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By N.T. Zalesskaya

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DISTRIBUTION OF THE BENTHIC FAUNA IN SOUTH SHELIKHOV BAY

(Sea of Okhotsk)

BY

N. T. ZALESSKAYA

The benthic population of Shelikhov Bay (SB)[1] has been given little study to the present time. Investigations of the benthos carried out in the northern part of the Sea of Okhotsk covered only a portion of the SB (Ushakov, 1953; Savilov, 1957, 1961). The work of N. G. Vinogradova (1954) was especially devoted to the SB, but she had at her disposal the material collected at only 10 stations.

In the present work we have utilized the quantitative materials pertaining to the benthic fauna that were collected at 43 stations by the expedition organized by TINRO - VNIRO (Tinro: Pacific Research Institute of Fishing Economics and Oceanography; and VNIRO: All Union Research Institute of Marine Fishery Economics and Oceanography) in the summer of 1964, on board the trawler "Baidar". Of these, 34 are situated in the southern portion of the SB, and 9 on the western coast of the Kamchatka Peninsula (Figure 1).

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1. The translator has used the letters SB in the text as an abbreviatic of Shelikhov Bay. - Revisor.

ова посвящена работа гг. г. Виноградовой

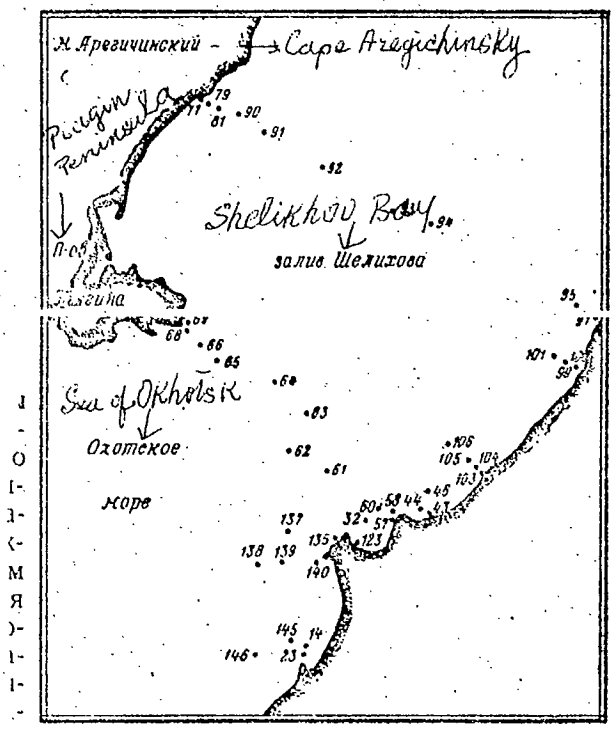

Рис. 1. Карта станций СРТ «Байдар» 1964 г.

Figure 1. Map of the stations / occupied by the Trawler "BAIDAR" in 1964.

The quantitative samples of the benthos were taken by the bottom grab "Ocean" (whose opening area was .25 square meters), and these samples were washed on a brass sieve with mesh opening of 1 millimeter. The material so obtained was fixed on board ship with a 4 per cent solution of formalin. The laboratory procedures were carried out by the author in the Department of Invertebrate Zoology of the Biology and Soil Science Faculty of the Moscow State University, and also at the Institute of Oceanology of the Academy of Sciences U.S.S.R.

Determinations were carried out by the following: Polychaetes - by R. Ya. Levenshtein and partly by the author under the direction of V. A. Sveshnikov; Cirripedia - by G. B. Zevina; Tanaidacea - by R. K. Pasternak; Amphipoda - by R. Ya. Margulis; Decapoda - by N. A. Zarenkov; the bivalve molluscs - by the author under the direction of Z. A. Filatova; Echinodermata - by the author; Brachiopoda - by O. N. Zezina; and Ascidia - by N. G. Vinogradova.

DISTRIBUTION OF TROPHIC ASSOCIATIONS

The trophic factor is the basic one determining the quantitative distribution of animals in water reservoirs. In order

to understand the quantitative distribution of the benthos, we analysed the distribution of the trophic groupings (Figure 2).

For the classification of animals in accordance with their mode of nutrition, we have taken as a basis the scheme of A. P. Kuznetsov (1963). The following trophic associations were dealt with separately: the sessile sestonophages (the fauna of overgrowths); the mobile sestonophages; the "gathering" detritophages, and the "swallowing" detritophages.

The overgrowth fauna is widely distributed in this area and is represented, in comparison with other ecological groups of animals, by a large number of species. This fauna includes many species of hydroids, hydro-corals, Alcyonariae, Bryozoa, Ascidia, Brachiopoda, Cirripedia, sponges (Euspongia sp.), some bivalve molluscs (Pododesmus, Musculus, Modiolus, Hiatella), Polychaetes from the family Serpulidae, and others. Also very characteristic of this zone is the presence of large numbers of predators (crabs, hermit-crabs, star fishes, sea urchins (family Echinoidea) and some mobile Polychaetes).

