BENTHOS AND PREY STUDIES IN FEEDING GROUNDS OF THE OKHOTSK-KOREAN POPULATION OF GRAY WHALES

FINAL REPORT

ON MATERIALS FROM FIELD STUDIES ON THE RESEARCH VESSEL *NEVELSKOY* IN 2002

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Whale feeding in Offshore Area (Chayvo Bay). Depth 43 m. September 2002. Photo by V. I. Fadeev.

VLADIVOSTOK
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INTRODUCTION

General information*. There are two independent gray whale (*Eschrichtius robustus*) populations in the Pacific Ocean (LeDuc et al. 2000): the Eastern or California-Chukotka population, which currently numbers as many as 26,000 individuals (Rugh et al. 1999, Le Boeuf et al. 2000) and the Western Pacific Ocean or Okhotsk-Korean population, numbering approximately 100 (Weller et al. 2002).

Since commercial whaling was halted in the 1940's, the Eastern gray whale population has fully recovered. Despite the fact that an increase in the mortality rate, a low birth rate and deterioration of the physical condition of some individuals were discovered in the California-Chukotka population in 1999 and 2000 (Moore et al. 2001), the status of the population is quite stable due to the large number of whales (Le Boeuf et al. 2000).

In contrast to the eastern population, the Okhotsk-Korean gray whale population has never been large and is estimated by experts to have numbered no more than 2000-2500 individuals at its peak (Berzin 1974, Yablokov and Bogoslovskaya 1984). Many years of commercial whaling drove the population to the edge of practical extinction, and it was only in the early 1970's that gray whales began to be seen off Northeastern Sakhalin (Berzin 1974, Brownell and Chun 1977). A 40-year ban on whaling (beginning in the 1960's) failed to produce a substantial restoration of the whale population. According to optimistic estimates, the population numbers between 100 and 250 individuals, although most researchers estimate the number as no more than 100 (Weller et al. 2000, Sobolevsky 2001, Weller et al. 2001, Sobolevsky 2000, Weller et al. 1999, Vladimirov 2000). It is hypothesized that there are fewer than 50 remaining individuals capable of reproduction (Weller et al. 2001). Because of low reproductive rates, the genetic distinctness (LeDuc et al. 2000) and the small total size of the Okhotsk-Korean gray whale population (Weller et al. 2000, Vladimirov 2000), this population has been classified as Critically Endangered on the International List of Protected Species of IUCN (Weller and Brownell 2000) and as Category I in the Russian Red Book (Krasnaya Kniga Rossiyskoy Federatsii 2001).

The startup of commercial operations associated with the development of the offshore oil and gas complex on the East Sakhalin Shelf in the mid-1990's necessitated comprehensive study of the Western Pacific Ocean gray whale population to assess the possible anthropogenic impact on the population and to develop approaches to minimize possible effects of anthropogentic activity

* Since the history of benthos studies and data on the benthos distribution in the Eastern Sakhalin region and the feeding of the California-Chukotka gray whale population have been analyzed in detail and summarized in a report – Kusakin, O. G., E. I. Sobolevskiy and S. A. Blokhin. 2001. Published survey of benthos studies on the Northeast Sakhalin Shelf // Intermediate Report of the Marine Biology Institute of the Far East Branch of the Russian Academy of Sciences and the Pacific Research Institute of Fisheries and Oceanography (TINRO). Vladivostok, 89 pp. – we have not attempted to summarize the literature on this issues in this section. Published data will be referenced in discussing results and elsewhere as necessary. This is also appropriate because the report in question [Kusakin *et al.*, 2001] is available on a website: www.sakhalinenergy.com.

(Vladimirov 2000, Berzin and Vladimirov 1996). In particular, in development of the joint declaration of the Gore-Chernomyrdin Commission "On Measures to Ensure Biodiversity Conservation in the Sakhalin Island Area" dated 7 February 1997, in connection with the development of oil and gas fields on the island shelf, the Russian and American sides in 1998 prepared a joint "Okhotsk-Korean Gray Whale Population Monitoring and Research Program," which was approved by the State Committee on Protection of the Environment (Goskomekologiya) of Russia and the U. S. National Marine Fisheries Service. (Weller et al. 2001). The program proposed multidisciplinary studies of the Okhotsk-Korean population during the feeding period of the whales off Eastern Sakhalin: recording of the number and distribution of whales, acoustic studies, and a study of benthos as the basic component in the diet of gray whales. Although some studies of abundance and population health (mainly photo-identification and tissue sampling studies) in the Piltun feeding site were conducted under the auspices of the joint US-Russia program, no detailed studies of gray whale distribution and abundance, ambient or industry-generated noise, or gray whale prey/benthos were conducted.

Starting in 2001, under joint sponsorship by Exxon Neftegas Limited (ENL) and Sakhalin Energy Investment Company (SEIC). comprehensive aerial surveys, vessel-based surveys, acoustic surveys, and gray whale prey/benthos studies were conducted over broad areas off the northease coast of Sakhalin Island. In 2002, a Russian-based photo-identification study was also initiated on the northeast Sakhalin Shelf. This report discusses the prey/benthos studies conducted in 2002.

In 2001, 10 diving transects were sampled in the Northeast Sakhalin coastal zone in an area from Niyskiy Bay in the south to Tront Bay in the north. Four transects were completed in the only known at the time feeding grounds of the gray whales in summer 2001 – the area of Piltun Bay (Figure 1). It was demonstrated that at depths of 5 to 15 m, this area is characterized by a great abundance of forage benthos, primarily amphipods and isopods (Fadeev 2002).

On 10 September 2001, a previously unknown heard of gray whales (more than 80 individuals) was documented and surveyed systematically (aerial and vessel-based surveys) at an offshore location well south of Piltun Bay . This new feeding site was located 25-40 km offshore from the Chayvo Bay – Niyskiy Bay area, in water depths averaging 30 – 40 m.

Specialists from LGL Limited (Canada) developed the statement of work for a multidisciplinary study of gray whales, both in the nearshore area along Piltun Bay and in the new deepwater area (Offshore Area). The complex of studies included the investigation of gray whale prey. The field phase of the work was done in 2002 within the scope of an expedition aboard the research vessel *Nevelskoy*.

<u>The purpose of this investigation</u> was to study the quantitative distribution and status of benthos in the Piltun and Offshore gray whale Feeding Sites and on sections of the shelf between

the main areas (Intermediate Area) and in control areas where gray whales were not known to feed. The work was done under the "Okhotsk-Korean Gray Whale Population Monitoring and Research Program," funded by Sakhalin Energy Investment Company Ltd. and Exxon Neftegas Limited.

Objectives of the Study. This report was prepared based on the results of benthos studies conducted in September-October 2002 by an expedition of the Marine Biology Institute of the Far East Branch of the Russian Academy of Sciences.

The objectives of the study and the methodological approaches to the performance of the work were specified in the scope of work (*Scope of Work for Prey Studies* "Western Gray Whales, Sakhalin Island, 2002") developed by the LGL Limited specialists:

- to perform benthic and epibenthic studies in three areas (Piltun, Offshore and Intermediate) and three Control Test Zones using bottom grabs and other equipment for collecting samples;
- to investigate the benthos composition at sites where gray whales were feeding;
- information on the species composition and quantitative abundance (colony density, biomass) of individual taxonomic groups and common species of benthos is to be obtained from analysis of macrobenthos collections; to assess the composition and abundance of macrobenthos in the whale feeding grounds and outside the Feeding Sites;
- to perform a morphometric analysis of the common species of amphipods to assess the size composition;
- to obtain data on the particle size distribution of sediments in feeding areas and at Feeding Sites of gray whales; and
- to perform a comparative analysis of the distribution of benthos of the Piltun Area based on materials from 2001 and 2002.

MATERIALS AND METHODS

1. Materials and methods for field studies

1.1. Materials

Timing of the execution of the studies. The expeditionary work to study benthos and the gray whale prey were performed by an expedition group from the Marine Biology Institute of the Far East Branch of the Russian Academy of Sciences aboard the *Nevelskoy* research vessel from 7 to 30 September and 7 to 15 October 2002. Adverse weather conditions were the reason for the interruption in the expeditionary work from 1 to 6 October.

Characteristics of field collections. The system of transects and the locations of stations were planned in advance by LGL Limited (Appendix 1. Figures P1.1. – P1.3.). The plan called for studying three main areas: 1 – the Odoptu Bay – Piltun Bay area (hereafter **Piltun Area**); 2 – the area from Piltun Bay to the middle part of Chayvo Bay (**Intermediate Area**); and 3 – an offshore area in the section from the middle part of Chayvo Bay to Niyskiy Bay (**Offshore Area**). Control stations were planned for each of the three main areas. A diagram of the completed (sampled) stations is shown on Figure 1. In addition, opportunistic samples of benthos and epibenthos were gathered where gray whale were feeding (at **Feeding Points**). Bottom grab benthos collections were performed at 170 stations (539 samples), of which collections were made with an epibenthic net (Table 1) at 84 stations (177 samples). All stations were sampled using Van Veen grab; a subset of these stations was also sampled using Ponar grab (Table 1). A total of 716 samples were collected at 170 stations. Characteristics of the stations are presented in Appendix 2.

Table 1. Characteristics of materials collected on the research vessel *Nevelskoy* in 2002.

Item	Area	Sample collecting equipment			
		Bottom grabs: Van Veen (Ponar Grab)		Epibenthic net	
		stations	samples	stations	samples
1	Piltun Area	60	163(18)	36	93
2	Intermediate Area	13	39(0)	6	14
3	Offshore Area	36	105(8)	11	18
4	Control Areas	15	45(0)	7	14
5	Whale Feeding Sites	46	145(16)	24	38
	TOTAL	170	497(42)	84	177

The location was recorded at each station by GPS, and the depth and the surface water temperature were recorded, and bottom samples were taken for analysis of the particle size distribution (165 samples). Washed benthos samples were photographed with a digital camera – 392 photographs.

