, and the school size of these whales was between 8 and 28. In a school (sighting No. 31) there are three groups of the animals. The group composed of 11 adult animals, 5 subadult ones, and 2 calves was placed between two groups, one of which was consisted of 6 adult animals and the other 4 adult ones. One school (sighting No. 38) had eight adult whales and these were found side by side approximately 2–3 m apart. Sperm whales in one

TABLE 1. SIGHTING RECORDS OF CETACEANS DURING THIS SURVEY

Sighting No.	Species	Date	Position	Time	Surface temperature (°C)	School size	Comments
1	*Balaenoptera edeni*	30 I '76	00°54′N, 142°05′E	06: 45	28.8	1	
2	,,	31 I '76	00°16′N, 143°28′E	08: 25	29.2	1	
3	,,	1 II '76	01°35′N, 142°03′E	14: 20	30.0	1	
4	,,	1 II '76	01°40′N, 142°03′E	15: 00	30.0	1	
5	,,	1 II '76	01°43′N, 142°03′E	15: 20	30.0	1	
6	,,	5 II '76	00°55′S, 146°35′E	14: 35	29.0	1	
7	,,	5 II '76	00°57′S, 146°38′E	15: 10	29.0	2	
8	,,	6 II '76	01°05′S, 147°01°E	06: 15	29.0	2	
9	,,	6 II '76	01°16′S, 147°00′E	09: 15	29.0	1	Many remoras attached to the back of this animal.
10	,,	6 II '76	01°21′S, 147°05′E	10: 55	28.8	1	
11	,,	6 II '76	01°22′S, 147°06′E	11: 20	28.8	1	
12	,,	6 II '76	01°27′S, 147°21′E	14: 15	29.0	1	
13	,,	6 II '76	01°23′S, 147°22′E	15: 15	29.0	1	With many seabirds and a school of bonito.
14	,,	6 II '76	01°15′S, 147°28′E	16: 30	29.0	6	With many seabirds and a school of bonito.
15	,,	7 II '76	01°25′S, 148°14′E	09: 10	29.0	1	With many seabirds and a school of bonito.
16	,,	13 II '76	04°08′S, 154°17′E	10: 10	29.2	1	
17	,,	18 II '76	00°04′N, 162°27′E	08: 35	29.1	2	One female with a calf was found.
18	,,	21 II '76	00°55′N, 165°24′E	10: 35	28.5	1	
19	,,	21 II '76	00°47′N, 165°27′E	12: 15	28.7	7	One female with a calf was found.
20	,,	21 II '76	00°37′N, 165°35′E	14: 40	29.0	2	One female with a calf was found.
21	,,	21 II '76	00°30′N, 165°38′E	16: 10	29.0	3	One female with a calf was found.
22	,,	4 III '76	06°06′S, 156°53′E	06: 50	29.6	1	With many seabirds and a school of bonito.
23	,,	4 III '76	06°07′S, 156°56′E	07: 50	29.5	8	With many seabirds and a school of bonito.
24	,,	4 III '76	06°05′S, 156°07′E	10: 55	29.3	2	With many seabirds and a school of bonito.
25	,,	6 III '76	03°16′S, 153°39′E	10: 45	30.2	1	
26	*Physeter catodon*	30 I '76	00°56′S, 142°03′E	08: 00	28.8	18	Four females with a calf were found. Together with two Risso's dolphins.
27	,,	7 II '76	01°24′S, 148°06′E	07: 15	29.0	8	
28	,,	7 II '76	01°34°S, 148°42′E	12: 10	29.2	19	One female with a calf was found.
29	,,	7 II '76	01°50′S, 148°47′E	15: 20	28.8	15	One female with a calf was found.
30	,,	8 II '76	03°16′S, 150°24′E	15: 10	29.7	12	Two females with a calf were found. Many remoras attached to the back of calf.

31	,,	22 II '76	00°44′S, 166°37′E	13: 30	28.8	28	
32	,,	24 II '76	08°51′S, 163°50′E	16: 00	28.7	16	
33	,,	29 II '76	09°11′S, 159°56′E	17: 30	28.8	1	
34	,,	29 II '76	09°11′S, 159°56′E	17: 30	28.8	1	
35	,,	29 II '76	09°10′S, 159°57′E	18: 35	28.8	1	
36	,,	29 II '76	09°10′S, 159°57′E	18: 48	28.8	1	
37	,,	3 III '76	06°14′S, 157°08′E	17: 25	29.2	10	
38	,,	10 III '76	02°17′N, 151°34′E	06: 20	29.6	26	
39	*Stenella coeruleoalba*	21 I '76	30°47′N, 138°33′E	17: 20	18.2	40–50	
40	,,	23 I '76	23°21′N, 138°27′E	09: 15	22.4	10–20	
41	,,	5 III '76	04°02′N, 155°41′E	13: 35	30.5	400–500	Several females with a calf were found.
42	,,	16 III '76	25°23′N, 143°04′E	07: 05	22.6	30–40	Two females with a calf were found.
43	,,	16 III '76	25°56′N, 143°06′E	09: 45	22.2	50–60	Three females with a calf were found.
44	,,	16 III '76	26°40′N, 143°07′E	15: 05	22.0	40–50	Three females with a calf were found.
45	,,	16 III '76	26°42′N, 143°00′E	17: 00	22.0	20–30	
46	,,	17 III '76	28°29′N, 142°30′E	11: 10	20.6	100–150	Several females with a calf were found.
47	*Stenella attenuata*	25 I '76	14°50′N, 138°28′E	07: 55	27.4	10–20	
48	,,	27 I '76	04°52′N, 138°35′E	16: 30	29.1	10–20	Together with a school of *Pseudorca crassidens*.
49	,,	14 II '76	01°09′S, 157°49′E	16: 05	29.8	50–60	One specimen (specimen No. 6) was collected.
50	,,	16 II '76	02°20′S, 159°49′E	09: 10	29.0	20–30	
51	,,	1 III '76	08°20′S, 160°00′E	11: 00	29.1	20–30	One specimen (specimen No. 7) was collected.
52	,,	1 III '76	08°09′S, 160°04′E	13: 15	29.4	150–200	Several females with a calf were found.
53	,,	2 III '76	06°37′S, 159°35′E	10: 00	29.0	500–600	One specimen (specimen No. 5) was collected. Five females with a calf were found.
54	,,	2 III '76	06°02′S, 159°15′E	16: 35	29.5	400–500	One specimen (specimen No. 8) was collected.
55	,,	5 III '76	04°20′S, 155°51′E	10: 15	30.1	30–40	Several females with a calf were found.
56	,,	5 III '76	03°48′S, 155°04′E	17: 10	30.0	100–150	Serveral females with a calf were found.
57	,,	6 III '76	03°25′S, 153°44′E	09: 35	30.2	70–80	
58	,,	6 III '76	03°06′S, 153°31′E	12: 15	30.4	50–60	Several females with a calf were found.
59	,,	7 III '76	01°49′S, 151°53′E	10: 15	29.8	40–50	
60	,,	16 III '76	26°41′N, 143°07′E	16: 40	22.0	100–150	
61	*Stenella longirostris*	2 II '76	03°03′N, 141°57′E	13: 35	29.5	40–50	
62	,,	2 II '76	03°11′N, 142°07′E	15: 50	29.2	30–40	One specimen (specimen No. 13) was collected.
63	,,	12 II '76	04°55′S, 152°56′E	16: 25	29.6	150–200	One specimen (specimen No. 11) was collected.
64	,,	14 II '76	02°09′S, 157°45′E	10: 05	29.0	40–50	