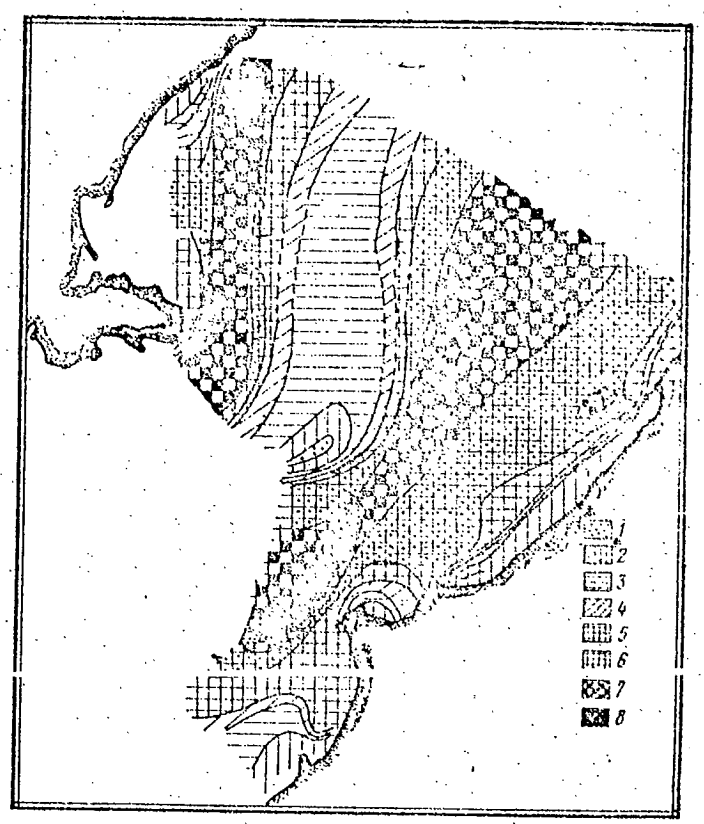

Рис. 2. Распределение общей биомассы бентоса (в *г/м²*) в южной части залива Шелихова:
1—1; *2*—1—25; *3*—25—50; *4*—50—100; *5*—100—250; *6*—250—500; *7*—500—1000; *8*—1000.

Figure 2. Distribution of the general mass of benthos (in g. per square meter) in the southern part of Shelikhov Bay:

1 - 1; 2 - 1 - 25; 3 - 25 - 50; 4 - 50 - 100; 5 - 100 - 250; 6 - 250 - 500; 7 - 500 - 1000; 8 - 1000

The overgrowth fauna occupies mainly the coastal belt with a stony sea bottom, and reaches here the highest quantitative biomass (Figure 3).

The sessile sestonophage fauna develops most luxuriously in the vicinity of capes and peninsulas projecting into the open sea. In the regions of Piagin Peninsula and Cape Yuzhny (Southern) the biomass of such fauna reaches its maximum, being over 1,100 g. per square meter. The overgrowth fauna in these locations is mainly represented by sponges, Cirripedia, and hydro-corals. As has already been noted by A. I. Savilov (1961), it is precisely in this location with mass development of sponges, hydroids and Cirripedia that the Stylasteridae, forming here large colonies of hydro-corals, attain great numbers with a large biomass.

Toward the north and south of the Cape Yuzhny (Southern), along the eastern seaboard of the continental mass, the biomass of the sessile sestonophage fauna decreases considerably. (up to 50 - 100 g. per square meter). However, in the vicinity of Cape Piatibratsky and Cape Kakhtaninsky it again increases somewhat, mainly on account of development of

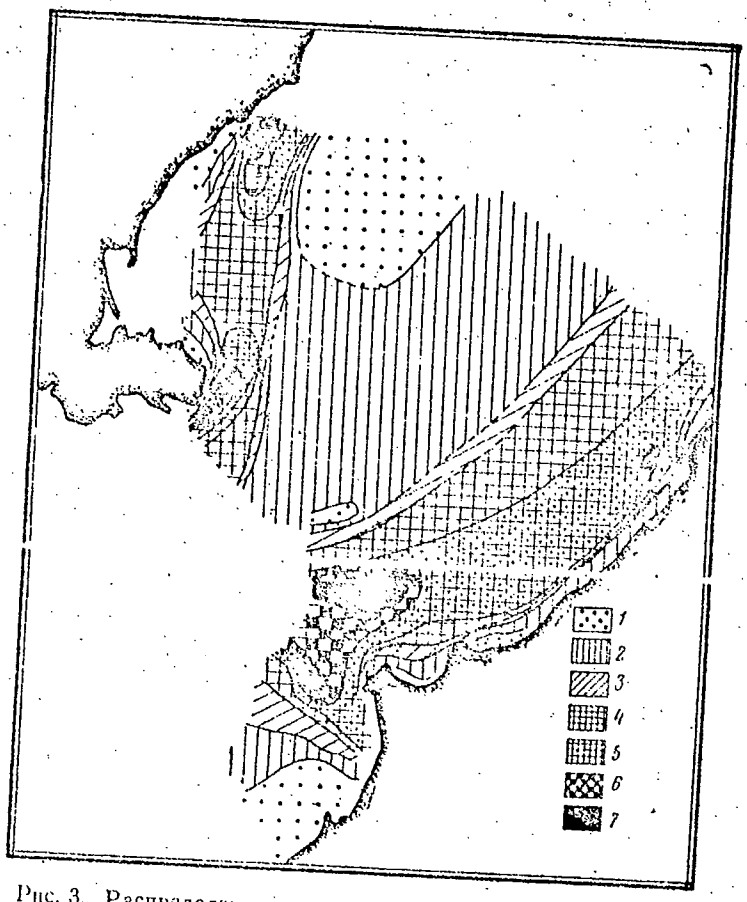

Рис. 3. Распределение неподвижных сестонофагов (в *г/м²*) в южной части залива Шелихова. Обозначения те же, что на рис. 2.

Figure 3. Distribution of sessile sestonophages (in g. per square meter) in the southern part of Shelikhov Bay. Legend: the same as in Figure 2.

the Cirripedia (Balanus crenatus), the biomass of which reaches here 306.6 g. per square meter, which equals 88.6 per cent of the total biomass.

A similar distribution of the biomass may also be traced in the western part of the SB. North from the Piagin Peninsula there is also a slight decrease in the biomass of the overgrowth fauna, but in the vicinity of Cape Aregichinsky the biomass again begins to increase, reaching at Station 81 the maximum value for this location, 677.3 g. per square meter, which represents 74.3 per cent of the total biomass. As is the case on the eastern seaboard, the increase in the biomass in this area is due to the abundant development of Cirripedia (Balanus balanus, B. rostratus dalli, and B. rostratus apertus), which make up 49.1 per cent of the total biomass (911 g. per square meter).

