THE POST-BREEDING DISTRIBUTIONS OF ICE-BREEDING HARBOUR SEAL (*Phoca largha*) AND RIBBON SEAL (*Phoca fasciata*) IN THE SOUTHERN SEA OF OKHOTSK

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ABSTRACT

The distribution of harbour seal (*Phoca largha*) and ribbon seal (*P. fasciata*) was studied. The field survey was performed from 1 May to 3 June of 1975 in the four pack ice areas along the eastern coast of Sakhalin. In these areas harbour seal was dominant in the southern area and overcomed by ribbon seal in northern areas. The pups of both species appeared in low frequency. However in the southern area, the pups of ribbon seal appeared frequently. The female adult harbour seals were dominant compared with the adult males, and it was suspected that adult females stay longer on the ice floes. In this connection ribbon seal showed the same sex ratio between males and females through all age classes except pups. However, the different sex ratio of subadult seals was observed between areas such as male dominant area and female dominant area. While the group size of harbour seal was composed of small number of individuals (average 1.8 seals), ribbon seal did not form the any group but appeared in solitary.

INTRODUCTION

The harbour seals (Family Phocidae, Genus and Subgenus *Phoca* 1758) were studied from the point of view of taxonomy and systematics in recent years, and it was supposedly concluded that there exist two harbour seal species in the North Pacific. Those are, namely, ice breeding harbour seal (*Phoca largha* Pallass 1811) and land breeding harbour seal (*Phoca vitulina richardsi* Gray 1864). Among these seals, ice living harbour seal is still little known species. Especially the knowledges concerning to their life in the ice region are quite scarce. As a consequence, knowledges on their distribution and migration are some times speculative. Similar to ice breeding harbour seal, ribbon seal (*Phoca fasciata* Zimmermann 1783; Family Phocidae, Genus *Phoca*, Subgenus *Histriophoca*) is also one of the most unknown species.

The unconfirmed knowledges concerning to their distribution and migration

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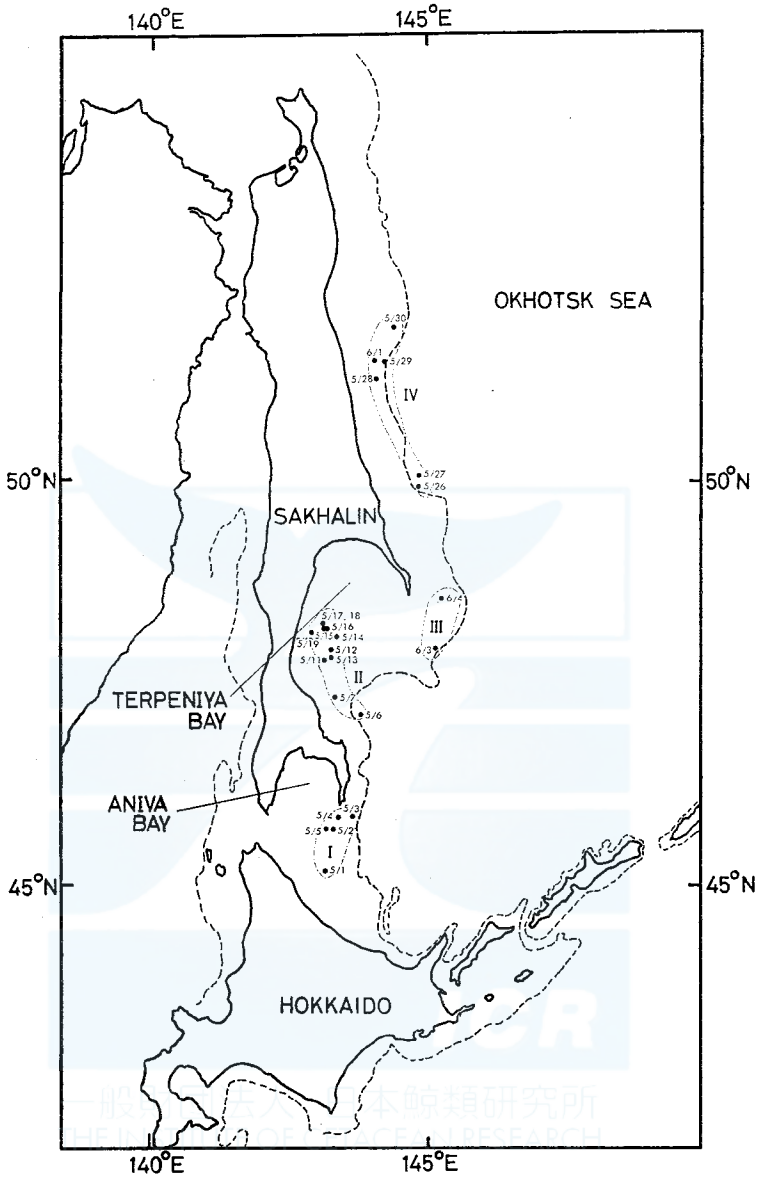

