THE OCCURRENCE OF THE PHOCID SEALS ALONG THE COAST OF JAPAN AND POSSIBLE DISPERSAL OF PUPS

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ABSTRACT

The distribution of the phocid seals was studied both outside area and in the border area of their habitat. Sixteen catch or observation records from Honshu, Shikoku and Kyushu of Japan were examined. Three species appeared, the ice-breeding harbour seal (*Phoca vitulina*), the ringed seal (*Pusa hispida*) and the bearded seal (*Erignathus barbartus*) occurred while the land-breeding harbour seal (*Phoca vitulina*) and the ribbon seal (*Histriophoca fasciata*) did not occur in those areas. In the border area of the habitat, all four species of the ice-breeding seals occurred. These seals were mostly pups indicating that the new born pups spread their distribution after ice season being carried by the ice floes and some of them occurred far south from their habitats.

INTRODUCTION

The author has studied the pagophilic (ice-breeding) and the pagophobic (land-breeding) harbour seals (*Phoca vitulina*) comparing their ecology and morphology. The pagophilic form annually shifts their habitat from the edge zone of drifting ice to coastal area, while the pagophobic form stays at the same habitat (coastal) even in breeding season. These differences of their life systems between two forms may strongly relate with their adaptation systems, especially in the period of new born pups. In the pagophilic form the shift of habitat occurs several weeks after their birth, and during this short period, important life events occur on the new born pups such as suckling, weaning, moulting, and moreover physical and morphological changes. It is the problem that these events are performed on unstable ice floes in the edge zone of the drifting ice. If the shift of habitat was unsuccessful processing these events, as Naito and Nishiwaki (1972b) suggested, the pups would be carried away by ice drift so as to spread their distribution. In the pagophobic form, however, such habitat shift does not occur, and mother-pup relationship continues longer to result the steady and successful weaning and independent life of the pups. Therefore, the pup distribution of this form is settled.

The present study is aimed to examine the above understandings by studying the distribution of these seals (including other species) in the border area of their habitat and also out side of the border.

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DISTRIBUTION OUT SIDE OF THE BORDER OF THE HABITAT

The present study deals with occurrences along the coast of Japan other than Hokkaido (Honshu, Shikoku and Kyushu). Catch or sighting records of the seals along the coast of Japan other than Hokkaido are rare and scarce, so it is difficult to collect such records. In the present study records and informations were collected from following three sources. (1) The newspaper or T. V. broadcasting as a local news; the seals in these areas are very strange animals, therefore if they were caught or sighted such seals were sometimes reported by them. (2) Aquariums; if the animals were caught alive, they were usually sent to the aquariums near by for display, and aquariums kindly sent me the informations to my requests. (3) The prefectural fisheries research station or local museum; the catch or sighting informations by local people were given to them. As to the biological informations, species, date, place and length or approximate length were available from above informations. However, to my regret, sex, body-weight and age determined from canine teeth are unknown.

Appeared species

Three species, bearded seal, ringed seal and harbour seal were accidentally caught or sighted along the coast of Honshu, Shikoku and Kyushu (Fig. 1). Only two bearded seals were recorded at Akita and Niigata of the Japan Sea coast of the Northern Honshu, and there are no records from Shikoku and Kyushu. Out of 5 records of ringed seals, two were from Japan Sea coast of Honshu and two were from Pacific Ocean coast of Honshu and Shikoku. The