The areas in which the overgrowth fauna mainly develops are confined to locations with rocky sea bottom. A regular diminution of their biomass can be traced parallel with the change in the character of the sea bottom. In the entire central part of the SB the representatives of this group are very scarce; their biomass is reduced to 1 - 25 g. per square meter in sea bottoms with mixed grounds, and it is less than 1 g. per square meter in the areas with silty - sandy bottoms.

The correlation of trophic associations according to the zones in which they predominate is presented in the Table. For the zone of sessile sestonophages the presence of large numbers of the predators (21.3 per cent of the total biomass) is quite characteristic.

The zone with predominant development of mobile sestonophages occupies, in the location in which our investigations were carried out, a very small area of the sea bottom. The most important role in this grouping is played by the flat sea urchins, E. parma, the bivalve molluscs (Spisula polynina voyi, Liocyma fluctuosa, Cardium californiense, Venericardia sp., and others), and some Amphipoda (Ampelisca macrocephala, Haploops tubicola, Erichthonius hunteri, and others).

In the western part of the SB the zone of predominance of mobile sestonophages extends along the entire coastal belt (Figure 4) and reaches the 100 meter isobath.

Correlation of trophic groupings of benthic invertebrates in different trophic zones in the southern part of Shelikhov Bay.

Trophic Zone	Number of Stations	Trophic groupings and their biomass percentages						Mean total biomass in g. per square meter
		sessile sestonophages	mobile sestonophages	"gathering" detritophages	"swallowing" detritophages	predators and necrophages	other	
Zone with predominant development of sessile sestonophages	21	68.5	2.2	6.4	1.2	21.3	.4	452.2
Zone of predominant development of mobile sestonophages	7	13.9	63.5	12.2	4.4	4.6	1.4	204.5
Zone of predominant development of "gathering" detritophages	9	2.5	34.1	44.8	3.7	10.9	4.0	84.4
Zone of predominant development of "swallowing" detritophages	6	.4	.26	15.1	70.7	11.5	2.04	21.8

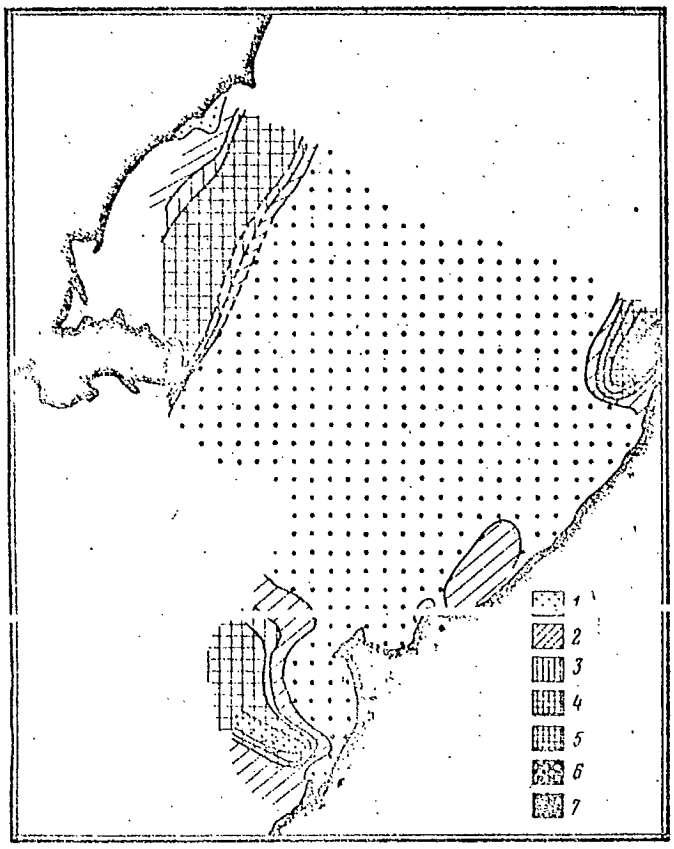

Рис. 4. Распределение подвижных сестонофагов (в $г/м^2$) в южной части залива Шелихова. Обозначения те же, что на рис. 2.

Figure 4. Distribution of mobile sestonophages (in g. per square meter) in the southern part of Shelikhov Bay. Legend: the same as in Figure 2.

In coastal shallow waters near the Piagin Peninsula is located a mass concentration of E. parma, the biomass of which attains 153 g. per square meter (Station 69), being 84.5 per cent of the total biomass. This biocoenosis is confined to clean sandy sea bottom and is situated at a depth of 23 meters. On the remaining area of the bottom, northward from the Piagin Peninsula, the distinctive features of which are silty sea bottom and great depth, an increase of the biomass of mobile sestonophages (but not their predominance over other ecological animal groupings) occurs as a result of mass aggregations of the amphipod Haploops tubicola, the biomass of which attains, at a depth of 80 meters (Station 90), 61.7 g. per square meter, which equals 8.3 per cent of the total biomass at this station; and at a depth of 98 meters (Station 91) it reaches 82.3 g. per square meter, i.e., equalling 38.9 per cent of the total biomass.

The mobile sestonophage (Chlamys albidus) forms, in the vicinity of Cape Piatibratsky in the eastern part of the SB, a biocoenosis whose biomass equals 261.5 g. per square meter, thereby comprising 56.8 per cent of the total biomass at this station. Moreover, we have found here some of other mobile sestonophages, Venericardia borealis and Erichtonus hunteri, in small numbers.

