Krylov, V. I.

KRYLOV, V. I. 1971. O PITANII TIKHOOKEANSKOGO MORZHA (ODOBAENUS ROSMARUS DIVERGENS ILL.). pp. 110-116, In Issledovaniya Morskikh Mlekopitayuschikh. Trudy, vyp. XXXIX, Atlanticheskii Nauchno-issledovatel'skii Institut Rybnogo Khozyaistva i Okeanografii (AtlantNIRO), Kaliningrad. 344 pp.

Krylov, V. I. 1971. On the food of the Pacific walrus (Odobenus rosmarus divergens Ill.). ~~Investigations on Marine Mammals.~~ Trudy AtlantNIRO, 39:110-116.*/

The literature on the biology of the walrus, both domestic and foreign, is rather extensive, but on the food of this animal, it is insufficient. The majority of investigators (A. I. Malmgren, 1864; M. W. Elliott, 1882; O. Nordgvist, 1883; Romer und Schaudin, 1900; H. Winge, 1902; N. A. Smirnov, 1908, 1935; I. I. Gapanovich, 1923; V. K. Arsen'iev, 1927; A. Pedersen, 1931, 1962; L. I. Leonov, 1954; I. L. Buckley, 1958; A. W. Mansfield, 1958, 1960 and others) mainly list the representatives of the benthic fauna, fishes, and even certain warm-blooded animals found in walrus stomachs. K. K. Chapskii (1936) and V. I. Tsalkin (1937) examined the food of the Atlantic walrus in more detail. A more thorough investigation of the question was undertaken by P. G. Nikulin (1941), who presented the first data on the food of the Pacific walrus. However, because of the small quantity of material examined by him, it seems that his list of food items was not exhaustive.

Our goal is to compile, as far as possible from our own materials and the data from the literature, the most complete list of food items and to shed light on the question of quantitative composition of the diet of the Pacific walrus.

The material was gathered by the author in 1960 and 1963 in the northwestern part of the Chukchi Sea (vicinity of Wrangell Island). The stomachs of 650 walruses were opened, of which only 35 contained food in such condition that allowed determination of its composition. In 62 stomachs, the contents were so advanced in digestion (chyle) that it proved impossible to determine their composition. The available material is clearly insufficient for detailed chacterization of the food of the Pacific walrus, but it helps to broaden our knowledge of this subject.

The determination of food items found in the stomach of walruses was accomplished with the help of candidate in biological science IA. I. Zhitlo, hydrobiologist in the Magadan Section of TINRO, and with assistance from other hydrobiologists and ichthyologists of TINRO.

The results of our work on the 35 samples disclosed the following organisms (Table 1).

About 10 species of benthic animals in our list were not recorded in previous investigations.

111 From Table 1 it follows that the principal place in the diet of the Pacific walrus is occupied by mollusks. P. G. Nikulin (1941) indicated that small mollusks of the family Astartidae predominated in the food of the walrus, but those species were completely absent from our sample. Likewise, we did not

*/ Translation by F. H. Fay, 11 Oct. 73

МОРЖА (ODOBAENUS GENS ILL.)

ак отечественная, так и за-
питание этого животного
следователей (A. I. Malm-
Fordgvist, 1883 Romer und
А. Смирнов, 1908, 1935;
в, 1927; A. Pedersen, 1931,
leu, 1958; A. W. Mansfield,
лишь перечисляют обнару-
авителей бентосной фауны,
животных. Более подробно
ого моржа К. К. Чапский
е обстоятельно исследовал
торый впервые привел дан-
оокеанского моржа. Одна-
на приведенные им списки
вающими.
териалам и литературным
можности наиболее полный
ь вопрос о количественном

1963 годах в северо-запад-
острова Врангеля). Было
орых только 35 содержали
ии, что оказалось возмож-
дках содержимое было на-
), что определить его со-
йся материал, безусловно,
истики питания тихоокеан-
ить наши знания в этом во-

йденных в желудках мор-
дробиолога Магаданского
ических наук Я. И. Житло,
в ТИНРО.
наружены следующие жи-

тосных животных не отме-

Таблица 1

Объекты питания тихоокеанского моржа (по данным автора)