Fig. 1. Sampling was performed in the above 4 areas in the southern Sea of Okhotsk. The figures in each area show the date of sampling. Dotted line shows 200 m isodepth line.

are due to the difficulties in the ice region survey. Especially the latter seal have pelagic habitat visiting coast seldom after the ice floes melt (Burns 1970). Therefore it is still more difficult for us to access to them.

Our objective here are generally to provide some informations on their distribution and migration in the ice floe region and especially to add the informations

on their social structures.

Our field studies were dependent on the commercial sealing which started from the first of May continuing for about a month when the breeding season was over and the ice floes were melting and retreating. Therefore, we missed the important breeding season for our purpose. The breeding season of harbour seal was suggested from mid to end of March (Naito and Nishiwaki 1972), and the ribbon seal was from mid March to first of April (Tikhomirov 1971). Therefore we studied the distributions of post breeding season (1–1.5 month later).

MATERIALS AND METHODS

From 1 May to 4 June in 1975, field studies were made in the eastern coast of Sakhalin to analize the harbour seal and ribbon seal distribution. The sealing were first operated from south to north following the retreating pack ice. The pack ice was almost final melting stage in this season, and the pack ice showed relatively low density and they were dispersing. However the sealing boat in some occasion did not penetrate into the pack ice to stop sealing. In this study the areas where the sealing operated were separated into four areas in accordance with the pack ice distribution. These areas were: area I, the south eastern part of Aniva Bay or the first operation area; area II, the mouth of Terpeniya Bay or the second operation area; area III, the eastern mouth of Terpeniya Bay or the last operation area; and area IV, the eastern coast of northern Sakhalin or the third operation area (Fig. 1). Among these areas, except area III the sealing was performed from south to north as season advances. The ice conditions, depth of water, date of sealing of these areas were shown in Table 1.

TABLE 1. THE ICE CONDITION, DEPTH OF WATER AND DATE OF OPERATION OF EACH SEALING AREA. THE ICE CONDITION WAS INDICATED BY THE DEGREES OF ICE COVERED AREA IN SIGHT AND THE ICE COVERED AREA WAS CLASSIFIED INTO TEN DEGREES.

Area	Average amount of ice	Range	Depth of water (m)	Date
I	3.75/10	3/10-4/10	100-200	1-5 May
II	3.40/10	1/10-7/10	60-100	6-19 May
III	3.10/10	1/10-4/10	150-200	26 May-1 June
IV	1/10	1/10	100-150	3-4 June

Through this field work, the right lower jaws were collected from 390 harbour seals and 761 ribbon seals, and preserved in 5–10% formalin. These collected numbers reached at about 40% of total number of seals caught, and these canine teeth sampling was made quite at random for the purpose of this study. In this field study we also made field observations from the upper bridge of the mother boat to collect the data for group size analysis.

Concerning the age determination of harbour seal, the same methods as reported by Naito and Nishiwaki (1972) was followed. However, the method of

ribbon seal age determination was newly studied by using the tooth of known age of dead seal which was kept at Kamogawa Sea World in Chiba Prefecture, Japan. The age determinations of the ribbon seals were successfully performed by reading both dentine layers and cementum layers (Naito and Tobayama; unpublished).

Concerning the catch selection in this study, there exist no strong selectivity between each species, for sealing were made only on the ice floes by using the riffle with the scope. However, in general harbour seal was more cautious than the other. The species dealt in this study were only harbour seal and ribbon seal. There distribute ringed seal (*Phoca hispida*) and bearded seal (*Erignathus barbatus*) in these areas. However these seals, if identified by hunters, were not caught owing to the low quality of their fur. Therefore, these species were not studied in this study.

SPECIES COMPOSITION

In this study it was difficult to obtain data to evaluate catch effort such as hunter's skill, catch difficulty by ice or weather conditions and etc., therefore in this chapter only comparative species ratio was treated.