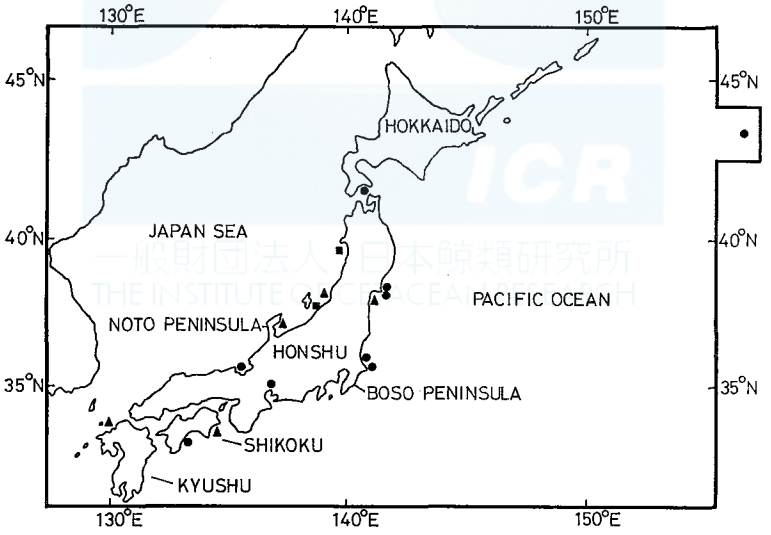

Fig. 1. Some catch or observation records of the phocid seals from the coast of Honshu, Shikoku and Kyushu of Japan and others. ●, the ice-breeding harbour seal; ▲, the ringed seal; ■, the bearded seal.

far south record was from Fukuoka-city, Kyushu. Nine ice-breeding harbour seals were recorded. Out of nine, 6 seals were recorded from the Pacific Ocean coast of Honshu and only one seal was from Japan Sea coast of Honshu. None were recorded from Kyushu. In the present study, records of occurrences from Japan coast other than Hokkaido were dealt with as a materials, however, in this chapter additional two examples were also included. One was the catch record by fishing boat from the Pacific Ocean, about 300 miles from the coast. The other is sighting record by research vessels at the mouth of Port Hakodate, the most south of Hokkaido. From above records, it is supposed that the ringed seal and the ice-breeding harbour seal occur more often and futhermore south than the bearded seal, but it is quite difficult to get any conclusion as to the migration route of these seals from their habitat towards southern areas. The most stressed facts in this chapter is that none of the ribbon seals which are as popular as the ice-breeding harbour seal in the Sea of Okhotsk, and none of the land-breeding harbour seal of which habitats distribute in the furthest south of Hokkaido, were recorded in the coast of Honshu, Shikoku and Kyushu.

Appeared season

The seasons when the seals occurred along the coast of Honshu, Shikoku and Kyushu were shown in Fig. 2. In this chapter, the seals were not treated separately by species but as a total records of 3 species were treated, and addional 2 records of the ice-breeding seal from the Pacific Ocean and the port of Hakodate were excluded because they were not the records from intended area (Honshu, Shikoku and Kyushu). As shown in Fig. 2, the seals begin to occur from April at 12.5% frequency, and the highest frequency was 25% in May. After May seals decrease to occur. In June and July 18.7% of the total occurred

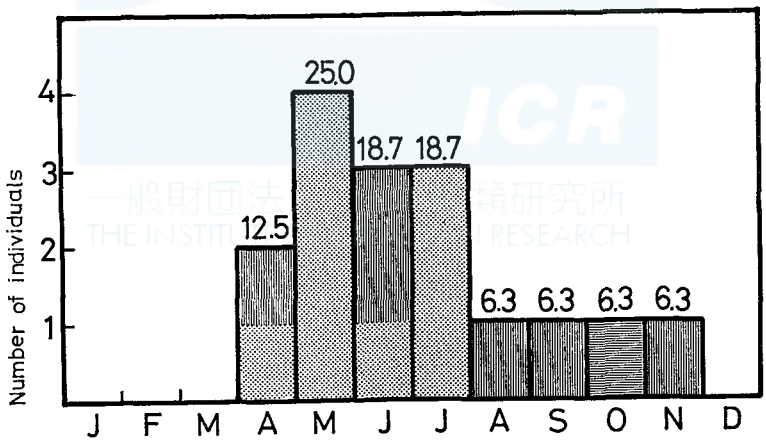

Fig. 2. The seasonal appearance frequency of the seals occurred along the coast of Honshu, Shikoku and Kyushu. Numbers were shown in percentage. Dotted space shows the ice-breeding harbour seal; horizontal line, the ringed seal; vertical line, the bearded seal.

