

COMPARISON IN COLOUR PATTERN OF TWO SPECIES OF HARBOUR SEAL IN ADJACENT WATERS OF HOKKAIDO

YASUHIKO NAITO*

Ocean Research Institute, University of Tokyo

ABSTRACT

The pelage of *Phoca vitulina largha* shows a clear colour contrast between the lighter ventral and the darker dorsal. On the other hand, the pelage of *Phoca kurilensis* shows little such contrast. There is much variation in the pelage of both species. Sometimes *Phoca kurilensis* has pelage closely resembling that of *Phoca vitulina largha*, and identification by colour pattern is difficult. Hard scars are often found on the pelage of *Phoca kurilensis*, which are presumably caused by fights between males during the breeding season.

INTRODUCTION

The pelage colour and pattern of the harbour seal have been reported in the literature ever since biologists have been interested in this animal. It is generally said to be quite difficult to describe them precisely because of their endless variations. However, in spite of the above difficulties, the importance of pelage studies of this seal has increased all the more, in the light of recent studies on its taxonomy and zoogeography in the North Pacific.

In the North Pacific, there are three types of harbour seal; *Phoca vitulina largha*, *Phoca vitulina richardi*, and *Phoca kurilensis* (i.e., *Phoca insularis*). These three seals differ in their distribution, breeding grounds and habitat. *P. v. richardi* breeds on sand bars or rocky shores and occurs along the Pacific coast of North America (Scheffer and Slipp, 1944; Fisher, 1952; Scheffer, 1958; King, 1964; Stutz, 1967; Bigg, 1969). *P. v. largha* is an ice breeding type and occurs mainly in the Bering Sea and the Sea of Okhotsk (Inukai, 1942 a, b; Wilke, 1954; Scheffer, 1958; King, 1964; Burns, 1970; Tikhomirov, 1971; Fay, 1972; Naito and Nishiwaki, 1972 a). *P. kurilensis* breeds on rocky shores and occurs along the Kurile Islands and Hokkaido (Inukai, 1942 a, b; Belkin, 1964; Belkin *et al.*, 1969; Naito and Nishiwaki, 1972 a). The distribution of this species is incompletely known.

It is generally recognized that the differences in the pup coat are important characters that distinguish each species or subspecies. The white-coat pup of *P. v. largha*, according to McLaren (1966) is one of the most important characters by which this seal can be regarded as an independent species (*P. largha*) from other *P. vitulina* groups which do not bear such a pup coat. The colour and pattern of the

* Present address: Kominato Marine Biological Laboratory, Tokyo University of Fisheries. 1 Uchiura, Amatsu-Kominato, Chiba 299-54.

adult pelage also seem to be important. Variations among local populations of the pelage colour and pattern are reported in *P. v. richardi* (Stutz, 1967). However, studies on these problems in the above mentioned three types of harbour seals still do not provide sufficient data for comparative taxonomic evaluation. Furthermore these studies seem to be important to establish the relationship between pelage character and habitat of each type from the point of view of adaptation and speciation.

The present paper provides some new data on the pelages of *P. v. largha* and *P.*

