Report on Biological Studies of Dall's Porpoise Taken by the Dedicated Vessel, Hoyomaru No.12, Cruise in 1985

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REPORT ON BIOLOGICAL STUDIES OF DALL'S PORPOISE TAKEN BY THE DEDICATED VESSEL, HOYOMARU NO.12, CRUISE IN 1985

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ABSTRACT

Biological samples from Dall's porpoises taken by the Hoyomaru No.12 cruise in 1985 were examined. The catch consisted of 7 males (6 dalli-types and 1 truei-type) and 11 females (all dalli-types). Six males and nine females (over 80 %) were sexually mature. Six of nine mature females were in their first ovulation. None of females having corpus luteum in the ovaries had fetus in the uteri. The mean age of females having one corpus luteum and no corpus albicans was calculated at 4.8 years, and their mean body length was 177.2 cm (N=5).

INTRODUCTION

To investigate the life history of Dall's porpoise, Phocoenoides dalli in the northwestern North Pacific, the research cruise has been yearly conducted by the dedicated vessel chartered by the Fisheries Agency of Japan since 1982. Some biological analyses of the samples collected by the former cruises were reported by Kasuya and Jones (1984), Kasuya and Shiraga (1985) and Miyazaki and Fujise (1985).

Also in 1985, the dedicated vessel conducted a sighting survey of marine mammals, and captured Dall's porpoises with hand-held harpoons in the northwestern North Pacific and Bering

Sea during the period of 6 August to 16 September, or after the parturition peak of the species (Newby, 1982). The present paper reports the result of biological analysis of samples collected in the cruise.

MATERIALS AND METHODS

Harpooning was conducted outside the USSR and US Fisheries Conservation Zones, and 18 Dall's porpoises (17 dalli-types and 1 truei-type) were captured. Table 1 lists these specimens. Twelve of them (67 %) were captured in the Bering Sea surrounded by 55°N-, 59°N-, 175°E- and 177°W-lines (Fig.1).

Biological samples (teeth, blood, muscle and reproductive organs etc.) were collected on board after obtaining body weight and external measurements in the same way as in the past cruises (Kasuya and Jones, 1984). The weight of left testis, left and right ovaries were measured in the laboratory on formalin fixed samples.

Male sexual maturity was determined by using the weight criteria of Kasuya and Jones (1984) (i.e., left testis weighing 40 g or over was considered as mature).

The number of ovarian corpora was counted for each ovary. Females with at least one corpus luteum (CL) or corpus albicans (CA) were regarded as sexually mature. When a CL was present in the ovary, three diameters were measured, and mean diameter was obtained as the cube root of their product. Diameters of largest follicles were also measured. Uteri of all females were brought back to laboratory after injecting 10 % formalin solution into

them, and the uteri of females with a CL were opened carefully in the laboratory to examine the presence of a small embryo. Left testis of a male (field No.1) and right ovary of a female (No.2) were not collected in the field. Sexual maturity of No.1 was estimated from the weight of right testis, and that of No.2 from the status of left ovary.

One to three tooth sections were prepared for age determination using a method described by Kasuya (1978). The number of hematoxylin stainable layers in cementum was counted. Age was determined assuming annual deposition of the layer.

RESULTS

Body Length Frequency and Sex Ratio

Table 2 shows the body length frequency of dalli-types by maturity and sex. Truei-type animal will be described separately. Male body lengths ranged from 187 to 203 cm, while female from 159 to 189 cm. Contrary to the catch in the past cruises, there were more females than males in the present catch. But the sex ratio was not significantly different from parity (Chi-square test, $p>0.1$).

Male Sexual Maturity

Out of six dalli-type males captured, five animals were sexually mature (Table 3). Their body lengths ranged between 187 and 203 cm. One 190 cm individual (No.1) whose left testis was not collected had right one weighing only 25 g. Although the weight of left testis was unknown, this animal was regarded as

sexually immature.

