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Peculiarities of harp seal biology (the White Sea population) in 1987-88

by

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ABSTRACT

The following deviations in ecology of the harp seal in the White Sea during 1987-88 were identified: the delay in terms of rookery formation during the reproduction, low density of animals on rookeries, non-typical harp seal occurrence in the White Sea in summer-autumn and sharp reduction in abundance of juveniles on moulting rookeries. Decrease in weight of moulting puppies, delay in maturation of follicles in female ovaries, predominance of females among progeny were also noted in the years considered.

INTRODUCTION

The area of the harp seal White Sea population covers the White and the Barents Seas. The seals do not constantly occur in the White Sea, but the most important stages of their annual life history such as birth of puppies, coupling and moulting take place in this area. The Barents Sea is a feeding area of the seals.

Investigations conducted in the White Sea in 1987-88 showed considerable alterations in the biology of the harp seal White Sea population, which influenced the distribution, migrations, age composition and reproduction.

MATERIAL AND METHODS

The paper is based on the data collected by the author in the White Sea in 1987-88 during the harp seal catch as well as out of hunting season.

The seal distribution was investigated with the aid of air-crafts, during sea cruises and expeditions to the coast. Additional sources of information were also used.

Air flights were conducted by IL-14 and AN-30 aircrafts for the research purpose in late February-April. Observations were made from the height of 200-400m and at a speed of 240-300 km/hour. In 1987 the flying made up 51 hours.

The data were collected on the moulting rookeries from the seal-hunting vessel "Teriberka" in the period of 15 April-8 May 1987. The colour of 2327 specimens was fixed and 2247 fangs were aged during that cruise.

The ovaries were collected in the first decade of March, fixed in 4% formalin, cut into slices and visually examined. The follicles were recorded and the diameter of the largest ones was measured by ruler.

The progeny sex ratio was determined in the first decade of March, soon after the seal birth.

Moulting puppies were weighted in the third decade of March.

Distribution and migrations

The area of the White Sea had been monitored from the air from late February to April 1987 which allowed to represent the peculiarities of the harp seal distribution during reproduction and moulting.

Small rookery at the stage of formation was discovered from the aircraft on 28 February 1987 on the boundary between Bassein and Gorlo, in the area of 39°N and 65°45'E. The air-survey of that rookery was conducted on 1 March. 2360 seals were assessed in the area of 17 km^2. No other rookeries, more significant in abundance and size, were recorded in the White Sea. Similar distribution of the harp seal in the White Sea had not been observed in the previous years. The densier rookeries with female abundance being tens of millions of specimens are formed in the White Sea usually by early March. So, for instance, 56 x 10^3 harp seals with the average density of 524 spec./km^2 were

assessed by air-photo-survey on one of the rookeries in the north-eastern Bassein of the White Sea on 1 March 1985.

The distribution of the harp seal in the season considered was so unusual, that it influenced a character of helicopter hunting, which was extremly intensive and the planned size of catch had to be reduced at first during recent twenty years.

In 1988 the deviations in the harp seal distribution during reproduction were less significant than in 1987. Dense rookery, on which a bulk of reproductive females was concentrated, was formed in the north-eastern Bassein on 1 March 1988. However, some rookeries with a smaller size and lower female abundance were formed south of the main rookery only by the end of the first decade of March.

The White Sea is known as a temporary habitat of the harp seals. Such important stages of their annual life history as reproduction and moulting take place in this area. Then they leave the White Sea. Nevertherless, some seals stayed in the White Sea (Fig.1). The following facts indicate it. The harp seals had occurred in the top of the Kandalaksha Bay in summer untill it was covered by ice. Judjing by colour, they were the animals from different age groups.

In mid-September 1987 two stocks with total abundance of about 150 specimens were registered from the aircraft in the Kandalaksha Bay, in the area south of Olyenitsa settlment. The animals occurred at the distance of 2-3km from the coast and moved to the central part of the bay.

4 adults were caught in September 1987 during the ringed seal hunting by nets near the western coast of the Dvinski Bay. One specimen was examined. Fat layer on the skeen being 1.5cm indicated the animal exhaustion.

Some harp seals were recorded in late August-early September 1987 in the estuary of the Koida River (the Mezensky Bay). Unusual behavior of the animals was noted. They did not show the caution peculiar to them in that period.

The harp seals were recorded in the Gorlo of the Barents Sea in August 1987. Some specimens were found in nets when fishing salmon in the area of the Voronov Cape and Maida and Ruch'y settlments. So, for example, two adults - male and female - were caught near the Voronov Cape. The examination indicated their low condition factor.