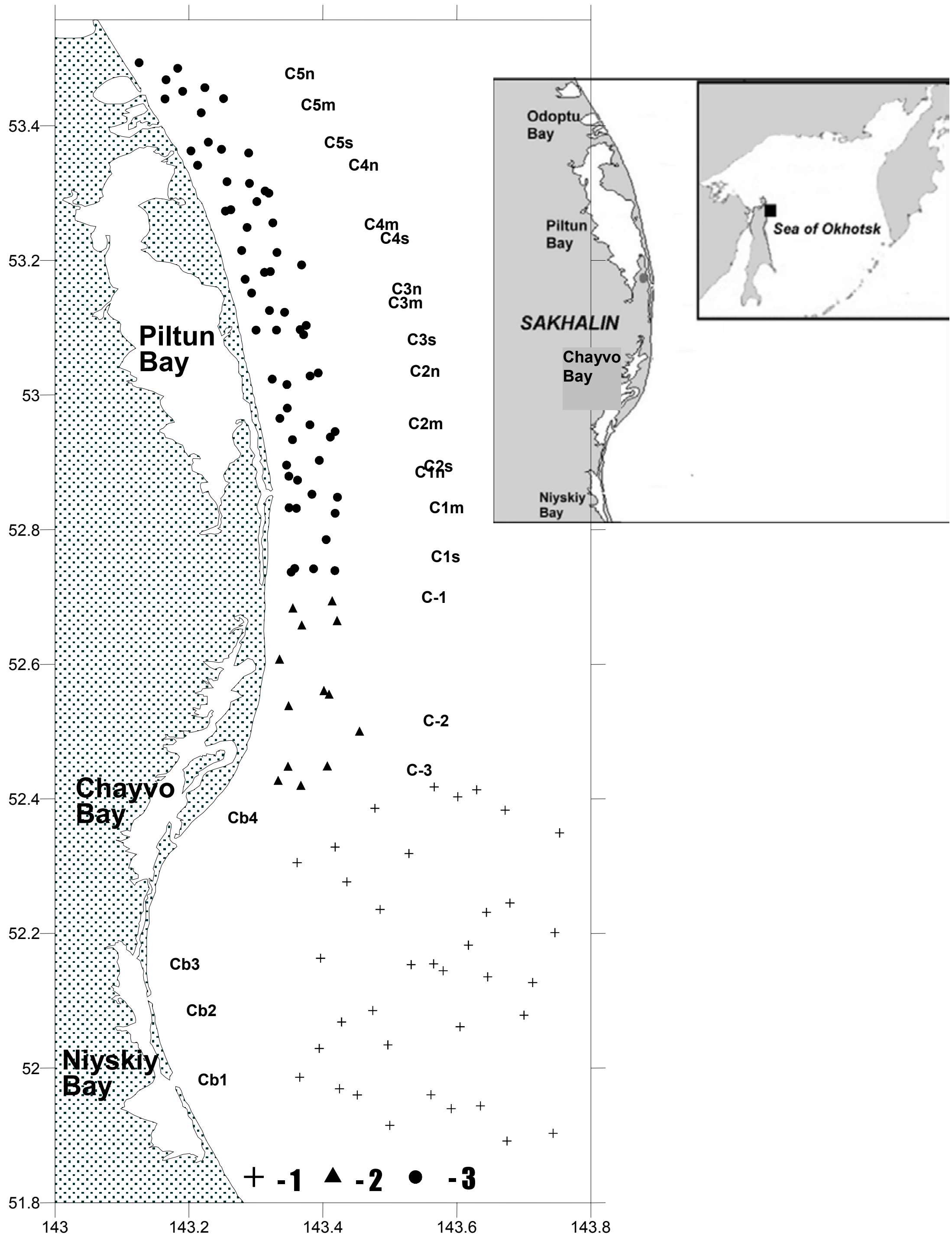

Figure 1: Diagram of the locations of stations in the study area in 2002.

1 – stations in the Offshore Area;
2 – stations in the Intermediate Area;
3 – stations in the Piltun Area;
C – control stations.

In the area of Piltun Bay (Piltun Area), bottom grab samples were taken in 2002 in the areas of the diving transects of 2001. The sampling depths in the Piltun Area for 2002 and 2001 were as follows:

Depth	Number of stations	
	2002	2001
1 - 5 m	0	5
6 -10 m	0	5
11-15 m	16	5
16-20 m	13	5
21-25 m	18	5
26-30 m	11	5
31-35 m	2	0

Most of the collections in 2002 were made at depths greater than 11 m, which was the result of the difficult in conducting deep draft vessel-based operations in this area at depths less than 10 m. In 2001, 10 diving stations were completed in the range of 5–10 m.

1.2. Methods for field studies

Samplers. The set of samplers was specified in the Statement of Work by the LGL Limited specialists based on what had been learned by experience in the study of the feeding of the California-Chukotka (eastern) gray whale population (*Scope of Work for Prey Studies* “Western Gray Whales, Sakhalin Island, 2002”). The samplers used are shown in Photo 1. The Piltun area is characterized by difficult conditions to conduct benthos studies – a high current velocity, and a dense, sandy bottom. As demonstrated by the results of the diving studies in 2001 (Fadeev 2002) and the data of underwater video photography in 2002, the presence of a periodic microrelief in the form of ripples and sand waves is characteristics of the nearshore sandy bottom areas. This microrelief resulted in varying effectiveness in the use of the proposed samplers.

Pipe sampler (Photo 1, D). From eight attempts to use this sampler at depths of 8 to 20 m, not a single sample was obtained. At shallow depths, the operation of the instrument is hampered by the density of the sandy bottom, while at depths greater than 15 m, it is hampered by the strong current, which results in a significant deviation from the vertical in free descent of the sampler. The sampler was not used any further.

Epibenthic net (Photo 1, C). Data on sampling using this sampler are presented in Appendix 5. The maximum depth for successful use of the instrument is 43 m. Despite attempts to conduct epibenthos collections at each station, the collections were successful at only 50% of the stations. In this process an average of only two samples could be taken at the stations. The main reason is the significant drifting of the sampler from the place it enters the water under the influence of the strong currents. The effectiveness of the use of the epibenthic net improved as the depth decreased. However, the most basic issue that arises in the analysis of samples obtained with this sampler is the considerable discrepancies in assessing the quantitative abundance of the same species in comparison with data obtained with other samplers (see section 1.3).

Bottom grabs. Two models were used: the Van Veen bottom grab with a collection area of 0.2 m^2 (Photo 1, A) and a lightweight bottom grab model with a collection area of 0.025 m^2 (Petite Ponar Grab). The purpose of the Petite Ponar Grab was to conduct benthic sampling by hand from the zodiac in close proximty to feeding whales.

The Van Veen grab operated effectively throughout the depth range. Two series of collections of 10 samples were performed with each bottom grab to compare sampling effectiveness. The results of testing of sampling effectiveness of the bottom grabs in medium sand (depth 14 m) in the Piltun Area are given in Table 2.

Table 2. Comparison of sampling effectiveness of two bottom grab models.

Characteristics	Bottom grab model	
	Petite Ponar Grab	Van Veen Grab
Collection area, m^2	0.025	0.2
Weight, kg	14	57
Number of samples	10	10
Taxonomic groups	4	6
	Isopoda *Amphipoda* *Cumacea* *Polychaeta*	*Isopoda* *Amphipoda* *Cumacea* *Polychaeta* *Bivalvia* *Gastropoda*
Frequency of occurrence, %		
Isopoda	30%	80%
Amphipoda	60%	100%
Colony density, spec./m^2		
Isopoda	98 (24%)	440 (19%)
Amphipoda	890 (17%)	1620 (22%)

Note: Standard error of average value, in %, is shown in parentheses.

A

B

C

D

Photo 1. Samplers used in collecting material.

A – Van Veen bottom grab (collection area 0.2 m^2);

B – “Petite Ponar Grab” bottom grab (collection area 0.025 m^2);

C – epibenthic net (area 0.25 m^2); and

D – pipe sampler.

Results indicate that assessments of the basic quantitative characteristics obtained with the Van Veen bottom grab are higher than the assessments from the second model (Photo 2). It is not only the features of the samplers but also the significant intrinsic aggregation of benthos which affect the collection results.

Aboard the ship, all the macrobenthos samples were washed on a washing table through a system of three sieves: 5 mm (to remove coarse bottom fractions and large animals – flat sea urchins and mollusks), 1 mm, and 0.5 mm (the bottom sieve) and fixed with 4% formalin. Then all the samples were transferred to 75% alcohol. For analysis of the particle size distribution of the bottom, a sample was taken from the surface sediment layer using a teflon pipe sampler. The samples were placed in plastic packets and left in a cooler until they could be sent to the laboratory.

1.3. Comparative analysis of bottom grab and epibenthic collections

As mentioned previously, fundamental differences are observed in the assessments of the colony density of the same species based on the data of bottom grab and epibenthos collections. Stations from the Piltun and Offshore areas and whale feeding sites were selected for comparison. Simultaneous collections were performed at the stations with the epibenthic net and the Van Veen bottom grab.

In the Piltun Area, 43 stations were selected on sandy bottoms at depths less than 20 m. Amphipods and isopods have the highest incidence in both bottom grab and epibenthos collections. There were 34 amphipod species recorded in the bottom grab collections, and 4 (*Pontharpinia longirostris, Pontoporeia affinis, Eogammarus schmidti* and *Anonyx nugax pacificus*) in the epibenthic net collections. All these species are also present in mass in the bottom grab samples. There were no amphipods in the epibenthos collections at eight stations, while the amphipod density varied from 98 to 1120 specimens/m^2 in the bottom grab samples. In cases where amphipods were present in collections from both samples, the colony density assessed for the epibenthos collections was 2 to 1000 times lower than in the bottom grab samples. The number of amphipods in the epibenthos collections was 198 times lower, on the average. The average colony density of the 4 common species of epibenthic amphipods is 96±31 spec/m^2 according to epibenthic net collections and 3600±728 spec./m^2 (n=43), or 38 times higher, for bottom grab collections.

A similar tendency is observed in assessment of the colony density of the mass epibenthos isopod species *Synidotea cinerea.* The average colony density for this species is 61±10 spec./m^2 according to epibenthos collections and 10 times higher – 646±94 spec./m^2 – for bottom grab collections.

Such significant discrepancies in the assessments of the colony density of epibenthic crustacean species in shallow sandy sections of the Piltun Area are explained by relief features. According to the data of diving surveys in 2001 and underwater video photography in 2002, with the active hydrodynamics of the coastal waters, clusters of epibenthic animals are confined to the depressions of the microrelief, which creates difficulties in recording them using an epibenthic net.

Stations at depths greater than 20 m in a zone of dominance of the amphipod *Ampelisca eschrichti* and stations at gray whale feeding points (38 stations) were used for comparison in the Offshore Area. Three amphipod species – *Ampelisca eschrichti, Anonyx nugax* and *Photis sp.* – are encountered in the epibenthic net collections. All these species are common species, i.e., species encountered in >70% of all samples, in the bottom grab samples as well. In this comparison, the colony density of epibenthic amphipods for bottom grab collections was more than 600 times higher (a maximum of 6800 times) than the values calculated from the epibenthic collections.

Similar differences are observed in assessment of the abundance of the cumacean *Diastilis bidentata.* The colony density of cumaceans at the same stations averages 560 times higher (maximum factor – 4600) in the bottom grab collections than in the epibenthic net collections (Photo 3). Such enormous differences are explained by the unsatisfactory operation of the epibenthic net in the strong currents characteristic of this area.

Hence relief features in the shallow Piltun Area and the hydrodynamics in the relative deep Offshore Area call into question the advisability of conducting epibenthic net collections. The material obtained using this sampler does not simply fail to provide new information; it severely distorts the assessments of quantitative abundance of epibenthic species.