In the vicinity of Cape Omgon, on the sandy-silty sea bottom of the shallow coastal waters are located the biocoenoses of Mya ovata, A. macrocephala and E. parma (Stations 43, 44 and 57). At Station 43, out of 72.1 per cent representing the fauna of mobile sestonophages, Mya ovata accounts for 66.0 per cent, and the remainder are represented by Liocyma fluctuosa, Axinopsis orbiculata, Spisula polynina voyi and A. macrocephala. The biomass of this grouping reaches here 31.5 g. per square meter. At Station 44, situated in an area with silty sea bottom, the mobile sestonophages are represented exclusively by A. macrocephala which / comprises 29.8 per cent of the total biomass. At Station 57, in addition to flat sea urchins, the biomass of which in this location reached 110.9 g. per square meter (53.8 per cent of the total biomass), there were also /Spisula polynina voyi (30.9 per cent of the total biomass) and small numbers of A. macrocephala.

Southward from Cape Yuzhny (Southern), the zone of predominance of mobile sestonophages is located in the Khairiuzovsk district. The S. polynina voyi biocoenosis is situated here on a sandy shingled bottom.

The mobile sestonophage fauna in this region also includes E. parma and L. fluctuosa. The biomass of

of the entire grouping / comprises 27.1 per cent of the biomass at this Station. The Siliqua media predominates (82.2 per cent of the total biomass) on the sandy sea bottom; this is quite characteristic for the entire belt of sandy and sandy-silty sea bottom of the coastal shallow waters of Western Kamchatka (Gordyeyeva, 1948). It is a characteristic feature here, as in other regions of the Sea Okhotsk, that biocoenoses of the molluscs / and sestonophages alternate with aggregations of flat sea urchins. In the deepest waters of the SB and on heavily silted sea bottoms the mobile sestonophages are practically absent.

The distribution of detritophages is closely associated with that of C_{org} in sediments. However, we do not / have accurate data in this respect. It is only known that a mean C_{org} content in the SB equals .5 per cent (Bezrukov, 1955).

In the trophic zone of predominance of "gathering" detritophages (Figure 5) are incorporated the areas of mass development of the bivalve molluscs (Tellina lutea, Macoma calcarea, M. loveni M. torelli, Yoldia myalis, Y. hyperborea, and others); Ophiures (Ophiura sarsi), and other detritophagous animals.

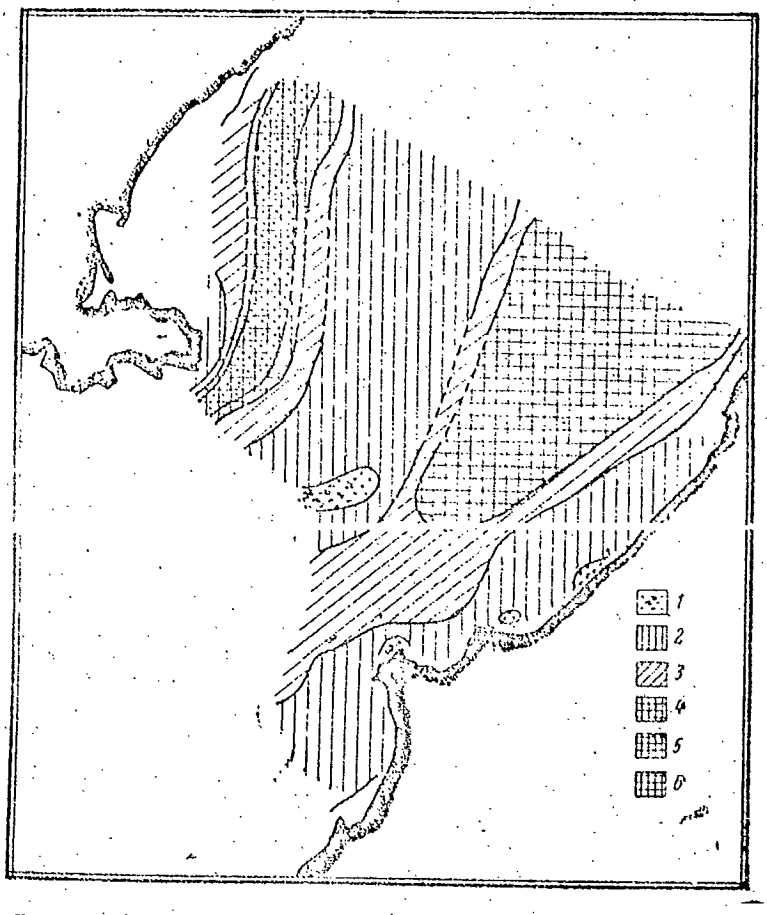

Рис. 5. Распределение собирающих детритофагов (в *г/м²*) в южной части залива Шелихова. Обозначения те же, что на рис. 2.

Figure 5. Distribution of "gathering" detritophages (in g. per square meter) in the southern part of Shelikhov Bay. Legend: the same as in Figure 2.

The region of high biomass (more than 50 g. per square meter) continues northward in a wide belt at a depth of 100 - 150 meters. Here the bivalve molluscs attain great development (mainly M. torelli, M. calcarea, M. loveni, Y. myalis, Y. hyperborea, Nucula tenuis).

In the western part of the SB, at the same depths along the littoral of the continent, there extends a fairly wide belt of "gathering" detritophages with high biomass (more than 100 g. per square meter). In this area the increase in the biomass is due to the massive aggregations of Ophiures (Ophiura sarsi sp.), which comprise about 40 per cent of the total biomass.

In the central part of the SB the biomass of "gathering" detritophages remains fairly high (about 20 g. per square meter), and it is only at Station 63 (depth 353 meters) in the middle of the SB that this grouping is not represented at all. In shallow waters in the upper and middle sections of the sub-littoral, their biomass is also fairly high (up to 50 g. per square meter); it is only in some places in shallow waters of the eastern coast that their biomass decreases to .5 g. per square meter, and even less.