The harp seals were observed in the White Sea in summer-autumn and in 1988. In June an adult male was recordered at the coast in the south-eastern Gorlo in the area of the Zolotitsa River estuary, that was unusually, since it is known, that harp seal, a typical inhabitant of the drifting ice, never appears at the coast under the normal conditions.

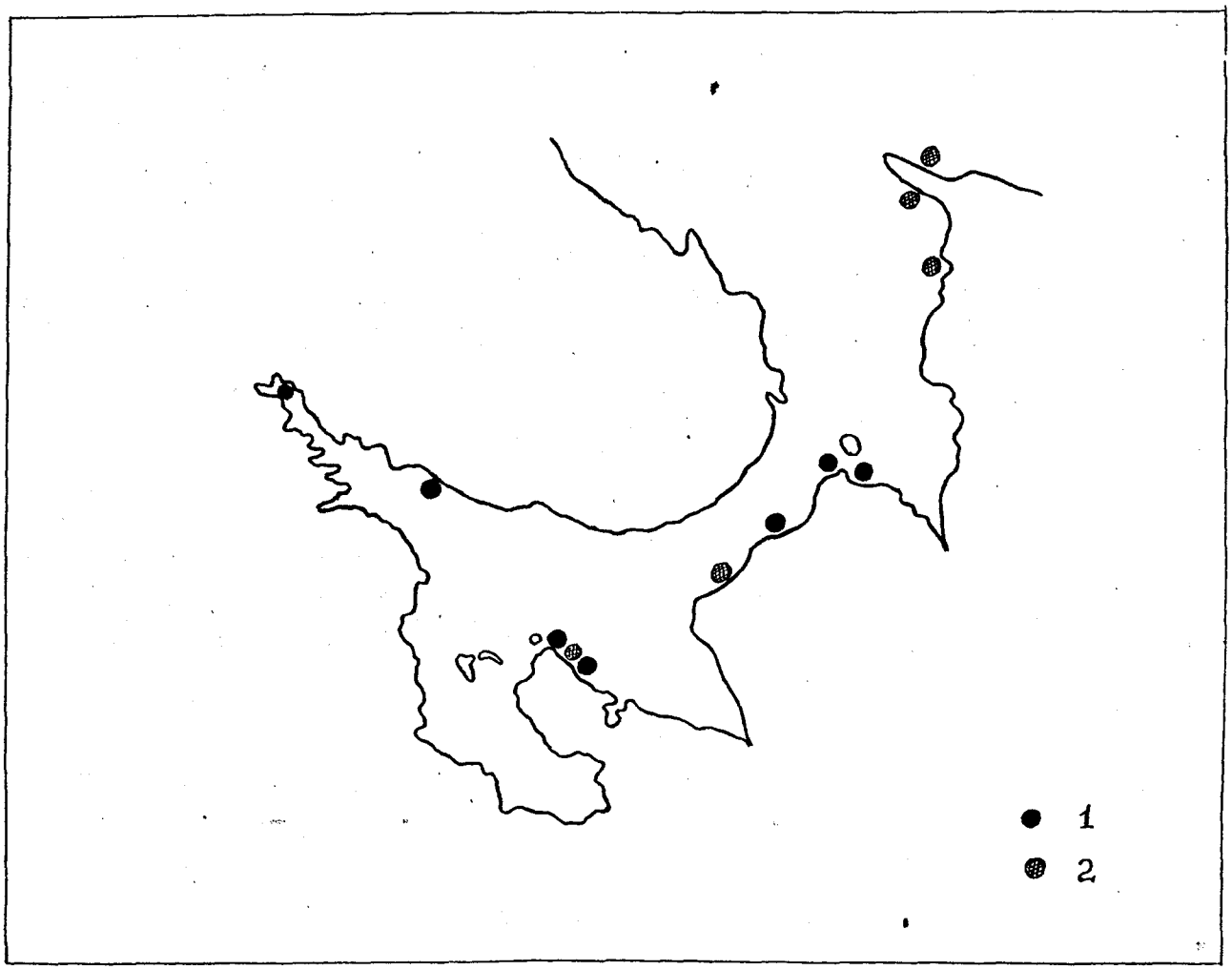

Fig.1 Positions of the harp seal recording in the White Sea in summer-autumn 1987 (1), 1988 (2)

An adult male was caught by nets in early September in hunting ringed seal at the western coast of the Dvinski Bay.

Two adult females were registered in mid-July 1988 at the northern and western coasts of the Kanin Peninsular. It should be noted, that one of them lay on the stones.