Photo 2. Samples collected at the same station with the Petite Ponar Grab (A) and the Van Veen bottom grab (B). Piltun Area. Whale feeding point FP-08. Depth 14 m. Composition: A – Amphipoda (light) and Isopoda (dark); B – Amphipoda (dominant crustaceans), Isopoda (a couple), Bivalvia (one large at the bottom) and Annelida (one worm near the top).

Photo 3. Samples collected simultaneously with an epibenthic net (left) and a Van Veen bottom grab (right) in a strong current. Offshore Area. Whale feeding point FP-26. Depth 39 m.

2. Laboratory analysis of materials

2.1. Analysis of particle size distribution of bottom sediments

The particle size distribution of bottom sediments was analyzed at the *Shelf Problems Laboratory of the Far Eastern National University* (DVGU) by two standard Russian methods: screen and areometric. The analysis determined the percentage concentrations in the soil of fractions of the following sizes: larger than 10 mm; 10-5; 5-2; 2-1; 1-0.5; 0.5-0.25; 0.25-0.1; 0.1-0.05; 0.05-0.01; 0.01-0.005; and smaller than 0.005 mm. The moisture content (W) and specific gravity of the bottom soil samples were determined preliminarily by the standard Russian method. Then the sample was dried and sifted through a set of screens with mesh sizes of 10, 5, 2 and 1 mm. The soil fractions remaining on the screens and passing through the screen with a 1 mm mesh were weighed. The sediment that passed through the screen with a mesh size of 1 mm was transferred to a porcelain cup that had been weighed in advance and then was weighed. The soil sample was poured into a flask with a capacity of 1000 cm^3, which was then filled with distilled water (about 300 ml). The soil with water added was allowed to stand for one day. After standing for a day, 1 cm^3 of a 25% ammonia solution was added to the sample, and the flask with the sample was boiled for one hour and then cooled to room temperature. The suspension obtained was poured into a 1-liter glass cylinder through a sieve with a mesh size of 0.1 mm. The soil particles left in the sieve with a mesh size of 0.1 mm were dried, sifted through a set of screens with mesh sizes of 0.5, 0.25 and 0.1 mm, and then weighed separately. The suspension was agitated for one minute, until the sediment was stirred up completely from the bottom of the cylinder. An areometer was introduced, and its readings were determined for the fraction smaller than 0.05 mm one minute after the agitation stopped, for the fraction smaller than 0.01 mm after 30 minutes, and for the fraction smaller than 0.005 mm after three hours.

The Classification of sediments by mechanical composition (Table 3) has been used to designate soil types.

2.2. Analysis of benthos samples

Laboratory processing of *macrobenthos* consisted of determining the benthos species composition and quantitative characteristics in the sample (biomass and number of each species and of individual taxonomic groups, and overall total biomass and macrobenthos count in the sample). A total sorting of animals was performed. Large organisms were counted visually, and small ones were counted under the MBS-10 microscope. The raw weight of large benthic organisms was determined on VLKT-100 electronic scales to an accuracy of 10 mg, while the weight of small organisms was determined on torsion balance scales to an acuracy of 1 mg. Before weighing, the organisms were dried on filter paper for one minute. Then the biomass per square meter was calculated taking into account the sampler area and rounded to the nearest 0.01 g. The mean biomass error was determined with the same accuracy. The population density of the organisms per square meter was also calculated and rounded to the nearest whole number.

Table 3. Classification of bottom sediments used in the report (Bezrukov and Listsin 1960, Shepard 1976).

Sediment groups	Types of sediments	Abbreviation in text	Predominant particle size, mm	Md, Mm
Coarsely fragmented (psephites)	Pebbles	Peb	>10	
Coarsely fragmented (psephites)	Gravel coarse medium fine	 Grc Grm Grf	 10-5 5-2 2-1	
Sandy (psammites)	Sand coarse medium fine	 Sc Sm Sf	 1-0.5 0.5-0.25 0.25-0.1	 1-0.5 0.5-0.25 0.25-0.1
Silt (aleurites)	Coarse aleurites Fine aleurite silt	Ac Af	0.1-0.05 0.05-0.01	0.1-0.05 0.05-0.01
Clay (pelites)	Coarse pelite	Pec	<0.01	0.01-0.005

Note: Md, mm, is the median diameter of the soil particles. Numbers in the column are the range of values for the type of sediment in question.

For colonial animals (*Hydroidea, Bryozoa, Spongia*), the number of individual colonies was counted; when it was not possible to determine the number of colonies without ambiguity (presence of fragments of colonies, aggregation of colonies, etc.), the number was indicated by the sign "?" in the table. Taxonomic processing of the sample collections was performed by qualified expert taxonomists* with many years' experience with the animal group in question. In the event that a species was represented by juvenile individuals (young individuals with no clear taxonomic features), i.e., there was no possibility of determinining the species to which the individuals beloned, the designation *sp. juv*. was used in the taxon name. It was impossible to determine the species of individuals in some cases because of severe damage. In this case, the designation *sp.* was used in the taxon name.

* Associates of the IBM DVO RAN, the DVGU and the Zoological Institute of the Russian Academy of Sciences (ZIN RAN) took part in the taxonomic processing of the main groups: candidate of biological sciences L. L. Budnikova (Amphipoda), candidate of biological sciences M. V. Malyutina (Isopoda), candidate of biological sciences G. M. Kamenev (bivalve mollusks), candidate of biological sciences V. V. Gulbin (gastropods), candidate of biological sciences E. V. Bagaveyeva (marine worms), candidate of biological sciences S. F. Chaplygina (hydroids), candidate of biological sciences V. N. Romanov (Ascidia), candidate of biological sciences A. V. Chernyshov (nemertines) and doctor of biological sciences V. S. Levin (Apoda).

The index "frequency of occurrence of the species" (P, %) – the ratio of the number of quantitative samples in which the species is encountered to the total number of quantitative samples in the area, expressed as a percentage – was used to assess the rate of occurrence (incidence) of species in the sandy bottom zone. This index is important primarily as a characteristic of food organisms; i.e., it characterizes their availability to the consumer.

Traditional single-factor methods as well as the methods of multidimensional statistical analysis, including classification and ordination methods (Afifi and Eyzen 1982) using the statistical package *Statistica* (Borovikov 2001), were used to describe the communities. A quadrate matrix of data in the form of a list of benthic species for each station with quantitative characteristics of the species served as the primary basis for the analysis. The Bray-Curtis similarity coefficient between each pair of samples was calculated based on the data matrix. Dendrograms were constructed by the median link method (Clarke and Green 1988, UNEP 1995).

For plotting charts of the distribution of the characteristics of bottom sediments and water layer, concentrations of contaminants and indices of quantitative abundance of macrobenthos, standard procedures of the SURFER 7 cartographic system (Surface Mapping System) were used. The cartographic system was used only for illustrating the general nature of the distribution of parameters in the water area studied. Therefore, the "simple planar surface" version of the polynomial regression method was used in calculating isolines. This method produces good results when large-scale trends in the spatial distribution of data need to be identified. The ideology of the method has been described in detail (Draper 1981). On the whole, the procedure for taking, processing and analyzing samples conformed to Russian and foreign methods (Bilyard 1987).

RESULTS AND DISCUSSION

3. Characteristics of water layer and bottom sediments

3.1. Water temperature distribution during the study period

Temperature measurements of the surface layer of water in the water area studied were performed during the periods 7 to 30 September and 7 to 15 October 2002. The measurement results are presented in Appendix 2, while the spatial distribution of water temperature fields in the Piltun and Offshore Feeding Sites is shown in Figure 2.

Water Temperature. During the period of the studies, the temperature of the surface water layer varied only slightly over the entire water area (Table 4).

Table 4. Temperature values (°C) of the surface water layer in the three areas.

Characteristic	Area		
	Piltun	Offshore	Feeding Points
Average	12.01	10.31	9.6
Standard error	0.19	0.23	0.26
Minimum	8	7	6
Maximum	15	13	13
Number of measurements	60	36	45

The water temperature is somewhat higher in the area of Piltun Bay (Piltun Area), which is the result both of heating of the water in the coastal area and of the inflow of warmer lagoon waters (Piltun Bay and Odoptu Bay). This situation is traced in Figure 2(A), in the form of regions of higher temperatures in the coastal belt of the sea adjacent to these lagoons.

The range of water temperature fluctuations in the Piltun Bay area in 2002 was smaller than in 2001. The water temperatures at the surface in this area in 2001 varied within limits of 2.1 to 16.4 °C, which was the result of an influx of cold deep-sea water and of particular features of the hydrometeorological situation during the study period in 2001 (Fadeev 2002). The spot of colder water with a temperature of ca. +10 °C was located near the northern part of Piltun Bay (Figure 2(A)). A spot of cooled water was also observed there in 2001, but with a lower temperature of 3 – 10 °C (Figure 3: Fadeev, 2002). It is possible that a steady influx of deep-sea water is observed in this area to a significant degree during the summer (Krasavtsev et al. 2000).

Comparable temperature data on the Offshore Area are not available.