TABLE 2. SPECIES COMPOSITION AMONG HARBOUR SEAL AND RIBBON SEAL IN EACH AREA

Area	No. harbour seal	%	No. ribbon seal	%	Total number
I	122	80.8	29	19.2	151
II	216	33.1	437	66.9	653
III	39	18.2	175	81.8	214
IV	13	9.8	120	90.2	133
Total	390		761		1,151

Species composition of harbour seal and ribbon seal collected in each area are shown in Table 2. The numbers collected in all 4 areas were 390 harbour seals and 761 ribbon seals respectively. This result may indicate that ribbon seal distributed 1.95 times as much as harbour seal in these areas and season. To the contrary, however, each areas showed the different specific structure. As shown in Table 2, area I was considered as a harbour seal dominant area, and area II was possibly considered as both species mixed area. Ribbon seal highly dominant in areas III and IV, showing 81.8% and 90.2% respectively. Therefore it was considered that ribbon seal appeared frequently in northern areas and later season. Although the explanation for this phenomena is still uncertain, it may related with difference of ice utilization by both species. Tikhomirov (1961) and Naito and Nishiwaki (1975) stated that in May and June harbour seal begin to appear in the coastal area coinciding with ice melting season, and Tikhomirov (1961) also reported that ribbon seal seldom descend into the water in May and June when they are moulting. In this connection, it was quite natural that ribbon seal was generally abundant in these areas, and being hunted in later season in areas III and IV where harbour seal was less dominant.

AGE AND SEX COMPOSITIONS

Harbour seal

Age composition of harbour seal is shown in Table 3 and Fig. 2. Of all age classes the pups and one year old seals of both sexes appeared most frequently, and the appearance frequency of older seals gradually decreased. The females seemed to show less gradual decrease, and the oldest seal was 30 years old in male and 33 years old in female.

In general the standing stock of pups should be most abundant. However

TABLE 3. AGE COMPOSITION OF 390 HARBOUR SEALS COLLECTED FROM ALL 4 AREAS

Age	No. males in sample	% in male sample	No. females in sample	% in female sample
0	47	28.0	40	18.0
1	47	28.0	46	20.7
2	11	6.5	19	8.5
3	15	8.9	22	9.9
4	13	7.7	17	7.6
5	5	3.0	13	5.8
6	7	4.1	8	3.6
7	1	0.6	10	4.5
8	3	1.8	5	2.2
9	3	1.8	2	0.9
10	0	0	0	1.3
11	3	1.8	4	1.8
12	1	0.6	5	2.2
13	3	1.8	2	0.9
14	0	0	6	2.7
15	2	1.2	2	0.9
16	1	0.6	1	0.5
17	1	0.6	2	0.9
18	1	0.6	0	0
19	1	0.6	2	0.9
20	0	0	2	0.9
21	0	0	0	0
22	1	0.6	1	0.5
23	1	0.6	2	0.9
24	0	0	1	0.5
25	0	0	1	0.5
26	0	0	1	0.5
27	0	0	0	0
28	0	0	0	0
29	0	0	2	0.9
30	1	0.6	1	0.5
31	0	0	1	0.5
32	0	0	0	0
33	0	0	1	0.5
Total	168	100.0	222	100

in this study pups appeared in same abundance as one year old seals. According to Natio and Nishiwaki (1975), pups are dependent on ice floe even after weaning, and they are much dispersed by ice movements. This suggestion may explain the above result. Concerning the sex ratio, it is very clear that both sex of pups and 1 year old seal appeared almost same frequency and, in the most of other age classes females were dominant. Not shown in Table 3, but the sex ratio is 52.2% females for both pups and one year old seals and 64.8% females for other older seals. This may suggest that the older female seals remain longer on ice floes than male seals. To analyse more precisely, the age was classified into several classes, such as (1) pup class, (2) immature class (1–2 years old), (3) subadult class (3–6 years

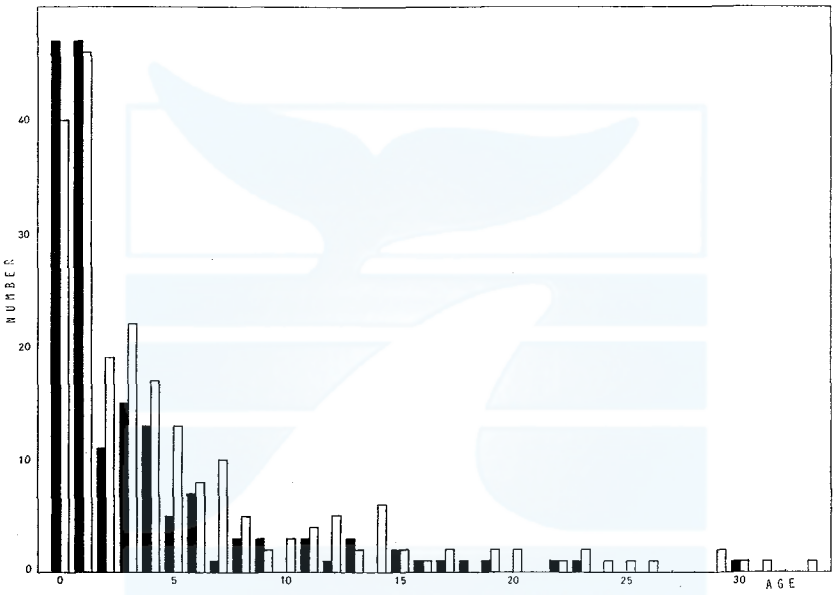

Fig. 2. Age composition of harbour seal. Black column represents the male seal and white column represents the female seal.