Along the coasts of Western Kamchatka the zone of predominant development of the "gathering" detritophages is mainly represented by bivalve molluscs. In the vicinity of Cape Khairiuzov there is

an area with a fairly small biomass of "gathering" detritophages, 12.3 g. per square meter (32.1 per cent of the total biomass), composed mainly of the bivalve molluscs Y. myalis, Y. ioani, M. calcarea, and N. tenuis. Along with increase in depth, drop in temperature and deterioration of aëration conditions, the bivalve molluscs disappear and the Ophiures and Polychaetes begin to predominate.

The biomass of the "gathering" detritophages fluctuates between fairly wide limits (from 18 g. to 203 g. per square meter).

A zone of predominance of the "swallowing" detritophages is formed as a result of the mass development of Polychaetes from the family Maldanidae and Opheliidae which feed on the detritus and organic matter on the sea bottom, which they swallow indiscriminately.

The "swallowing" detritophages attain their greatest development in the middle of the SB at a depth of 200 - 300 meters in locations with silted sea bottom (Figure 6). Here are located the biocoenoses of Maldane sarsi and Travisia forbesii, comprising 40 - 70 per cent of the total biomass which is generally fairly small in this location.

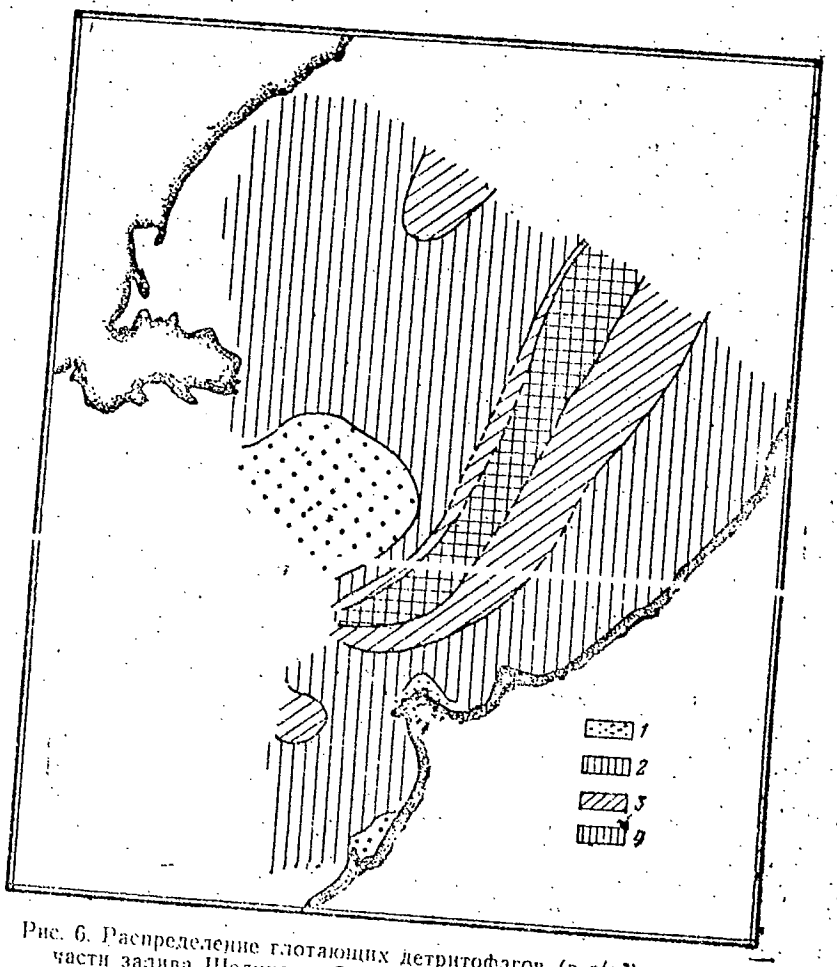

Рис. 6. Распределение глотающих детритофагов (в $г/м^2$) в южной части залива Шелихова. Обозначения те же, что на рис. 2.

Figure 6. Distribution of "swallowing" detritophages (in g. per square meter) in the southern part of Shelikhov Bay. Legend: the same as in Figure 2.

The Travisia forbesii biocoenosis is situated on sandy-silty sea bottom at a depth of 353 meters; 30.2 per cent of the total biomass is represented by the mobile sestonophages, mainly of the family Ampeliscidae. This biocoenosis is characterized by an extremely low total biomass (.12 g. per square meter).

The biocoenosis of M. sarsi, situated much farther northward at a depth of 203 meters, has a higher total biomass (43.0 g. per square meter) and is much richer insofar as its species composition is concerned. Here are also included Rhodine gracilior, Scalibregma inflatum, Scoloplos armiger; the bivalve molluscs - from among the "gathering" detritophages - M. calcarea, and Leda pernula; and the Polychaetes - from among the predators - Nephthys sp. and Lumbriconereis sp. The "swallowing" detritophages, mainly represented by the Owenia fusiformis, also predominate in shallow waters farther southwards from Cape Aregichinsky, in the western part of the SB.

Thus, the principal groupings of the benthic fauna of the region investigated by us are the sessile sestonophages of sea bottoms with hard (rocky) grounds, and the "gathering" detritophages; it is indeed these groupings that determine the quantitative distribution of the entire benthic fauna.

THE ZOOGEOGRAPHICAL DISTRIBUTION OF THE BENTHIC FAUNA

The question of the zoogeographical regionalization of the Okhotsk Sea was subject to dispute for a long time. P. Yu. Shmidt (1901, 1904, 1935), A. Ortmann (1896) and some other authors regarded the Okhotsk Sea as part of the Arctic Region; while others, S. Ekman (1935), A. Andriyashev (1939), and later L. Vinogradov distinguished in the northern part of the Okhotsk Sea the glacial - Okhotsk Sea fauna, as distinct from the genuine arctic fauna. L. Vinogradov made a suggestion that the limit of the glacial area should be drawn from Cape Terpyeniye along the isobath of 200 meters right up to the mouth of the SB.