Thus, the facts mentioned indicate, that in 1987 and 1988 not all harp seals left the White Sea after reproduction and moulting. A number of animals stayed in the White Sea. Similar phenomena have not been noticed in previous years both during our investigations conducted in three recent ten-year periods and the local people observations

Age composition on moulting rookeries

The moulting of harp seals takes place in April-May. In this period the seals form dense and extent concentrations, so-called moulting rookeries, in the ice. Age-sex composition of the animals on the rookeries varies. The rookery composition is more pronounced in the third decade of April-May. Therefore, studying of the rookery structure during this period is of significance, since it allows to estimate the populational structure and its variability.

Table 1 Relative abundance of grey-patched harp seals when hunting on moulting rookeries in the White Sea by years; the third decade of April-the first one of May

Years	Number of animals examined, spec.	Including grey-patched harp seals	
		Number	%
1960-64	8233	3960	48.1
1970	644	419	65.1
1983	2526	690	27.3
1984	2582	955	37.0
1986	763	178	23.3
1987	2327	161	6.9

The data on catch composition on moulting rookeries by colour, showing the approximate age of seals, are given in Table 1. The table shows an extremly low abundance of grey-patched juveniles (at age 1-6) as a distinctive feature of the catch composition on the moulting rookeries in 1987. In the third decade of April-early May of that year the relative abundance of the grey-patched males and females was, on the average, amounted to 6.9% of catch. It should be noted, that the samples analysed were obtained from the extent area of the White Sea (Voronka, Gorlo, the Dvinskɨ Bay). Therefore, there are good reasons to consider the data representation.

The analysis of absolute age of animals caught on the moulting rookeries confirmed the identified regularity. In 1987 the portion of males and females at age 1-2 among samples amounted to only 0.7%, which was a minor value (Table 2). The portion of animals aged 3-6 being 6.7% in 1987 was also insignificant.

Table 2 Age composition when hunting harp seal on moulting rookeries in the White Sea, 17 April - 4 May 1987

Age, years	Females		Males		Total	
	number	%	number	%	number	%
1	4	0.8	2	0.1	6	0.3
2	5	1.0	4	0.2	9	0.4
3	19	3.8	13	0.7	32	1.4
4	11	2.2	17	1.0	28	1.2
5	20	4.0	23	1.3	43	1.9
6	14	2.8	35	2.0	49	2.2
7	18	3.6	44	2.5	62	2.8
8	20	4.0	59	3.4	79	3.5
9	30	6.1	68	3.9	98	4.4
10	33	6.7	72	4.1	105	4.7
11	24	4.9	97	5.5	121	5.4
12	23	4.7	111	6.3	134	6.0
13	24	4.9	109	6.2	133	5.9
14	17	3.4	102	5.9	119	5.3
15	32	6.5	134	7.6	166	7.4
16	25	5.1	100	5.8	125	5.6

17	34	6.9	117	6.7	151	6.7
18	21	4.3	112	6.4	133	5.9
19	12	2.4	74	4.2	86	3.8
20-30+	108	21.9	460	26.2	568	25.3
Total:	494	100	1753	100	2247	100

Rates of follicles maturation in female ovaries

The White Sea harp seals start to couple early in the second decade of March. By this period mature follicles ovulating in ovaries (graafian follicles) should appear. Usually, the largest follicle ovulates, which allows to consider its size as a criterion of maturation. Follicles with a diameter of more than 10mm may rank among the mature ones, relatively, since yellow bodies of ovulation at early stages are characterized by the same size.

Table 3 Characteristics of the White Sea harp seal female ovaries by the number of mature follicles (with a diameter of more than 10mm) by years, the first decade of March

Years	Number of having born female ovaries examined (pairs)	Including ovaries having follicles with diameter of more than 10mm	
		Number of ovaries (pairs)	%
1962	312	190	60.9
1976	423	262	61.9
1977	135	73	54.1
1984	121	59	48.8
1987	366	140	38.3
1988	459	157	34.2
1989	442	364	82.4

The data analysis (Fig.3) indicates that the relative abundance of females having fillicles with a diameter of more than 10mm in the first decade of March fluctuates by years. It should be noticed that the least number of females with mature follicles in ovaries was recorded in 1987-88. This phenomenon should be explained by the delay in follicle maturation during this period. It is not difficult to assume

the negative influence of this process considering that the occurrence of ovulating mature follicles in mammal ovaries during the period before coupling is a necessary condition for successful completion of reproduction. Otherwise, it may result in non-conformity of coupling and ovulation terms and a lack of female pregnancy, on the whole. The delay in follicle maturation is likely to lead to the later ovulation and later birth of puppies, in consequence.