old), (4) adult class (7–10 years old) and (5) old class (11 or more years old). As seen in Table 5, the sex ratios with 46% and 52.8% female for pup and immature class clearly differ from the ratio with 60%, 74.1% and 69.8% females for subadult, adult and old classes. From these facts, it was possibly concluded that the adult female harbour seal remain longer on ice floes.

Ribbon seal

Age composition of ribbon seal is shown in Table 4 and Fig. 3. A number of pup seals appeared in quite low level as in the case of harbour seal pup. However, after one year old, the both sexes of seal decreased gradually in almost same rate. The oldest seal was 26 years old in male and 22 years old in female. Concerning the longevity of this seal, almost same result was obtained as reported by

TABLE 4. AGE COMPOSITION OF 761 RIBBON SEALS COLLECTED FROM ALL 4 AREAS

Age	No. males in sample	% in male sample	No. females in sample	% in female sample
0	18	4.7	30	8.0
1	90	23.4	96	25.5
2	71	18.5	61	16.2
3	52	13.5	47	12.5
4	49	12.8	35	9.3
5	29	7.6	31	8.2
6	14	3.6	18	4.8
7	17	4.4	16	4.2
8	6	1.6	10	2.7
9	9	2.3	6	1.6
10	7	1.8	5	1.3
11	6	1.6	3	0.8
12	2	0.5	2	0.5
13	4	1.0	4	1.1
14	3	0.8	1	0.3
15	1	0.3	2	0.5
16	0	0	2	0.5
17	1	0.3	1	0.3
18	3	0.8	3	0.8
19	0	0	0	0
20	0	0	0	0.5
21	0	0	1	0.3
22	0	0	1	0.3
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	2	0.5	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0
31	0	0	0	0
32	0	0	0	0
33	0	0	0	0
Total	384	100	377	100

Tikhomirov (1971). He reported that the maximum age reached by ribbon seal in natural conditions is 22–26 years.

The low appearance frequency of harbour seal pups was considered in relation to it's ice dependent life and ice movements. In ribbon seal, though uncertain, the same reason may be considered as well. Contrary to harbour seal, sex ratio of pups seemed to be quite abnormal. However this low representation of male pup in Fig. 3 seemed to be caused by small sample size. As well as harbour seal, the difference of sex ratio was compared between several age classes such as (1) pup class, (2) immature class (1–2 years old), (3) subadult class (3–6 years old), (4) adult class (7–10 years old), (5) old class (11 or more years old). These age

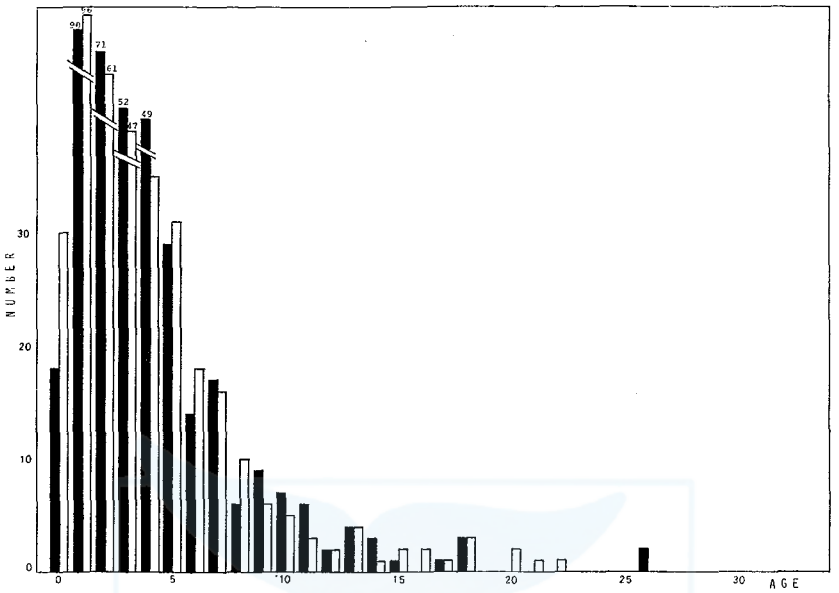

Fig. 3. Age composition of ribbon seal. Black column represents the male seal and white column represents the female seal.