Объекты	Встречаемость в желудках	Общее количество объектов, шт.	Вес объектов, г	Максимум объектов в одном желудке
Моллюски				
Macoma calcarea	13	423	910	110
Nucula tenuis	5	250	—	170
Trochidae (Margarites)	6	—	315	—
Ioldia hyperborea	5	273	113	220
Mactra	5	56	160	27
Thyasira flexuosa	3	36	95	25
Mya truncata	1	5	—	5
Octopus californicus	1	1	—	—
Черви				
Priapulus caudatus	12	106	405	18
Echiurus echiurus	3	50	—	—
Onuphis conchylega	1	4	—	4
Асидии				
Pelonaia corrugata	6	425	260	247
Cucumaris sp.	1	60	55	60
Tethyum aurantium	2	25	90	15
Ракообразные				
Gammaridae	2	130	40	100
Hyas coarctatus	2	20	90	18
Chionoecetes opilio	2	20	50	20
Mysidae	2	8	—	5
Pandalus	1	5	—	5
Hippolytidae	1	2	—	2
Nectocrangon lar	1	3	—	3
Рыбы				
Blennidae	1	8	—	8
Lumpenidae	1	2	—	2
Морские млекопитающие	3	—	—	—

Из табл. 1 следует, что основное место в питании тихоокеанского моржа занимают моллюски. П. Г. Никулин (1941) указывал, что в пище моржа преобладали мелкие моллюски семейства Astaridae, однако в наших пробах эти виды совершенно не встречались. Мы не обнаружили также еще три вида моллюсков из рода Saxicava и Buccinum, которые Н. А. Смирнов (1908), В. К. Арсеньев (1926) и В. И. Цалкин (1937) указывали как виды, наиболее часто поедаемые тихоокеанскими и атлантическими моржами. Мансфилд (1958) пишет, что основной пищей атлан-

p. 111

Table 1. Food items of the Pacific walrus (from the author's data)

Item	Occurrence: No. of stomachs	Total no. of items	Total wt.(g) of items	Maximal no. items/ one stomach
Mollusks				
Macoma calcarea	13	423	910	110
Nucula tenuis	5	250	-	170
Trochidae (Margarites)	6	-	315	-
Yoldia hyperborea	5	273	113	220
Mactra	5	56	160	27
Thyasira flexuosa	3	36	95	25
Mya truncata	1	5	-	5
Octopus californicus	1	1	-	-
Worms				
Priapulus caudatus	12	106	405	18
Echiurus echiurus	3	50	-	-
Onuphis conchylega	1	4	-	4
Ascidians				
Pelonaia corrugata	6	425	260	247
Cucumaris sp.	1	60	55	60
Tethyum aurantium	2	25	90	15
Crustaceans				
Gammaridae	2	130	40	100
Hyas coarctatus	2	20	90	18
Chionoecetes opilio	2	20	50	20
Mysidae	2	8	-	5
Pandalus	1	5	-	5
Hippolytidae	1	2	-	2
Nectocrangon lar	1	3	-	3
Fishes				
Blennidae	1	8	-	8
Lumpenidae	1	2	-	2
Marine mammals	3	-	-	-

find three species of mollusks of the genera Saxicava and Buccinum, which N. A. Smirnov (1908), V. K. Arsen'iev (1926), and V. I. Tsalkin (1937) indicated as the species most frequently eaten by both Pacific and Atlantic walruses.
p. 112 Mansfield (1958) wrote that the principal food of the Atlantic walrus in the Canadian sector of the Arctic proved to be the mollusk Macoma calcarea.

In our sample were mostly small bivalve mollusks: the calcareous macoma (Macoma calcarea), the delicate nut shell (Nucula tenuis), and northern yoldia (Yoldia hyperborea), and the large mactra (Mactra). A relatively prominent place in the food of the walrus is occupied by the gastropod mollusks of the top-shell family (Trochidae). Apparently, these species are the most numerous in the study area (vicinity of Wrangell Island), and this explains their predominance in the diet of the walrus. Of the cephalopod mollusks, only the California octopus (Octopus californicus) was found. The last 4 species (northern yoldia, mactra, top-shells, and California octopus) were discovered for the first time in the stomach of a walrus, the octopus being only a single example. Probably, it was caught together with the basic foods.

Second in frequency of occurrence in our list are the worms, of which the priapulids (Priapulidae) predominate over the rest of the species, as in the data of P. G. Nikulin (1941). Rarely, walruses also eat some common echiuroids (Echiurus echiurus). Of the polychaete worms, we found some shelled onuphids (Onuphis conchylega), which have been almost unmentioned in previous investigations. Only in Nikulin's list has one species from the same class of polychaete worms been indicated (Nephthys).