For the zoogeographical characteristic of benthic animals we have used the system of Vinogradov (1948). The following zoogeographical categories were accepted by us: 1. arctic-northern-boreal species; 2. arctic-boreal; 3. infra-arctic-boreal; 4. boreal; 5. boreal-bathyal; 6. cosmopolites; and 7. endemics.

The greatest importance in the benthic fauna of the north-eastern part of the Okhotsk Sea is possessed by the arctic-boreal species which predominate in most of the stations (Figure 7). In addition, we must also note the important role played by the species endemic to the Okhotsk Sea, the species distributed mainly along the Continental and Kamchatka coasts.

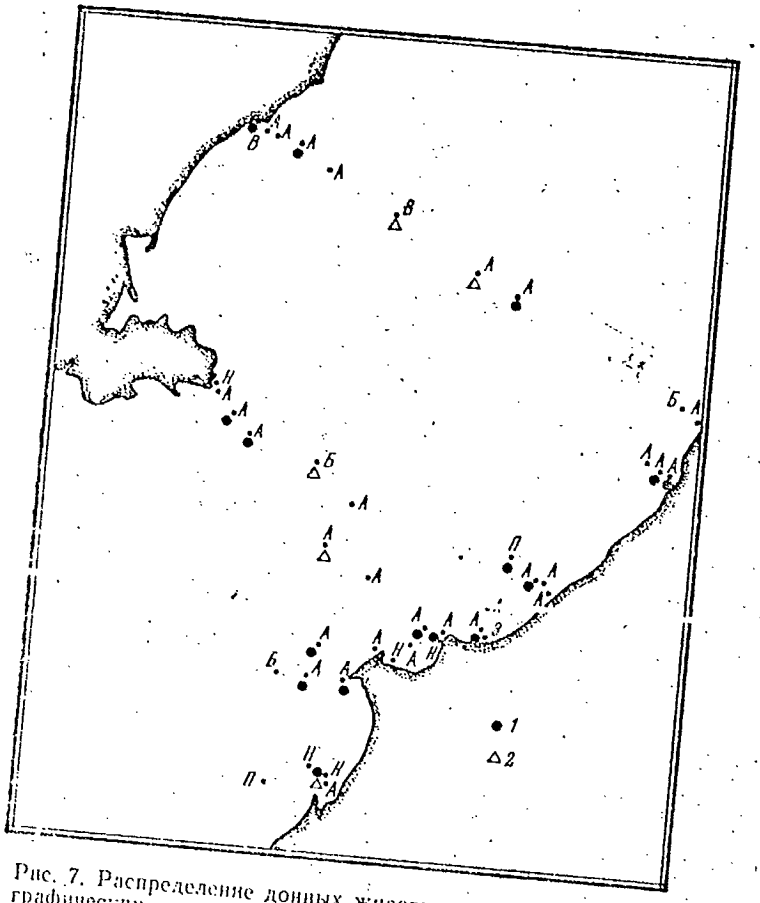

Рис. 7. Распределение донных животных различных зоогеографических групп в южной части залива Шелихова. Количественное преобладание на станциях:
П — арктическо-северо-бореальных видов; *А* — арктическо-бореальных; *Н* — низкоарктическо-бореальных; *Б* — бореальных; *В* — космополитных; *Э* — эндемиков. Места нахождения: *1* — эндемиков; *2* — бореально-батиальных видов.

Figure 7. Distribution of benthic animals of different zoogeographical groups in the southern part of Shelikhov Bay. Numerical predominance at stations:

П - arctic northern-boreal species; A - arctic-boreal species; H - infra arctic-boreal species; Б - boreal species; B - cosmopolite species; Э - eudemic species.

Locations where the following species are found:

1 - eudemic sp.; 2 - boreal - bathyal sp.

As should be expected, the boreal species are quantitatively dominant in the low sub-littoral where there are low but fairly constant positive temperatures.

The coastal waters of the SB undergo considerable chilling in winter, which naturally impedes the northward penetration of the more thermophilic forms.

In the southern part of the SB the infra-arctic-boreal species predominate; these are mainly the bivalve molluscs Spisula polynina voyi and Siliqua media, and also the flat sea urchin E. parma.

The representatives of the boreal-bathyal complex mainly develop in the central deep part of the SB. Here are encountered the Polychaetes, Laonice cirrata and Rhodine gracilior, as well as the Ophiura Ophiura leptoctenia, which are indicators of waters of the warm intermediate layer whose currents penetrate the SB. (Ushakov, 1953).

C O N C L U S I O N S

1. The benthic fauna of the southern part of the SB is characterized by a fairly high total biomass - 326.2 g. per square meter - and this region may be regarded as one of the most productive in the world ocean. However, the biomass of nutritional benthos forms a very small portion of the total biomass, comprising 19 per cent of the total biomass, or 64.9 g. per square meter. The bivalve molluscs and the Polychaetes, so important as food material, account for only 13.2 per cent of the total biomass. The areas with the maximal total biomass (up to 2,000 g. per square meter), mainly composed of the echinoderms and sponges, are situated in the mouth of the SB. Indeed, the SB itself is a very unpromising area from the point of view of a nutritional base for benthophagous fish. (Moiseyev, 1954).

2. In the southern part of the SB, four trophic zones have been demarcated by us:

The first zone is that of predominance of the sessile sestonophages possessing a powerful filtering apparatus; this zone is mainly confined to the coastal belt with rocky sea bottom, and strong currents generated by the ebb and flow tides, in the vicinity of capes and peninsulas projecting far out into the open sea.