TABLE 5. AGE GROUP COMPOSITION OF 390 HARBOUR SEALS (UPPER) AND 761 RIBBON SEALS (LOWER) COLLECTED FROM ALL 4 AREAS

Harbour Seal

Age class	No. males in sample	% in male sample	No. females in sample	% in female sample	Total No.	% in total sample
0	47	54.0	40	46.0	87	22.3
1-2	58	47.2	65	52.8	123	31.5
3-6	40	40.0	60	60.0	100	25.7
7-10	7	25.9	20	74.1	27	6.9
11-	16	30.2	37	69.8	53	13.6
Total	168	43.1	222	56.9	390	100.0

Ribbon Seal

Age class	No. males in sample	% in male sample	No. females in sample	% in female sample	Total No.	% in total sample
0	18	37.5	30	62.5	48	6.3
1-2	161	50.6	157	49.4	318	41.8
3-6	144	52.4	131	47.6	275	36.1
7-10	39	51.3	37	48.7	76	10.0
11-	22	50.0	22	50.0	44	5.8
Total	384	50.5	377	49.5	761	100.0

classes were settled by considering the sexual maturity data by Tikhomirov (1968). The sex ratios of each age class are shown in Table 5. The sex ratio of 62.5% of female pup is little higher than expectation. However, the ratios of 49.4%,

47.6%, 48.6%, 50% females for immature class, subadult class, adult class and old class indicate that both sexes of this seal appeared in same ratios, and this result was quite different from the result obtained from harbour seal. The ratios for male and female of all classes in total are 50.5% and 49.5% respectional. From these facts it may be concluded that sexual segregation does not occur, even in adult and subadult classes. This result, however, was different from that indicated by Tikhomirov (1961). He described that in some aggregations occasionally the predominance of males and females had been observed. The above mentioned different results may due to the surveyed area size. In this chapter, sex ratios of all seals from all four areas were discussed. However in this study, we compared the age and sex composition between each areas of I-IV to obtain the more detailed knowledge on distribution of these species.

Harbour seal

As seen in Table 6, of all 390 harbour seals 122 seals were collected in area I and 216, 39 and 13 were collected in areas II, III, IV respectively. These sample numbers generally reflect the abundance in these areas and indicate that harbour seal were much abundant in area I and II. Concerning the age compositions, pups appeared to distribute in all areas, with age class ratio between 15.4%–30.8% of totals, and it was presumed that pups showed the scattered distribution in all areas, even in areas III and IV where this seal was less abundant. Immature class (1–2 year class) seals appeared in high frequency in areas I and II with ratio 46.7% and 28.7% and low frequency in areas II and IV with ratio both 7.7%. This may indicate that the immature seals concentrate to a certain degree in areas I and II. The subadult and adult class seals seemed to appear randomly, and old class appeared in areas I and II less frequently with ratio 4.1% and 11.6%, and more frequently in areas III and IV with ratio 41.0% and 53.8%.

It may be true that the distribution of pup widely spreads out and scatters. As already mentioned pups stay on ice floes for a while even after weaning and have ice dependent life (Naito and Nishiwaki 1972) and as a consequence, pup occurrs in far south water along the coast or Japan (Naito 1976). These facts may support above result. In this study some tendency of concentrations by immature seals occurred in southern area and it was not widely known that immature harbour seal tend to concentrate. However the fact that concentration of young harbour seals was annually observed near St. Mathew Island in the Bering Sea (Tikhomirov and Kosygin 1966) may support the result obtained in this study. Furthermore, the imformations from hunters that the immature harbour seals are distributed in concentration should be taken into the considerations. However, we are still short in data to obtain the clear result.

Concerning the sex ratio, there obtained the clear result in this study that older female seals appeared in high frequency in southern area of I and II and both sex of immature seals appeared almost same frequency (Fig. 4 and Table 6). However in northern areas of III and IV, such phenomena were not observed due to shortage of data.