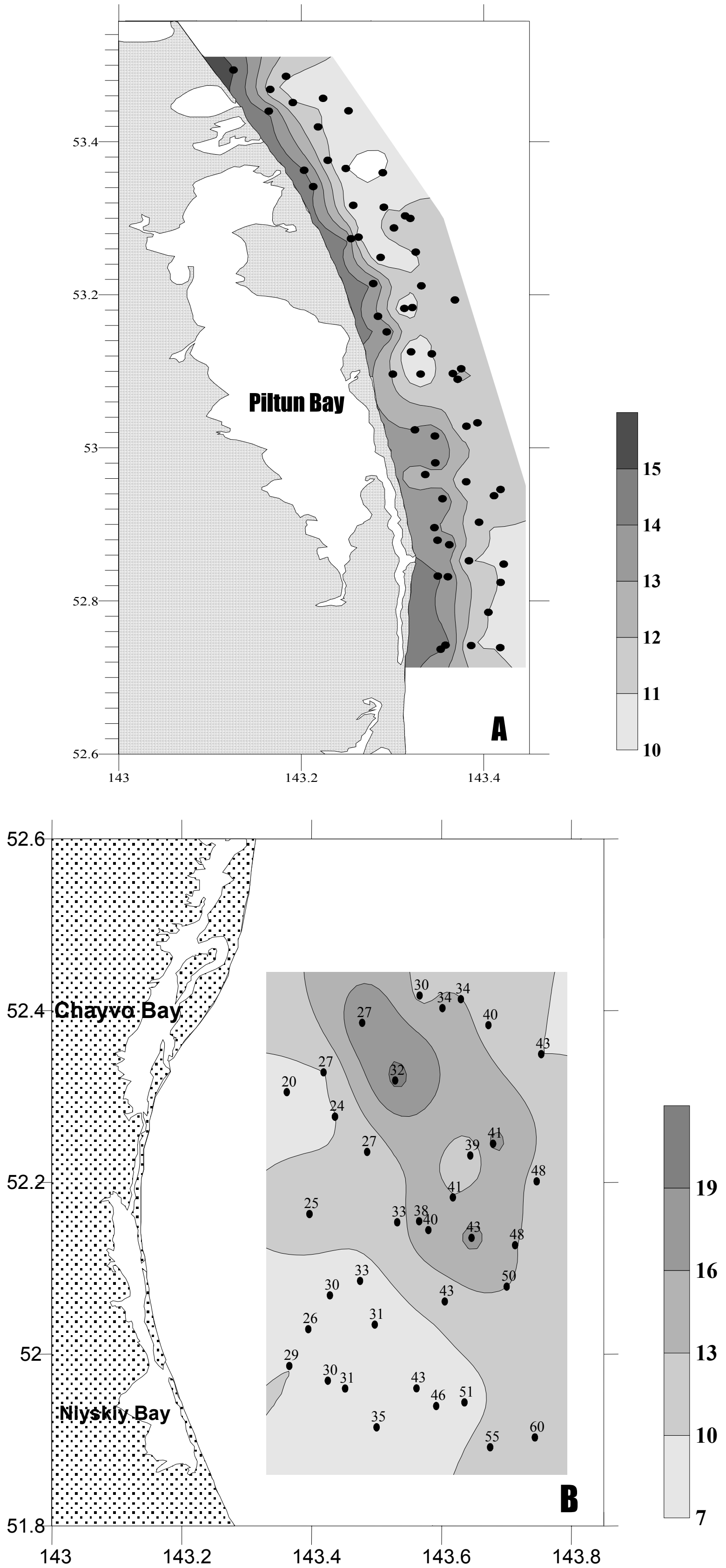

Figure 2. Distribution of temperature (T °C) of the surface water layer in the Piltun (A) and Offshore (B) areas.

3.2. Particle size distribution of bottom sediments in the areas

The study of the particle size distribution of bottom sediments was performed based on laboratory analyses of 165 bottom samples taken at the benthos stations (no samples could be taken at five stations in a gravel-pebble-bottom area). The sediment grain size distribution is given in Appendix 2. A breakdown of the main fractions of bottom sediments (coarse aleurite and sand: fine, medium and coarse, and small gravel) is shown in Figures 4-6 for the Piltun Area and Figures 8-10 for the Offshore Area.

Figures 3 and 7 show the distribution of depths in the Piltun and Offshore areas according to the data of stations in these areas.

A sharp prevalence of sandy (psammite) fractions is characteristic of the bottom sediments throughout the water area. Of 165 stations in all areas, sands (fine – 40%; medium – 33%) are prevalent at 75% of the stations; another 18% is made up of mixed sands of various grain sizes. The proportion of the fine sand fraction is in excess of 60% at most of the stations.

Piltun Area. In the description of the breakdown of soils according to materials of the 2001 expedition (Fadeev 2002), it was mentioned that fine sand bottoms are prevalent throughout the area at depths of 10 – 15 m. With an increase in the depth, the fine sands are mixed with medium and coarse sands.

According to data of the 2002 expedition, fine sands are prevalent at 45% of the stations in this area, and medium sands are prevalent at 25% of the stations. Gravel bottoms are encountered in a patchy distribution at depths greater than 15 m (Figure 4). The distribution of fine (aleurite-pelite) bottom fractions is significant. Despite considerable entrainment of fine sediment fractions from the numerous coastal lagoons, the proportion of aleurite-pelite fractions in the bottom sediments of the area is very small (not more than 6%). The active hydrodynamics of the area probably promotes the transfer of fine soil fractions to greater depths. The effect of the lagoons on the accumulation of coarse aleurites is traced in Figure 6 in the form of two sections: at Odoptu Bay and in the Piltun Bay area. This tendency was demontrated previously in the materials of the 2001 expedition.

Offshore Area. The depths in the area increase smoothly from 20 to 50 m (Figure 7). With an increase in the depth, there is an increase in the proportion of the fine sand fraction in the bottom (Figure 10(D)). Overall fine sands are prevalent at 41% of the stations in this area, and medium sands are prevalent at 34%. Gravel bottoms and coarse-grained sand have a spotty distribution (Figsures 8 and 9).

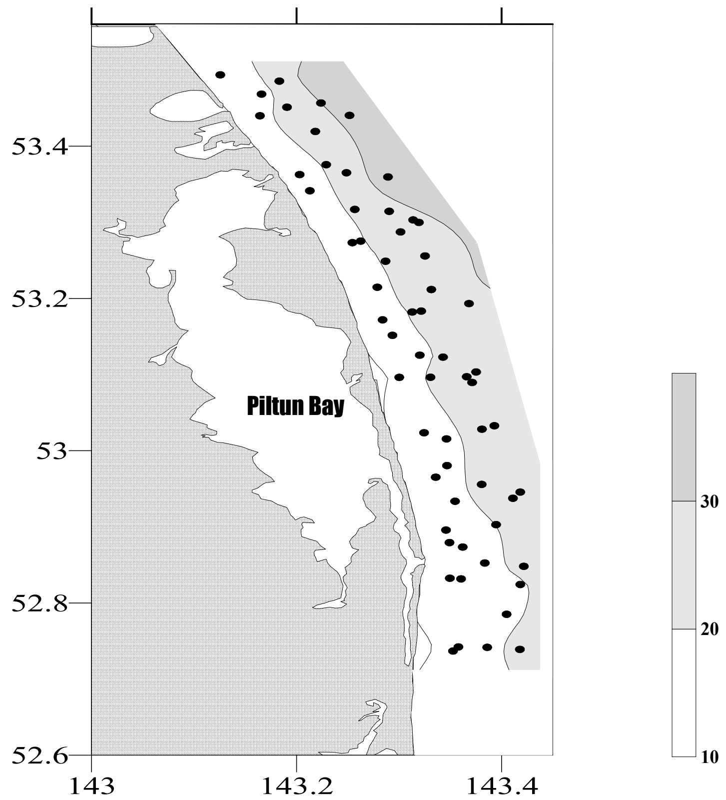

Figure 3. Distribution of depths (m) in the Piltun Area.

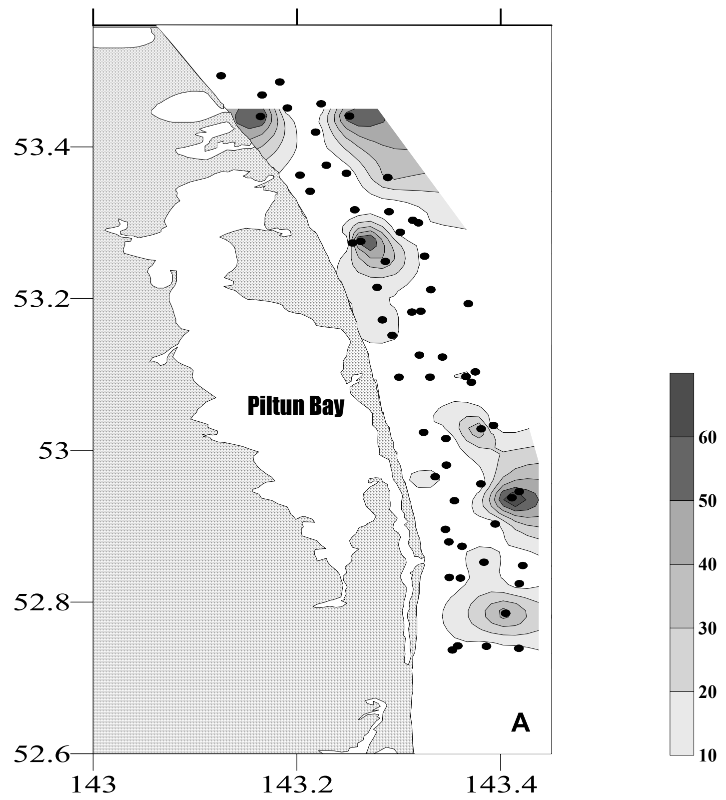

Figure 4. Distribution of bottom sediment fractions (% of dry sediment weight) in thePiltun Area gravel fraction (A; > 1 mm).

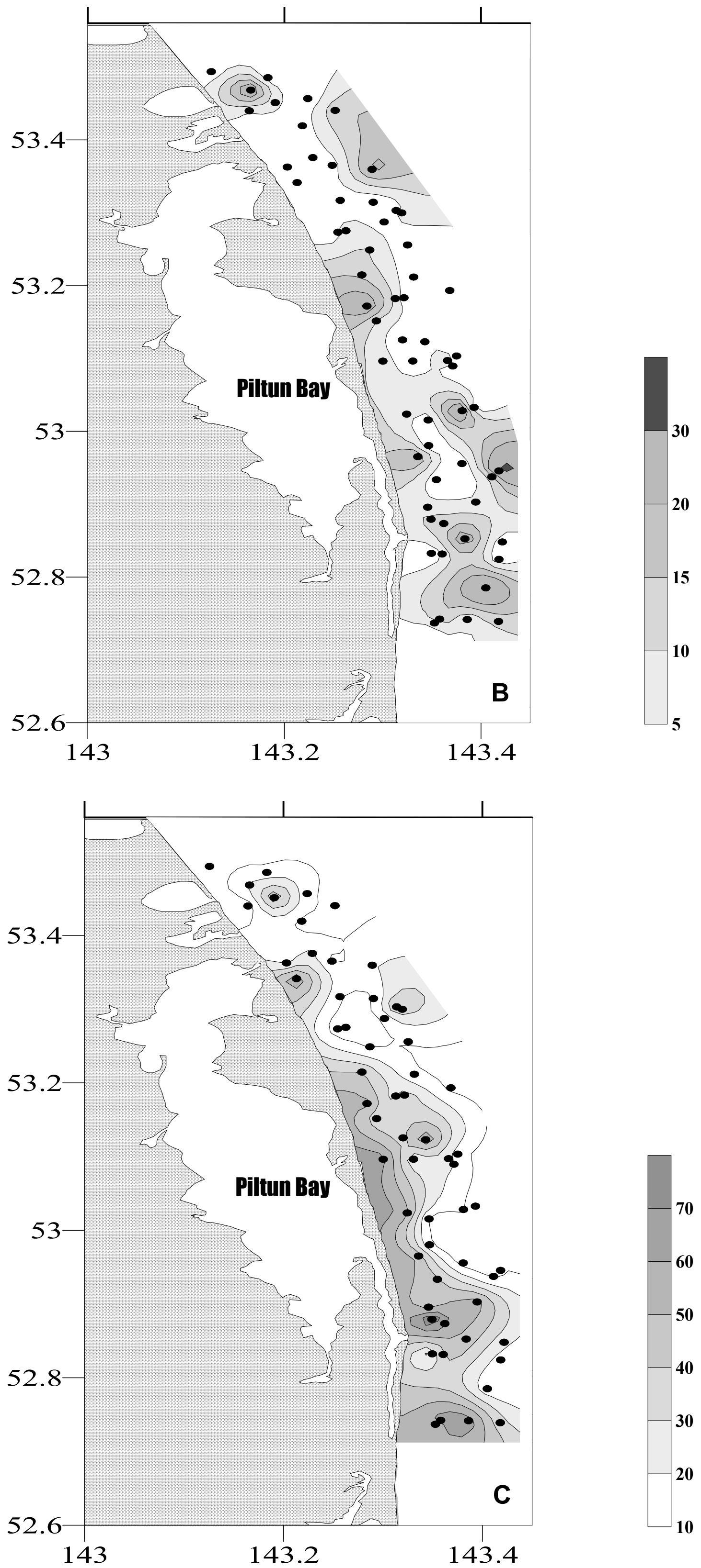

Figure 5. Distribution of bottom sediment fractions (% of dry sediment weight) in the Piltun Area: coarse sand (B; 0.5 – 1 mm); medium sand (C; 0.25 – 0.5 mm).

