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CHUKOTSKI

CHUKCHEE WALRUS

P.G. Nikulin

The material used as the base for the present work was collected by us on the vessels of the "Far East Seas Animal Investigation" in 1934, 1935 and 1937. In addition to this we managed to collect some additional material characteristic for distribution and behaviour of walrus inwaters near Chukotski peninsula by participating in the work of NARKOZEM R.S.R.S.R. in 1937-39. During this period we have measured, investigated and opened about 1000 specimens. In addition to the original material we have made use of data collected from the inhabitants of Chukotski peninsula as well as of all available manuscript and literature sources.

We have centered our work around the distribution and migration of walrus during the period of one year. We have attempted to throw some light on this difficult question and thus help to plan walrus hunting on the base of the checked data on distribution and migration of walrus.

(Acknowledgements)

Geographical Distribution of Walrus

Walrus belongs to the animal species spread all over the world. In the basin of Arctic Ocean these animals are at present represented by one species (O. rosmarus) which can be divided into two substecies: Atlantic walrus (O. rosmarus rosmarus L.) and Pacific walrus (O. rosmarus divergens). In addition to this there is a theory now (65) about a special population of walrus in Laptev Sea.

Atlantic subspecies: On western side it is found in Canadian archipelago, along the coast of Greenland and seldom near the

coast of Iceland, in the district of Spitsbergen archipelago, on Novaja Zemlja (New Land), Franz Joseph Land, near archipelago, of Severnaja Zemlja (North Land), along the Siberian coast to Natansk Bay and New Siberian Is. Until the beginning of intensive extermination, the southern border of continuous habitat of atlantic species was White Sea, coast of Finmarken, Scotland, Gulf of St. Lawrence, coast of Nova Scotia and North England.

The pacific subsepcies reaches towards the north until 72 degree of lattitude. The essential region of distribution of pacific subspecies are Chukchee sea and the eastern shallow point of East Siberian Sea. To the west, the pacific walrus reaches along the siberian coast until the estuary of River Kolyma; to the east - along the coast of Alaska to the Cape Barrow. Until the beginning of predatory extermination by American hunters, the pacific walrus was a permanent inhabitant of the southern region of Kamtchatka (east coast). Some time ago on Karaginski Island as well there were large settlements of walrus. Even in 1909 walrus was found in Morzhovaja Bay. Along the American continent, walrus was a permanent inhabitant of Pribilof Island (Isle of St. Paul and Morzhovij Island.). To the south, walrus didn't reach farther than Aleutian Island (20). In the North-West point of Bering Sea until the development of American whaling fleet large herds of walrus inhabited the shallow flats (14). In addition there are some indications that traces of walrus were found on the shores of Penzhina and Gizhiga bays; e.g., in 1931 B.A. Zenkovich received as a gift a pair of walrus tusks, darkened with age, found

on the shore around village Kinkilsko point to the fact that walrus used to inhabit Okhotsk Sea.

Present Distribution of Walrus

As we have already noted, after the predatory extermination of pacific walrus the boundary of its habitat moved north. This is confirmed by the fact that walrus is not any more found on the Karagin Island where it used to be found by thousands. It is true that nowadays walrus is still found there, but only by dozens.

Unfortunately, we cannot say anything about the contemporary distribution of walrus along the American Coast. Walrus trade, which provided previous data on distribution, has declined because there is no demand for it in America and all the interest in walrus has faded. American eskimos (inhabitants of Small Diomede) are therefore forced to sell walrus skins and tusks to our factories.

In the present work we aim to give a detailed description of distribution of walrus along the Russian far-east Coast. Some authors consider the gulf of Anadyr to be the southern boundary of walrus habitat. We are also inclined to believe that for the main mass of these animals Gulf of Anadyr is indeed the southern border. Yet during the few last years separate groups and single individuals of walrus have been seen by a number of observers in seas south from Gulf of Anadyr. "In the summer of 1931 - writes Rasumovksi (49) - a small group of walrus reached down to Korf Bay: 3 of them were killed by local in habitants and three were found dead. In winter of 1928-29,

according to the report of the factory manager in Apuk, walrus were observed even farther to the south - down to the village Uka. In summer of 1935, as codfishermen have informed us, the districts of Natalie Bay (Eastern Coast of Kamtchatka) was inhabited by a herd of walrus numbering up to 500 individuals. (Chart No. 1, p. 30). In August walrus left the region. During their stay in the above mentioned Bay, walrus used to get out onto the shore forming settlements. When in water, they used to swim up to the fishing boats frightening fishermen by their appearance.

In the first half of June 1937, sailing on "Paltus", we met a large herd of walrus (more than 1000 individuals) south from the cape Navarin. The senior scientist of Kamtchatka division of Pacific Science Institute of Fisher. Indust. and Oceanography K.I. Panin, informed us that in June 1939 walrus was observed on ice around the northern edge of Karagin I. In July of the same year walrus was observed in the region of cape Paklan. On Ilpyr Peninsula Panin found 8-10 skulls and bones of walrus killed about 3 to 5 years ago. He also reports that in the middle of August 1939 he saw two killed walrus (from the ones that were coming out on the shore) on Verhoturov Island.

We have to note however that the encounters of walrus south to the Gulf of Anadyr are single cases. We are inclined to think that during the winter and spring time under the influence of long-lasting winds of northern quarter separate groups of walrus are brought south along with the ice. The ice that reaches the southern region of the Bering Sea melts and walrus are forced to

stay near the coast of this region for the whole duration of the summer period. Region, inhabited by walrus during this summer period are the waters across from Cape Bering and at the estuary of the Holy Cross Bay (Kaliv Kresta). Favourable conditions of ice (it seems that the ice in these regions keep longer than in the other regions of the Bay), shallow waters and abundance in bottom-dwelling animals that serve walrus as food, are the reasons for accumulation of walrus in this region. After the disappearance of ice, walrus form settlements near Mechigmen and near Cape Bering.

Following farther to the north we see that almost all summer walrus persists along the coast line of the whole of Bering Strait. Here during the summer-autumn period they form a settlement on the beach on the Arakamtchetchen Island and past the cape Dezhnev; they form their 4th permanent settlement on Cape Incov, near village Intchown. The main mass of these animals spend the whole summer in Chukchee Sea, preferring edges of drifting ice. The existance of drifting ice and abundance of bottom animals, which serves them as food, makes it possible for walrus to live in open sea, far from the coast.

Under the influence of winds and currents, ice in Chukchee sea is in a constant movement. Consequently, using icebergs as places for rest, walrus at the same time move from one place to another.

During the three year period of our observations of distribution of walrus settlements, we have never met them at the same place (with the exception of region near Cape Stone-Heart - "Mys Serdtse Kamen"). Along the whole coast, beginning north-west

from Kolyuchinskaya Bay and to the Cape Billings, local inhabitants were hunting walrus. Along the coast of Kolyuchinskaya Bay hunters shot 40 walrus, in village Vancarem about 20, near Two Pilots 6, in village Pilnen up to 15, on the Cape Billings 6. Chukchy Papek, who lives near Two Pilots, reports that when he goes hunting into the open sea, about 25 to 30 km. away from the coast, he observes settlements of walrus numbering several thousands individuals. L. Leonov (28) reports on the large accumulation of walrus in the region of Wrangel Island. He was a polar worker who visited Wrangel Island and lived there. He writes: "Observations of G.A. Ushakov who was the director of the polar station Wrangel Island in 1926 witness as to the great numbers of walrus in the region of Wrangel Island. From a plane he observed herds of walrus that numbered more than 10,000 individuals. In 1930, answering to the request of a hunting expedition in Chukchee Sea, the Mayor of the island reported the appearance of masses of walrus on the dirfting ice in region of Wrangel Island during the summer months. In 1935 the director of the station at Uelen, J.A. Zherdev, during his flight to Wrangel Island, observed large herds of walrus on the ice between the Wrangel Island and Herald Island.

According to the people that spend winters there and to eskimos hunters, in 1937-38 mass settlements of walrus, over two to three thousands of individuals, were observed on four places on the island, and the same number of walrus in water and on the ice near their coastal settlements. Finally, according to my own observations in August 1938 from the ice-breaker "Okhotsk", on the way from the estuary of River Kolyma to Wrangel Island, there were a great many walrus of the drifting icebergs there.