Continued . . .

TABLE 1. Continued.

Sighting No.	Species	Date	Position	Time	Surface temperature (°C)	School size	Comments
65	,,	20 II '76	01°18′N, 165°13′E	16:45	28.7	100–150	Three females with a calf were found.
66	,,	22 II '76	00°52′S, 166°42′E	15:50	29.1	30–40	One specimen (specimen No. 10) was collected.
67	,,	24 II '76	07°18′S, 164°34′E	07:00	28.6	150–200	Several females with a calf were found.
68	,,	1 III '76	08°50′S, 159°52′E	07:35	28.8	30–40	One specimen (specimen No. 15) was collected. Two females with a calf were found.
69	,,	1 III '76	07°53′S, 160°05′E	16:00	29.5	80–100	Several females with a calf were found.
70	,,	1 III '76	07°52′S, 160°04′E	16:25	29.5	150–200	Four females with a calf were found.
71	,,	1 III '76	07°41′S, 159°55′E	18:00	29.5	500–600	One specimen (specimen No. 14) was collected.
72	,,	3 III '76	06°34′S, 158°08′E	09:20	29.0	50–100	One specimen (specimen No. 9) was collected. Several females with a calf were found.
73	,,	3 III '76	06°31′S, 157°26′E	14:25	29.9	200–300	One specimen (specimen No. 12) was collected.
74	,,	4 III '76	05°10′S, 156°34′E	18:10	30.6	20–300	
75	,,	5 III '76	04°54′S, 156°11′E	07:15	30.0	150–200	Several females with a calf were found.
76	,,	5 III '76	03°48′S, 155°18′E	15:45	30.6	150–200	Several females with a calf were found.
77	,,	6 III '76	02°55′S, 153°22′E	13:45	30.4	500–600	
78	,,	9 III '76	00°25′N, 153°09′E	07:25	29.4	20–30	
79	*Stenella* sp.	31 I '76	00°56′N, 143°30′E	17:55	30.0	10–20	
80	,,	21 II '76	00°23′N, 165°37′E	18:20	29.0	10–20	
81	*Tursiops* sp.	7 II '76	01°55′S, 148°53′E	17:15	28.8	200–300	One specimen (specimen No. 4) was collected.
82	,,	26 II '76	10°33′S, 160°33′E	14:15	28.4	10–20	
83	*Lagenodelphis hosei*	23 I '76	23°15′N, 138°27′E	10:00	22.9	200–300	One specimen (specimen No. 1) was collected. Several females with a calf were found.
84	,,	1 II '76	01°33′N, 142°04′E	13:10	30.0	40–50	One specimen (specimen No. 2) was collected. Several females with a calf were found.
85	,,	2 II '76	03°00′N, 141°55′E	10:30	29.5	40–50	
86	,,	20 II '76	01°43′N, 164°53′E	12:10	28.7	400–500	Several females with a calf were found. Together with a school of *Peponocephala electra*.
87	*Peponocephala electra*	20 II '76	01°43′N, 164°53′E	12:10	28.7	20	One specimen (specimen No. 3) was collected. Together with a school of *Lagenodelphis hosei*.
88	*Pseudorca crassidens*	27 I '76	04°52′N, 138°35′E	16:30	29.1	10	Together with a school of *Stenella attenuata*.
89	,,	6 III '76	02°37′S, 153°01′E	16:45	30.8	20–30	Several females with a calf were found.
90	*Orcinus orca*	19 II '76	02°21′N, 164°08′E	15:15	28.7	9	Two females with a calf were found.
91	*Grampus griseus*	30 I '76	00°56′S, 142°03′E	08:00	28.8	2	Together with a school of *Physeter catodon*.

