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Sizes, Growth and Sexual Dimorphism of the Ringed Seal (Pusa hispida Schreber 1775)

by

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There is no information concerning age and sex variability in the papers on the ringed seal of the Northern European region of the USSR. Only in some papers data on the limits of variability of the body size of this seal are found. (Naumov, 1933; Rutilovski, 1939; Chapski, 1940, 1963; Moskalenko, 1945; McLaren, 1958; Mansfield, 1963, Nazarenko, 1965 and others). According to these data the size of adult seals vary from 1.2 to 1.5 m. In some cases the data given by these authors do not coincide. This is probably due to the number of investigated animals, their age and the time they were caught. In the cited literary sources the sizes of seals are not related to age groups, and sexual dimorphism is not investigated at all.

Data and Methods

Data collected in the southern Barents Sea (Cheshskaya Inlet, Tobseda) in January-February are used in the present investigation. These data gave a possibility to investigate the morphometry and sexual dimorphism of this seal. The age of the animals (172 females and 179 males) was determined in accordance with the grinding of a lower jaw tusk (Laws, 1952; Klevezahl, Kleinenberg, 1967). The zoological length (L_c) was determined by means of putting a tape-measure on the back of the animal from the tip of the nose to the end of the tail following all the curves of the body. From other morphological features only those were used which were definitely stated in the process of measurements. The weighing of parts and organs of the body and also measurement of eye, nasal and labial vibrissae were carried out at the places of material collection. The measurements of the skull were made according to the accepted schemes (Yablokov, Sergent, 1963).

Data on Sizes, Growth and Weight of Seals

The comparison of the zoological length of the animal with its age makes it possible to establish the sizes of the animals in the age groups, and particularly at the time of first maturity and physical ripeness, and to follow the growth-intensity by years. (Figure 1).

Figure 1 shows that the greatest growth-rate was observed during the first 5-7 years of life, that is before the first maturity (Nazarenko, 1965). By this time the zoological length of the animal reaches 112-115 cm. Later on the growth slows down and after 11-13 years of life it practically stops. This can be regarded as the time of physical ripeness. At this time the animals are 126 cm long on an average.

This regularity of body growth is characteristic both for males and females. It is observed, however, that from the first year of life the length of males is somewhat greater than that of females. This difference can be seen in all age groups. The comparisons by 18 year-olds show that males are greater than females by 2-4 cm in 12 cases, and only in 6 cases are the females somewhat greater than the males.

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Greater size of the body corresponds to greater measurements of the nose-navel and navel-anus distance (Table 1).

Table 1. Morphometrical measurements, cm.

Age and Sex	Nose-navel			Navel-anus		
	n	limit	M	n	limit	M
1 year-old						
males	10	56-66	62	10	23-28	25
females	13	55-69	60	13	22-27	24
2 year-old						
males	36	56-70	63	36	24-31	28
females	31	52-70	62	31	23-29	26

In all cases under comparison the average size of males are by 1-2 cm greater than that of females. This is evidently not an accidental fact. One must note that these differences as well as the differences in zoological length can be observed at the age of one year already.

The weight characteristics were made in accordance with age and sex of animals (Table 2). 13 indices of 18 are higher in males than in females, one index has equal values in both sexes, and only four indices are higher in females.

The percentage ratio of the weight of inner organs to the weight of the entire body are of considerable interest.

Table 2. Weight of parts and organs of the body

	1 year old				2 year-olds				5 year-olds			
	males		females		males		females		males		females	
	n	M	n	M	n	M	n	M	n	M	n	M
Weight of the body (kg)	10	21.7	10	21.2	1	25.0	1	28.0	9	42.0	3	37.0
Seal pelt with oil (K (kg))	10	11.7	10	11.9	1	15.0	1	13.7	10	17.3	2	13.5
Carcass without inner organs (kg)	10	4.4	8	4.3	-	-	-	-	-	-	-	-
Heart (g)	10	160	10	160	19	150	21	135	11	280	3	260
Liver (g)	10	460	10	480	19	520	21	525	11	1100	3	1080
Kidneys (g)	10	110	10	105	15	125	19	110	11	200	3	150
Lungs (g)	10	385	10	380	19	430	20	390	11	880	3	810

The relation of the weight of inner organs to the weight of the whole body is nearly equal in males and females, and fluctuates very little. Of special interest is the fact that at an age of 2 years the inner organs under comparison are relatively lighter than the inner organs of animals of one year of age. Evidently during the embryonic development a more intensive growth of the organs than of the body takes place. As years pass by this difference gradually disappears in relation to the liver and lungs. As for the heart and the kidneys, their relatively greater weight remains as it was.