Mineev (33), the ex-mayor of Wrangel Island, writes: "In summer time walrus are found near every part of the Coast. Severnoye is especially abundant. According to Eskimos, walrus in large masses enter the Bay. In these cases they hunt for them even without going into open sea.

"There are no beach settlements on the Island. Before, when Somnitelnaya Bay was not populated, walrus used to come out to the edge of the neck of the land (south part of Somnitelnaya Bay). From the time when men settled down inthis region, the animals have left it. The settlements on the beach can be observed only where the ice is far from the coast. Near the Island there is usually some ice at a small distance from the shore, and there walrus settle with greatest pleasure, especially because the presence of man is always connected with a lot of danger. However, when ice is blown away from the shore, walrus have to overlook these dangers.

In 1935 on the expedition of the icebreaker "Krasin" walrus were found in the water and also in a small settlement on the Herald Island.

Consequently, the distribution of Pacific subspecies in summer period essentially encloses waters south to Cape Navarin (we are not taking into consideration encounters of these animals farther south). They are found along the whole Asiatic Coast of Bering Sea - near the coast of Chukotski Peninsula and farther northwest from Cape Dezhnev to Cape Billings. In the open part of Chukotski Sea walrus are found everywhere in northwest region. It seems that the main mass of walrus spend their winter in northern part of Bering Sea. The hunters from Chaplino say that in some years walrus are within the reach of sight from the coast all winter. In January 1934 two walrus were killed in

Chaplino: in 1936 walrus were seen in February and March.

Some data on the Morphological Characteristics of Walrus

Walrus belongs to the largest representatives of pinnipeds. According to our data, the maximum length of adult male reaches 410 cm., average length (more than 200 specimens were measured) is 336 cm.; maximum length of adult females 367 cm., their average length (more than 200 specimens were measured) - 283 cm. According to our data, maximum weight of a male measuring 350 cm. in length (5 specimens were weighed) is 951 kg. Weight of adult female, measuring 299 cm., is 801 kog. The table given below shows weight and length of walrus according to the data of 1938:

TABLE I

Sex	Length (cm)	Tusk Length (cm)	Tusk circumf. (cm)	Weight (kg)
Male	350	45	20	951
Male	260	20	10	579
Male	335	38	19	903
Male	337	24	21	829
Male	330	26	18	609
Female	299	50	15	801

According to the sources from literature, weight and length of adult animals vary. According to data of Perfilievksi (47) maximum weight of a male whole length is 392 cm. is 1093 kg.; weight of a female measuring 308 cm. in length if 850 kg. Measurements and weighings of adult walrus as performed by Perfiliefski in 1931, 1934 and 1935 are given in Table II.

TABLE II

Sex	Length (cm)	Tusk Length (cm)	Tusk Circumf. (cm)	Weight (kg)
Male	362	53	21	950
Male	362	64	22	835
Male	367	67	-	1000
Male	392	87	23	1093
Male	213	8	-	500
Male	340	78	-	1000
Female	343	58	-	695
Female	308	74	-	850

Karaev (23), who lived for a considerable length of time on Chukotski Peninsula, points out that the weight of walrus is about 1000 kg. N. A. Smirnov (52) writes that walrus reaches 6 - 7 m. in length and 1.5 tons in weight. Naumov (42), speaking of large walrus says that individuals measuring 7 m. in length can be met in regions where there is no hunting on walrus. Veniaminov (9) points out that large walrus weight up to 2400 kg. Silnitzky (54) gives the weight of a large walrus as 4800 - 6400 kg. We suppose that the first three authors mentioned give us data that seem to be most accurate; the others exaggerate the weight of this animal, making him almost a giant. Also, we don't agree with N. A. Smirnov and Naumov that large walrus reaches 7 m.; we can allow that the largest male can reach 5 m. in length and up to 1.5 tons inweight but walrus measuring 7 metres in length and weighing over 6 tons undoubtedly do not exist in nature.

This huge animal at first appears to be quite clumsy; and when it lies on the ground in reminds us on a shapeless, dark mass. The

head, as compared to its large and powerful body, is very small. Whiskers are distributed into 13-14 rows and reach 10 - 12 cm. in length. In the middle of the snout whiskers are always very short (0.5-1 cm.) and sometimes they are worn off completely. Anterior and posterior flippers have an edge which continues beyond the distal phalanges of their digits; thus claws do not reach the ends of the flippers. On the ground walrus move with all 4 limbs; they jump by supporting themselves by anterior and tucking the posterior flippers under themselves.

The hair covering, consisting of tough hair is sparse; with advancing age the greatest part of it falls out and the animals are almost naked. The color changes with age; the newborns have a greyish-brown color; later on their hair becomes brown. After one year of life walrus are reddish-brown, and it becomes progressively lighter until it reaches the straw-yellow color of old age.

Walrus have very thick and tough skin; thickness of the skin of adult animals reaches 3 - 4 cm. The subepithelial layer of fat, which serves as a thermo-insulator, is relatively thin and does not exceed 10 - 12 cm. The surface of the skin is covered with great many folds and wrinkles. In addition to that, the neck, chest and shoulders of adult males are covered with wartlike protuberances. Out of 188 adult and young males only 56 were found without these protuberances: 21 out of which number were under 300 cm. in length - they obviously haven't reached theirsexual maturity. It should be mentioned that the number of protuberances increased with the age. For the confirmation of the mentioned fact we are supplying Table 3, concerning the number of protuberances on adult males.

TABLE III

Av. length (cm)	Av. tusk length (cm)	Av. tusk circumf. (cm)	No. of specimens investigated	No. of protuberances.
308	39	16	56	None
333	54	18	53	Few
340	52	21	49	Average
346	51.5	21.6	30	Many

From Table III it is evident that walrus having large or average number of protuberances have an average length of 350 cm. and the circumference of the tusk at its origin over 20 cm. "Smooth" walrus, considerably smaller in size, essentially belongs to a sexually immature group. The results given above confirm the data of S. J. Freimann (59) concerning the nature of formation of protuberances. Among the investigators of this problem there is at present a great deal of contradiction.

E.g., N. A. Smirnov (51) supposes that protuberances in males are secondary sexual characteristics; S. J. Freimann (59) definitely proves that the formation protuberances corresponds to the age of sexual maturity and that they are undoubtedly secondary sexual characteristics; M. Slepcov considers protuberances to be the scars of daily fights that these animals have among themselves. We support the point of view of the first two authors and consider that the presence of protuberances in sexually mature males is an expression of sexual dimorphism.

In the upper jaw (in males as well as in females) there is a pair of powerful tusks. Tusks are indispensable to walrus who belong to the group of animals that feel on bottom fauna. With the help

of tusks walrus obtains its food from the ground. In addition to this, tusks are used for self-defence and seem to help the animals when they are getting out onto a firm ground.

It is interesting to note, that specimens with 3 and even 5 tusks are sometimes found. E.g., Schtamm (61) mentions the skull of a Pacific walrus that had 5 tusks in its jaw; Degerbol (16) describes 4 skulls obtained near the coast of Greenland that had 3 tusks each in their jaws. Maximum length of tusk in adult walrus reaches 80 cm., circumference near the origin - 25 cm; maximum length of tusk in female - 60 cm., circumference of the tusk origin - 20 cm.

It should be mentioned that the tusks of males and those of females show certain differences. The tusks of males, as a rule, diverge to the sides (ill. 4). The tusks of majority of females are parallel, or else, they converge towards the center (ill.5). Females with crossed tusks can be often met. An experienced eye can distinguish at once males from females by the shape of their tusks. A pair of tusks of an adult walrus weighs up to 8 - 10 kg.; Krashennikov (24) points out that the weight of a pair of tusks can reach 16 kg.

In 1935, when opening walrus (38) we have discovered paired air-sacs, which represent a dilation of the upper part of the oesophagus. Volume of each sac is considerable: it can contain more than 50.1 of water. When these sacs are filled with air a large swelling can be observed in the neck region. Having filled his sacs with air, walrus reaches a certain degree of floating capacity. In this condition it can sleep while in water. A great many times we have observed large males sleeping on water. Animals, having filled their sacs with air, slept in a semi-vertical position, while only a part of the neck with the

air sac and the tip of the nose showed onthe surface. Posterior part of the body was covered with water. Sometimes the head remained completely submerged under the water and was extruded only for the animal to inhale. We have also observed cases when a walrus with filled air sacs who was killed in water and remained floating on the surface. During a walrus hunt in 1937 two hunters were on an iceberg; a large walrus, not noticing the presence of men, swam towards them. The Harpooner thrust his harpoon into the side of the animal while the other hunter killed it with his gun. The dead walrus continued to float on the surface and did not sink.