respectively and none of seals occurred in December. Seventy five percent seals of all occurred from April to July. Being still short data, from mentioned above, the following two problems were indicated. 1) The seals begin to occur in April. This time well corresponds with after-season of drifting ice in Hokkaido. 2) The seals decrease to occur after May. This may indicate that the smaller number of seals occur in later season in farther south area. The problem 1) will be discussed later. The problem 2) may be explained by Fig. 3. In

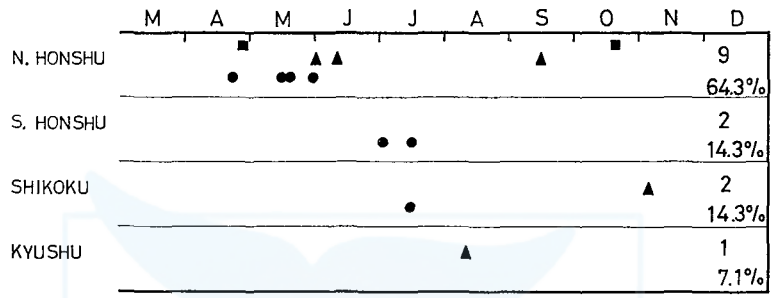

Fig. 3. Time difference of the first occurrence between each area. The seals begin to occur from north. They occur in Northern Honshu at ffrst and in Kyushu at latest. ●, the ice-breeding harbour seal; ▲, the ringed seal; ■, the bearded seal.

Fig. 3, the area where the seals recorded were separated to four districts, from north to south; northern Honshu, southern Honshu, Shikoku and Kyushu. Honshu was sepatated by the line between Boso Peninsula and Noto Peninsula. As shown in Fig. 3, in northern Honshu 9 seals (64.3%), in southern Honshu and Shikoku 2 seals (14.3%) in each and only 1 seal in Kyushu were recorded respectively. Furthermore, the seals were recorded from earier season in northern Honshu, and in Kyushu it recorded in latest season. From all above mentioned, it is suggested that the seals move towards south from main habitat in the Sea of Okhotsk and the adjacent waters.

Ages of the seals recorded

In the present study, age informations based on examination of canine tooth were not available. Only measured body size or approximate body size was used for growth developmental class estimation. In general it is difficult to estimate ages by body size, however, body size indicates such growth stages as pup, young subadult and full adult. Tikomirov *et al.* (1969) showed the growth curves of the bearded seal, ringed seal and the ice-breeding harbour seal. Naito and Nishiwaki (1972) also showed the growth curves of the ice-breeding harbour seal. From these curves and the measured body size or approximate body size shown in Table 1, the growth developmental classes were possibly estimated to be pups in the ice-breeding harbour seal and ringed seal. In the bearded seals one was young or subadult and the other was also pup.

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TABLE 1. THE LIST OF SEALS CAUGHT ALONG THE COAST OF JAPAN.