92	〃	31 I '76	00°27'N, 143°41'E	10:20	29.7	10	
93	〃	31 I '76	00°39'N, 143°42'E	12:50	30.0	10	
94	〃	1 II '76	01°20'N, 142°08'E	11:40	30.0	10	
95	〃	4 III '76	05°59'S, 157°04'E	11:55	30.2	20–30	
96	〃	13 III '76	14°04'N, 144°56'E	13:00	27.6	8	
97	*Globicephala macrorhynchus*	30 I '76	00°48'S, 142°14'E	12:40	29.2	9	
98	〃	16 III '76	25°58'N, 143°06'E	10:20	22.2	30–40	
99	*Feresa attenuata*	6 III '76	02°48'S, 153°16'E	14:50	30.6	150–200	
100	*Ziphius cavirostris*	31 I '76	00°54'N, 143°29'E	15:35	29.9	3	
101	〃	1 II '76	01°20'N, 142°09'E	11:25	30.0	3	
102	〃	19 II '76	01°22'N, 163°04'E	06:30	28.5	1	
103	〃	20 II '76	02°06'N, 164°33'E	09:20	28.6	1	

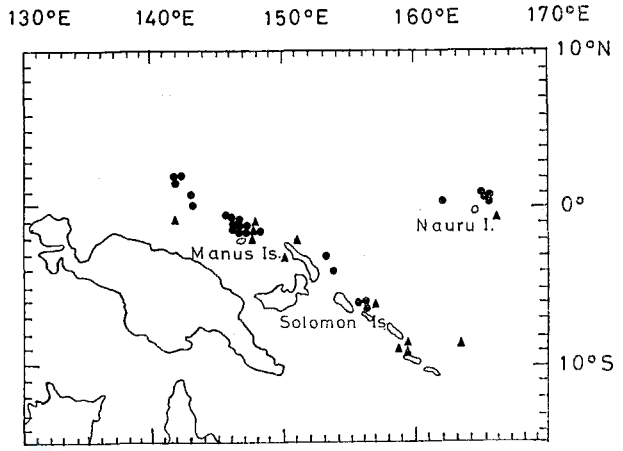


Fig. 2. Sighting records of *Balaenoptera edeni* and *Physeter catodon*. Circles and triangles indicate *B. edeni* and *P. catodon*, respectively.

school (sighting No. 26) were found together with two Risso's dolphins, *Grampus griseus*. Although many remoras were attached on the backs of two calves in one school (sighting No. 27), we did not observe any sucking fish on the backs of the adults or subadults in this school.

Stenella coeruleoalba

Striped dolphin, *Stenella coeruleoalba* is common along the eastern coast of Japan (Miyazaki *et al.*, 1974). Eight schools of striped dolphin were found. Six schools (75%) had less than 100 dolphins (Fig. 5). The maximum school size was estimated to be 400–500 dolphins. Several females with calf were observed in five schools (Table 1). Estimated body lengths of these calves were 110–140 cm. Although several dolphins from two schools (sighting Nos 43 and 46) approached the bow of the vessel, but no dolphin from the other schools approached the bow.

Striped dolphins were found between from 04°02′N to 30°47′N latitude (Fig. 3), and sea surface temperature ranged from 18.2 to 30.5°C (Table 1). Especially 6 schools (75%) were found between 20°N and 30°N latitude. On the other hand, most of spotted dolphins and all of spinner dolphins were found between 10°S and 10°N latitude in this survey as indicated in the latter part of this report. Considering from these data, striped dolphins seem to have larger distribution in the northern Pacific than spotted and spinner dolphins. According to Miyazaki *et al.* (1974), spotted dolphins are found in warmer area than striped dolphins. This supports our result.

Stenella attenuata

Spotted dolphin, *Stenella attenuata* is common in the coast of Japan (Miyazaki *et al.*, 1974), in the tropical Pacific (Dawbin, 1966) and in the eastern Pacific

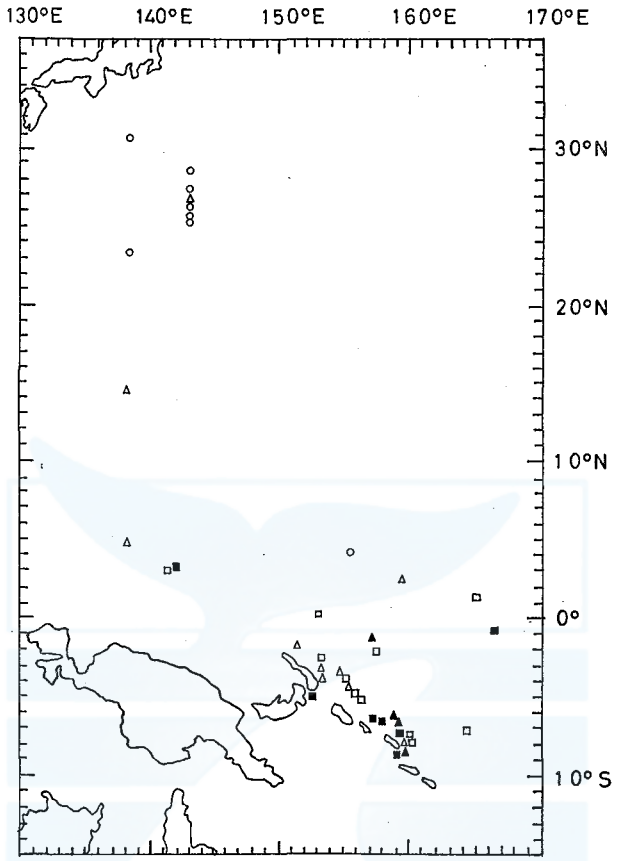


Fig. 3. Sighting and catch records of *Stenella* spp. Circles, triangles, and squares mean *S. coeruleoalba*, *S. attenuata*, and *S. longirostris*, respectively. Open and shaded symbols are sighting and catch records, respectively.

(Perrin, 1975). Perrin (1975) reported that there are at least two races of spotted dolphin in the eastern Pacific.

Fourteen schools of spotted dolphin were found. Nine schools (65%) were less than 100 dolphins (Fig. 5). The maximum school size was estimated at about 500–600 dolphins. Several females with calf were observed in three schools (Table 1). Although some spotted dolphins off the Pacific coast of Japan often approached the bow of ship, in this survey no spotted dolphin did so.