Biology of Reproduction

Birth of young takes place on ice. According to literary sources the period of birth of young is in May - June. E.g., Allen (1), using the reports of local inhabitants of Alaska, writes that birth of young begins in June; Belopolsky (5) supposes that it begins in May; N. A. Smirnov, quoting a number of authors, points out that period of birth of the young is in May and June. It should be noted, that none of the mentioned authors had observed the process themselves.

Visiting mixed settlements (consisting of females with sexually immature young of both sexes) in the first half of May we met along with the newly born ones, the independently swimming calves whose age can be considered to be within the limits of one month. However, in May we didn't find any pregnant females with large embryos. Local inhabitants of Chuktoski Peninsula say that the birth of young begins in April. An Eskimo from Chaplino informed us that in April 1927 he saw blood on ice where females were lying. He definitely claims that this blood must be the result

of the birth of young.

The time of copulation of walrus has not been exactly established yet, and consequently the duration of pregnancy is unknown. Belopolski (5) thinks that copulation occurs in June. He bases this theory on the reports of eskimos and also on sizes of embryos which he lists in his work. On page 769 Belopolski writes: "Males and females are seen together only during the period of copulation; the rest of the time they are separated." We agree with Belopolski as to the period when males and females meet. However, his dates of copulation are not confirmed by our data, because, observing mixed settlements in May and June, we always saw only adult females with sexually immature individuals of both sexes: adult males were found in these settlement only in rare cases. At the same time we observed large (over a thousand) herds of adult males without a single female present. Considering that even in May in walrus settlements (Bering Strait, 1938) there were no adult males, we are inclined to believe that copulation takes place soon after the birth of young, i.e. in April.

Nobody yet has described the external characteristics of new-born walrus. Our observations allow us to some extent to fill this gap. The new-born is about 1 m. long and during first days of his life has thick dark greyish-brown hair covering and a thick and long (to 40 - 50 cm.) unbilical cord (ill. 5). Gradually it looses its hair and after 1-2 months it looks almost naked. Umbilical cord disappears, but not in all individuals does the navel heal by that time. The table below shows changes of these characteristics in the calves that we have observed.

TABLE IV

Sex	Length (cm)	Condition of the hair covering	Condition of the navel
Calves obtained in June 1937			
Male	140		Navel not healed
Male	127		" " "
Male	125		" " "
Male	138		" " "
Male	138		" " "
Male	132	Almost naked	" " "
Male	142	Short hair	" " "
Male	133	" "	" " "
Male	137	Continuous hair covering	" " "
Male	135	Bald spots present	" " "
Male	137	" " "	" " "
Male	143	" " "	" " "
Female	140	" " "	-
Female	134	-	Navel not healed
Female	140	-	" " "
Female	137	Almost naked	" " "
Female	134	Bald spots present	" " "
Female	140	" " "	" " "
Female	137	Naked	" " "
Female	141	Large number of bald spots	" " "
Female	150	Large number of bald spots	" " "
Aver. length	136		Navel not healed

TABLE IV - Contd.

Calves obtained in July 1937

Male	143	New hair growing	Navel not healed
Male	132	Bald spots present	" " "
Male	142	Naked	" " "
Male	149	Tough hair	" " "
Male	148	Naked	" " "
Female	138	Tough hair	" " "
Female	138	" "	" " "
Female	149	Bald spots present	" " "
Female	132	Tough hair	" " "
Male	153	Naked	Navel almost healed
Male	152	Large number of bald spots	" " "
Male	159	Naked	" " "
Male	148	"	" " "
Female	154	"	" " "
Female	148	"	" " "
Female	137	"	" " "
Female	150	"	" " "
Female	148	"	" " "
Female	135	Large number of bald spots	" " "
Male	184	New hair growing	Navel healed
Male	156	Tough hair	" "
Male	149	" "	" "
Male	150	Almost naked	" "
Male	159	Naked	" "
Male	150	Tough hair	" "
Male	155	" "	" "
Male	143	" "	" "

TABLE IV (contd.)

Male	143	Tough hair	Navel healed
Male	141	Almost naked	-
Male	167	Bald spots present	-
Female	150	Large number of bald spots	Navel healed
Female	160	Almost naked	" "
Female	143	" "	" "
Female	142	Naked	" "
Female	143	"	" "
Female	145	"	" "
Female	140	"	" "
Female	165	Almost naked	" "
Female	146	" "	" "
Aver. length	144		14 indiv. have their navel healed.

It is seen from Table IV that in June there are no young calves with their navels healed, while in July there are 50%. If we assume, as we will see later, that the climax of birth of young falls into the second part of April, then the process of disintegration of umbilical cord lasts about 2 months. We can also see from Table IV that during the period of observation an intensive loss of embryonic hair was going on. We met walrus only a few days old which were helpless, could not escape from men, had long umbilical cords and relatively thick and soft hair covering (relatively to bald calves) of dark brown color. (ill. 6). New born walrus lack teeth. After few months tusks appear. By one year of age tusks grow up to 2 - 9 cm.

Feeding on mother's milk of young lasts over a year. In 1937 we have discovered milk in stomachs of three one year and two two-year old and in some even older animals. Measurements of these animals are as follows:

a) length - 190 cm.; length of tusks - 3 cm.

b) length - 200 cm.; " " " - 2 cm.

c) length - 186 cm.; " " " - 4 cm.

d) length not recorded;" " " - 10 cm.; circumference - 6 cm.

e) length - 225 cm.; " " " - 11 cm.; circumference - 8 cm.

S. J. Freimann (58) also mentions the presence of milk in stomachs of one and two year olds. He writes: "One year olds, i.e. those born in 1936, whose age at the time of expedition was 13 - 16 months, in most cases had milk in their stomachs. In the stomach of one 2 year old specimen (female, length 218 cm., length of tusks - 9 cm.) we found milk as well as debris of molluscs; the young walrus was apparently changing over to independent feeding.

In order not to repeat the work on growth and sexual maturity of walrus we quote conclusions of S. J. Freimann which are based on a large amount of material. Having at his disposition about 800 measurements of length of body and tusks of walrus, together with the analysis of other morphological changes[1] S. J. Freimann established precisely the age groups of males and females until the beginning of sexual maturity. As he points out, sexual maturity in females begins considerably earlier than in males. We present S. J. Freiman's data on classification of age groups.

1. Calves: length 125-170 cm., no tusks. Sizes are identical for males and females.

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1. About 600 measurements were made by us and handed over to S. J. Freimann.

2. One year olds: length 170 - 220 cm., tusks 2 - 8 cm. Sizes identical for males and females.

3. Two year olds: length 215- 260 cm. tusks. 8- 12 cm. measurements are identical for males and females.

4. Three year olds: growth of females slows down and therefore the measurements are given separately for males and females:

Males: length 260-290 cm., tusks - 12 - 32 cm.

Females: length 235-265 cm., tusks - 14-34 cm.

For his 5th group, Freimann gives only the measurements of 4 y. o. males, because growth ceases in females with sexual maturity. Length of 4 year old males is 290-315 cm., length of tusks 26-42 cm.

"As to the other groups - 5 years old and over - writes Freimann (58) - distribution curves do not show separate peaks. Instead of it, there is one curve with one maximum related to all corresponding groups. It shows that, amohg the 5 y. o. group and all other older groups variations in sizes are not determined by age but rather by individual variability. Thus, male walrus reaches limits of his growth at the age of 6.

For determination of the period of beginning of sexual maturity in females, Freimann takes the smallest size group in which individuals with embryos and mammary glands filled with milk can be found.

On the basis of special tables comparing the length of the body and the length of tusks with the presence of embryos and mature mammary glands in females, Freimann establishes beginning of sexual maturity in female walrus. He writes: "The first size group in which embryos are encountered is the group of "260 cm" - out of five females opened, 3 had embryos. Mature mammary glands were found in females 240-250 cm. in length. However, most of the individuals of this group did not have developed mammary glands

and none had embryos. Taking into consideration individual variability of walrus and also the possibility of mistakes in measurements, we are taking the number of embryos and mature mammary glands encountered as a criterion of sexual maturity of a group. Such a group is the 260-270 cm. one.