Species	Date of catch	Locality	Sex	Body length	Body weight
Erignathus barbartus	Apr. 28, '68	set net Teno-cho, Akita	male	145 cm	—
„	Oct. 18, '70	Port of Niigata	—	180 cm	120 kg
Pusa hispida	Sep. 15, '73	Senami-Beach Murakami-city, Niigata	—	100 cm (total length)	—
„	Jun. 11, '69	Teisan-Cannal Yuriage, Natori-city Miyagi	male	75.0cm	11.3 kg
„	Aug. 7, '74	Creek in Tsuyasaki-Bay Fukuoka	—	75.0 cm (total length)	12.4 kg
„	Jun. 2, '75	Shiratori-Beach Toyama	male	60 cm (total lenght 88 cm)	—
„	Nov. 4, '75	Azirozaki-Beach Hiwasa, Tokushima	—	90 cm (total lengh)	10 kg
Phoca vitulina largha	Jun. 7, '68	mouth of Hakodate-Bay Hodkaido	—	— (young)	—
„	May 20, '69	'Pacific Ocean 43°14′N; 156°34′E	male	— (pup)	16 kg
„	May , '54	Port of Ayukawa, Miyagi	—	less than 100 cm	—
„	May , '54	Ayukawa, Miyagi	—	less than 100 cm	—
„	Jul. , '58	Susaki-Bay, Kochi	—	about 100 cm	—
„	Jul. , '53	Miyazu-Bay, Kyoto	—	about 100 cm	—
„	Jul. , '73	Kiso-River, 20-25 km up from mouth of river	—	about 150 cm	—
„	—	Kominato.Bay, Chiba	—	85 cm (measured by molted specimen)	—
„	Apr. 23, '72	Hazaki-Beach, Kashima, Ibaragi	—	80 cm	—
„	May 30, '49	Kashimanada, Ibaragi	female	104 cm (total length)	—

THE CATCH RECORDS IN THE BORDER OF THE HABITAT

As already described, the bearded seal, the ringed seal and the ice-breeding harbour seal had occurred along the coast of Honshu, Shikoku and Kyushu, and the ribbon seal and the land-breeding harbour seal had never occurred in these areas. It is also mentioned that these occurred seals were mostly pups. They begin to occur from north to south indicating the southwards moves, and these occurrences began from April indicating some relation with the time of habitat shift from the ice floe to the coast in these three species, because the ice floes melt and disappear from mid March to mid April in Hokkaido. In this chapter, to examine above problems more precisely the catch records by fishing nets in the border of the habitat were studied in two seasons, after ice season and in October (6 months after ice season).

There are two border parts in Hokkaido. One is the Soya Strait which connects the Sea of Okhotsk to the Japan Sea, and the other is the Nemuro Strait which connects the Sea of Okhotsk to the Pacific Ocean. The study was performed in the Nemuro Strait which is generally known as the southern border of the habitat of the pagophilic seals in the Sea of Okhotsk (the bearded seal, the ringed seal, the ice-breeding harbour seal and the ribbon seal, Naito, 1969). Especially in the ice-breeding harbour seal the lake Furen in the Nemuro Strait area is known as the southern edge of the distribution of their hauling grounds.

The catch records after the ice season

The Nemuro Strait area are also known as almost southern limits of annual constant occurrence of the drifting ice from the Sea of Okhotsk. The ice prevails through this strait area from early February to mid or late March, sometimes mid April when the ice is eminent (Ruhyo-Sokuho, 1969–1975). During this season, the ice moves from north to south being carried by the wind and current, and it occurs in the Pacific Ocean passing through the strait (Fig. 4). After the ice occurred in the Pacific Ocean it melts quickly near around the Nemuro Peninsula. However, when the ice is extensive, it is occasionally driven as far as the Point Erimo. The ice condition in the Nemuro Strait is not constant, and it is always drifting making open seas somewhere in this strait. The ice floes occuring in these areas are relatively small but varied such as slush ice, ice-cake, small or medium floe berg, rafted or hummocked ice, brash ice. These ices in these areas are capable of supplying hauling or breeding site for the seals. However, the breeding population were found only in the area between the Shiretoko Peninsula and the Kunashiri Island (Naito, 1969; informations from the hunters). In this area, the dominant breeding species is the ice breeding harbour seal and the ribbon seal, and the ringed seal and the bearded seal are quite rare (Naito, 1969). After the ice season, from May only the ice-breeding harbour seal occurs along the coast to haul out the grass bars making 30–70 individuals groups in Odaito and the Lake Furen which open