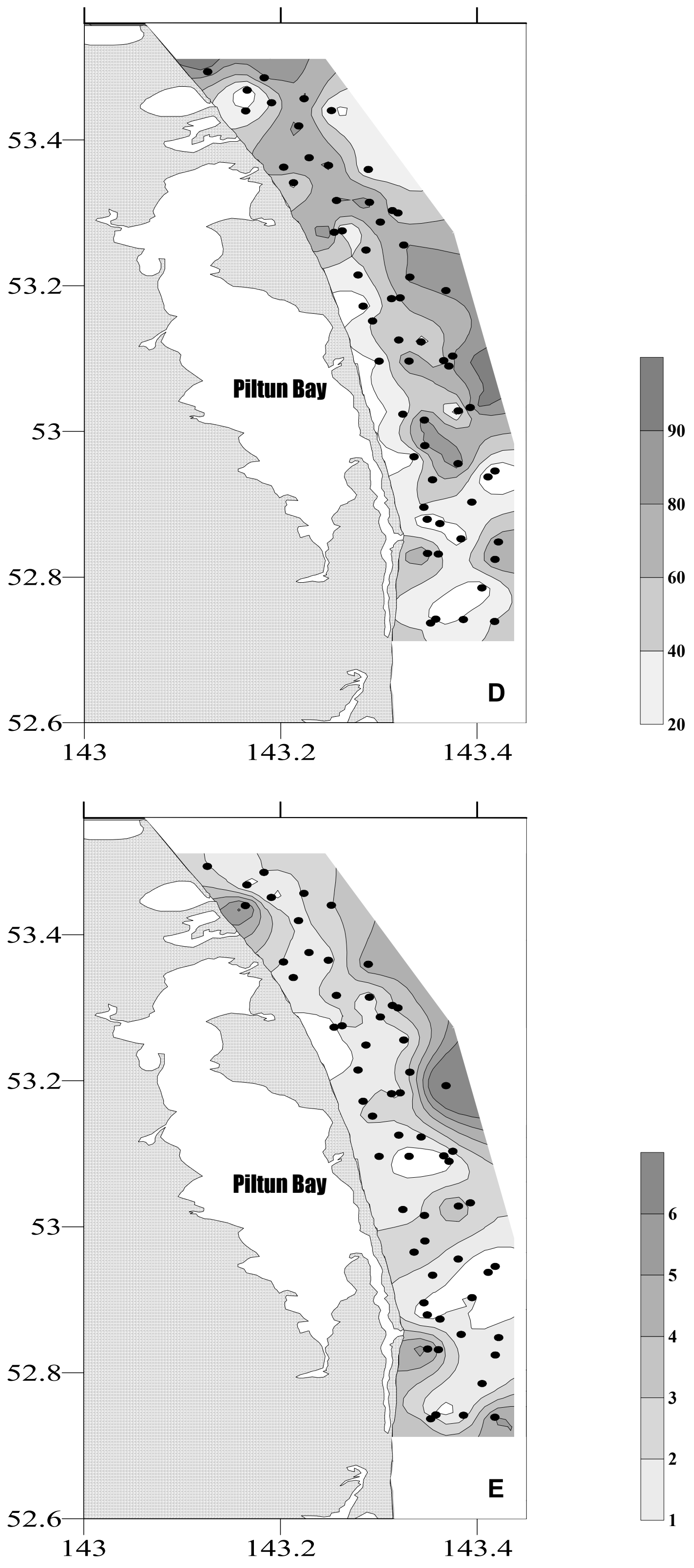

Figure 6. Distribution of bottom sediment fractions (% of dry sediment weight) in the Piltun Area: fine sand (D; 0.1 – 0.25 mm); silt (E; < 0.1 mm).

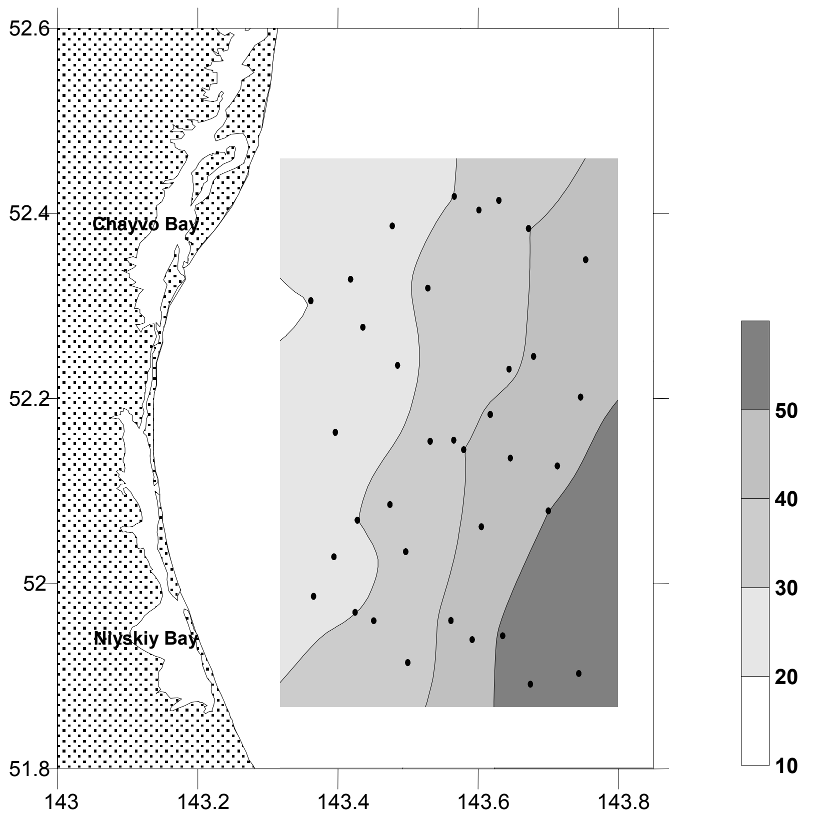

Figure 7. Distribution of depths (m) in the Offshore Area..

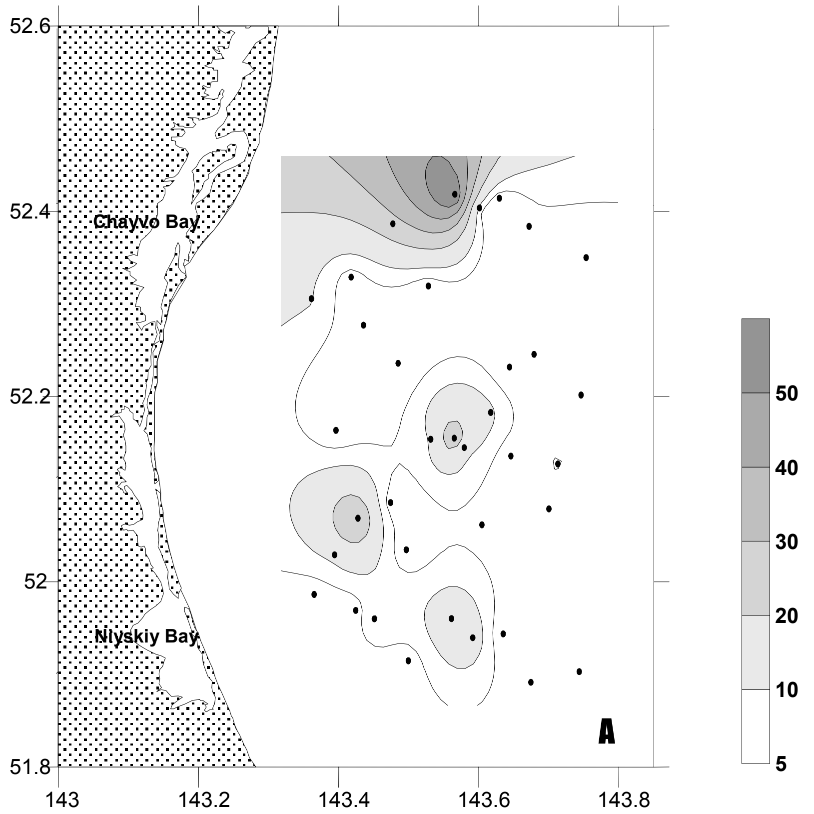

Figure 8. Distribution of bottom sediment fractions (% of dry sediment weight) in the Offshore Area: gravel-pebble fraction (A; > 1 mm).