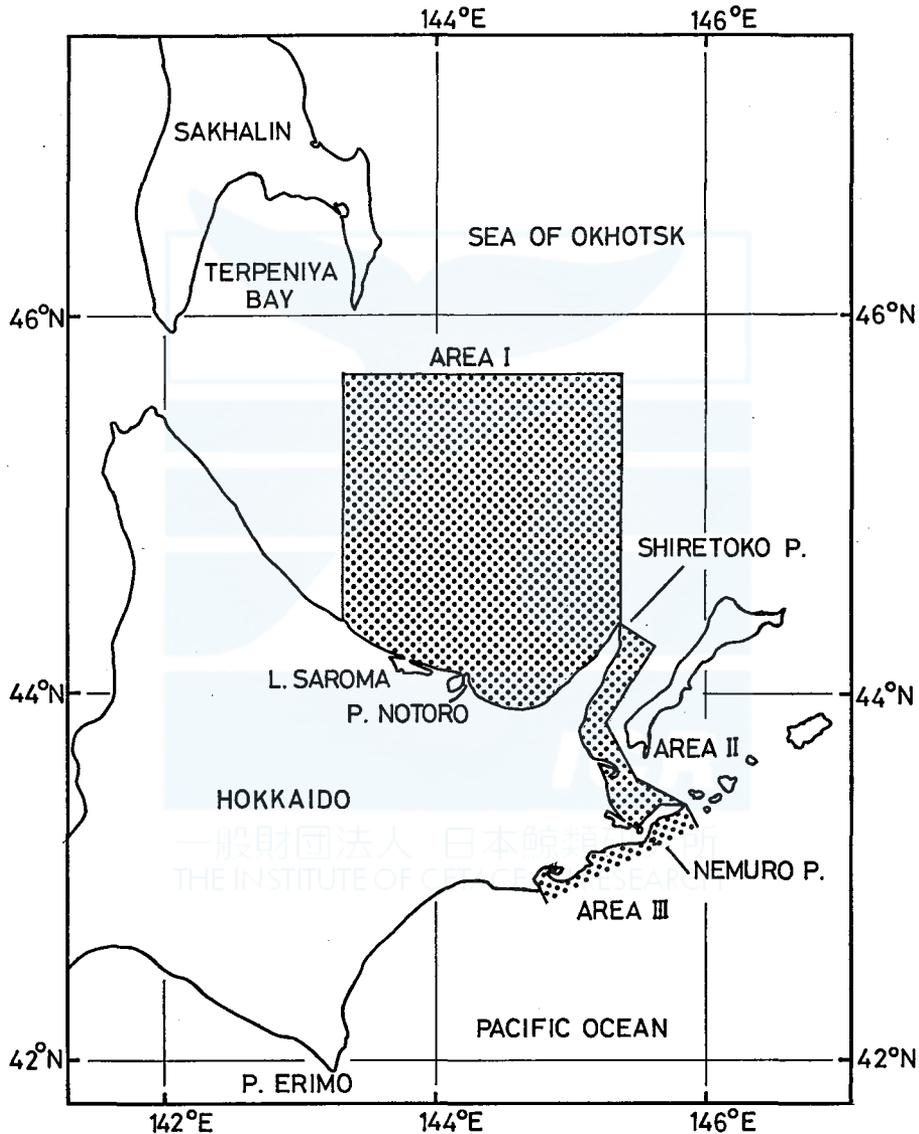


Fig. 1. Sampling areas for *P. v. largha* and *P. kurilensis* in the southern Sea of Okhotsk and the Pacific coast of Nemuro Peninsula.

kurilensis and attempts to clarify the above mentioned problems.

MATERIALS AND METHODS

Field studies on the harbour seal (*P. v. largha* and *P. kurilensis*) were made in the southern Sea of Okhotsk and Hokkaido from 1969 to 1971. Pelage studies were included during the same period and mostly in the same area (Fig. 1). The pelage of *P. v. largha* for this study was recorded from the southern Sea of Okhotsk (area I) and from Nemuro Strait (area II). The pelage of *P. kurilensis* was recorded from area III of Pacific coast of Nemuro Peninsula. Ninety-four skins of *P. v. largha* and 37 of *P. kurilensis* were examined to establish the range of variation in pelage colour and pattern of each seal by studying photographs taken at the factories of fur companies.

PUP COAT OF *P. KURILENSIS*

It is widely reported in the literature that *P. v. largha* is a pagophilic seal and bears its pup without exception with a white coat. Belkin (1964) and Belkin *et al.* (1969) reported however that the pup of this seal is born with the adult type coat. *P. v. richardi* is also generally recognized to bear the adult type coat pup, the white coat being lost *in utero* before birth. However, there are some reports on the pups of *P. v. richardi* which still retain their white coat after birth (Scheffer and Slipp, 1944; Fisher, 1952; Burns, 1970; Stutz, 1966). The same phenomenon is suggested for *P. kurilensis* (Naito and Nishiwaki, 1972 a). The present paper gives more details of exceptional white-coat pups of *P. kurilensis*.