Sex ratio and weight of progeny

In the third decade of March in the White Sea mean weight of the moulting puppies was estimated at 32.1kg in 1987 (n = 151), 30.6kg (n = 252) in 1988. For comparison, it will be noted that the index was equal to 36kg in late 70s - early 80s.

In 1987-88 the sex ratio of progeny was different from the usual one and characterized by the female prevalence being 56.3% (n = 3164) and 54.2% (n = 3043), respectively. In previous years the sex ratio of 1:1 or insignificant predominance of males were observed.

DISCUSSION

Results of the investigations indicate considerable deviations in the harp seal ecology observed in 1987-88 during their occurrence in the White Sea. The reasons may be explained by this species habit of life.

Such important stages of harp seal annual life history as reproduction and moulting proceed in the White Sea. Total duration of these periods is over two months. Progeny and moulting require the long-term stay of the seals in the ice. Therefore, the opportunities for food searching are extremly limited in this period. Besides, there are no significant accumulations of organisms (fish, invertebrates), which might be a food for seals, in the areas of puppy and moulting rookeries. Occasional registration of food in the seal stomaches in this period (Timoshenko, 1963) shows the feeding from time to time. During this time vital activity of organism and energy loss connected with processes of reproduction and moulting are performed due to the nutrient supply from the hypa[illegible]l fat. Therefore, seals including harp seals feed intensively before reproduction and moulting to pro-

vide the normal functioning of organism in these important periods. Intensive feeding should be considered as an important condition for normal proceeding of the subsequent stages of the seal annual life history. Meanwhile, deviations of the Barents Sea migration routes registered in 1987-88 and accompanied by their mass approaches to the Norwegian coast (Wigg, 1988) indicate the deterioration in feeding conditions. This phenomenon shows visually the serious breaks in trophic chains of the Barents Sea ecosystem. Sharp reduction in the stocks of fish being the objects of the harp seal feeding (especially, Polar cod and capelin) had an impact on their ecology. Such breaks in trophic chains of the Barents Sea ecosystem have influenced the population. In our opinion, the noticed peculiarities of the seal behavior in the White Sea in 1987-88 during the reproduction and moulting as well as in summer-autumn should be considered regarding this fact. Deterioration in feeding conditions led to a prolonged stay of immature females in the Barents Sea in the period before the birth of puppies, which, in its turn, resulted in a delay in the terms of the animal migration to the White Sea and formation of puppy rookeries, their low density and etc.

The mentioned facts of registration of the harp seals in the White Sea in summer-autumn, which emphasize the extent of breaks in population migration, deserve attention. Our long-term observations show, that the seals start to migrate from the White Sea to the north usually in late April. In the second half of May they do not occur in the White Sea, as a rule. Progeny having a prolonged stay in the White Sea in anomalous by ice and meteorological conditions years (high ice-covery, prevalence of the northern winds) are an exeption. Further the seals migrate to the high latitudes. Therefore, this migration requires considerable losses of energy and the organism of animal should be adapted for prolonged migration.

It was assumed, that some specimens were not ready for migration northward and stayed in the White Sea due to unfavourable conditions of feeding. This is confirmed by the results of our investigations on moulting rookeries. In the third decade of April-early May 1987 the condition factor (the ratio of the weight of skeen with fat and total weight, in %) of seals caught in the White Sea (mature specimens) was, on the average, 40.6% (n = 66). But the condition factor

of two examined males at age 7 and 27 was 32.6% and 31.2%, respectively.

Certainly, the other reasons causing the prolonged stay of the animals in the White Sea should not be excluded. It is worth noting, that different deseases may appear in population weakened by unfavourable enviromental conditions (status of nutritive base).

As for peculiarities of the catch composition observed on moulting rookeries in 1987, the extremly low percentage occurrence of juvenile animals on moulting rookeries in the White Sea should be considered as a consequence of their high mortality. Probably, the peculiarities of their distribution contributed to it. Judjing by the availability of juvenile animals in samples, the mortality was extremly high.

The decrease in the weight of moulting puppies and delay in maturation of follicles in female ovaries in 1987-88 should be also regarded, mainly, as a result of deterioration in feeding conditions in this period.

The reasons of deviations of progeny sex ratio in 1987-88 remain to be not completely understandable. Possibly, in this case specific intrapopulational mechanism allows the population to respond to the change of habitat.

Thus, the obtained data show significant deviations in ecology of the White Sea harp seal population, which are conditioned by the change of habitat and, naturally, have an influence on its stock status.

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