Spotted dolphins were found between from 08°20'S to 26°41'N latitude (Fig. 3), and sea surface temperature ranged from 22.0 to 30.2°C. Between 10°S and 10°N latitude 12 schools (86%) were found. One school of spotted dolphin sighting No. 47) was found between 10°N and 20°N, and another (sighting No. 60) between 20°N and 30°N latitude. On the other hand most of striped dolphin were found between 20°N and 30°N, and all of spinner dolphin were found between 10°S and 10°N latitude in this survey. From these information, it can be

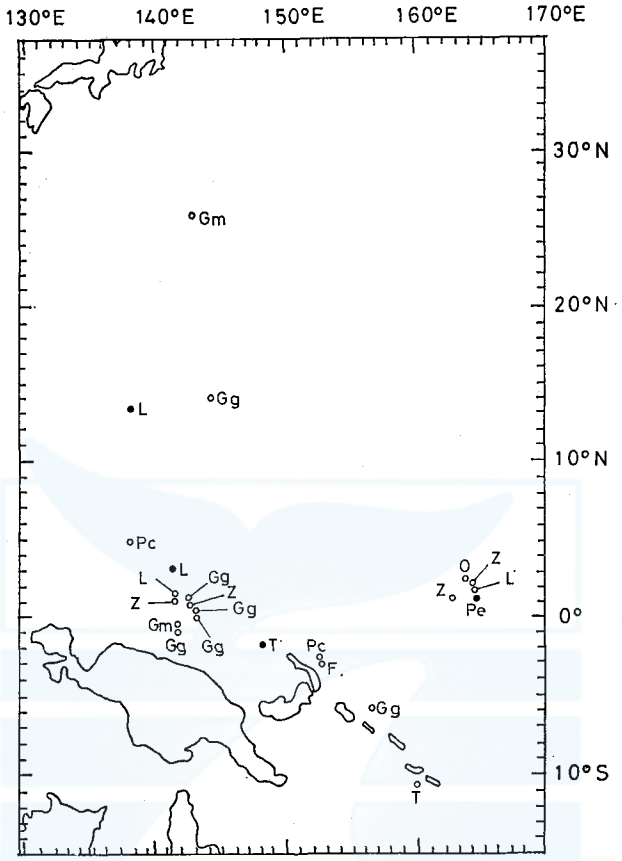


Fig. 4. Sighting (oen circle) and catch (closed circle) records of small cetaceans. Pc., O., Gg., T., L., Pe., Gm., F., and Z mean *Tursiops* sp. *Lagenodelphis hosei*, *Peponocephala electra*, *Pseudorca crassidens*, *Orcinus orca*, *Grampus griseus*, *Globicephala macrorhynchus*, *Feresa attenuata*, and *Ziphius cavirostris*.

said that spotted dolphin may have larger distribution in the western northern Pacific than spinner dolphin.

Four specimens were collected from four different schools (Table 2). These specimens consist of one female and three males. As the left ovary of the female (specimen No. 5) was heavier than the right, and the diameter of Graafian follicles of the left ovary became bigger, the female seems to be in the early stage of ovulation. Two animals (specimen Nos 6 and 7) showed no spermatozoa in the tissue of the testes but one (specimen No. 8) did.

Stenella longirostris

Spinner dolphin, *Stenella longirostris* is common in the eastern Pacific (Perrin, 1975), but little is known about spinner dolphins in the western Pacific.

Eighteen schools of spinner dolphin were found. Half of these schools had

TABLE 2. LIST OF SPECIMENS CAUGHT DURING THIS CRUISE

Specimen No.	Species	Sighting No.	Sex	Body length (cm)	Weight of ovaries (g)		Weight of testes (g)		No. of corpora		Sexual condition	Comments
					L.	R.	L.	R.	L.	R.		
1	*Lagenodelphis hosei*	83	Female	231	3.0	1.3			0–0	0–0	Immature	Diameter of maximum Graafian follicle is 3 mm
2	*Lagenodelphis hosei*	84	Male	183.5			8.6	8.6			Immature	
3	*Peponocephala electra*	87	Female	208	0.9	0.8			0–0	0–0	Immature	
4	*Tursiops* sp.	81	Female	238	3.0	2.7			0–1	0–4	Lactating	
5	*Stenella attenuata*	53	Female	178	1.1	0.4			0–0	0–0	Immature	Diameter of maximum Graafian follicle is 3 mm
6	*Stenella attenuata*	49	Male	173			7.3	7.1			Immature	
7	*Stenella attenuata*	51	Male	176			4.2	4.3			Immature	
8	*Stenella attenuata*	54	Male	215			200	200			Mature	
9	*Stenella longirostris*	72	Female	152	0.2	0.2			0–0	0–0	Immature	
10	*Stenella longirostris*	66	Female	158	0.5	0.5			0–0	0–0	Immature	
11	*Stenella longirostris*	63	Female	167	0.7	0.5			0–0	0–0	Immature	
12	*Stenella longirostris*	73	Female	189	6.4	0.8			1–1	0–0	Pregnant	Body size of the foetus is 75 cm
13	*Stenella longirostris*	62	Female	191	1.3	1.3			0–6	0–3	Resting	
14	*Stenella longirostris*	71	Male	181			320	250			Mature	
15	*Stenella longirostris*	68	Male	187			620	620			Mature	

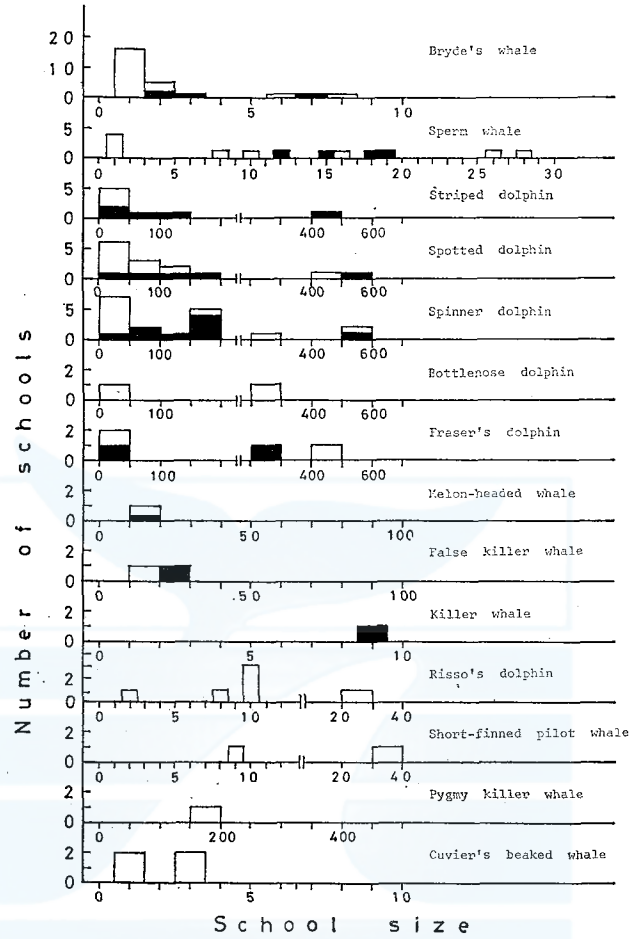


Fig. 5. Frequency of school size in cetaceans. Shaded and open areas are schools with several female and calf and schools without it, respectively.