TABLE 1. SOME MEASUREMENTS OF WHITE-COAT PUPS OF *PHOCA KURILENSIS* AND THE EXCEPTIONAL PUP WITH THE *LARGHA*-TYPE COAT OF *PHOCA KURILENSIS*.

	field number	date of catch	locality	sex	body length	body weight	
white coat pup	NM 16	1969-5.20	Moyururi Is.	male	89 cm	16 kg	with 10 cm umbilical cord
	'70-154	1970-5.25	Daikoku Is.	female	93 cm	14.5 kg	with 9.5 cm umbilical cord
pup with the <i>largha</i> type coat	'70-173	1970-5.18	Pacific coast of Nemuro P.	female	98 cm	23 kg	with 5.5 cm umbilical cord

* mean body length of *P. kurilensis*: 98.2 ± 3.2 cm (Naito and Nishiwaki, 1972a)

As shown in Table 1, two exceptional white-coat pups were collected from area III. One was mostly covered with a white coat except for head, flippers and tail. The colour of the hair is creamy white itself, however, as shown in Plate I, the adult type coat under it imparts a greyish hue. The other exceptional pup possessed a partial white coat (15 cm wide) on its dorsal parts, the hair being so thin that its existence was easily missed if the body was wet. These exceptional pups occurred among 20 pups which possessed a fresh umbilical cord (5-10 cm).

Burns (1970) reported the retention of the white coat in early-born pups of *P. v.*

richardi in the Alaska Peninsula, where this seal has a longer pupping season (late-May to mid-July) than *P. kurilensis* in Hokkaido (mid to end of May; Naito and Nishiwaki, 1972 a). According to a fisherman, the earliest record in Hokkaido is 28th of April). The birth of these exceptional pups occurred during the normal birth season of this seal and their body size is quite normal. The frequency of appearance of these white-coat pups is still unknown because of inadequate data, however, it is said that the specimen of Plate I collected 20th of May 1969 was the first example in the long experience of the fur company and the fisherman. Belkin *et al.* (1969) observed more than 100 newborn pups of this seal in the southern Kuril Islands some of which possessed fresh umbilical cords; however, they found none of the above type of exceptional pup. Therefore, it seems that the white-coat pup is considerably rare in the southern Kuril Islands and Hokkaido.

THE PELAGE COLOUR AND PATTERN

Inukai (1942 a) and Belkin (1964) recognized the pelage colour and pattern as important characters distinguishing *P. kurilensis* from *P. v. largha*. However, in spite of their work, the range of variation of the pelage colour and pattern of each species is still unknown. In *P. v. richardi*, Stutz (1967) studied the range of variation of pelage colour and pattern and named three basic categories: "black", "common" and "muddy", and suggested that these three categories typify three largely isolated local populations. In the present study, the range of variation of the pelage colour and pattern of *P. v. largha* and *P. kurilensis* were examined in 94 and 37 photographs respectively.

TABLE 2. FREQUENCY OF APPEARANCE OF EACH COLOUR TYPE

	lighter ← colour degrees → darker					Total
	1	2	3	4	5	
<i>P. v. largha</i> numbers examined	9	17	44	18	6	94
(%)	(9.6)	(18.1)	(46.8)	(19.1)	(6.4)	
<i>P. kurilensis</i> numbers examined	3	11	14	6	3	37
(%)	(8.1)	(29.7)	(37.8)	(16.0)	(8.1)	