Female Sexual Maturity and Reproductive Status

The number of ovarian corpora and reproductive status of females are shown in Tables 3 and 4. Females having a CL and neither fetus nor small embryo were classified as ovulated, and non-lactating females having only CAs as resting.

Two of 11 females were immature (Nos.2 and 12). Of these two, the maturity of No.2 was determined from status of left ovary and the small body length, 159 cm. Another immature female, No.12, had a large follicle (9 mm in diameter). It appeard that she would have ovulated shortly and attained sexual maturity in the year.

Nine of the 11 females (82 %) were sexually mature. Their body lengths ranged between 169 and 189 cm.

Number of corpora in the ovaries ranged from 1 to 5. The mean was 2.1 per mature female. Approximately 70 % of mature female animals (6 out of 9) had only one CL (five animals) or only one CA (one animal). Females having only CL and no CA, however, had neither fetus nor small embryo in their uteri, and they were regarded as ovulated. One female having only one large CA (7 mm in diameter) and no CL was not lactating. Also in the 1982- and 1983 pooled samples, females having one corpus luteum or albicans occupied 76 % of mature ones, and the proportion was high (Kasuya and Shirga, 1985). The mean age of females having a CL and no CA was calculated at 4.8 years. Their mean body length was 177.2 cm (range: 169-187 cm).

The remaining three mature animals had four (Nos.11 and 14) and five (No.3) corpora in the ovaries, respectively. The former two had a CL in the left ovary, but they did not have a fetus, either. The last had a pigmented corpus (4 mm in diameter) assumed to be corpus atreticum in the left ovary besides five CAs.

The mean diameter of CLs of seven females was calculated at 17.1 mm (S.D.=2.6). This was smaller than the mean diameter of CL of females in late pregnancy described by Temte and Spielvogel (1985). Additionally, the majority (88 %) of the mature females of the present sample had follicles measuring 5 mm or over (maximum, 9 mm).

Although it has been reported that mother-calf pairs did not ride the ship waves (Kasuya and Jones, 1984; Miyazaki and Fujise, 1985), two females (Nos.3 and 14) accompanied by neonates were captured, and were lactating as expected.

Ageing

Table 5 shows a relation between the number of cemental layers and sexual maturity in males and females. The oldest animal had seven layers (one male and two females). Out of the aged samples, there was a female having four ovarian corpora even if only one stainable layer could be read. Since body length of the animal was 180 cm, it seemed difficult to consider that she was 1 year old, estimating from the growth curve for females described by Newby (1982). Although he stated that female can be sexually mature by 1 year, it appears that more consideration

should be needed on the present method of age determination. Also in males, there was a mature animal only with two layers (189 cm in body length).

Truei-type animal collected in the cruise

One truei-type porpoise was captured off Sanriku coast of Japan. This animal was 206 cm in body length and sexually mature (left testis weight 198 g).

DISCUSSION

Newby (1982) described that in Dall's porpoises incidentally taken in the salmon gill-net fishery operated in May to July, apparant pregnancy rate was markedly high, and pregnant females had larger fetuses (63-110 cm in body length). According to Miyazaki and Fujise (1985), the samples taken by the cruise conducted in May to June, 1984 also showed the apparant pregnancy rate of 80 %. The average body length of the fetuses was 77.9 cm (range: 69.0-87.5 cm). Contrary to these samples, there were found no large fetus in females harpooned in August to September, 1982 and 1983, but the proportion of ovulated females was as high as in the present material (Kasuya and Shiraga, 1985). These indicate that the period of August to September is at least the estrus season of Dall's porpoise (Newby, 1982).

It is difficult to find a ovum just after fertilization in the uterus. Therefore, it cannot be denied that some or all of females we regarded as ovulated could be in their early pregnancy. Temte and Spielvogel (1985) reported that the mean serum progesterone level of females in their late pregnancy

raised extremely high (approximately 20 ng/ml in mean value). They also showed a significant correlation between serum progesterone level and mean diameter of CL. Since CL on the process of regression after infertile ovulation is considered to be less active in secreting progesterone and to be becoming smaller in size, hormonal analysis may provide useful information for distinguishing CL of ovulation and that of early pregnancy.