Table 3. The relation between weight of internal organs and body weight of the entire animal (%).

	1 year-old	2 year-old	5 and older
Heart of a male	0.74	0.60	0.66
- female	0.75	0.48	0.70
Liver of a male	2.12	2.08	2.62
- female	2.26	1.89	2.91
Kidenys of a male	0.51	0.50	0.47
- female	0.49	0.39	0.40
Lungs of a male	1.77	1.72	2.09
- female	1.79	1.39	2.10

The difference between females and males is also observed in the number of vibrissae.

Table 4. Number of vibrissae.

	Eye			Nasal			Labial		
	n	Limit	M	n	Limit	M	n	Limit	M
Males	14	3-6	4.9	14	1	1	14	46-55	50.6
Females	14	3-6	4.6	14	1	1	14	42-59	50.1

In all the animals investigated the number of nasal vibrissae happened to be one (measurement of vibrissae was carried out for one side of the head), whereas if we compare the number of eye and labial vibrissae we can observe a sex difference expressed by mean numbers of vibrissae at a rather wide limit of variability. Thus the difference between the maximum and minimum number of eye vibrissae in relation to the mean number is in the limit of 60% both for males and females. As for labial vibrissae the ratio of maximum and minimum number is much less, and the difference depends on the sex: 34.0% for females; 18.0% for males. It is characteristic that such difference in number of labial vibrissae between males and females is observed also in the Greenland seal (Yablokov, Klevesahl, 1964).

The length of the intestine of seals belonging to different age groups is also greater in males. As time passes by it decreases in relation to the length of the body both in males and females. Thus at an age of 1-2 years, the length of the intestine makes up 14.1, and at the age of 5 years and older it accounts only for 11.8. A similar fact is also observed in hooded seal (Yablokov, 1966).

Craniological Data

Skulls of 24 males and 22 females at an age of 9 years and older were used for measurements. The changes that take place in the skull when its growth has practically ceased are only individual and not related to age. These data have a certain advantage over the data on skull measurements carried out for young seals.

The comparison of skull measurements by 23 indices (Table 5) shows the exceeding of sizes of males over that of females by 21 indices, and the values of only two indices are somewhat higher in females than in males (the height of the occiput foramen and the length of the upper tooth row). Besides, one must note that both these measurements show no confident statistical differences, whereas the main part of the measurements that are greater in males show differences that are confirmed statistically, or are possible to confirm.

Sex distinctions reveal themselves in measurements both of the length and the width of the skull. But to a lesser extent they are seen in the "details" of the skull. The skull weight has a very high confidence of differences (t=34.2) due to great sizes and thickness of bones.

Conclusions

1. In all measurements and weights under comparison, which are used as indices, minimum-maximum fluctuations are great, though the data are collected at one and the same time and place. This fact is indicative of a considerable individual variability.

2. The most intensive growth of males and females of the ringed seal is observed during their first 6-7 years of life, that is until the time when they reach maturity and their reproductive stage. Later on the process of growth continues until 11-13 years of age, though less intensively (physical ripeness). After that it practically stops. At the time of reaching the puberty the zoological length of the animals is about 90% of the entire length.

3. Sex differences of the ringed seal are rather clearly shown in most indices under comparison in all age groups. The greatest differences in zoological length are observed at the age of 4-7 years. For older as well as younger mammals this difference is less remarkable.

4. It is necessary to note that in some cases differences in values of indices that are compared are not confirmed statistically. But this takes place, as a rule, only when the number of samples is small (less than 20). Therefore, due to the great individual variability, sex dimorphism reveals itself only on the basis of numerous data.

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Table 5. Skull measurements of the ringed seal, mm.