The zone of predominance of the mobile sestonophages, possessing a less powerful filtering apparatus, is situated in more placid waters with sufficient movement to ensure the maintenance

of seston in a state of suspension.

The zone of predominance of the detritophages, gathering the detritus from the surface of the sea bottom, coincides, as a rule, with the zone of calm waters and retarded current that does not impede the more or less considerable sedimentation of the organic suspension falling on the sea bottom.

The zone of predominance of the "swallowing" detritophages is mainly confined to the areas of silty sea bottom which are characterized by the absence of strong benthic currents.

3. The benthic fauna of the southern part of the SB is mainly arctic-boreal in character.

A LIST OF PRINCIPAL BENTHIC INVERTEBRATES IN THE SOUTH SHELIKHOV BAY

class - Hydrozoa
sub-class - Hydroidea
family - Eudendriidae
Eudendrium rameum Johnston
family - Campanulinidae
Lafoenia maxima Levinsen
family - Sertulariidae
Sertularella tricuspidata (Alder)
Sertularia tenera G. O. Sars
Sertularia cupressoides Clark
Sertularia robusta (Clark)
Abietinaria abietina (L.)
Abietinaria annulata (Kirchenpauer)
Abietinaria derbeki (Kudelin)
Thuiaria sp.
Thuiaria thuja (L.)
Thuiaria decemserialis (Mereschkowsky)
family - Plumulariidae
Cladocarpus formosus Allman
family - Stylasteridae
Errinopora latifundata Naumov
Allopora steinbergi Fischer
Allopora purpurata Naumov
Allopora norvegica pacifica (Broch)
class - Anthozoa
sub-class - Octocorallia
order - Gorgonaria
Primnoa resedeformis pacifica Broch
sub-class - Hexacorallia
order - Madreporaria
Cariophyllis clavus Ssachsi
class - Bryozoa
family - Heteroporidae

Continued 2 . .

Heteropora pelluculata Wat.

family - Biceliariidae

Dendrobaenia flustroides (Lev.)

family - Scrupocellariidae

Scrupocellaria scabra v. Ben. var. paenulata f. oriental

family - Smittinidae

Porella saccata Busk.

family - Reteporidae

Retepora imperati var. tumescens Ortmann

class - Polychaeta

family - Phyllodocidae

Phyllodoce grenlandica var. orientalis Zachs

Eteone longa (Fabricius)

family - Aphroditidae

Gatyana cirrosa (Pallas)

Eunoë nodosa (Sars)

Harmothoë imbricata (L.)

family - Glyceridae

Glycera sp.

Glycera capitata Oersted

family - Nephthididae

Nephthis sp.

Nephthis coeca (O. F. Müller)

Nephthis ciliata (O. F. Müller)

Nephthis longosetosa Oersted

family - Eunicidae

Onuphis sp.

Lumbriconeiras sp.

family - Ariciidae

Scoloplos armiger (O. F. Müller)

family - Spionidae

Laonice cirrata (Sars)

Spio fillicornis (O. F. Müller)

Spiophanes bombyx (Claparéde)

Continued 3 . . .

Spiophanes uschakovi Zachs

Pygospio elegans Claparede

family - Chratundae

Chaetozone setosa Malmgren

family - Chloraemidae

Brada sp.

family - Scalibregmidae

Scalibregma inflatum Rathke

family - Opheliidae

Travisia sp.

Travisia forbesii Johnston

family - Maldanidae

Rhodine gracilior (Tauber)

Maldane sarsi Malmgren

family - Owenüiiae

Owenia fusiformis Delle Chiaje

Myriochele oculata Zachs

family - Sabellariidae

Idanthirsus armatus Kinberg

family - Pectinariidae

Pectinaria granulata (L.)

family - Ampharetidae

Anobothrus gracilis (Malmgren)

family - Serpulidae

Serpula zygophora (Johnson)

class - Crustacea

order - Thanaidacea

Leptognathia gracilis (Krōyer)

Leptognathia multiserrata Hansen

Leptognathia longiremis (Lilljeborg)

Leptochelia filum (Stimpson)

order - Cirripedia

Balanus sp.

Balanus balanoides L.

Balanus balanus (L.)

Continued 4 . .

Balanus hesperius Pilsbry
Balanus rostratus apertus
Balanus rostratus dalli

order - Amphipoda

family - Lysianassidae
Anonyx nugax (Phipps)
Anonyx affinis Ohlin
Paratriphosites abyssi (Goës)
Paratriphosites minusculus Gurjanova
Orchomenella sp.
Orchomenella minuta Krõyer

family - Stegocephalidae
Stegocephalus inflatus Kröyer

family - Ampeliscidae
Ampelisca macrocephala Lilljeborg
Haploops tubicola Lilljeborg

family - Haustoriidae
Haustorius cheliferus (Bulytcheva)
Haustorius arenarius (Slabber)
Priscillina armata (Boeck)
Pontoporeia femorata Kröyer

family - Phoxocephalidae
Paraphoxus oculatus (Sars)
Harpinia kobjakovae Bulytcheva
Harpinia gurjanovi Bulytcheva
Harpinia pectinata Sars
Harpinia tarasovi
Pontarpinia robusta Gurjanova
Pontarpinia longirostris Gurjanova
Pararpinia simplex Gurjanova
Pararpinia uncigera Gurjanova
Parapinia calcarata

family - Stenothoidae
Metopa sp.
Metopa majuscula Gurjanova

Continued 5 . . .

family - Leucothoidae

Leucothoë spinicarpa (Abildgaard)

family - Acanthonotozomatidae

Odius carinatus (Bate)

Acanthonotozoma inflatum (Kroër)

family - Oedicerotidae

Pontocrates arenarius (Bate)

Westwoodilla sp.

Westwoodilla caecula (Bate)

Aceroides latipes var. robusta Gurjanova

Bathymedon sp.