Thus, on the base of large amount of material dealt with by S. J. Freimann, it is established that the period of sex maturity begins in females in third, in males in fifth year of age.

There were other investigators who, like Freimann, attempted to solve this problem. However, not having at their disposition a satisfactory amount of material, they did not solve it completely. E. g. Chapsky (64) worked out the measurements of body and tusk length and, taking into account the condition of sex glands, separated only: the young of the year, one year old and two year old walrus. The rest he divides into sexually immature and sexually mature ones. Belopolski (5), having worked out measurements of 70 walrus., constructed a table for determination of age according to increase in length of tusks. In this table, Belopolski does not separate males from females, yet he points out that beginning of sexual maturity is earlier in females than in males. He does not explain how he arrives to this conclusion. In addition to this, he considers annual increment in growth of tusks to be 3 - 3.5 cm., not taking into consideration that the rate of growth may vary with age. Thus, according to Belopolski, the beginning of sexual maturity in females occurs at the age of 4-5; on the other hand according to Freimann it begins at the age of 3. Comparing conclusions re tusk measurements of Freimann and of Belopolski, we notice great divergence:

Determination of age acc. to Beloposki		Det. of age acc. to Freimann
Calves (Length of teeth)	none	none
1 year old	3 - 3.5 cm.	2 - 8 cm.
2 year old	6 - 7 cm.	8 - 12 cm.
3 year old	9 - 10.5 cm.	Males: 12 - 13 cm. Females: 14-24 cm.
4 year old	12 - 14 cm.	26 - 42 cm.
5 year old	15 - 17.5 cm.	none

Female becomes strongly attached to her young. We have observed a female who would not leave her killed young even when people approached near to her. On the other hand, if the mother was killed and the young survived, it did not follow the frightened herd but swam around or crawled out on the iceberg where its killed mother was lying. E.g., July 18 1937, "Paltus" was cruising among broken ice of Chukchee sea, looking for walrus settlements. Noticing a walrus resting on an iceberg, the ship followed its direction. In spite of approaching boat, the animal would not dive into water. As we got nearer, we noticed that it was a female suckling her young. The young would not leave the nipple, while the mother, noticing the boat, showed some disturbance, yet didn't interrupt suckling. When we were at about 10 meters distance, one of the hunters shot the female. A minute later, the boat struck the iceberg where the female was lying and broke it. The dead female fell into water. The young followed her and, apparently, dived quite deep. After a few minutes he reappeared on the surface and screaming, was looking for his mother. Our boat followed its course. An interesting observation was told by Nansen (37). He writes: "I shot first the smallest one, and then a larger one. After the second shot the herd of frightened adults moved towards the water. Only mothers would not leave their killed young: one of them was smelling her young one over, pushing him, and apparently could not understand

what heppened to him; she only saw blood sprinkling from its head, and screamed and cried like a human. Finally, when the herd began to dive into water, she, too, started pushing her killed young towards the sea. Afraid to lose our prey, I ran to save it. But the animal prevented me: she grabbed the killed young with one of her anterior flippers and disappeared with him in the sea. The second mother did the same."

As we have pointed out before, feeding on mother's milk in a young walrus lasts over a year; probably about two years.

ON BOLYGAMY

Until the recent time, all investigators (1, 11, 20) considered walrus to be monogamous, and only according to the opinion of S. J. Freimann it seems to be polygamous: "All representatives of family Otarlinae - writes Freimann (58) - the closest genetical relations of walrus, which systematically make up (one) family, are polygamous. They form "harems" of different sizes during the period of reproduction.

The character of sexual dimorphism widely studied on sea-bears and sea-lions on one hand, and on walrus on the other, are very similar. Both in sea-bears and in Eumetopias jubatus (kind of seal) males are considerably larger and stronger than females, their neck and shoulders are covered with longer fur (mane) which functions in defence when fighting for females. In sea-bears sexual maturity begins in third year in females, and in 5th or 6th year in males. As we see, there is a complete analogy with walrus.

Thus, sharply expressed sexual dimorphism of walrus, its complete analogy with the dimorphism in the representatives of subfamily Otariinae, and finally, systematical relationship of Odobaeninae and Otariinae, allow us, with a certain degree of probability, in spite of lack of direct observations, to consider

walrus to be polygamous.

We agree entirely with the pointof view of Freimann. Extending this analogy between Otariinae and Odobaeninae further, we also notice close ressemblance between the two re their biology of reproduction. E.g., young of sea-bears and E. jubatus are born with the embryonic fur which ismuch darker than that of the adults; young of walrus, too, are born with dark embryonic hair covering. Feeding on maternal milk in young of Otarlinae lasts several months; walrus are fed by maternal milk over one year, while Phocidae are suckling their young less than one month, and then the mother leaves them and they change over to independant feeding. In addition to this, copulation in Otariinae occurs soon after the young are born; walrus, we think copulate the same time.

In sea-bears and E. jubatus we observe separate herds, consisting of single males, not taking part in copulation, and harems. Males of walrus during the whole summer keep away from the females. Yet, apparently, males are again subdivided into two groups: bulls and single animals. Investigators of walrus of the american continent, point out the settlements of males that last almost all year around. Thus Elliot (20) writes: "Since females never occur at Pribilof Island, I could not observe them. Why do these males stay almost the whole year round alone on the Island - I cannot explain. Local inhabitants maintain that they never see females or young males near these islands." Venyaminov (9) also denies the presence of females on Pribilof Island. He says "It is remarkable that walrus appearing in Alaska are all males, young and old, and females never have been observed among them."

If it is true that herds of males, consisting of old and young (probably sexually immature) animals spend the whole year in the

region of Pribilof Island as Venieminov points out, we are inclined to believe that these herds belong to the group of single animals which do not take part in copulation.

We should note however that nobody observed "harems" of walrus. We think that they are formed for a very short period, i.e. for the period of copulation, approximately - end of April, beginning of May. It is supposed that males approach the females before the beginning of birth of young, form "harems", fertilize females after the birth of young and then leave and form herds of bulls. Females however remain with their calves and with the sexually immature group for the whole summer.

Some authors (2, 23) point out that walrus live in families. Visiting settlements of walrus in 1934-35 and 1937-38 we often met with separate families of walrus consisting of: adult female, a calf, one, two, three and even the four year old animals. Duration of feeding on maternal milk, attachment of mothers to their young and vice versa, apparently account for older groups accompanying their mothers for several years.

NUTRITION

Until now, not only the quantitative, but also the qualitative aspects of walrus nutrition have not been sufficiently investigated. Some investigators deal only very generally with different representatives of bottom flora and fauna, few species of fish and other animals, found in the stomach of walrus.

We do not aim in our present work to deal with this problem in detail; however, samples of stomach contents collected by us and analysed by A. M. Volk, a scientist from Sc. Invest. Sta. of Aral, give a picture of qualitative aspect of nutrition of Pacific subspecies. We should note that the list of food objects, given

below, is not complete. In the stomachs of Pacific Walrus which we have opened we discovered representatives of bottom fauna, given in Table 6, and distributed in order of their occurence.

TABLE VI

Object	Depth of habitat (m)	Composition of soil (of the habitat)
Molluscs:		
Astarte borealis	31 -53	Pebbles, sand, mud
" sp. undet	31 - 53	"
Macoma calcarea	31 - 47	"
Serripes groenlandicus	33 - 37	"
Mya truncata	shallow waters	"
Nucula tenuis	36 - 81	Pebbles, sand, mud
Natica clausa	31 - 36	"
Solarinella sp. undet.	31 - 36	"
Buccinum sp. undet	37 - 40	Pebbles, sand
Chrysodomus sp. sp. undet	36	-
Polypus sp. undet	shallow waters	Stone
Worms:		
Priapulus caudatus	42 - 43	Sand and pebbles, mud
Echiurus echiurus	42 - 43	"
Nephtys	-	-
Maldane sarsi	31 - 81	Mud
Arthropods:		
Chionoecetes opilio pagurgus	33 - 75	Sand, mud, sand and pebbles
Ascidians:		
Pelonaja corrugata	-	-
Cucumaria sp.	-	-

It is evident from Table VI that molluscs are essentially the food of Pacific Walrus. In quant. aspect also molluscs are above all other animals indicated in the list. V. K. Arsenyev gives other three species of molluscs (Saxicava arctica, Buccinum sp., Saxicava rugosa) that weren't found in our observations. The second places, according to the number of species represented, on our list occupy the worms. We should note, that all former investigators, with the exception of Wollebaeck (62) who pointed out to Annelidae, didn't mention worms. On the third place on our list are arthropods, represented by two species. Arthropods found in stomachs of Atlantic walrus are Sclerocrangon, Hyas, Mesidothea, and Gammaridae. Ascidians occupy the last place on our list; they were found only in insignificant quantities.