No. m/m	Measurements	Males, 24	Females, 22	t
	Condylobasal length	171.88 ± 0.48	170.05 ± 0.48	2.62
	Basilar length of Hensel	160.55 ± 0.48	158.37 ± 0.28	3.89
	Length of the palate	72.62 ± 0.56	70.34 ± 0.49	3.08
	Width of the palate	37.02 ± 0.29	36.76 ± 0.30	0.67
	Zygomatic width	85.63 ± 0.32	85.28 ± 0.38	0.70
	Mastoid width	103.75 ± 0.33	100.99 ± 0.33	5.87
	The greatest width	105.40 ± 0.46	102.80 ± 0.60	3.44
	Zygomatic height	59.89 ± 0.42	58.49 ± 0.29	2.75
	Width of nostrils	22.86 ± 0.27	21.84 ± 0.24	2.87
	Width of snout at the tusks	26.80 ± 0.36	25.65 ± 0.25	2.61
	Length of the ear capsule	35.13 ± 0.37	34.29 ± 0.29	1.79
	Width of the ear capsule	27.07 ± 0.31	25.05 ± 0.33	4.39
	Interorbital width	5.66 ± 0.32	5.02 ± 0.36	1.33
	Width of the occiput faramen	28.41 ± 0.35	28.33 ± 0.37	0.16
	Height of the occiput faramen	21.95 ± 0.39	22.95 ± 0.41	1.75
	Width of the occipital condyles	55.61 ± 0.40	54.73 ± 0.44	1.49
	Length of the lower jaw	108.10 ± 0.53	107.01 ± 0.40	1.65
	Height of the lower jaw	45.61 ± 0.33	43.76 ± 0.30	4.13
	Length of the upper tooth row	52.77 ± 0.56	53.29 ± 0.31	0.03
	Length of the lower tooth row	45.89 + 0.22	45.13 + 0.25	2.30
	Height of the lower jaw behind the last tooth	17.69 + 0.26	16.91 + 0.25	2.17
	Tickness of the lower jaw behind the last tooth	6.16 + 0.36	4.68 + 0.33	3.08
	Skull weight, g	172.63 + 0.24	152.09 + 0.55	34.20
	Length from tip of nose to tip of tail (cm)	126.55 + 0.36	122.65 + 0.77	4.64

Table 6. Sex dimorphism of the ringed seal.

No. m/m	Indices that are compared	The number of investigated animals	The number of indices	Including a greater index value of:	
				males	females
	Zoological length	351	18	12	6
	Skull measurements	46	23	21	2
	Eye vibrissae	14	1	1	-
	Labial vibrissae	14	1	1	-
	Body measurements:				
	nose-navel	90	2	2	-
	navel-anus	90	2	2	-
	Weight of parts of the body	39	7	5	2
	Weight of organs of the body	74	11	8	3
	Length of the intestine	17	1	1	-
	Total	-	66	53	13
	%	-	100.0	80.3	19.7

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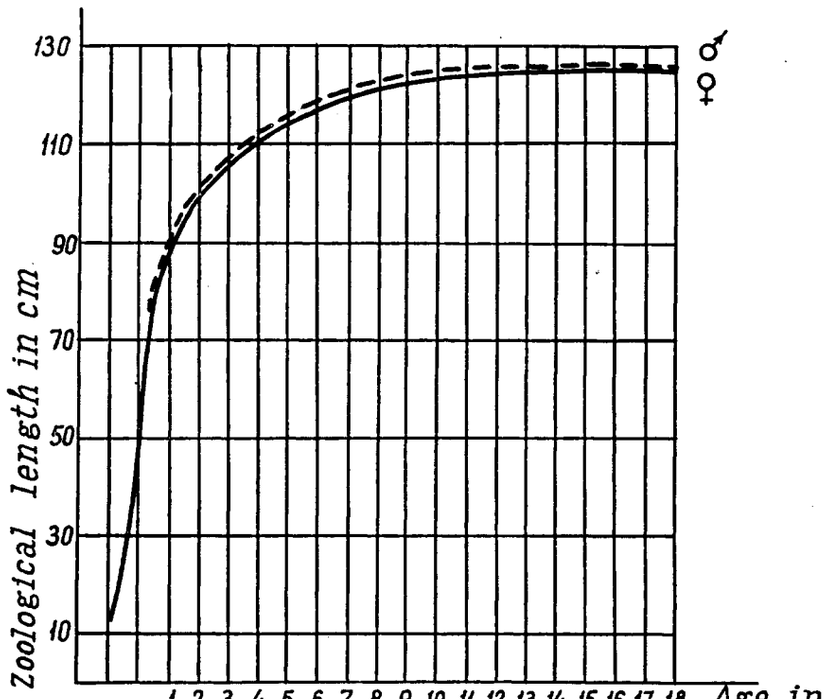

Development of embryo in the period between 6 months and delivery