Ninety-four pelages of *P. v. largha* were classified into five categories by the colour, from lighter to darker (Plate II), and the frequency of appearance was examined. These colour categories were chiefly determined by the number and size of dark spots on the ventral side. As shown in Table 2, the distribution in these categories seemed not to show any bias to the lighter side or blacker side. The colour of the pelage of this seal is, as shown in Plate II, composed of two parts, a darker part on the dorsal side and a lighter part on the ventral side. The mid-line of the dorsal side is darkest, showing black, blueish-black or dark grey, and dorsal dark colour sharply fades out in the border parts between dorsal and ventral sides, which show creamy white or silvery white. This contrast is clearer in the lighter colour type. Dark spots appear all over the pelage, showing wide variation in size

and form. Indistinct light marks are seen on the dark dorsal side, sometimes showing obscure small ring marks. The above-mentioned colour is not constant through the year. Moulting of the hair occurs in April and May, and the colour differs markedly in the moulting season. Light parts turn to creamy or sometimes light brown, dark parts turn to dark brown, and spot marks become obscure.

Thirty-seven pelages of *P. kurilensis* were also classified into five categories from lighter to darker. As shown in Table 2, the distribution in these categories as for *P. v. largha* seemed not to show any bias to lighter or darker. Plate II indicates that the pelage of *P. kurilensis* shows little or no colour contrast between dorsal and ventral side, as seen in *P. v. largha*. The colour of the dorsal side is black or dark brown, with dark grey or light brown on the ventral side. The pattern differs between dorsal and ventral sides. There are several clear light ring marks on the dorsal side, sometimes on both dorsal and ventral sides, and on the ventral side many deformed and complicated light ring marks or mottles are seen. These pelages in my observation seemed to have a good camouflage effect when the seals haul out on the rocky shores (Plate III).

As mentioned above, most of *P. v. largha* and *P. kurilensis* are divided by pelage colour and pattern as indicated by Inukai (1942 a) and Belkin *et al.* (1969). However, Plate II indicates that the darker pelage of *P. v. largha* (colour type 5) resembles the lighter pelage of *P. kurilensis* of colour type 1, and it is suggested that it is difficult to distinguish them completely by pelage colour and pattern. Furthermore, we collected a strange pup of *P. kurilensis*, of which the pelage colour and pattern do not belong to any colour degree of *P. kurilensis* but seem to belong to those of *P. v. largha* (Table 1). As shown in Plate IV, fig. 1, characteristic ring marks of *P. kurilensis* are recognized on the dorsal side while the ventral side is silvery white with little small spots, showing a clear colour contrast with dorsal side. It seems quite difficult to identify this pup from pelage colour and pattern. However, this pup was identified as *P. kurilensis* for the following reasons: 1) This pup possessed the incomplete hyoid bones, as the normal *P. kurilensis* does (Naito and Nishiwaki, 1972 b). 2) The birth time and place belonged to those of *P. kurilensis* (Naito and Nishiwaki, 1972 a). This *largha* type seal occurred among 153 collection of *P. kurilensis*. The other example of *largha* type *P. kurilensis* like the above pup was observed in our field observation at Moyururi Island in the beginning of April 1970. In this observation, only one such white pelage seal was found out of 92 *P. kurilensis* in the colony. Judging from the season and location, this seal was supposed to be *P. kurilensis*. From the above facts it is suggested that the *largha* type seal of *P. kurilensis* is quite rare in this area.

SCARS OF PELAGE

Inukai (1942 b) reported scars on the neck of large males of *P. kurilensis*. I found remarkable scars on the pelages of male *P. kurilensis*, while no scars were found on the pelages of both sexes of *P. v. largha*. These scars were mainly found around the neck, the hind flippers and the tail. The larger and harder scars were found around the neck (Plate IV, fig. 2). The scars were sometimes so heavy and severe that the

pelage around the neck showed an uneven surface, with many old ones. The cause of these hard scars is still unknown. However, the facts that the fresh bleeding scars were found only in the breeding season (May to June) and only on adult males (Table 3) suggests that the scars are caused by fighting between males in the breeding season. This is supported by the following observations. I observed hard struggles of this seal in the breeding season during the field observation performed at Moyururi Island in early June of 1969. However, in early April (two months before breeding season) none of struggles were observed among 92 in the population at the same island.