It can also be seen from Table 6 that types of bottom fauna which we found in stomachs of walrus[1] prefer the depth from 30 - 50 m. From this we can draw the conclusion that walrus can easily obtain its food from the bottom of the sea down to 50 m. of depth.

Some authors (2,20,53) maintain that in addition to molluscs, worms and arthropods, walrus feed on aquatic plants, birds, seals, fishes and even on carcasses of whales. S. K. Klumov, according to the reports of G. N. Safronov who spent great many winters at Cape Zhelanya and Cape Chemoskin, tells us about the single case when Boreogadus saida was found in stomach of walrus. Chapski (64), quoting Romer and Schaudinn, points out to the findings of B. saida in stomach of walrus: "As far as feeding on fish is concerned writes Chapski - there is only one direct observation confirming it that of Romer and Schaudinn (39) who found more than

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1. With the exception of Mya truncata and Polypus sp. which do not reach more than 30 m. in depth.

100 B. saida in the stomach of a walrus." In stomachs that we have opened - even though we have looked at a great many of them - there was no other kind of food found apart from the bottom dwelling animals mentioned in the list. However, in the feces on the icebergs left by walrus who were frightened by shooting of hunters, we found pieces of undigested aquatic plants and separate pieces of the skin of Phoca hispida about 10 - 12 square cm.

Chapski (54) considers walrus to be predators. "Walrus are not satisfied with eating the carcasses they come across - writes Chapski - apparently not infrequently they attack the animals themselves." Chapski gives as an example a report of Tulin, who in 1934 personally observed a fight between two walrus and a Delphinapterus leucas. Walrus were attacking from the sides, while D. leucas used its tail for defence. On the other hand, Chapski who observed in 1931 two walrus passing through aherd of D. leucas, didn't notice anything like it. Kuckenthall (25), basing his view on the reports of polar seamen, points out that D. leucas avoids the regions permanently inhabited by walrus.

We are not inclined to consider walrus to be a predatory animal, because we feel that the findings of different species of animals in the stomach of walrus bear an incidental character. However, we cannot omit to mention the predatory walrus who live separately from other animals. These feed on everything and often attack Ph. hispida. On Chukotski Peninsula we often heard from local hunters about these predatory walrus. They appear near the shore in fall and sometimes also in winter, when P. hispidae are found there. When a predatory walrus appears near the shores of Chukotski community he begins actively to pursue P. hispida who, in turn, leave this region at once and disappear. Hunters try to find and kill such walrus as soon as possible. Other authors also mention

this type of predators (2,23, 47).

As we have already noted, tusks of walrus are used for obtaining the food from the bottom of the sea, and whiskers - for piling this food up. As a result of intensive feeding, whiskers situated near the center of the snout can be worn out completely, and only the most lateral ones, less exposed to friction with the ground, reach the length of 10 cm. When, for one reason or another (e.g. - lasting migrations) walrus do not feed much or if they, having broken one of their tusks, have to obtain their food with the help of the other tusk only, whiskers reach much greater length. For example, in 1935, among the walrus that were killed one had a broken tusk. Breakage of the tusk occurred less than a year before it was killed. The animal had to obtain food with the help of one tusk only. As a result of this, whiskers on the side of the remaining tusk were worn out completely and they could be distinguished only by palpation; while the whiskers on the side of the broken tusk grew up to 25 cm. and were curled at the ends. We think that leanness and the presence of relatively long whiskers in the center of the snout are the result of long migrations during which time walrus did not feed.

Normally the change from the feeding on maternal milk to the feeding habits of adults occurs towards the end of second year of life. As it was pointed out before, in the stomachs of some two year old walrus we have discovered presence of milk. In the stomach of two year olds S. J. Freimann found traces of milk as well as of molluscs. This late changeto the independent method of feeding occurs as it was just described above.

Speaking of duration of feeding on maternal milk, Chapski (64) considers that a young walrus feeds on mother's milk for at least one year. Malgrem (36) maintains that until the age of two the

food intake of young walrus consists entirely of milk.

There are many conflicting opinions as to the age when a young walrus can be taught to take in food other than milk. Mitchell (34) describes two young animals brought to England from Land of Franz-Joseph. He estimates their age to be 9 months, and says that, while on the boat, sailors fed them with whale-fat. Chapski listing a number of facts, maintains that until the age of one walrus cannot be taught to take in any food but milk. He writes: "As to the duration of feeding on milk walrus 5 - 6 months old, as a rule, are not able to take in any other food but milk. This conclusion can be drawn from the fact that out of a few calves that happen to be taken alive on a hunting boat none survive. Therefore I am quite convinced that in all cases of feeding of young described by different authors these young must have reached the age of one and were capable of becoming used to the new kind of food which would be unnatural in their normal environment". Later on Chapski writes: "Young of the year would not take any food. In order to make them eat different devices were employed, but none, even forcing pieces of fat in their mouths, proved to be successful.

Information from S. J. Freimann re teaching young walrus of 5 - 6 months to take different food deny the assertions of Chapski about the impossibility to feed walrus under one year of age with other food than milk. In September 1937 hunters from the boat "Captain Pospelov" caught a calf and brought it on board. At the beginning they fed to him chopped, filled with milk, pieces of mammary gland of female walrus. Later the calf began to eat readily pieces of walrus fat. The young animal thrived on the boat and only due to carelessness of a sailor happened to fall overboard in Zolotoy Rog Bay (Vladivostok) after having been on board

for 1½ months.

MIGRATIONS

The spring-fall migration of Pacific walrus are described by many authors. However, majority of them mentions only very briefly and generally about the seasonal migration of this animal from south towards north and back. Belopolski attempts to give a more or less detailed scheme of migration of walrus which we will discuss later. S. I. Ognev (44) cites this scheme in his monograph. In the present work we will attempt to give the characteristics of walrus migration according to the material which we succeeded to collect during past three years. Actually these informations cannot claim to be fully exhaustive, yet to a certain degree they give a concrete picture of walrus migration during the spring-fall period.

As it already was mentioned, in winter time walrus inhabits shallow northern part of Bering Sea, keeping to the regions which are abundant with molluscs. Hunters from Chukchee Sea say that in the winter time a large accumulation of walrus can be found in the region of St. Lawrence Island 50 - 60 km. from the mainland. (ill. 9).

In March and April walrus begins to appear near the coast of Ckukotski Peninsula, in the regions of Preobrazhenie Bay and Cape Chaplino. In this region this period of the year is known as hunting season; and if hydrometeorological conditions are favourable and hunters were prepared for the season, they sometimes get several dozen of animals. E.g. in March and April 1938 hunters from villages Chaplino, Sereniki and Nunlingran obtained 41 walrus.

In May the number of walrus, near the coast of Chukotski Peninsula rapidly increases. During this month, walrus start appearing in the narrowest part of Bering Strait; this fact is witnessed

by the results of hunting along a larger region of Chukotski territory. In region from Preobrazhenie Bay to Cape Chaplino 638 walrus were killed, and in Bering Strait, on the cross piece of land of C. Dezhnev - 317 individuals.

In June walrus appear in Chukchee Sea. Sailing on "Paltus" Garin met first walrus at the end of June 1935 on the cross piece of C. Serdtse Kamen. At the end of this month rare settlements, consisting of females with young, were found on the edge of the ice mass at 70 degree lattitude. Apart from that large concentration of walrus is observed in Gulf of Anadyr in June. In 1935 "Paltus" met in the Gulf of Anadyr walrus settlements amounting to 10,000 individuals. In 1937, on the same boat, we have discovered large walrus settlements (counting in thousands) near Cape Navarin and on the cross piece of Cape Bering (ill. 9).