Ascidians and holothureans, according to the data of P. G. Nikulin (1941), occur in the diet of the walrus in very insignificant amounts, and he places them at the lowest level of importance as food. In his list are cited only the sandy ascidian Pelonaia corrugata and a holothurian sea cucumber, Cucumariidae.

In our sample, sandy ascidians were found very often and in significant amounts, but sea cucumbers were found in only one stomach. Besides the sandy ascidian, we found yet another species, the purple tethyum (Tethyum aurantium) of the family Pyuridae. However, this species occurred in only two stomachs and in small amounts. Apparently, sea cucumbers are either rare or difficult for walruses to obtain in this area of the Chukchi Sea.

Crustaceans apparently play an insignificant role in the diet of the walrus, although 7 species were found in our sample. In frequency of occurrence and number of species they could be ranked in second place, but in number of units they rank below worms and ascidians, in fourth place.

In stomachs of Pacific walruses, only one species of crustacean has been found
113 [previously?] -- Chionoecetes opilio (P. G. Nikulin, 1941), but in the Atlantic walrus, four species -- Sclerocrangon, Mesidothea, Gammaridae, and Hyas (Mansfield, 1958). (Translator's note: Mansfield lists at least 8 species of crustaceans, not including Hyas! Brooks listed Sclerocrangon and Hyas!)

In our material, three species of crustaceans in addition to those named were found. Those eaten most often by walruses are heteropods of the order Amphipoda (Gammaridae) and decapods of the order Decapoda (Hyas coarctatus, Mesidothea, and others).

Fishes are apparently eaten very rarely by walruses. Of the stomachs opened by us, only two contained demersal fishes: blennies of the family Blenniidae (8 examples) and two fishes of the lumpenid family (Lumpenidae). The last lives at depths of about 200 meters.

Romer and Schaudin (1900) counted more than 100 specimens of the polar cod (saiki), Boreogadus saida, in the stomach of one walrus. Pedersen (1962) indicated that in the period of mass migration of saiki through places occupied by walruses, this little fish seems to be the principal food of those animals. The rest of the authors (Smirnov, 1935; Chapskii, 1936; Nikulin, 1941; Leonov, 1954; Mansfield, 1958) only quote these data in their own works.

Thus, from the foregoing information, it follows that fishes are eaten by walruses very rarely. Apparently they are either taken accidentally or are eaten in times of absence in a given area of the basic foods (benthic animals).

Information on the quantity of food eaten by walruses is very scarce. According to the data of Fay (1955), a 6-month old walrus in captivity ate approximately 20 pounds (9 kg) consistently, plus 1400 to 1800 g of liquid food per day. Another animal at 2.5 years of age, the weight of which was 544 kg, consumed about 60 pounds (27 kg) of food per day. The stomach of one walrus that was killed contained more than 100 pounds (50 kg) of food. V. I. Tsalkin (1937), investigating walruses at Franz Josef Land, found in the stomach of an adult male that was killed 1704 feet of Cardium groenlandicum, 431 siphons of Mya truncata, and 168 siphons of Saxicava arctica.

In our data, the maximal weight of food items (half-digested) did not exceed 5 kg. Detailed data on the weight and amounts of food items of walruses are arranged in Table 1.

It is interesting to note that, in the Atlantic [sic] walrus, there is development of selectivity of food in relation to sex and age. Thus, Brooks (1954) considered that males prefer Mya, Clinocardium, and Molpadia, while the females and immature animals prefer the smaller mollusks Astarte and Macoma. (Translator's note: Brooks' work was on the Pacific, not Atlantic walrus!)

From his investigations of greater numbers of walrus stomachs, P. G. Nikulin (1941) wrote, "We found no other kinds of food than the benthic animals mentioned in the list. However, in the midst of some excrement on the ice, where some walruses had lain prior to being frightened off by rifle shots, we found pieces of Phoca hispida skin up to 10 to 12 cm square." A similar occurrence was recorded
114 by us. We found pieces of seal skin with blubber three times in walrus stomachs. That walruses consume carcasses of warm-blooded animals (seals, birds, and even whales) has been reported by many investigators (Gray, 1927; Tsalkin, 1937; Leonov, 1954; Kleinenberg, 1958; Mansfield, 1958). A. Pedersen (1931) verified that walruses eat seals by relating to us a Greenlander's story of how a walrus on the ice grasped a seal with the foreflippers and slit the abdomen open with its tusks. Kleinenberg (1958) reported an unusual incident observed near the pole on Golomyan Island (Severnaya Zemlya), when a walrus held the carcass of a large bearded seal (Erignathus barbatus) with the foreflippers and, with pleasure, ate the meat, tearing it with the tusks. Romer and Schaudin (1900) reported that fulmars are eaten by walruses, and Orleans (1907) wrote of their eating eiders.