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Table 1. Dall's porpoises taken by the Hoyomaru No.12 cruise in 1985.

Field No.	Date	Sex	BL* (cm)	BW* (kg)	Position	
1	7 Aug.	M	190	115	41° 49'N	143° 15'E
2	23 Aug.	F	159	75	58° 01'N	179° 57'W
3	24 Aug.	F	181	113	58° 01'N	178° 47'E
4	24 Aug.	F	187	93	58° 00'N	179° 39'E
5	25 Aug.	M	199	184	57° 30'N	176° 18'E
6	26 Aug.	M	203	183	57° 30'N	179° 10'W
7	26 Aug.	F	186	103	57° 30'N	178° 11'W
8	27 Aug.	F	169	86	56° 49'N	177° 01'W
9	27 Aug.	F	179	101	56° 49'N	177° 01'W
10	30 Aug.	M	200	169	56° 27'N	175° 00'E
11	1 Sep.	F	180	103	55° 33'N	179° 04'E
12	1 Sep.	F	174	96	55° 29'N	179° 27'W
13	1 Sep.	F	179	92	55° 30'N	177° 59'W
14	7 Sep.	F	189	113	49° 59'N	164° 10'E
15	10 Sep.	M	189	117	43° 39'N	154° 27'E
16	10 Sep.	M	187	128	43° 36'N	154° 21'E
18	12 Sep.	F	172	97	40° 34'N	148° 10'E
19**	12 Sep.	M	206	172	40° 35'N	148° 05'E

*: BL indicates body length and BW body weight.
**: truei-type.

Table 2. Body length frequency of dalli-types taken by the Hoyomaru No.12 cruise in 1985.

BL (cm)	Male			Female		
	immature	mature	total	immature	mature	total
155-				1		1
160-						
165-					1	1
170-				1	1	2
175-					2	2
180-					2	2
185-		2	2		3	3
190-	1		1			
195-		1	1			
200-		2	2			
Total	1	5	6	2	9	11

Table 3. Gonadal weight and corpora count of dalli-types taken by the Hoyomaru No.12 cruise in 1985.

Field No.	Male	Field No.	Female					
	left testis		left ovary			right ovary		
	weight*		weight	CL	CA	weight	CL	CA
1	25**	2	2.7	0	0	-	-	-
5	326	3	6.2	0	5	1.7	0	0
6	361	4	7.1	1	0	1.8	0	0
10	172	7	5.6	0	1	3.2	0	0
15	87	8	8.5	1	0	2.1	0	0
16	136	9	6.4	1	0	1.3	0	0
		11	14.3	1	3	2.4	0	0
		12	8.2	0	0	2.2	0	0
		13	6.2	1	0	1.1	0	0
		14	8.0	1	3	1.7	0	0
		18	10.1	1	0	2.5	0	0

*: weight in gram.
**: right testis.

Table 4. Reproductive status of dalli-type females taken by the Hoyomaru No.12 cruise in 1985.

No. of ovarian corpora	Immature	Mature			Total
		resting	ovulated	lactating	
0	2				2
1	-	1	5		6
2	-				
3	-				
4	-		1	1*	2
5	-			1	1
Total	2	1	6	2	11

*: lactating and simultaneously ovulated.

Table 5. Frequency of number of cemental layers in dalli-types taken by the Hoyomaru No.12 cruise in 1985.

No. of cemental layers	Male			Female		
	immature	mature	total	immature	mature	total
1					1*	1*
2		1*	1*	1		1
3				1	1	2
4					4	4
5		1	1			
6	1	2	3		1	1
7		1	1		2	2
Total	1	5	6	2	9	11

* see comments in the text.