For local hunters June is the best month. Apparently this is explained by the intensive migration of walrus towards their summer habitat. Number of walrus killed by local inhabitants grows during this period. In region between Preobrazhenie Bay and Cape Serdtse Kamen 524 walrus were killed. (in June). Across from C. Dezhnev - 253 animals were killed. In addition to this, in the parts of Gulf of Anadyr which are far from the mainland "Paltus" got in June 1935 - 135 walrus, in 1937 - 497 walrus.

In June walrus is constantly encountered in Chukchee Sea on the cross piece from Cape Serdtse Kamen. By the end of the month they reach the region of Wrangel Island. As far as earlier dates are concerned, evidences exist only for 1937. That year, sailing on "Paltus" towards the northwest of Chukchee Sea we met small settlements of walrus on single large icebergs and also in water across from Cape Serdtse Kamen. On June 13 we have discovered

in the same region a second large settlement of adult males. On the broken up ice-fields; there were several thousands of animals and our hunters were hunting on them until June 16.

Around June 20 "Paltus" discovered walrus settlements on the edge of ice in De Long Strait. At the end of the month single settlements were found near north-west coast of Wrangel Island.

In the Gulf of Anadyr walrus for sometime remain in water. Part of them remains all summer nearthe estuary of Bay of Cross. There, in fall, they crawl out on the shore. The other part, in small groups or singly, moves along the coast towards north and accumulates around Arakamtchechen Island and Cape Incov. (Ill. 11.).

No active migrations towards north-west from Cape Incov were observed.

In south-east region of the coast from Preobrazhenie Bay to Caep Dezhnev the number of walrus killed decreases in July; while at the sametime it begins to increase in north-west region, in the region between willage Chegitun and Cape Vankarem.

In the Table 7 we are giving the results of walrus hunting of local hunters in different regions of Chukchee Sea (along Chukotski coast), as well as the results obtained by hunting vessels in the open sea.

In August, when they reach their summer habitat, walrus remain until the beginning of winter in the region of Wrangel Island and along DeLong Strait. Sometimes they are met as well in the East Siberian Sea. According to our own observations, informations from S. J. Freimann and data from the hunting vessels which operate in August, large accumulations of these animals were noticed in the open part of Chukchee Sea, on the south and

and north-west parts of Wrangel Island and in DeLong Strait. According to Leonov's dates (28) walrus were observed in the Eastern part of the East Siberian Sea in the region between DeLong Strait and the estuary of River Kolyma.

In August the number of walrus killed decreases even more on the southern part of Chukotski Peninsula, and increases on its north-west part.

TABLE VII

Hunting region:	Years 1935	1936	1937	1938
From Preobrazhenia Bay to Cape Chaplino	-	-	-	375
Cape Dezhnev	-	-	-	30
From Chegitun to Cape Vankarem	-	-	-	17
Gulf of Anadyr	-	-	38	-
Chukchee Sea	400	500	1000	500

Decrease at the southern part of Chukotski Peninsula (from Preobrazhenie Bay to Cape Dezhnev) is explained by disappearing of drifting ice from this region. Along with the ice main mass of walrus moves into Chukchee Sea. At the sametime, in small groups or singly, walrus move along the Coast from the Gulf of Anadyr towards the north to the regions of their permanent settlements (towards Arakamchechen Island and Cape Inchown). Walrus regularly crawl out into their permanent settlements on the shore until the appearnace of Arctic ice. As soon as north-west winds bring along the ice, walrus moves on this ice and is transferred to its winter habitat. Knowing it, local hunters try to kill as many animals as possible until the appearance of ice.

In north-west region (from Chegitun to Cape Vankarem) in this period hunters usually kill only a few walrus, which they meet by chance. In October the summer hunting season is oven North-west winds do not allow hunters to go in the Sea on their whaleboats and coracles (small wooden boat covered with sea-skin).

In October and sometimes even in September walrus leaves settlements on the shore and disappears from the reach of sight. On October 18, 1938 in Uelen we observed walrus settlements distributed on large block of ice carried by the current along the Coast towards Bering Strait. We suppose that they were drifting away from their Inchown settlement.

Nobody has observed the migration of walrus from Wrengel Island and from northwestpart of Chukchee Sea into Bering Sea. It seems that in fall walrus pass to the south outside the reach of sight from the shore. Belopolski (5) who observed the mass migration of walrus from north-west to south-east on June 11, 1934 from the ship "Chelyuskin" reports that they passed 40-50 miles north from Cape Dezhnev.

In warm falls when Chukchee Sea remains for longer period free of ice walrus do not wait for the ice drifting southwards to come: they swim to their winter habitat across the open sea. When animals, apparently tired by long migrations in water, reach the shore, they crawl out on it evem if it is in some populated region. Recently in 1934 and 1937 falls in Chukotski Peninsula were warm. Animals, tired out, were crawling out on a great many shore regions thus forming temporary settlements. In 1934 these temporary settlements were found near Cape Vancarem, on Kolyuchin Island, near Chegutin, Uelen, on Great Diomede Island, near Tunytlen, on the Islands in St. Lawrence Bay, between villages

Chini and Nunyamo, and also in the permanent settlements: Inchown, Arakamtchechen, Redkin, Meechensk. In 1937 in late fall walrus settled down on a small island across from the village Neskan on Cape Serdtse Kamen, between villages Chegitun and Metkulin; and in the permanent settlements: Inchown, Redkin and Meechken. (ill. 12 and 13).

Summing up all personal observations, and using all questionnaire and literary informations, we imagine the scheme of migration of Pacific walrus in following order. The constant north current from Bering Sea into Chukchee Sea gains in strength during spring-fall period; i.e., after the change in prevailing winds from north-west to south-east ones. During this time walrus start to migrate. In March walrus approach near the shores of Chukotski Peninsula in the Regions of Preobrazhenie Bay and Cape Chaplino. Following farther north, in May walrus reach the narrowest part of Bering Strait, i.e., the cross-piece of Cape Dezhnev. Until the end of June walrus move northwards through Bering Strait. May and June are the most favorable months for the hunters who live in direct neighbourhood of Cape Dezhnev. The peak of hunting season in this region falls into May and June. After Bering Strait is freed from ice, walrus hunting is sharply cut down and hunters kill only single animals which are swimming towards Inchown settlement.

In some years, moving north-west, walrus reach Cape Serdtse Kamen in June; in July they are permanent in this region. First current moves towards Wrangel Island and second - to Cape Barrow. In order to tell now what current does the main mass of walrus follow (towards Wrangel Island or to Cape Barrows) we do not have enough information. However, according to the information we do have, we suppose that the greater part moves towards

Wrangel Island. According to the report of Generozov (13) american hunters consider the most profitable region to be, not near Alaskan coast - i.e. the best known whaling region, but the Siberian Coast. Generozov, quoting Captain Kleinschmidt, who sailed on a schooner in Bering Sea, points out that "the author directly recommends to hunt on walrus near the Russian Coast because there they are more abundant, and easier to approach". Later Genrozov wirtes: "Walrus form settlements on our coast and remain in American waters only during migration period; therefore they are of no economical importance to the inhabitants of the coast of the northern States."

Hunters from the village Nankan (Cape Dezhnev), Great Diomede Island and also American Eskimos from Small Diomede Island maintain that in spring the greatest part of walrus pass between Cape Dezhnve and Great Diomede Island and only an insignificant part passes between Prince of Wales Cape and Small Diomede Island. The possibility that walrus passing through narrow part of Bering Strait between Dezhnev Cape and Great Diomede Island follow the current toward Wrangel Island is not excluded.

Large accumulation of walrus along our coast of Chukchee sea and in the region of Wrangel Island is explained by the Hydrometeorological condition and abundance of bottom fauna. The bottom of Chukchee Sea, richly populated with bottom fauna serves walrus as an abundant feeding area.

Keeping to the edges of ice, hugh herds of walrus move from one place to another, thus changing their feeding regions.

During the period of spring migration not all walrus leave Bering Sea; some reach the north part of G. of Anadyr and remain on drifting ice near the Cape Bering and the estuary of the Bay of Cross, until the ice cover melts. After the ice in Gulf of

Anadyr has melted walrus for sometime remain in water. Part of these animals remains approximately in the same place and by the end of August and beginning of September starts crawling out onto their Redkin and Meechken settlements. After the disappearance of ice the other part of walrus swims in groups or singly from the Gulf of Anadyr northwards along Chukotski Coast and accumulates near Arakamchechen and Inchown settlements where beginning with the end of August they regularly crawl out on the shore.