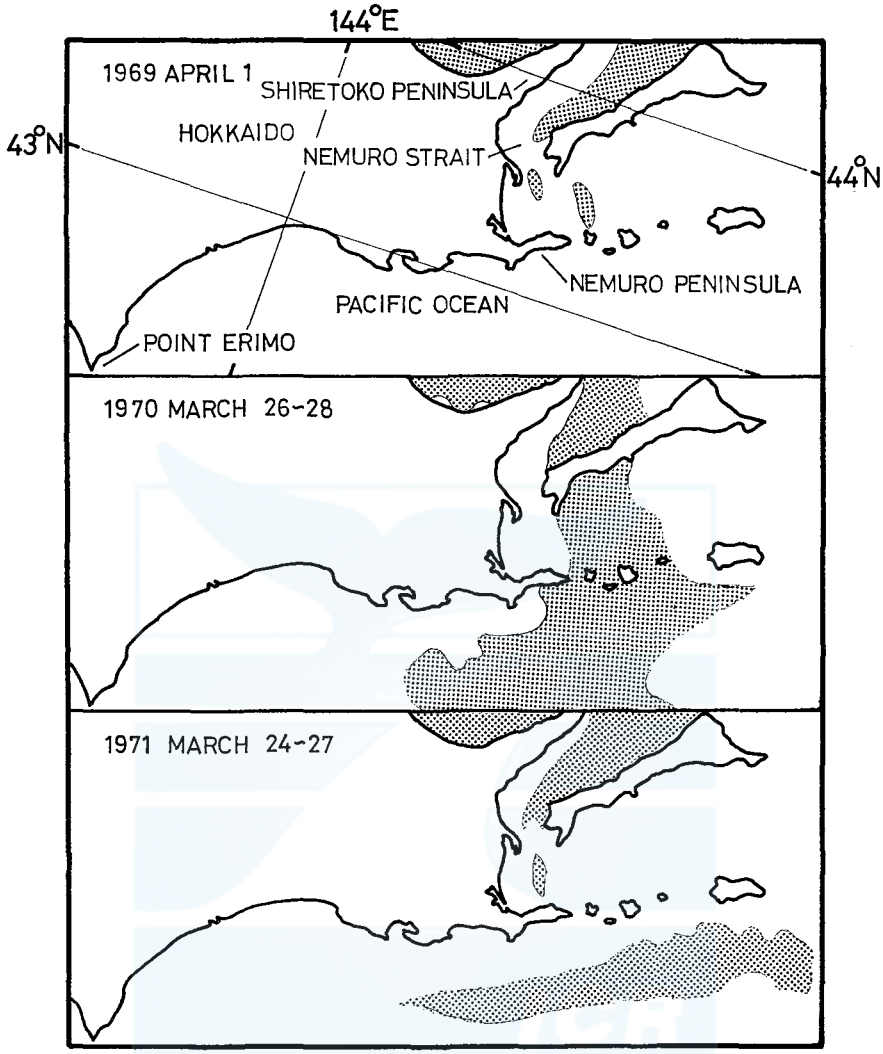

Fig. 4. The distribution of the pack ice in its southern border at the later puping season of the ice-breeding seals. The ice floes occur in the Pacific Ocean from the southern Sea of Okhotsk passing through the Nemuro Strait or near by.

to this strait.

Sampling was performed at Kanazawa Fur Company from 1969 to 1971 during later half of May and June (1969, 1970 May 8-June 30, 1971 May 11-June 30) when the ice completely disappeared. The results were shown in Table 2. The seals mostly caught accidentally by fishing nets along the Nemuro Peninsula (Both coasts of the Nemuro Strait and the Pacific Ocean) were collected at this Fur Company. Almost of these collected seals were examined in 1969 and 1970, however, in 1971 about half of the collected were examined. All 4 ice

TABLE 2. CATCH RECORDS ALONG THE NEMURO PENINSULA AFTER ICE SEASON.