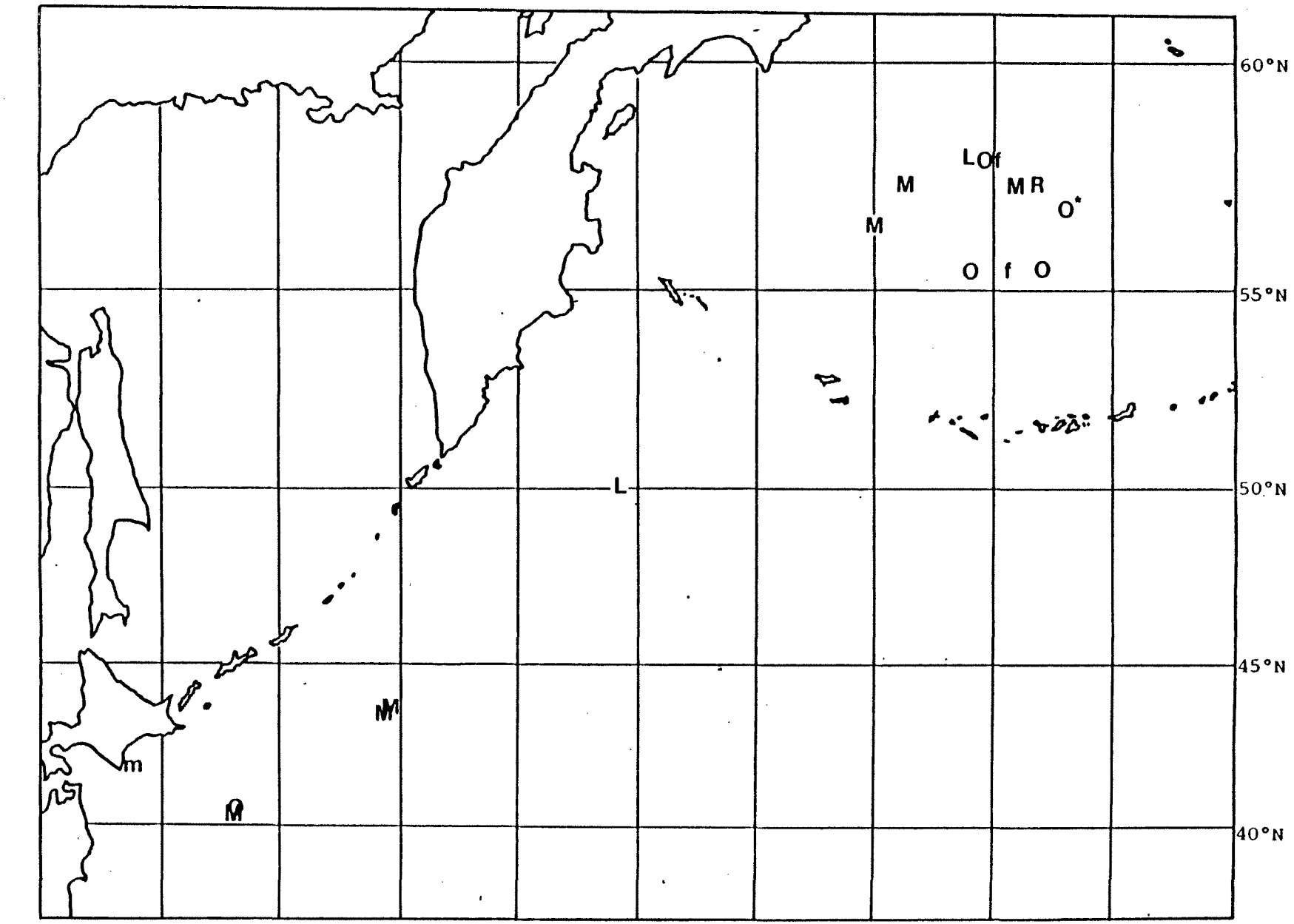

Fig.1. Catch position of Dall's porpoises taken by the Hoyomaru No.12 cruise in 1985. M:mature male, m:immature male, R:resting female, O:ovulated female, L:lactating female, f:immature female. Star indicates two animals.