As we have noted, the reverse (fall) migration of walrus north to south was not observed from the shore in large numbers. There are only the reports of Belopolski who from the ship "Cheljuskin" observed walrus in the open sea. One would suppose that in average years walrus, along with the drifting ice, begin to migrate southwards in September, October passing at considerable distances from the shore. In the years when the fall is warm and long walrus do not wait for the ice to appear and swim southwards by themselves. After long migrations tired walrus reach the shore and crawl out on it forming temporary settlements.

As a conclusion we find it necessary to pause on the migration scheme of Pacific walrus published by Belopolski (5). Our scheme of migration in general features is very close to it. However, we do not agree with Belopolski in a number of points. He divides Pacific subspecies into three distinct groups: Cross -, Wrangel- and American groups: "In April and May - writes Belopolski - main mass of Pacific Walrus accumulates in the extreme north part of Bering Sea near the American Island of St. Lawrence and farther north towards Diomede Island depending on density of the distribution of ice. A group walrus which I call the "Cross group" separates itself apparently in April from the main mass of walrus

and moves through the pass between St. Lawrence and Cape Chaplino to wards Bay of Cross. The remaining walrus stay for a certain time approximately for May and June in the north part of Bering Sea, gradually moving northward to Bering Strait.

In the middle of June - beginning of July walrus pass through Bering Strait and divide into two groups: one passes towards Wrangel and Heral Island - the "Wrangel group", the other - towards Cape Barrow and farther to MacKenzie Bay - the "American group".

Thus, according to Belopolski, these three distinct groups constitute the Pacific subspecies of walrus and each of them, during the spring-fall season from year to year, has its own permanent habitat. This point of view is not convincing, since Belopolski does not give any factual data as its proof.

The distribution of walrus in general area of their yearly habitat is influenced by a number of factors. One of them undoubtedly appears to be ice conditions. During the winter when all of the Chukchee Sea is covered with ice and uncovered area of sea is brought to minimum, walrus is compelled to migrate to more southern region - to the north part of Bering Sea. In spring, with the removal of ice northwards, the zone of distribution of walrus widens and in the summer period they coopy all favorable regions of Bering and Chukchee Seas. Moving northwards along with drifting ice walrus can either follow the current moving in north-east direction - i.e. towards Cape Barrow, or the north-west one - i.e. towards Wrangel Island. Also we do not agree with Belopolski as to the dates of passing of walrus through Bering Strait. Belopolski considers that walrus pass through Bering Strait in the middle of June - beginning of July, while according to our data they pass it in May and June.

Describing the migrations of "Cross group" Belopolski says that the "Cross group" having separated from the main mass passes Cape Chaplino on drifting ice. The spring migration of walrus by Cape Chaplino towards Gulf of Anadyr, i.e. westwards falls into April and May which coincides with the peak of hunting season (according to Leonov's data). We think that Belopolski is wrong in his considerations of the migration of walrus towards Gulf of Anadyr. According to him walrus along with ice drift from Cape Chaplino westwards towards Gulf of Anadyr. This clearly contradicts the chart of currents given in ill. 1. As it is seen from ill.1, in this region there is a current moving exactly in the opposite direction - from Gulf of Anadyr towards Bering Strait. Nobody has directly observed how does walrus reach Gulf of Anadyr in spring. It is possible that they are brought along with the drifting ice from the southern parts of Bering Sea. In addition to this, another possibility is not excluded: walrus from the open part of Bering Sea swim across the water towards the ice of the Gulf of Anadyr.

ENEMIES

In spite of the large size, powerful tusks and thick (up to 4 cm.) skin, walrus has enemies: Orca orca and polar bear (Ursus (Thalassarctos) maritimus). In Chukchee Sea polar bear is the chief enemy of walrus, in polar ice he feels at home and by his pursuits bothers walrus - especially females with young and the sexually immature animals. Orca orca pursue walrus most of all in Bering Sea. Orca orca as well as polar bears prefer to attack young animals avoiding the old ones who are very strong, have powerful tusks and are a serious enemy. On the other hand adult animals prefer to avoid the bothersome predator. In 1935 we observed

how Orca orcae appearing in Kolyuchinski Bay created a disturbance among walrus in the water. Walrus threw themselves towards the first iceberg; part of them managed to get on to it, while the others, surrounding the iceberg, kept close to its edge trying to remain above the level of the part of the iceberg which was submerged into water. Not without interest is the report of the captain of the whaling ship "Enthusiast" who (in 1935), noticing Orca orcae attaching walrus, stopped the ship and observed what was going on. "Two Orca orcae - he tells - surrounded a large walrus and three young ones. The young were crawling on the back of the adult who, kept turning its head towards Orca orcae menacing them with its tusks".

Polar bears in attaching walrus use a different technique. In August 1935 we observed in Long Strait a polar bear trying to capture a young walrus. We quote the diary: "At 1:00 p.m. the boat was drifting near the very edge of ice. The crew was finishing putting the salt on the walrus skins from the yesterday's Prey. One of the members of the crew noticed a polar bear approaching a walrus settlement which was spread along the edge of the ice 250-300 m. from the sea. The ice where the walrus were lying was crowded 80-90%. Animals were lying in groups from 15 to 20 to 300 individuals on an iceberg. Total number in the settlement reached several thousands. The settlement consisted of adult females with young, of the sexually immature animals of both sexes and of a few adult males. The polar bear was sneaking up to the walrus along the ice. When he was at 40 - 50 m. from them he started to run towards them. Frightened animals jumped into the sea and when the predator reached the iceberg it was empty. The bear disappointed, smelled over the spot where he intended to have his meal and then slowly continued in the direction of the next group

of walrus. The Bear was rather inclined to approach the settlements where there were only females with the young, or else - young animals 2 - 3 years of age. A settlement of adult males he approached cautiously and hesitantly. On the other hand the adult males, feeling their strength, weren't frightened by the enemy: they lifted their heads awaiting him to come nearer. The bear, having approached the adult males at 20 m. distance, stopped. He didn't dare to move closer. Shaking their heads and showing the powerful tusks the adult males withdrew to the water. When they were already plunging into the sea, the bear jumped on the iceberg but, again, without any success. As it was already mentioned, the walrus settlements stretched along the edge of the ice for several kilometers. While the bear, moving from one end of the settlement towards the other, would approach a group of walrus and chase them off into the sea, the next group, still on a considerable distance from him, watched his approach with great attention and, when he was at a distance of 30 - 40 m., left the iceberg.

On one of the icebergs the bear managed to capture a young walrus by his posterior flippers at the moment when the latter was about to plunge into the sea. In spite of his great strength, the bear did not succeed to pull him out of the water - the walrus freed himself and escaped. As the result, the bear chased off the whole herd without capturing a single walrus".

Garin also mentions polar bears attaching walrus. A great many females with their young - he writes - sleep near to the water. This precaution is explained by the fact that a number of polar

bears bother them constantly. Because of the presence of the enemies walrus are very cautious - many of them, when they saw our boat approaching, dived into the sea before the first shot was made.

Nansen (37), who spent winters at Rudolph Island, come up with a quite different observation: "When landing, we met a bear which we managed to shoot. In the water we noticed few walrus. Having skinned the killed bear, we went off into the interior of the land and were surprised to see near the same place where we first noticed bears, two walrus laying on ice". Here Nansen makes an abrupt transition: "According to my opinion, it proves how little walrus are afraid of bears which never attack them if they can avoid them. Later, I got an even more convincing proof for this". It is possible that the attacks of bear on walrus are not as successful as the ones on seals; however, this predator does frighten walrus, especially females with the calves and the young animals.

BEHAVIOUR OF WALRUS DURING THE HUNTING SEASON

Walrus lives in herds. Usually they keep in groups numbering from several dozen to several hundred individuals. During the active migrations and while feeding the group keeps together. When it gets out on the ice, the whole group tries to accomodate itself on one iceberg. Once on the ice, walrus lay very close to each other. If the herd consists of females with young, the young animals susually sit on the backs of the adults and latter do not seem to mind it. We observed one iceberg, apparently of an insignificant thickness, which was usbmerged into the sea for 10 - 12 cm., under its load. Animals had to lay in water, yet they would not leave the iceberg. From such groups huge herds are formed which reach several thousands individuals. However, even the walrus

of one herd keep in separate groups. Mixing of separate groups occurs only when the animals crawl out on the shore. Here walrus lay close to each other, sometimes up to a thousand individual and more in one spot. Yet, when walrus go into the sea for feeding or else if, during a storm, a strong wave chases them off the shore they break up again into separate groups and swim in this manner until the favorable conditions for getting out on the shore are created again.