TABLE 3. LIST OF MALES OVER 140 cm IN BODY LENGTH OF *PHOCA KURILENSIS* ON WHICH SCARS WERE FOUND.

density of scars	field number	date of catch	body length	estimated age
heavy	1970-208	1970-6.6	191.4 cm	19
	1970-221	1970-6.16	192.5	—
medium	1970-223	1970-6.16	183	10
	1971-444	1971-6.7	183	10
	1971-455	1971-6.28	184	8
	1971-456	1971-6.28	180	9
light	1970-224	1970-6.16	170.5	—
none	1970-219	1970-6.16	165.5	4
	1970-215	1970-6.10	160.0	4
	1971-457	1971-6.28	161	—
	1971-447	1971-6.27	152	3
	1970-209	1970-5.6	146.5	5
	1971-424	1971-5.22	144	3

DISCUSSION

It is revealed that shore pupping *P. kurilensis* bear a white-coat pup quite exceptionally. In my study, the occurrence of white-coat pups of *P. kurilensis* seemed to be rare, while the occasional occurrence of a white coat in newborn pups of *P. v. richardi* is reported from Alaska to as far south as California (Scheffer and Slipp, 1944; Fisher, 1952; Stutz, 1966; Burns, 1970). It would be interesting to know which seal shows a higher frequency of white-coat pups between *P. kurilensis* and *P. v. richardi*, in consideration of the phylogenetic aspects of *P. v. largha*, *P. v. richardi* and *P. kurilensis* in the North Pacific.

With regard to pelage colour and pattern, it was found that *P. v. largha* shows a lighter phase ventrally, contrasting with a dark dorsal side; *P. kurilensis* has a darker phase both ventrally and dorsally, showing less or no contrast between both sides. The difference in pelage colour and pattern between *P. v. largha* and *P. kurilensis* as mentioned above seems to relate to differences in their habitats or hauling grounds. *P. v. largha* stays on ice floes in winter and spring, occupying the edge of the pack ice (Wilke, 1954; Burns, 1970; Fay, 1972). After ice-melt, seals are highly migratory (Fay, 1972). In Hokkaido, the hauling grounds of this seal show wide topogra-

phical variation. They haul out on the rocky reefs at Point Notoro and grass bars or sand bars of the inland sea the mouth of which opens to the Sea of Okhotsk or Nemuro Strait, where such environments are often found. They are rarely seen however on the Pacific coast of Nemuro Peninsula (Fig. 1), where rocky shores prevail. The lighter pelage of *P. v. largha* seems to adapt to the above mentioned lighter circumstances, and furthermore the lighter phase of the ventral side, in contrast with darker dorsal side, may have a camouflage effect by obliterative counter shading as seen in pelagic fish (Lagler *et al.*, 1962) when they migrate offshore. On the other hand, *P. kurilensis* occurs on the rocky coast of Nemuro Peninsula (Naito and Nishiwaki, 1972 a), rarely penetrating the inland sea of the Nemuro Peninsula where *P. v. largha* is dominant. These seals are non-migratory and are found along the coast throughout the year, hauling out on the rocky shores of small islands (Belkin, 1964; Belkin *et al.*, 1969). The darker colour and white ring marks of their pelages are supposed to be well adapted to their habitat or hauling grounds as mentioned already. We are still uncertain, but the above facts may suggest that *P. v. largha* and *P. kurilensis* select their own habitats or hauling grounds in accordance with their pelage colour and pattern. This interpretation may be supported by their following behaviour. According to some fisherman or hunters in Hokkaido, when *P. v. largha* and *P. kurilensis* haul out at the same place and are hunted, *P. v. largha* swims away offshore, while *P. kurilensis* goes along the coast where rocky reefs are well developed.