TABLE 6. AGE CLASS COMPOSITION AND SEX RATIOS OF EACH AGE CLASS HARBOUR SEAL IN EACH AREA

Age class	Area I				Area II				Area III				Area IV			
	No. of males (%)	No. of females (%)	Total No.	% in total sample	No. of males (%)	No. of females (%)	Total No.	% in total sample	No. of males (%)	No. of females (%)	Total No.	% in total sample	No. of males (%)	No. of females (%)	Total No.	% in total sample
0	16 (50.0)	16 (50.0)	32	26.2	24 (53.3)	21 (46.7)	45	20.8	5 (83.3)	1 (16.7)	6	15.4	2 (50.0)	2 (50.0)	4	30.8
1-2	27 (47.4)	30 (52.6)	57	46.7	28 (45.2)	34 (54.8)	62	28.7	3 (100.0)	0 (0)	3	7.7	0 (0)	1 (100.0)	1	7.7
3-6	6 (25.0)	18 (75.0)	24	19.7	31 (46.3)	36 (53.7)	67	31.0	3 (37.5)	5 (62.5)	8	20.5	0 (0)	1 (100.0)	1	7.7
7-10	0 (0)	4 (100.0)	4	3.3	4 (23.5)	13 (76.5)	17	7.9	3 (50.0)	3 (50.0)	6	15.4	0 (0)	0 (0)	0	0
11-	0 (0)	5 (100.0)	5	4.1	2 (8.0)	23 (92.0)	25	11.6	10 (62.5)	6 (37.5)	16	41.0	4 (57.1)	3 (42.9)	7	53.8
Total	49 (40.2)	73 (59.8)	122	100.0	89 (41.2)	127 (58.8)	216	100.0	24 (61.5)	15 (38.5)	39	100.0	6 (46.2)	7 (53.8)	13	100.0

TABLE 7. AGE CLASS COMPOSITION AND SEX RATIOS OF EACH AGE CLASS RIBBON SEAL IN EACH AREA

Age class	Area I				Area II				Area III				Area IV			
	No. of males (%)	No. of females (%)	Total No.	% in total sample	No. of males (%)	No. of females (%)	Total No.	% in total sample	No. of males (%)	No. of females (%)	Total No.	% in total sample	No. of males (%)	No, of females (%)	Total No.	% in total sample
0	2 (25.0)	6 (75.0)	8	27.6	12 (41.4)	17 (58.6)	29	6.7	4 (66.7)	2 (33.3)	6	3.4	0 (0)	5 (100.0)	5	4.2
1-2	9 (52.9)	8 (47.1)	17	58.6	100 (50.3)	99 (49.7)	199	45.5	26 (54.2)	22 (45.8)	48	27.4	26 (48.1)	28 (51.9)	54	45.0
3-6	1 (33.3)	2 (67.7)	3	10.3	100 (62.5)	60 (37.5)	160	36.6	34 (48.5)	36 (51.5)	70	40.0	9 (21.4)	33 (78.6)	42	35.0
7-10	0 (0)	1 (100.0)	1	3.5	19 (54.3)	16 (45.7)	35	8.0	15 (50.0)	15 (50.0)	30	17.2	5 (50.0)	5 (50.0)	10	8.3
11-	0	0	0	0	7 (50.0)	7 (50.0)	14	3.2	11 (52.4)	10 (47.6)	21	12.0	4 (44.4)	5 (55.6)	9	7.5
Total	12 (41.4)	17 (58.6)	29	100.0	238 (54.5)	199 (45.5)	437	100.0	90 (51.4)	85 (48.6)	175	100.0	44 (36.7)	76 (63.3)	120	100.0

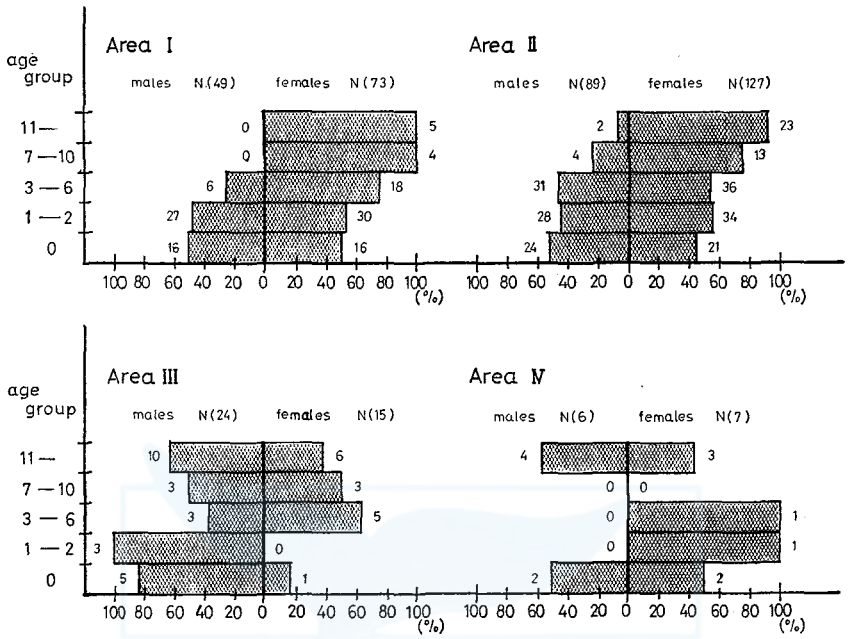

Fig. 4. Sex ratios for age groups of harbour seal in each area, 0: pup class, 1~2: immature class, 3~6: subadult class, 7~10: adult class and 11~: old class