	Species	Field number	Date of catch	Locality	Sex	Body size	Age
1969							
	Bearded seal	NM 17	May 21	Sankaku	female	141.0 cm	pup
	Ringed seal	NM 5	May 13	Nemuro	female	68.0 cm	pup
	"	NM 15	May 19	—	female	77.5 cm	probably pup
	"	NM 24	May 30	Nemuro	female	72.5 cm	pup
	Ice-breeding harbour seal	NM 10	May 17	—	male	73.5 cm	pup
	"	NM 21	May 26	Sankaku	female	87.0 cm	pup
	"	NM 22	May 26	Sankaku	female	95.0 cm	pup
	"	NM 23	May 28	Tomoshiri	female	91.0 cm	pup
1970							
	Bearded seal	148	May 14	Sankaku	female	149.5 cm	pup
	"	213	June 7	Ochiishi	female	146.0 cm	probably pup
	"	227	June 23	Honioi	male	151.5 cm	probably pup
	Ringed seal	166	May 23	Onneto	female	83.5 cm	pup
	Ice-breeding harbour seal	145	May 12	Sankaku	female	125.0 cm	2
	"	150	May 17	Sankaku	female	95.5 cm	pup
	"	160	May 20	—	male	100.5 cm	1
	"	161	May 20	—	male	101.0 cm	1
	"	165	May 23	Horomoshiri	male	76 cm	pup
	"	167	May 24	Tokatan	male	104.5 cm	1
	"	175	May 26	Onneto	female	78.0 cm	pup
	"	182	May 30	Sankaku	female	85.5 cm	pup
	"	214	June 7	Hanasaki	male	89.0 cm	pup
	Ribbon seal	147	May 14	Onneto	female	89.0 cm	probably pup
1971							
	Ice-breeding harbout seal	422	May 22	—	male	88.0 cm	pup
	"	439	June 2	Futatsuiwa	male	97.0 cm	pup
	"	446	June 27	Hokake	female	98.0 cm	pup
	"	452	June 27	Hokake	female	99.0 cm	pup
	Ribbon seal	419	May 16	Sankaku	male	91.0 cm	pup

breeding seals occurred in this area. The ice-breeding harbour seal occurred at the highest frequency as same as seen in Honshu, Shikoku and Kyushu areas. The bearded and the ringed seals occurred at the same frequency. The ribbon seal has never been reported in Honshu, Shikoku and Kyushu, but occurred in this area at the lowest frequency. Concerning the ages of these seals, some were not examined by the canine tooth, for the whole skulls were reserved and attached to the skin for the moulted specimen. However, as well as in former chapter, the ages were estimated by the body size. In all species, the seals caught in this area were mostly pups indicating same tendency seen in Honshu, Shikoku and Kyushu areas. These facts may strongly relate to the movement of ice mentioned above. In the present study, there were no direct observation that the ice carried such pups through this strait to the Pacific Ocean. However, to examine the seasonal changes the author studied the distribution of these seals in other season, October, in the same area.

Catch records in October

The sampling was performed in October 1969 (3-30) by visiting the fishing village when informations were brought by fishermen. The results were shown in Table 3. In this season the result was quite different from that of the after ice season. Only two species, the ice-breeding harbour seal and the ribbon seal were caught. None of the ringed seal and the bearded seal were caught. The

TABLE 3. CATCH RECORDS ALONG THE NEMURO PENINSULA IN OCTOBER (1969)

Species	Field number	Date of catch	Locality	Sex	Body size	Age
Ice-breeding harbour seal	7	—	Ochiishi	male	162.0 cm	8
„	9	—	Habomai	female	149.0 cm	3
„	16	October 14	Toritoishi	female	160.5 cm	18
„	18	October 15	Tohbai	female	—	adult
„	36	October 23	Habomai	female	156 cm	10
„	39	October 26	Odaitoh	female	130.5 cm	3
„	40	„	„	male	133.5 cm	2
„	41	„	„	female	—	—
Ribbon seal	33	October 23	Sankaku	male	153.0 cm	adult
„	34	„	„	male	132.0 cm	immature
„	43	October 27	Sankaku	male	149.0 cm	immature

data are quite small, however as seen in Table 3, half of the ice-breeding barbour seals were adults, which had been never caught after ice season. In the ribbon seal the adult seal was included.