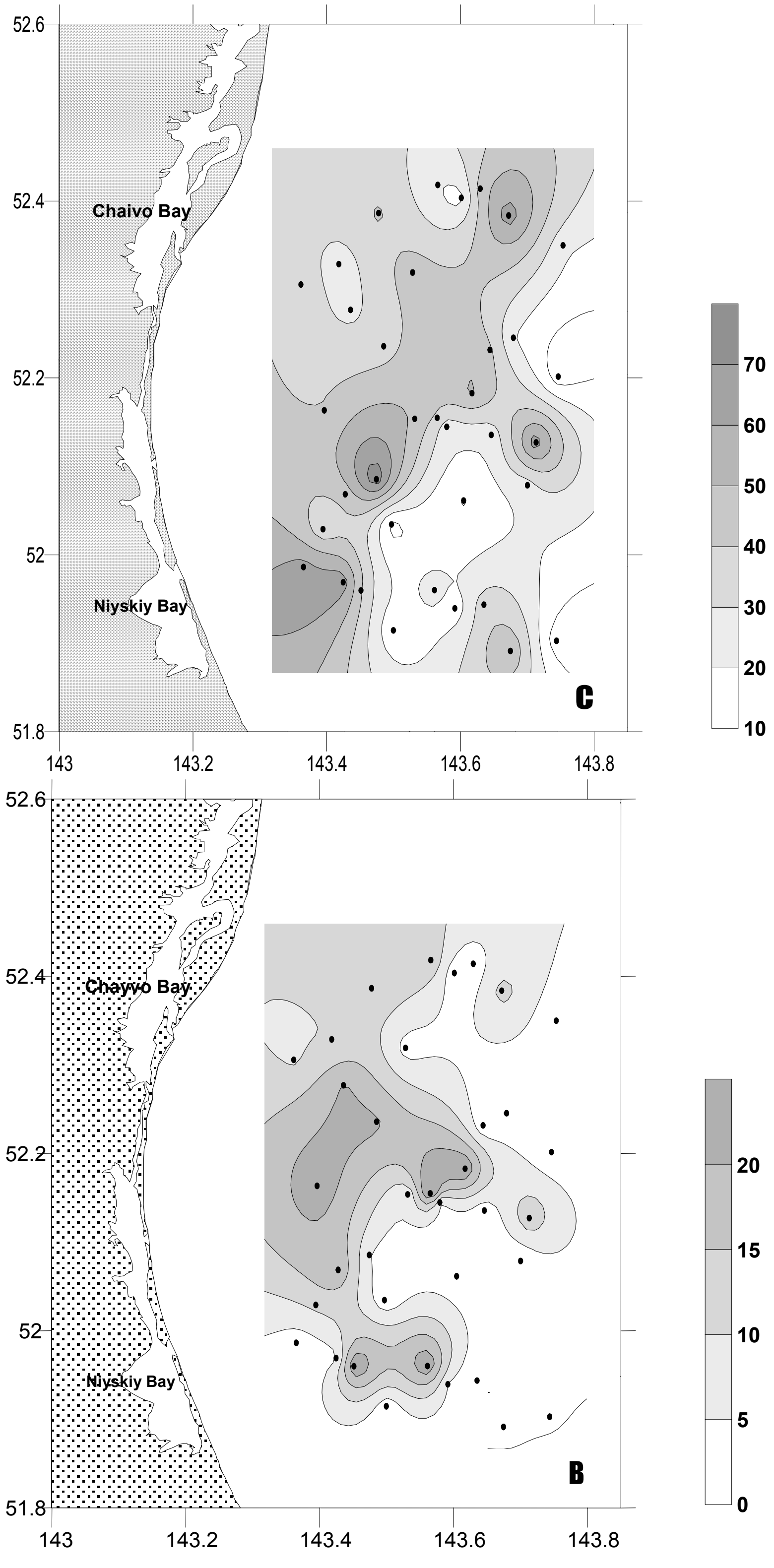

Figure 9. Distribution of bottom sediment fractions (% of dry sediment weight) in the Offshore Area: coarse sand (B; 0.5 – 1 mm); medium sand (C; 0.25 – 0.5 mm).

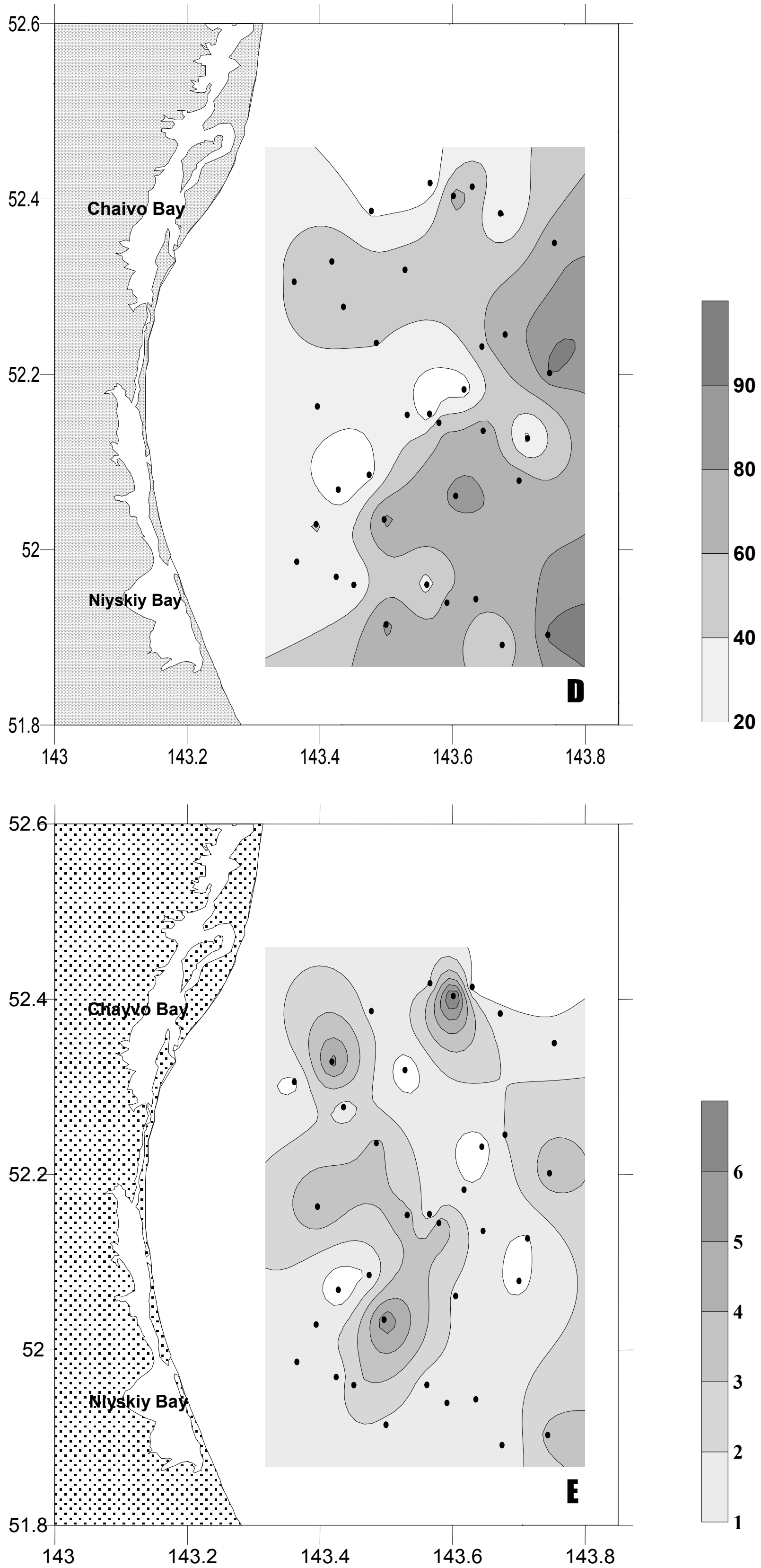

Figure 10. Distribution of bottom sediment fractions (% of dry sediment weight) in the Offshore Area: fine sand (D; 0.1 – 0.25 mm); silt (E; < 0.1 mm).

3.3. Classification of stations according to similarity of particle size distribution

Data on the 10-fraction compositions of bottom sediments at stations in each area have been grouped and classified by procedures of cluster analysis (Ward method, distance of Euclid). The dendrograms obtained are shown in Figure 11.

It follows from the dendrograms that three basic groups of stations can be distinguished in all the areas according to similarities in particle size distributions: groups A, B and C. Table 5 gives averaged characteristics for each of the sediment groups for each of the three areas.

Table 5. Characteristics of sediment groups in two areas according to 2002 materials†.

Sediment group	Sediment fractions						Code
	Peb	Gr	Sc	Sm	Sf	Al+Pe	
	Piltun Area 2002 data						
A	0.39	1.21	0.77	11.41	84.52	1.7	Sf
B	0.26	8.11	9.64	47.81	32.64	1.54	Sm+Sf
C	1.05	37.28	14.81	17.49	25.96	3.41	Gr+Sfmc
	Piltun Area 2001 data (Fadeev 2002)						
A	0	1	0.8	5.9	89.5	2.8	Sf
B	0.2	3.4	5.6	40.8	48.4	1.6	Sm+Sf
C	9.7	46.8	18.8	12	8.9	3.9	Gr+Scm
	Offshore Area 2002 data						
A	0.71	2.74	2.4	15.65	75.4	3.1	Sf
B	0.31	3.49	5.41	52.03	37.55	1.21	Sm+Sf
C	0.44	18.49	21.83	36.69	20.66	1.89	Gr+Scmf

Group A in all areas is made up of stations with a dominant fraction of 0.1-0.25 mm in the sediment. ***Group B*** includes stations with prevalence of two fractions – 0.1-0.25 mm and 0.25-0.5 mm – in the soil. ***Group C*** in all three areas is made up of stations without clearcut dominance of any of the fractions. Fractions of 0.5-1.0 mm and 1.0-2.0 mm have the greatest significance.

Hence *group A* corresponds to well-sorted fine-grained sands, *group B* to medium-sorted sands of varying grain size (a mixture of fine and medium sands), and *group C* corresponds to poorly sorted gravel bottoms with the addition of sands of varying grain size, pebbles and exposed detritus.

The composition of the sediment groups in the Piltun Area described according to 2002 data matches the results of soil analysis based on the materials of the 2001 studies well (Table 5).

† Shading in this and other tables indicate predominant classes (e.g., sediment fractions in this table).