After having crawled out on the firm ground, the animals soon fall asleep. Usually walrus lie for several days and then sluggishly go into water. It should be mentioned that walrus are very untidy. While lying on ice, fast asleep, they excrete and urinate. On the iceberg where several hundreds are lying, the excremats form streams of dark-yellow fluid (fluid excrements) which follow the slope of the iceberg into the sea. Where there is no slope, they soak through the ice forming round holes. A horrible smell spreads around the walrus settlements. In fog this smell serves as the indicator of the presence of walrus to the hunters.

While lying on ice, separate individuals wake up from time to time producing specific sounds. Young animals (calves and one year olds) sound like deep barking of a dog; the sounds produced by adults remind one of the bellowing of a cow. As to the strength of the sound - the roar of walrus is considerably stronger than that of domestic animals and it is heard for miles around. In the fog hunters listen to these sounds and thus discover walrus settlements. After they get out on the firm ground, walrus behave very restlessly for the first few hours and it is very easy to frighten them at this time. But after lying for certain time they react very little or not at all to the approach of men or any foreigh object. In 1934 the hunters from "Nazhim" were in Chukchee Sea.

Not being acquainted with the habits of walrus they wore white coats immitating the ice. Soon they were convinced that this disguise is unnecessary. Animals which were lying for already quite a while would let the boat withhunters dressed in black fur jackets and caps approach quite near. It often happened that hunters who approached a sleeping walrus had to produce loud noises (piercing scream, strong whistle) to wake the animal up otherwise it was difficult to shoot it in its head.

As the illustration we give few observations of our own. On August 7, 1935 a large walrus slept on the edge of an iceberg. He woke up only when we struck him with the boat. A moment later he was shot. The same day we found another walrus sleeping in water. He slept so soundly that he didn't hear when the boat approached him and when the harpooners struck him with 2 harpoons.

On August 21, 1935 near a walrus settlement our men went off to hunt. They killed 34 individuals and at the same spot started to skin them. At the same time on the adjoining iceberg, 50 m. from the place where shooting was going on there was another group of walrus. The animals peacefully slept and didn't react to the sound of people. Having finished with the first animals, hunters went to this group and started to shoot them. Animals dived in the sea only after the shooting had started.

On July 13, 1937 "Paltus" was drifting while the crew had dinner. On the edge of an ice-field not far from the ship slept walrus. After the crew got up "Paltus" approached the settlement up to 300 m. distance and then slowed down the engine. There were at least a thousand walrus on one of the ice-fields. They were lying in groups from several dozens to several hundreds. In two boats the hunters started towards two closely situated groups. After the

shooting was over we counted the dead ones: 23 walrus were killed. At the same time all small groups of animals lying on the same iceberg didn't show any reaction. During the shooting they just looked at the hunters and went back to sleep. Then the hunters shot at a few more groups: only those animals at which the hunters aimed plunged themselves into the sea. Having killed a considerable number - 90walrus, the hunters started to skin them. When the hunting was over, the killed walrus with the help of a capstan were lifted up on board. At the same time we observed ten animals getting out on a small iceberg not far from the ship. In addition to this, the group of walrus which hunters did not touch remained at their places and slept peacefully. Animals which were chased off by shooting swam around the boats and around the remaining groups. The noise of the capstan, loud talk and laughter of men didn't frighten them. Near the edge of one of the icebergs floated a killed walrus with his air sacs filled with air. Soon another animal appeared near him. Lifting up his head he looked around; then swam by the killed walrus in the water to another dead animal which was lying on the iceberg with his head hanging over the water. He hooked the dead walrus up with his tusks and pulled him down in the sea. Luckily enough a rope was attached to his posterior flippers and fastened to the ice - therefore he didn't sink. After this the curious walrus dived in the sea and disappeared. After 20 - 25 minutes he appeared at the same spot and disappeared again after 2 - 3 minutes. After 30 minutes he reappeared, and, lifting up his head, looked for a long time at the killed animal. This last time he swam around for 10 min. He even allowed us to approach him as near as 5 ft. and didn't exhibit any fear.

While the storing up of killed beasts was going on, the current brought a small group of walrus (about 40) towards the ship. Animals

slept soundly. Once in a while two old males would lift up their heads and fiercely strike each other with their tusks. One of the men approached the group at 9 - 10 m. distance and silently observed them. Then he started throwing at them small pieces of ice. They didn't pay any attention. Then he took a large block of ice and threw it with both hands at the sleeping animals. This time the ice apparently hit one of them and he, half asleep, jumped into the sea. The rest followed him.

Some authors (Arsenyev, 2) point out that, when preparing to fall asleep, walrus leave a sentry who in case of danger roars and strikes around with his tusks to wake up the rest.

"A herd of walrus - writes Arsenyev - has a sentry who stays awake and, having a good sense of smell, turns his head all the time from one side to another. At the first sign of danger, pushing the other animals and roaring, he wakes them up and then the whole herd jumps in the sea."

Elliot, observing a settlement at Morzhovij Island, writes: "When they are out of the sea, walrus sleep all the time. They have devised an original method of defence. In front of me is a herd of bulls (about 400). They seem to be all asleep. However, a movement of one walrus wakes up the one next to him, who, lifting up his head, grunts once or twice, and goes back to sleep at the same time touching the one next to him, who, lifts up his head and transfers the shock to the next one in the row, etc. Because of this constant movement one or two animals are always awake."

We should mention that all the time during our own observations we never noticed a "sentry" as Arsenyev calls it. Also, we didn't always observe this "collective" method of defence, although we did see it in some cases. It is possible that walrus use this method until they fall asleep; yet, having slept for long time, they loose all caution.

In 1934 we approached a small iceberg with walrus sleeping on it. There were only 10 animals and they slept so soundly that we couldn't discover signs of a guard. The hunters shot all of them. Then they started to skin them. As they were turning animals on their backs, one male, who was burried under the rest, lifted up his head and, surprised, looked at what was going on. He was killed at the spot. We have thoroughly investigated his head, and except for this last wound, we didn't find any bullet holes. Apparently the animal lying under his brothers didn't hear the shooting and woke up only when the hunters started to skin the animals.

This sound sleep and, often, a complete carelessness of walrus, found especially among adult males, is explained by the confidence they have in their own strength. Not infrequently does the wounded walrus attack the hunters. We often observed how the animal, seeing that it can not escape, fiercely throws itself on the sides of the boat, scratching it. Sometimes walrus, accumulated in huge herds (up to 1000 and more) attack the boats. E.g., in August 1934 the hunters took off for the last time. There were a few large settlements remaining on the ice. The greatest part of walrus, chased off after the hunt of the previous day, swam in water. The motor boat went towards one of the remaining settlements. On their way the hunters met a group of adult walrus numbering up to 500 individuals. When the hunters passed them, the animals turned back and went after them. The hunters soon started shooting the sleepy animals in the settlement which numbered also about 500 individuals. Almost all animals jumped into the sea - only nine remained on ice. Walrus that were following the boat caught up at that time and joined the ones that were chased off the ice. The whole herd of 1000 individuals surrounded the boat. The little boat found itself

in the centre of enraged beasts. All animals kept on the surface of water and, becoming more courageous all the time, lifted their heads higher. In spite of the fact that the 6 H.P. engine worked at full speed, the boat hardly moved from its place because the propeller was catching the bodies of the animals. The whole boat was rocking. Attacked by this hugh herd we felt like a straw thrown in a whirlpool. In order to weaken the pressure of the attacking walrus, from time to time we fired in the air. Then walrus would disappear for a while under the water, in order to continue their attack again. Finally we managed to escape them and approach the nearest iceberg. Only when already near the iceberg we discovered a leak in the boat: walrus had broken the oak bottom of our boat.

In June 1939 several brigades of local kolhoz members hunted walrus in Bering Sea. During the hunt, walrus attacked one of the brigades sailing on an old whale-boat. Walrus broke the boat and the men were saved by another brigade which happened to be near at the time.

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