Stutz (1967) classified the pelage colour and pattern of *P. v. richardi* into three basic categories, "common", "black" and "muddy". The pelage of "common" and "black" of *P. v. richardi* seem to correspond to that of *P. v. largha* and *P. kurilensis* of the present study respectively, and it is known that *P. v. richardi* haul out on both sand bars of river estuaries or inland sea and rocky coast (Scheffer and Slipp, 1944; Fisher, 1952; Fisher, Bigg, and Newby, personal communication). However, it is still unknown whether *P. v. richardi* shows any tendency of habitat segregation by the pelage colour. Newby, in private communication, informed me of the pelage colours of seals in the different areas of the state of Washington, with a comment on inadequate data. The San Juan seals that haul out on rocks are darker than those found on the sandy beaches of the coast and inland sea.

From these findings, it appears important in future studies to consider the systematic relation between *P. v. largha*, *P. v. richardi* and *P. kurilensis*. Stutz (1967) reported that his "common" pelage (resembling that of *P. v. largha*) appears in 15-47% in the pelages of *P. v. richardi* collected from some places in Alaska and British Columbia. It was quite rare in *P. kurilensis* in our study. However, unfortunately there are quite few data from the Kuril and Aluetian Islands as far east as the Alaska Peninsula, for considering this problem genetically and zoogeographically.

The scars on the adult male pelages of *P. kurilensis* are of interest from the point of view of social behaviour. *P. v. largha* mates in the ice floe region, displaying "family groups" (consisting of male, female and pup) which are rarely closer together than 0.2 Km (Burns *et al.*, 1972). *P. kurilensis* on the other hand breeds on narrow rocky shores in large herds (70-90 individuals including young were ob-

served at Moyururi Island in 1969 and 1971), and fighting was observed among them. Ohsumi (1971) suggested that scars on the male sperm whale may indicate social maturity of the males in the harem. In the present study, as I am still uncertain as to the minimum ages and body size at sexual maturity in this seal, I cannot discuss the relation between these scars and sexual maturity. Therefore, I do not know what these scars mean. However, I can indicate that they are closely related to their breeding habitat and their social behaviour when I consider that the sexual dimorphism of this seal in body size is larger than that of *P. v. largha* (Naito and Nishiwaki, 1972a). Further studies on these problems are required in *P. kurilensis* and also in *P. v. richardi*.

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一般財団法人 日本鯨類研究所
THE INSTITUTE OF CETACEAN RESEARCH

EXPLANATION OF PLATES

PLATE I

The exceptional white-coat pup of *Phoca kurilensis* (middle). Upper, white-coat pup of *Phoca vitulina largha*; lower, normal pup of *Phoca kurilensis*.

PLATE II

Classified five colour types from light to dark of *Phoca vitulina largha* (left side) and *Phoca kurilensis* (right side).

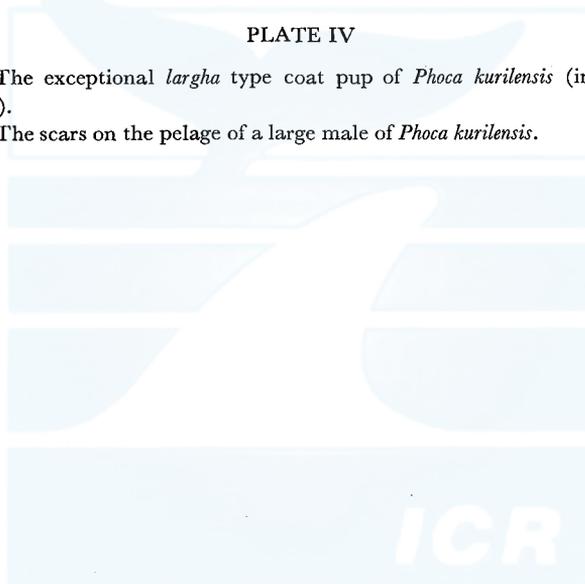
PLATE III

Phoca kurilensis have a camouflage effect by their pelage colour and pattern when they haul out on the rocky shores.

PLATE IV

Fig. 1. The exceptional *largha* type coat pup of *Phoca kurilensis* (in a stuffed specimen).

Fig. 2. The scars on the pelage of a large male of *Phoca kurilensis*.



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