Aboves are quite short data to get some conclusion, however it is clear that age composition of the ice-breeding harbour seal which occurred in this area

is quite different between after ice season and in October. In the former season, seals were mostly pups (76.5%) and none of adult seals occurred. On the other hand in the later season adult seals (50%) occurred in the same area. It is still uncertain when these age compositions change, yet it is supposed that the dispersion of adult seals in this area is due to the salmon migration, because these seals were caught by the salmon set nets which were operated from summer to autumn when the salmons migrate to the coast for their up river spawning migration. There is no clear explanation why the bearded seal and the ringed seal never occurred in this season. However, it is supposed that their habitats (hauling grounds) are too far north in Sakhaline (Inukai 1942) to occur in this area except ice season. Three ribbon seals were caught in this season, however, these seals were not caught by the coastal salmon nets but caught by the gill nets offshore in this area, and this seal is still seemed to be rare species in the coast.

DISCUSSION

The author examined the distribution of the pagophilic seals in area outside of their habitat and in the border area, and the followings are recognized. The ice-breeding harbour seal, the bearded seal and the ringed seal occurred in Honshu, Shikoku and Kyushu moving from north to south. These seals were mostly pups. The ribbon seal has never occurred in this out side area of their habitat. The land-breeding harbour seal also has never occurred in this area. In the border area of their habitat, all 4 pagophilic seals occurred along the coast of the Nemuro Peninsula after ice season. The most of these seals were pups. However in October in the same area, only two species, the ice-breeding harbour seal and the ribbon seal occurred, and the adult seals occurred in high frequency.

The present study depended on short data, however, above facts furthermore lead to the important conclusion as follows. The pagophilic seals especially ice-breeding harbour seal (except the ribbon seal) disperse their distribution during or after the drifting ice melted. On the contrary, the land-breeding harbour seal which distributes along the Nemuro Peninsula to the Point Erimo does not shows such wide dispersion not only by the pups but also by others. These difference may due to their mode of life. The ice breeding seals shift their habitat from ice floe to the coast except the ribbon seal. These shift may occur pretty shortly after birth for the pups especially in the ice-breeding harbour seal (2–3 weeks after birth), for they occupy the edge zone of the seasonal pack ice (Burns, 1970; Fay, 1972; Naito, 1972a). During this short period, pups have to accomplish their life events on ice floe such as suckling, moulting of the lanugo coat and the weaning for their swimming life. The dispersion carried by the ice floes is innevitable for the pups which possess such above life, and this periods is highly critical for their survivals. However, perhaps for compensating these critical early stage of life, pups of these seals

possess the very thick blubber as energy storage (Naito and Nishiwaki, 1972b). The pups of the land-breeding harbour seal have much more stable life. They begin to swim soon after birth. The mother-pup relationship continues longer (about 4-6 months—Naito and Nishiwaki, 1972b; Belkin *et al.*, 1969), and the weaning occurs gradually. Therefore the dispersion of pups may not occur. In the present study the ribbon seal has not occurred in Honshu, Shikoku and Kyushu areas. This may relate with that the ribbon seal apparently becomes pelagic after the breeding and moulting season (Burns, 1970; Fay, 1972).

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Through this work, I owed it to many people that I could collect records and informations about wondering seals along the coast of Japan for many years. The greatest thanks are due to many aquariums, museums, prefectural fisheries experimental stations who are very kind to send me the valuable informations for my requests. In the field works, I wish to thank to Mr. Nobuyoshi Kanazawa, Kanazawa Fur Company, and many fishermen who gave me informations and chances to examine the specimens.

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