less than 100 dolphins (Fig. 5). The maximum school size was estimated at about 500 to 600 dolphins. Several females with calf were observed in nine schools (Table 1). No spinner dolphin approached the vessel during this survey.

Spinner dolphins were found between from 08°50'S to 03°11'N latitude (Fig. 3), and sea surface temperature ranged from 28.6°C to 30.6°C. Considering from sighting records of striped, spotted, and spinner dolphins in this survey, spinner dolphin seems to have the most limited distribution in the western north Pacific among these three species of the genus *Stenella*.

Seven specimens were collected from seven different schools (Table 2). These specimens consist of five females and two males. Based on biological examinations of ovaries, mammary gland, and uterus, sexual condition of these females were determined as indicated in Table 2. Pregnant female (specimen No. 12) had a

foetus of 75 cm in body length. According to Perrin *et al.* (1977) estimated average length at birth of the spinner dolphin in the eastern Pacific is 77 cm. Therefore, it seems that the foetus collected was probably about term. Two males (specimen Nos 14 and 15) showed spermatozoa in the tissue of the testes.

Stenella sp.

On 31 January a school of approximately 10–20 dolphins, and on 21 February a school of about 10–20 dolphins were found. As these dolphins were found late in the evening, it was impossible to identify the species. However, we thought these dolphins probably to be *Stenella* sp. based on body size, the shape of the snout and the dorsal fin, and their swimming behavior.

Tursiops sp.

On 7 February, a school composed of approximately 200–300 bottlenose dolphins was found (Fig. 4). Sea surface temperature was 28.8°C. Several bottlenose dolphins approached the vessel. A lactating female was collected from them (Table 2). In this animal greyish speckles were characteristically found on the ventral portion between the umbilicus and genital region. Comparing with adult females of *T. gilli* off the Pacific coast of Japan, this animal is shorter in body length and higher in body height, and it appears to be thickset than adult females of *T. gilli*. One open pit was observed on the left lateral portion above the flipper and under the dorsal fin, respectively. Several whale lice were attached to the inside of these two open pits. On 26 February a school composed of about 10–20 bottlenose dolphins were found (Fig. 4). Sea surface temperature was 28.4°C.

Lagenodelphis hosei

Fraser's dolphin, *Lagenodelphis hosei* is rare all over the world. Recently Perrin *et al.* (1973) reported the discovery of the species in tropical and subtropical areas, and Tobayama *et al.* (1973) described specimens from the western North Pacific.

On 23 January a school composed of approximately 200–300 dolphins was found (Fig. 4). This school was consisted of two small schools (100–150 individuals), and several members of one small school approached the bow of the vessel but the other did not. In the small school at least a group of ten, eight, and seven individuals, three groups of six ones, two groups of five ones, and a pair of adult female and calf were observed. The similar school formations is found in *S. coeruleoalba* (Miyazaki and Nishiwaki 1978). One specimen (TK 451) was collected from this school with harpoon. On 1 February a school composed of about 40–50 dolphins with several females with calf were found (Fig. 4). In this school no dolphin approached the bow of the vessel, but one spec imen (TK 452) was captured from the school with shotgun. This specimen showed no spermatozoa in the tissue of the testes. On 2 February a school of about 40–50 dolphins was found (Fig. 4). Any dolphin did not approach the bow of the vessel. No dolphin was captured. On 20 February a school of approximately 400–500 dolphins was found

together with a school of *Peponocephala electra* which was composed of about 20 dolphins (Fig. 4). This shows that Fraser's dolphin may rarely mix with other species. Several leaping dolphins were observed, but no dolphin was captured. Sea surface temperature at sighting areas ranged from 22.9°C to 30.0°C.

Peponocephala electra

According to Perrin (1976) and Bryden *et al.* (1977), Melon-headed whale, *Peponocephala electra* appears to be distributed in tropical and warm temperate waters in the world. On 20 February a school composed of approximately 20 dolphins with several females with calf were found together with about 400–500 Fraser's dolphins (Fig. 4). Sea surface temperature was 28.7°C. One immature female was collected from this school (Table 2). In this animal several whale lice attached to the ventral portion between flippers, around the mammary gland and the umbilicus, and under the right eye.

Pseudorca crassidens

On 27 January a school composed of approximately 10–20 false killer whales were found together with about 10–20 spotted dolphins (Fig. 4). Sea surface temperature was 29.1°C. Although a false killer whale was shot and killed with shotgun, the carcass was lost at sea. The estimated body length of this carcass suggests that this animal is subadult one. This school was composed of several groups of two or three animals. Distance between groups ranged from 10 to 50 m. On 6 March a school of approximately 20–30 false killer whales with several pairs of female with calf was found (Fig. 4). Sea surface temperature was 30.8°C.

Orcinus orca

Although the killer whale, *Orcinus orca* is found primarily in polar and temperate regions, the species is sometimes found in the tropical areas. On 19 February a school of 9 killer whales was found (Fig. 4). Sea surface temperature was 28.7°C. Based on body size and shape of the dorsal fin of the animals, and their behavior this school seemed to be composed of 3 adult males, 2 adult or subadult whales, and 2 females with calf. It is noted that three adult males were all found on the outer edge of the school. Estimated body lengths of adult males, adult females, and calves were 7–9 m, 4–6 m, and 2–3 m, respectively.