V. K. Arsen'iev (1927) and K. K. Chapskii (1936) wrote that walruses not only eat carrion but actively attack live animals. Chapskii, in his study of the walrus of the Kara Sea, cites a report from Tyulina of observations in 1934 of a conflict between two walruses and a belukha in which the walruses were the attackers. However, Chapskii himself in 1931 saw two walruses swim amongst a herd of belukhas without any signs of hostility between them. It is known that belukhas avoid the places occupied by walruses (W. Kukenthal, 1893). This observation is reported also

by other authors (Smirnov, 1903; Heptner, 1930; Freund, 1933). Pedersen (1931) wrote concerning the attacks of walruses on seals, that there are numerous cases attesting to the disappearance of seals from an area when walruses appear.

Our observations, made in the course of a series of summers on the coastal hauling grounds (Rudder, Inchoun) and amongst the ice-inhabiting walruses in the vicinity of Wrangell Island (in the northern part of the Bering and Chukchi Seas), allow us to offer some other opinions on the inter-relations of walruses and other pinnipeds. On Rudder hauling ground we repeatedly observed fur seals calmly resting amongst 3 to 4 thousand walruses. In one case, this animal lay in the middle of a group of resting walruses, and, in the second case, on the perimeter of a group, but the walruses never touched them. On one occasion in the same hauling ground, a bearded seal lay 15 to 20 meters from some resting walruses, and in this case also, the walruses paid no attention to it.

From analysis of the results of our own observations and of the few data in the literature, we think that it is not basically correct to refer to walruses as carnivores. The same opinion is held by P. G. Nikulin (1941), who considered that the development of the carnivorous habit in walruses is very uncommon. In this
115 connection, K. K. Chapskii (1936) wrote, "Walruses only occasionally take seals, apparently when they have difficulty in obtaining their basic, natural foods."

We consider that the category "carnivore" can be applied only to isolated examples, which occur very rarely. Apparently, when such animals appear in the vicinity of an aggregation of seals, the latter forsake that area. In other cases, seals and walruses live peacefully, side-by-side, and the walruses show no aggression whatever. To the Chukchi, the carnivorous walrus is known by a special name "klyooch", in contrast to "ryrka", which refers to walruses in general -- so wrote V. K. Arsen'iev (1927). L. I. Leonov (1954) investigated at length the question of the origin of carnivorous walruses that were obliged to eat warm-blooded animals, and he came to the following conclusion: that some of the young animals, at the end of their second year of life when they separate from their mother, are not yet able to feed themselves (i.e., to seek and obtain mollusks buried in the bottom), and they begin to catch birds (chicks) on the surface of the water, in shallow places, and to eat them. Later, as they grow up, they also attack marine mammals. Our observations confirm Leonov's conclusions. Carnivorous walruses truly frighten away seals, thereby lowering the harvest by local natives. The Chukchi hunters recognize these walruses and strive to kill them. These walruses, it is true, possess large, sharp-pointed tusks, are not as fat as the normal walruses, and remain alone.

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УДК 599.745.2

УЧЕТ ПРИП

В 1953 году Н. С.
менен самолет для
нерпы. Однако, как
1965), аэровизуальны
ных погрешностей. П
особенностям байкальс
и т. д.), а также при
режима Байкала, бы
(В. Д. Пастухов, 1965
прямом подсчете всех
ществить, а в учете то
вищных отдушин.

Логово, представляю
иногда длиной до 7 м.
дой отдушиной и нич
1—1,5 месяца после р
логовах, успевая за эт
нять. Со второй полов
тепла и жизнедеятель
начинают обваливаться
достигая в мае до 3—3

Критерием того, что
именно к логовищной
расширенным «отныркo
половозрелых зверей и
линная шерсть новоро
женная в лед, а также
ний нерпенка, чего ник
Нередко логовищную о

В силу неоднородн
стаивание снега со льд
происходит в южной ч
в северной.

При такой же посл
го покрова.

В конце апреля — и
лярный выход зверей
лежат возле своих от