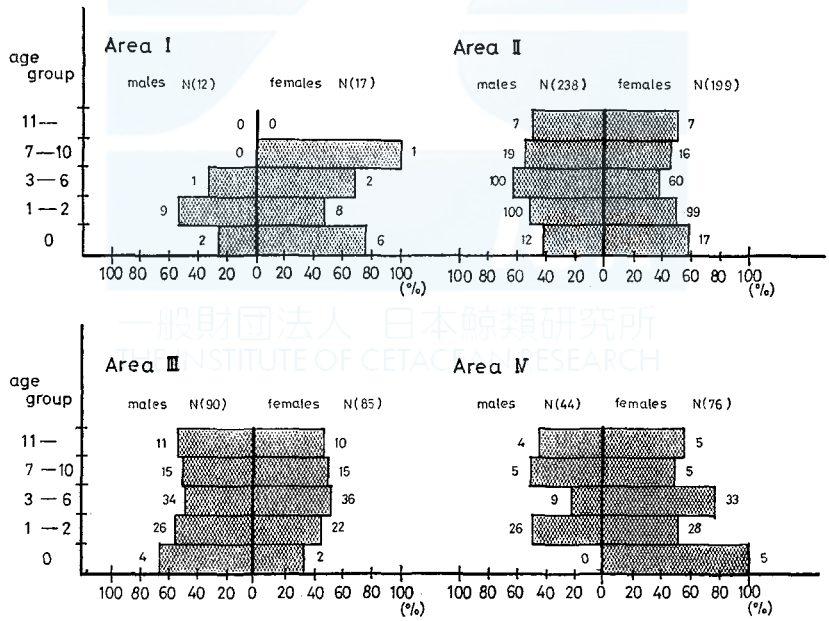

Fig. 5. Sex ratios for age groups of ribbon seal in each area, 0: pup class, 1~2: immature class, 3~6: subadult class, 7~10: adult class and 11~: old class

According to Tikhomirov and Kosygin (1966), south of Nunivak Island in the Bering Sea they found every spring aggregations of female which had recently given birth to their pups. In our study, pups had been weaned almost 1.5–2 month before and such female agregations were not observed. Although our result may indicate that adult females keep some aggregation to a certain degree even after weaning, it may be more reasonable to understand that the female adult seals remain longer in ice floe region while adult male seals shift their habitate from ice region to the coastal region.

Ribbon seal

In the case of ribbon seal, the relative larger number of samples (761 seals) were obtained. Out of 761 seals, 29 seals were collected from area I and 437, 175, 120 seals were from areas II, III, IV respectively. And in area II ribbon seal was most abundant and least abundant in area I (Table 7). Concerning the age composition in each area, as seen in Table 7 appearance frequencies of pup class and immature class were relatively high in area I compared with other three areas. Especially pup class seals appeared high frequency in area I. On the contrary subadult class, adult class and old class seals appeared less frequently in arae I and more frequently in other 3 areas, especially in area III.

From above, it was supposed that the southern area of area I was less abundant area and young seals were predominant like as harbour seal. The area II was the most abundant area and immature and subadult seals were dominant. The area III was relatively abundant and older seals were dominant. The area IV was widely operated area (Fig. 1) and the seals was not abundant, while similar age composition as in the area II of the most abundant area was observed.

At this stage of study, we could not obtain any reasonable explanation for above phenomena.

Concerning the sex ratio, as seen in Fig. 5, ratios for all age classes in area I were fluctuated very much due to the small sample size. From same reason, sex ratio for pup class also fluctuated among each area.

The male and female seals of immature, adult and old adult classes appeared in similar ratio among areas except area I showing the ratios of about 50% for both sexes. However, only subadult seals showed the different ratio among areas II, III and IV. In area II, sex ratio with 37.5% for females were observed, on the other hand, in area IV females were dominant, and ratio of 78.6% for females was observed. Being still uncertain, it was possibly considered that ribbon seal shows sexual segregation of some certain degree. It is necessary to obtain the data from much smaller areas in order to analyze the above problems. In this study, the several hunting boats operated in wide spreaded areas. These hunting boats made operations about twice a day, from 4 AM to noon and from 13 PM to 18 PM. After operation, the seals were boarded on the mother boat where we collected specimens. Therefore we could not make any more detailed analysis for ribbon seal distribution.