Grampus griseus

Risso's dolphin, *Grampus griseus* is common in Pacific Ocean, but there are few records of the species in the western tropical Pacific (Dawbin, 1966). Six schools of the species were found. Five schools (85%) had less than 10 animals. The maximum school size was about 20–30 animals. One school (sighting No. 91) was found together with 18 sperm whales, *Physeter catodon*. Rissos's dolphins were found between 20°N and 30°N latitude (Fig. 4) and sea surface temperature ranged from 27.6°C to 30.0°C.

Globicephala macrorhynchus

On 30 January a school of approximately 10 shortfinned pilot whales was found (Fig. 4). Sea surface temperature was 29.2°C. Based on body size and the shape of the dorsal fin, at least two animals of this school seemed to be adult males. On 16 March a school of about 30–40 shortfinned pilot whales was found (Fig. 4). Sea surface temperature was 22.2°C. Judged from body size and the shape of the dorsal fin, it seems that there were some adult males in the school.

Feresa attenuata

On 6 March a school of approximately 150–200 pygmy killer whales was found (Fig. 4). All members of the school were well united in their behaviour. Sea surface temperature was 30.6°C. Although no specimen of the species were collected, these animals were identified as *Feresa attenuata* by the following three reasons. 1) Body size of all animals in the school were about 2.5 m–3.5 m. 2) These animals were of slender bodies with round head and no beak. 3) Their dorsal fins lead edgeslopes backwards, the rear margin is slightly concave, and the tip is pointed.

Ziphius cavirostris

Since Cuvier's beaked whale, *Ziphius cavirostris* is too nervous about the vessel and always dive into the sea for 30–40 minutes before approaching, it is difficult to identify the species by sighting. During their jumping above the sea, however, Cuvier's beaked whales were identified by the body size, the position of the dorsal fin, and the shape of the head.

Cuvier's beaked whales were observed four times (Fig. 4). Two sightings were of single animal and three whales were found in each of the other two pods.

ACKNOWLEDGMENTS

We thank the captain and other crew of the *Miwa-maru* for their cooperation, and Drs S. Ohsumi, Y. Fukuda and I. Ikeda of the Far Seas Fisheires Research Laboratory for giving us chance for this study. Drs T. Kasuya, K. Mizue and T. Kajiwara of the Ocean Research Institute, and Professor M. Nishiwaki of University of the Ryukyus are acknowledged for their kind help during this study. We are indebted to Dr R. L. Brownell of the Smithsonian Institution who read draft of manuscript and gave us valuable suggestions.

REFERENCES

Bryden, W. F., W. H. Dawbin, G. E. Heinsohn, and D. H. Brown, 1977. Melon-headed whale, *Peponocephala electra*, on the east coast of Australia. *J. Mamm.*, 58: 180–187.

Dawbin, W. H., 1966. Porpoises and porpoise hunting in Malaita. *Australian Natural History*, 15 (5): 207–211.

Masaki, M., 1972. Tagging investigation of whale in Ogasawara and Mariana Islands. *Geiken Tsushin*, 249: 35–42 (in Japanese)

MIYAZAKI, N. and M. NISHIWAKI, 1978. School structure of the striped dolphin off the Pacific coast of Japan. *Sci. Rep. Whales Res. Inst.*, 30; 65–115.

MIYAZAKI, N., T. KASUYA, and M. NISHIWAKI, 1974. Distribution and migration of two kinds of *Stenella* in the Pacific coast of Japan. *Sci. Rep. Whales Res. Inst.*, 26: 227–243.

PERRIN, W. F., 1975. Distribution and differentiation of populations of dolphins of the genus *Stenella* in the eastern tropical Pacific. *J. Fish. Res. Board Can.*, 32 (7): 1059–1067.

PERRIN, W. F., P. B. BEST, W. H. DAWBIN, K. C. BALCOMB, R. GAMBELL and G.J.B. ROSS, 1973. Rediscovery of Fraser's dolphin *Lagenodelphis hosei*. *Nature*, 241 (5388): 346–350.

PERRIN, W. F., 1976. First record of the Melon-headed whale, *Peponocephala electra*, in the eastern Pacific, with a summary of world distribution. *Fish. Bull.*, 74: 457–458.

PERRIN, W. F., D. B. HOLTS, and R. B. MILLER, 1977. Growth and reproduction of the eastern spinner dolphin, a geographical form of *Stenella longirostris* in the eastern tropical Pacific. *Fish. Bull.*, 75: 725–750.

TOBAYAMA, T., M. NISHIWAKI, and H. C. YANG, 1973. Records of the Fraser's sarawak dolphin (*Lagenodelphis hosei*) in the western North Pacific. *Sci. Rep. Whales Res. Inst.*, 25: 251–263.

WADA, S., 1975. Tagging investigation of whales in the south-western areas of the NorthPacific. *Geiken Tsushin*, 284: 27–34. (in Japanese)

EXPLANATION OF PLATES

PLATE I

Fig. 1. Bryde's whale, *Balaenoptera edeni*, at sea in 00°55′S, 146°35′E, on February 5, 1976. Note three ridges on the snout.

Fig. 2. A part of school of sperm whales, *Physeter catodon*, at sea in 02°17′N, 151°34′E, showing side by side in the interval of 2–3 m between whales, on March 10, 1976.

Fig. 3. An adult male killer whale, *Orcinus orca*, at sea in 02°21′N, 164°08′E, on February 19, 1976.

Fig. 4. A part of school of Fraser's dolphin, *Lagenodelphis hosei*, at sea in 01°43′N, 164°53′E, on February 20, 1976.

PLATE II

Fig. 1. Lateral view of immature female *Peponocephala electra*, 208 cm long, taken at sea in 01°43′N, 164°53′E, on February 20, 1976.

Fig. 2. Lateral view of the cephalic region of the same specimen.

Fig. 3. Ventral view of the cephalic region of the same specimen.

Fig. 4. Anterior view of the oral region of the same specimen, showing whitish skin on the lip margins and palatine portion.