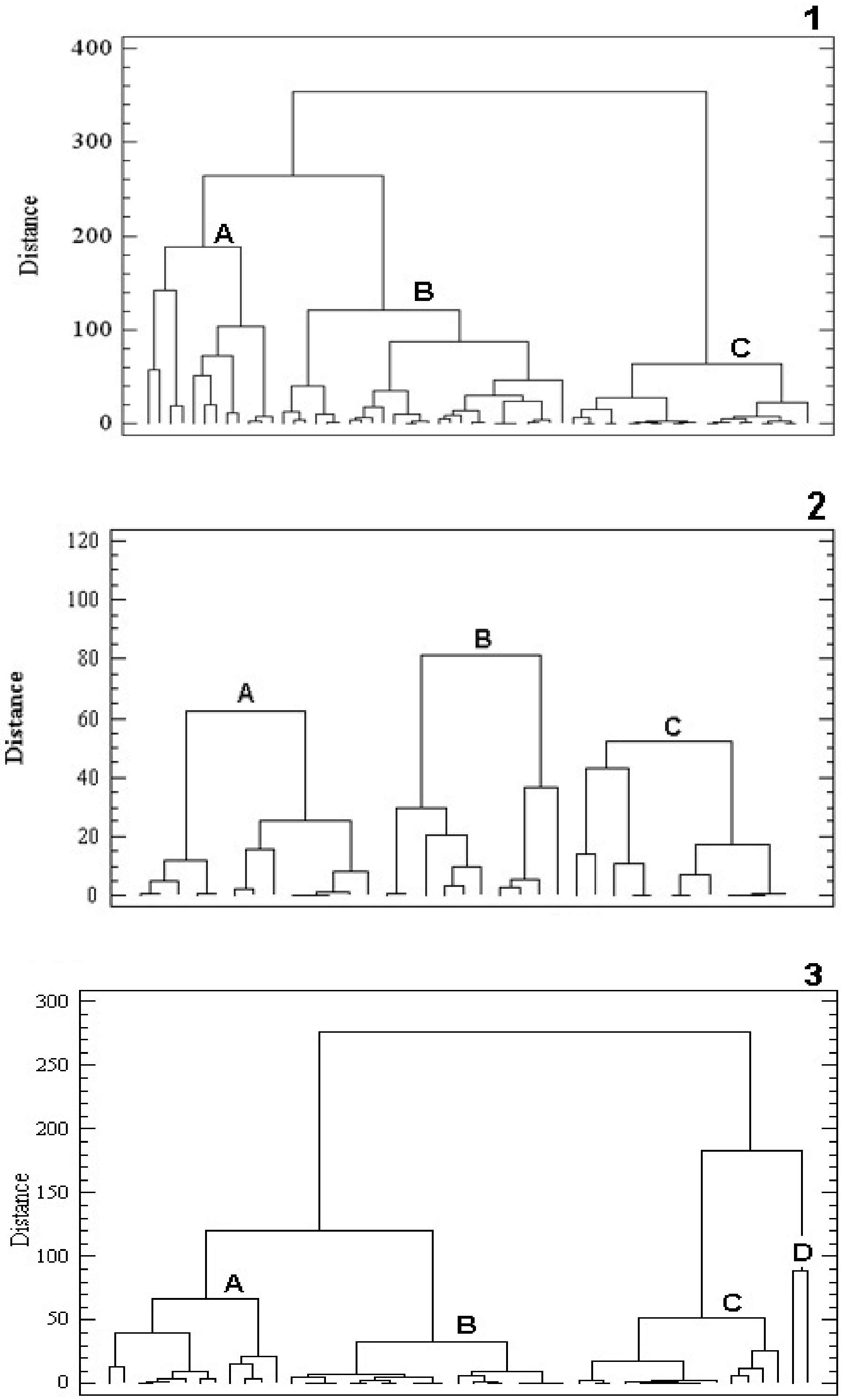

Figure 11. Dendrograms of the similarity of stations in regard to the 10-fraction sediment composition in the three areas.

1 – Piltun Area;
2 – Offshore Area;
3 – Stations at gray whale Feeding Points; and
A, B, C – sediment groups.

3.4. Particle size distribution of bottom sediments at gray whale Feeding Sites

Bottom sediments were sampled in the area of Piltun Bay at nine gray whale Feeding Sites in 2001. The average depth of the Feeding Sites was 9±0.9 m. Analysis indicated that the at the Feeding Sites soils were fine-grained sands in all cases (proportion of the fraction of 0.1-0.25 mm, from 73.95 to 94.34%); i.e., the soils are classified as *soil group A* (Fadeev 2002).

In 2002, bottom sediments were sampled at 46 whale Feeding Sites in the Piltun Area (21 stations; average depth 12±0.71 m) and the Offshore Area (25 stations; average depth 41±0.92 m). Sandy bottoms were prevalent at all the Feeding Sites in the Piltun Area. Fine-grained sands were prevalent at 53% of the stations, medium sands at 38%, and a mixture of fine and medium sands was observed at 9% of the stations. Sandy bottoms were also prevalent at the whale Feeding Sites in the Offshore Area. Medium sands and a mixture of medium and fine sands were prevalent at 36% of the stations, 12% of the stations had fine and coarse sands, and fine gravel bottoms with an addition of soils of varying particle size (group D on the dendrogram in Figure 11(3)) were noted at 9% of the Feeding Sites. Averaged characteristics of the soil groups discovered at the whale feeding sites are given in Table 6.

Table 6. Characteristics of sediment groups at whale Feeding Sites.

Sediment group	Sediment fractions						Code
	Peb	Gr	Sc	Sm	Sf	Al+Pe	
	Whale feeding grounds (Feeding Point stations)						
A	0.73	2.14	1.34	9.98	81.97	3.84	Sf
B	0.22	5.98	4.79	57.83	29.65	1.53	Sm+Sf
C	0.38	26.61	34.6	30.22	6.54	1.65	Gr+Scm
D	13.44	64.65	4.02	2.08	10.04	5.77	Grf

4. Benthos composition and quantitative distribution in the areas

In light of the fact that the areas in question differ considerably in regard to environmental conditions and the nature of the bottom population, we shall consider the distribution of benthos separately in each of three areas: Piltun, Intermediate and Offshore.

4.1. Piltun Area

There were 60 stations within the area during the 2002 expedition at depths of 11 to 35 m (181 bottom grab samples, average depth 20.4±0.8 m). Figure 12 shows the locations of the stations. In 2001, 30 diving stations were processed within this area at depths of 5 – 30 m; of these, 10 stations were in the range of 5 – 10 m. No samples were taken at these depths in 2002 (Table 2).

The distribution of benthos is considered below based on the materials of the field studies in 2002 and 2001 (Fadeev 2002).

4.1.1. Quantitative abundance and distribution of benthos according materials of 2002 and 2001 field studies[‡]

Total benthos biomass. According to the 2001 materials, an increase in total biomass with depth is observed in the Piltun Bay area. Biomass increases from 507.4 g/m^2 at a depth of 11 m to 1153 g/m^2 at 30 m and average 984.7±132.3 g/m^2 (Table 7). The increase in total biomass with depth is defined by the course of the change in the biomass of flat sea urchins, as their share in the total biomass of the area reaches 61.1%. The biomass of other groups decreases with depth. The proportion of the biomass of basic groups in the total biomass is as follows: crustaceans – 17.2%; bivalve mollusks – 13%. The proportion of marine worms does not exceed 4% of the total biomass for the area as a whole and remains stable at all depths.

The average biomass for the entire area in 2002 was 481.5 g/m^2 at depths of 11 – 30 m, with a colony density of more than 6600 spec./m^2. The flat sea urchin *Echinarachnius parma* has the greatest proportion in the total biomass (71.3%). The proportions of the other groups are significantly smaller: amphipods make up 9%, bivalve mollusks – 8.5%, and isopods – 4%. An increase in the total benthos biomass occurs with depth, from 274 g/m^2 in the range 11 – 15 m to 755 g/m^2 at 30 m (Table 7; Figure P1.4). This increase is defined by the increase in the biomass of flat sea urchins as the depth increases. The proportion of the sea urchins in the average biomass increase from 13% in the range 11 – 15 m to 87% at 30 m. The proportion of benthos groups which are potentially important gray whale prey decrease sharply with depth: amphipods from 40% in the range 11 – 15 m to 1% at 30 m, bivalve mollusks – from 24% to 2%, and isopods – from 14% to 1% (Figures 13 and 14). However, caloric values of different groups of macrobenthos are quite different (Fadeev 2002, Chapter 4.2.4).

‡ Since the collections in 2002 covered a depth range of 11 to 30 m, collections from 2001 made only in that depth range were used for comparison (see Table 7).

Table 7. Macrobenthos biomass distribution (g/m^2) in the Piltun Area according to materials of field studies in 2001 and 2002.*

Taxonomic groups	Depth								For entire area		Error of average
	15 m		20 m		25 m		30 m				
	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	%
Amphipoda	85.4	110.9	26.2	22.53	16.1	28.3	16	4.99	35.9	42.68	20.2
Isopoda	65.2	38.63	17.7	18.46	9.8	13.13	7.4	5.63	25.0	18.96	24.4
Bivalvia	207.8	65.01	74.6	11.68	95.6	67.84	34.7	16.9	103.2	40.36	21.9
Cumacea	2.2	5.35	18.9	3.74	31.1	5.83	28.9	48.89	20.3	10.95	26.2
Decapoda	14.1	2.3	12.8	2.22	10.3	2.08	14.5	13.76	12.9	5.09	24.8
Echinoidea	82.2	36.92	825.3	247.91	1005.5	428.09	987.5	660.52	725.1	343.4	33.3
Polychaeta	33.4	11.34	27.2	16.04	29.3	11.42	11.3	9.67	25.3	12.12	20.9
Rest	17.1	3.45	42.2	3.39	35.8	10.68	22.8	14.35	29.5	7.97	28.2
TOTAL	**507.4**	**273.9**	**1044.9**	**329.96**	**1233.5**	**567.36**	**1153.1**	**754.72**	**984.7**	**481.5**	**21.2**

* Since the collections in 2002 covered a depth range of 11 to 30 m, collections from 2001 made only in that depth range were used for comparison.

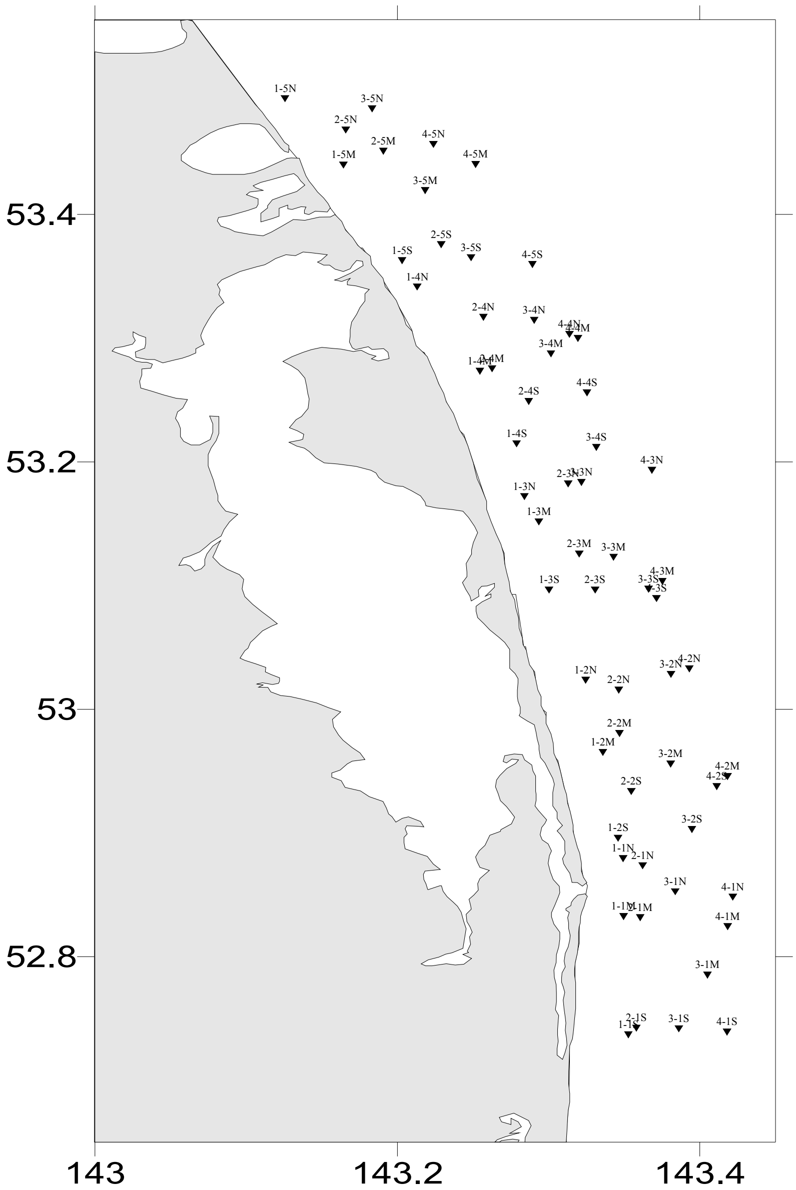

Figure 12. Locations of stations in the Piltun Area.