GROUP SIZE

In this study we also performed the observations on group size of both species. The group size was estimated by the number of seals laying themselves on the same ice floe. The size of ice floes showed much variations. The largest size was about 150–200 m in diameter.

Harbour seal

The group size of the two species was studied in order to know the social structure of each species. The observations were performed from the top of the mother boat bridge while the hunting boats were out from it. As shown in Table 8, 58.9% of the harbour seal groups was composed of a single seal, and 22.3% was composed of two seals. The larger the group size, the frequency gradually decreased so far, and the maximum group size was 8 individuals. The average group was composed of 1.8 seals.

TABLE 8. GROUP SIZE AND FREQUENCY OF EACH GROUP SIZE OF HARBOUR SEAL AND RIBBON SEAL. TOTAL NUMBER OF INDIVIDUALS OF EACH GROUP SIZE WAS ALSO SHOWN IN THIS TABLE. GROUP SIZE WAS ESTIMATED BY THE NUMBER OF INDIVIDUALS THAT HAULED OUT ON THE SAME ICE FLOE

Group size	No. of sighting		No. of individuals	
	Harbour seal (%)	Ribbon seal (%)	Harbour seal (%)	Ribbon seal (%)
1	66 (58.9)	90 (97.8)	66 (32.5)	90 (95.7)
2	25 (22.3)	2 (2.2)	50 (24.6)	4 (4.3)
3	10 (8.9)	0	30 (14.8)	0
4	5 (4.5)	0	20 (9.9)	0
5	2 (1.8)	0	10 (4.9)	0
6	2 (1.8)	0	12 (5.9)	0
7	1 (0.9)	0	7 (3.4)	0
8	1 (0.9)	0	8 (3.9)	0
Total	112 (100)	92 (100)	203 (100)	94 (100)

The group size observed in this study seemed to be rather small than what it was under the natural condition, because we obtained the data from the area where some hunting boats operated around and more or less the seals were disturbed. As the matter of fact, the largest group size was smaller than the group size of 12 young seals obtained in the same season and same area in 1971 (Naito and Nishiwaki 1975). From above result, unfortunately, we could not analyze the group size from the point of view of sex, age or areas in this study.

Ribbon seal

The ribbon seal showed the distinguishable aspect from the point of view of group size. The group of this seal was composed of a single seal in 97.8% frequency, and only twice a couple of seals laying themselves on same ice floe was observed (Table 8). Even in these two cases, it was not supposed that they were

either associated each other or located close together, but observed laying themselves apart on the ice floe.

From these facts, we can conclude that ribbon seal does not form the group but keep a distance each other on ice floes in this season. Thikhomirov (1961) also reported that ribbon seal appear solitary on ice floe.

DISCUSSION

It is generally said that ribbon seal and harbour seal occupy almost similar ice region. However Burns (1970) reported that in the ice edge zone of the central Bering Sea, ribbon seal had been most numerous along the inner (northern) edge of the zone and gradually outcomed by harbour seal towards the southern edge. In the same sense, we also attained the similar result. However, in our study the season was different from the above suggestion as already mentioned high frequency of ribbon seal in northern area may be only due to the longer staying on ice floes compared with harbour seal as suggested by Tikhomirov (1961). We need the much more data for long period in order to obtain the reasonable conclusions.

Concerning the age and sex ratios, we obtained the result that female adult harbour seals occurred in high frequency and to a certain degree age and sexual segregation were observed. On the other hand ribbon seals showed no age and sexual segregation as a whole. However, in some areas, sexual segregation was observed in subadult class. Burns (1978) described that he had seldom seen male and female ribbon seal together. We also observed same as he described. Our above result was based on the data from relatively larger area and the degrees of sexual segregation seemed to be lower estimation than what it was, because we sometimes observed the adult males dominant zone and adult female dominant zone separately in smaller areas. This sexual segregation seems to occur even in breeding season (Tikhomirov, 1961). In Nemuro Strait of eastern Hokkaido, sex ratio of female adult seal exceeded 70% (Itoh unpublished data) in breeding season. Burns (1978) also reported that in breeding season both sex of ribbon seal seldom appear together. The reason why these segregation may occur on ribbon seal is still uncertain. The peculiar pelage pattern of ribbon seal may play some role between both sex as some communication like as reported in harp seal (*Phoca groenlandicus*) (Evans and Bastian 1969). However, we found that not only matured ribbon seal, but also immatured seal appeared in solitary. Probably this seal is ecologically adapted and specialized as pelagic seal. In this study we were quite uncertain on this problems.

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