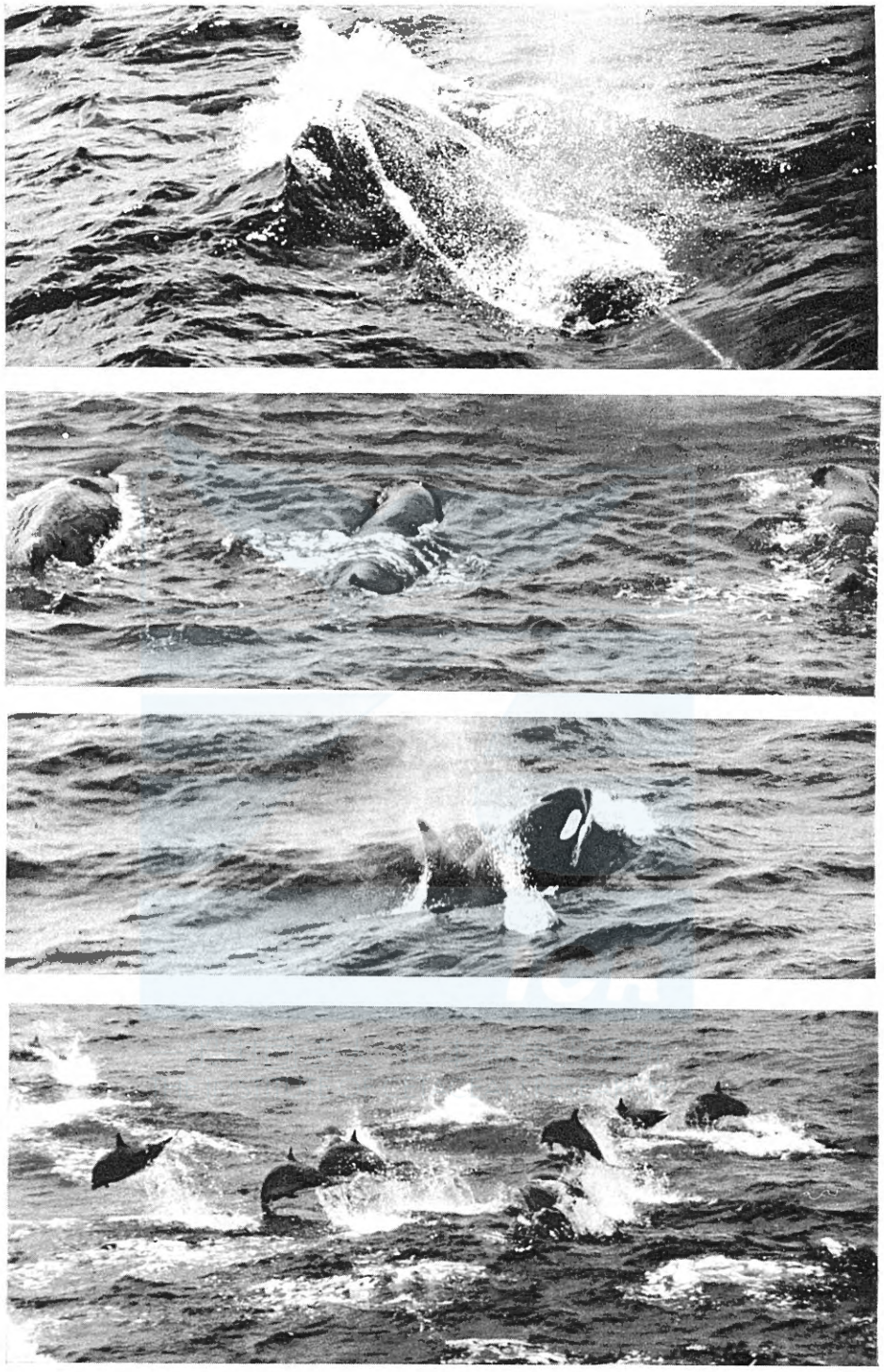
PLATE III

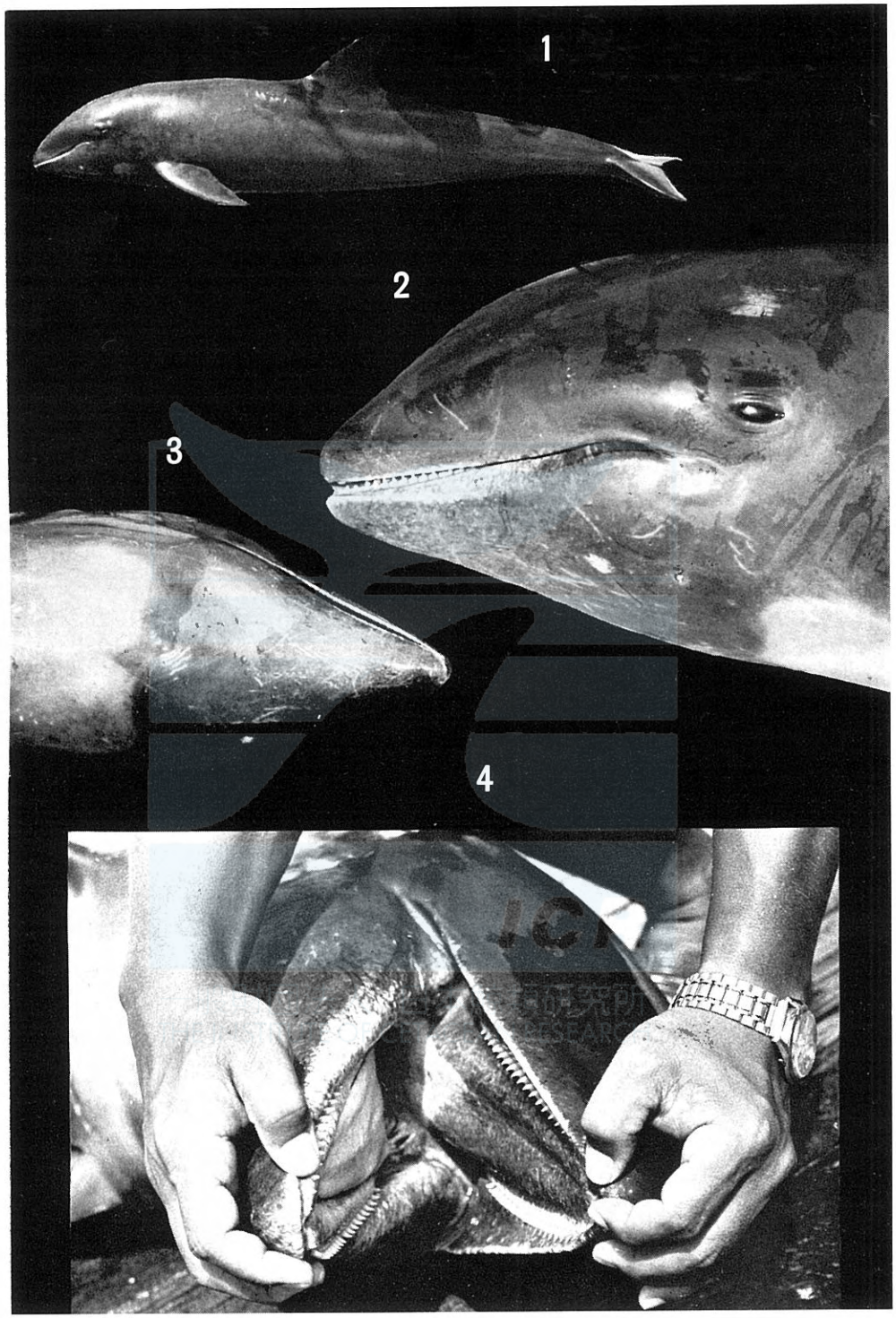
Fig. 1. Lateral view of lactating female *Tursiops* sp., 238 cm long, taken at sea in 01°55′S, 148°53′E, on February 7, 1976.