Bathymedon longimanus (Boeck)

Monoculodes sp.

Monoculodes crassirostris Hansen

Monoculodes carinatus

Monoculodes zernovi Gurjanova

family - Tironidae

Tiron acanthurus Lilljeborg

family - Pleustidae

Neupleustes pulchellus (Kröyer)

Sympleustes sp.

Sympleustes quadridens Bulytcheva

Sympleustes quadrangularis

Sympleustes glaber (Boeck)

family - Atylidae

Nototropis brüggeni Gurjanova

family - Gammaridae

Melita dentata (Kröyer)

family - Talitridae

family - Aoridae

Lembos arcticus (Hansen)

family - Photidae

Photis sp.

Eurysteus melanops (Sars)

Continued 6 . . .

Protomedeia sp.
Protomedeia grandimana Brüggen
Protomedeia fasciata Kroër
family - Amphithoidae
Amphithoë rubricata (Montagu)
family - Jassidae
Jassa pulchella Leach
Jassa sp.
Ischyrocerus sp.
Ischyrocerus commensalis Chevreux
Ischyrocerus chamissoi Gurjanova
Ischyrocerus cristatus Gurjanova
family - Corophiidae
Ericthonius sp.
Ericthonius megalops (G. Sars)
Ericthonius tolli Brüggen
Ericthonius hunteri (Bate)
Corophium crassicorne Bruzelius
family - Podoceridae
Dulichia sp.
Caprellidae
Caprella sp.
order - Decapoda
family - Pandalidae
Pandalus montagui tridens
family - Hippolytidae
Eualus fabricii (Kröyer)
Eualus middendorffi Brashn
family - Crangonidae
Crangon septemspinosa Say.
Sclerocrangon boreas (Phipps)
family - Lithodidae
Hapalogaster grebnitzkii Schalfeev
Dermaturus Mrandtii Brant

Continued 7 . . .

family - Paguridae

Pagurus undosus (Benedickt)

Pagurus pubescens (Kröyer)

Pagurus rathbuni (Benedickt)

family - Majidae

Oregonia gracilis Dana

Hyas coarctatus alutaceus Brandt

family - Atelecyclidae

Telmessus cheiragonus (Tilesius)

class - Bivalvia

family - Nuculidae

Nucula tenuis (Montagu)

family - Ledidae

Leda pernula Müller

Leda minuta Fabricius

Yoldia sp.

Yoldia myalis Couthouy

Yoldia hyperborea (Loven)

Yoldia johanni Dall

family - Mytilidae

Arvella manshurica Bartsch

Modiolus modiolus L.

Musculus corrugatus (Stimpson)

Musculus nigra (Gray)

Musculus minutus Scarlato

family - Pectinidae

Chlamys albidus (Dall)

family - Anommiidae

Pododesmus macroschisma Deshayes

family - Astartidae

Astarte alaskensis Dall

family - Carditidae

Venericardia sp.

Venericardia crassidens (Brod et Sowerby)

Venericardia paucicostata (Krause)

Continued 8 . . .

Venericardia borealis Conrad

family - Montacutidae

Montacuta sp.

family - Carditidae

Cardium californiense Deshayes

Cardium corbis Martyn

Serripes laperousii Deshayes

family - Veneridae

Liocyma fluctuosa (Gould)

family - Mactridae

Spisula polynyma voyi (Gabb)

family - Tellinidae

Macoma sp.

Macoma calcarea (Chemnitz)

Macoma lama Bartsch

Macoma loeveni (Steenstrup)

Macoma torelli (Steenstrup)

Tellina lutea venulosa Schrenk

family - Solenidae

Siliqua media Gray

family - Saxicavidae

Hiatella arctica (L.)

family - Myacidae

Mya ovata

family - Thraciidae

Thracia sp.

family - Lyonsiidae

Lyonsia sp.

family - Ungulinidae

Axinopsis orbiculata Sars

Diplodonta sp.

Thyasira off. cygnus Dall

type - Echinodermata

class - Asteroidea

family - Echinasteridae

Henricia dyscrita Fischer

Continued 9 . . .

family - Asteridae

Asterias rathbuni (Verrill)

class - Ophiuroidea

family - Gorgonocephalidae

Gorgonocephalus caryi (Lyman)

family - Ophiactidae

Ophiopholis aculeata (L.)

family - Amphiuridae

Amphipholis squamata (Delle Chiaje)

Amphiura inepta Djakonov

Amphiura sundevalli (Müller et Troschel)

family - Ophiolepididae

Ophiura sarsi Lütken

Ophiura leptoctenia Clark

Ophiura maculata (Ludwig)

Ophiopenia tetracantha Clark

class - Echinoidea

family - Strondylocentrotidae

Strongylocentrotus droebachiensis (O. F. Müller)

family - Scutellidae

Echinarachnius parma Lamarck

class - Ascidia

Molguia aff. arctica

family - Pyuridae

Boltenia ovifera (L.)

Boltenia echinata (L.)

family - Styelidae

Cnemidocarpa sp.

Dendrodoa lineata (Traust)

Dendrodoa tuberculata Ritter

Styelopsis grossularia (Bened)

Pandocia divisa Ostr. and Pavl.

family - Rhodosomatidae

Cheiyosoma macleyanum Brod et Sow.

Synascidia

Continued 10 . . .

class - Braciopoda

family - Terebratulidae

Cnismatocentrum sakhalinensis Dall

family - Terebratellidae

Diestothyris frontalis (Midd.)

family - Rhynchonellidae

Hemithiris psittacea (Gmelin)

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Notes:

TINRO: Pacific Research Institute of Fishery Economics and Oceanography;

IOAS: Institute of Oceanography of the Academy of Sciences of the U.S.S.R.

IZVESTIYA: Information Bulletins