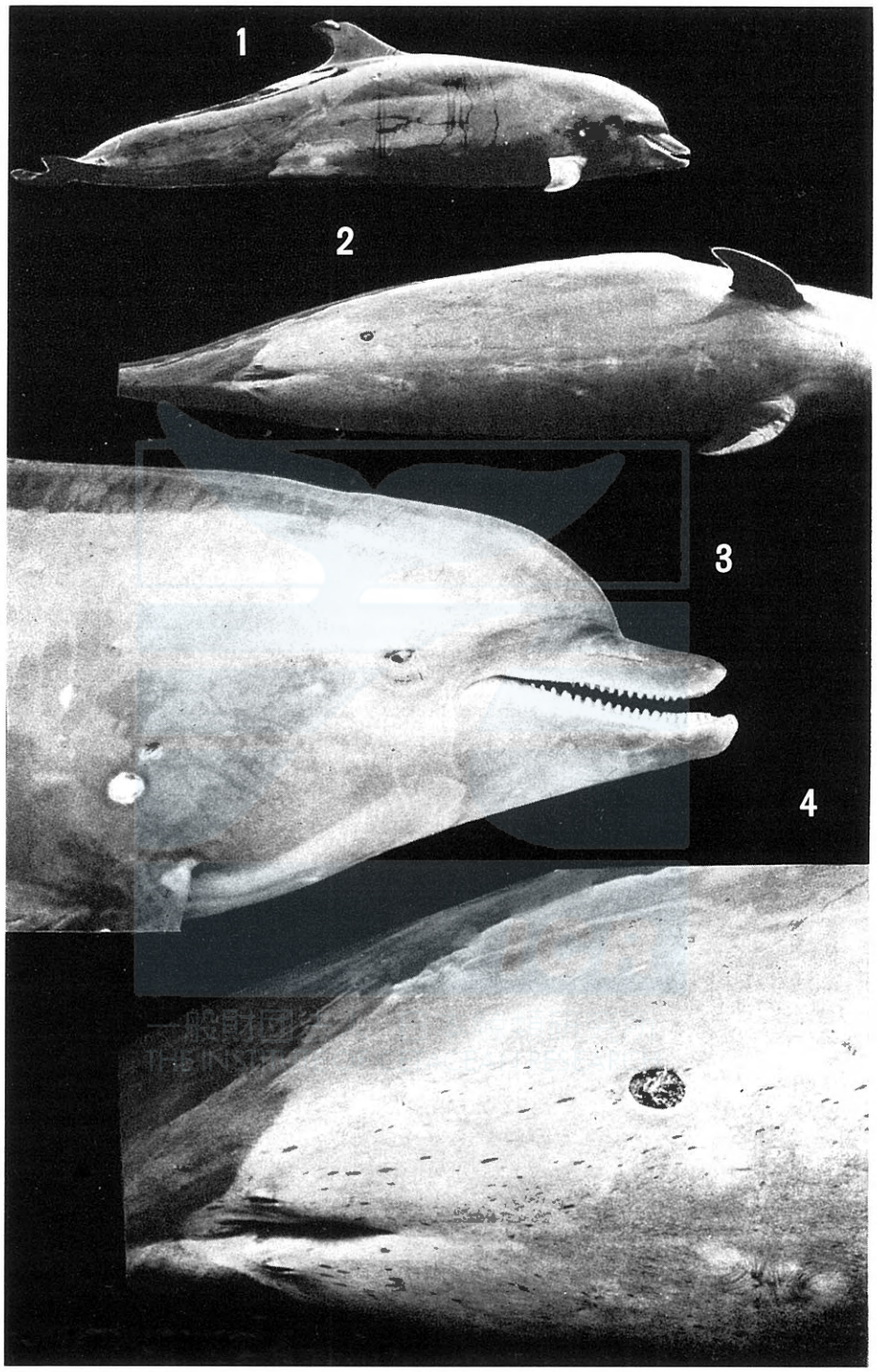
Fig. 2. Ventral view of the same specimen, showing greyish speckles on the ventral side.

Fig. 3. Lateral view of the cephalic region of the same specimen.

Fig. 4. Ventral view of the genital region of the same specimen.




1
2
3
4


1
2
3
4