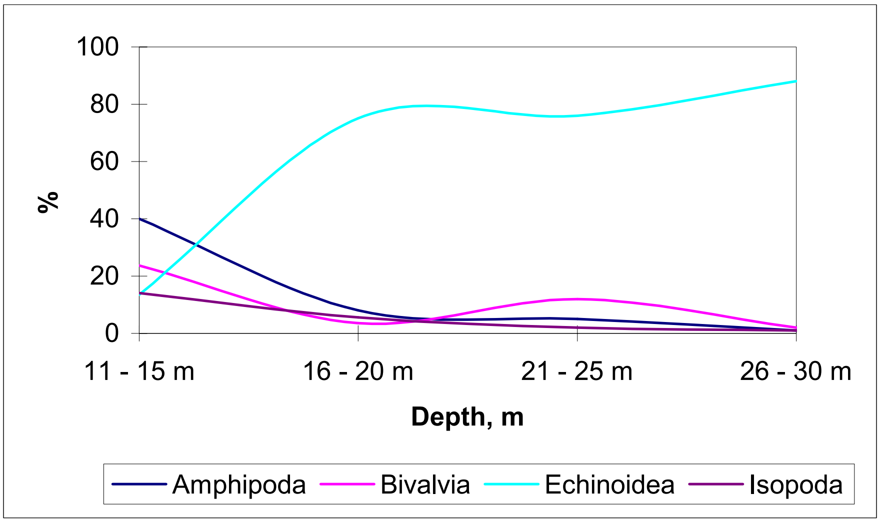

Figure 13. Variation in the proportion (%) of four benthos groups in the total benthos biomass by depth in the Piltun Area.

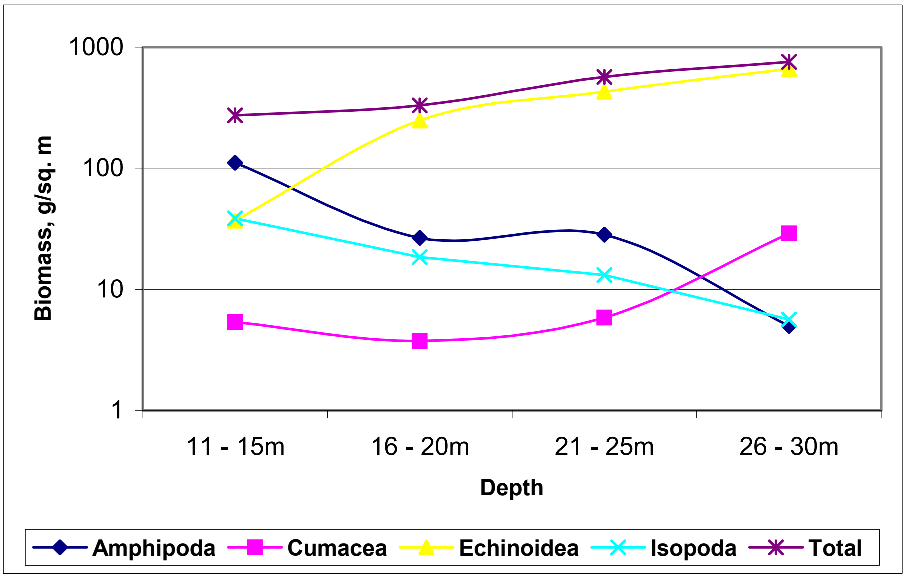

Figure 14. Variation in biomass (g/m^2) of four benthos groups by depth in the Piltun Area.

Hence similar trends in the distribution of total benthos biomass are observed in the materials of 2001 and 2002. Groups that display highest degree of aggregation (patchiness), e.g., Echinoidea or Bivalvia, also show larger differences between the 2001 and 2002 data (Table 7).

Biomass of basic taxonomic groups and common species of benthos. Crustaceans (amphipods, isopods, decapod crayfish and cumaceans), bivalve mollusks and marine worms are potential gray whale prey in the area studied.

Crustaceans (Crustacea). According to the materials of 2001, the overall proportion of crustaceans in the macrobenthos biomass in the area of Piltun Bay was 45.1% in the range 5 – 10 m and only 10% in the range 11 – 30 m (Table 7 in Fadeev 2002). Three types of crustacean biomass variation were observed with increasing depth. Amphipods and isopods had maximum biomass in the range 5 – 15 m; it decreased sharply at depths greater than 20 m. The change in cumacean biomass was in the opposite direction. It is at a minimum at depths up to 20 m but increases as the depth increases. The decapod biomass was nearly the same at all depths.

The total proportion of crustaceans in the range 11 – 30 m in 2002 was 16% (Table 7). Trends in the variation of crustacean biomass with depth noted in 2001 are fully confirmed – the biomass of amphipods and isopods decreases with depth, that of cumaceans increased, and decapod biomass remained quite stable (Table 7, Figures 13 and 14).

Isopods (*Isopoda*). According to materials of 2001, the relative proportion of isopods in the total macrobenthos biomass was 14.1% in the range 5 – 10 m and only 2.4% at depths of 11 – 30 m. The average isopod biomass in this range was 25.0 g/m^2.

According to the data from 2002, the proportion of isopods in the total biomass at depths of 11 – 30 m was 6.6% at an average biomass of 19 g/m^2. Two types of isopods were observed. The large isopod *Saduria entomon* has a frequency of occurrence of 16%. The biomass of this species at depths of 11 to 30 m varies from 1.5 g/m^2 to 56 g/m^2.

Synidotea cinerea has the greatest significance in the isopod biomass. According to materials from 2001, this isopod had the maximum frequency of occurrence of all macrobenthos species – 86% – at depths of 5 – 30 m. This species had the greatest biomass values at depths up to 15 m. At depths greater than 25 m, *S. cinerea* was encountered only in isolated cases. In 2002, in the range 11 – 30 m, the frequency of occurrence was 34%, with an average biomass of 14.3 g/m^2. According to the materials of diving studies, the greatest colony density of *S. cinerea* (up to 5000 spec./m^2) is associated with tube mats of the sea worm *Onuphis shirikishinaiensis*. The maximum density in 2002 collections was 1990 spec./m^2. The nature of the spatial distribution of isopods in the area has similar tendencies in 2001 and 2002 (Figure 15). Clusters with a higher density are associated with the southern part of Piltun Bay.

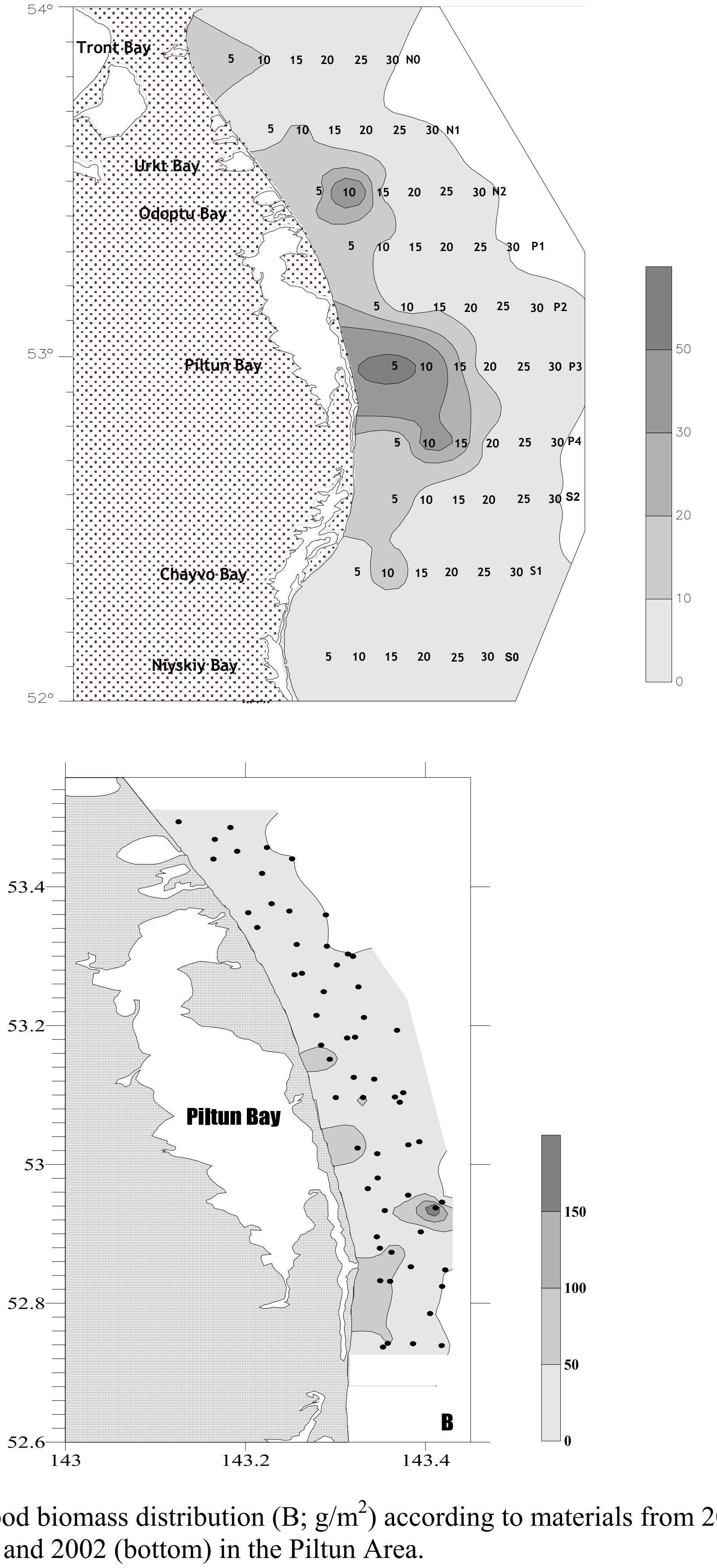

Figure 15. Isopod biomass distribution (B; g/m^2) according to materials from 2001 (top) and 2002 (bottom) in the Piltun Area.

Amphipods (*Amphipoda*). According to data from 2001, 10 species of amphipods had a frequency of occurrence higher than 25% at depths of 5 – 30 m in the water area studied, and three species had a frequency of occurrence higher than 50% (*Eohaustorius eous eous* – 81%, *Pontharpinia longirostris* – 75%, *Pontoporeia affinis* – 71%). The average amphipod biomass for the entire area was 114.1±15.7 g/m^2, in the range 11 – 30 m (Table 7 in Fadeev 2002). The most substantial variations in biomass and frequency of occurrence of common species are in the range 15 – 20 m.

In the 2002 collections, among the species with a frequency of occurrence higher than 25% in the range 11 – 30 m, nine species have the greatest biomass values: *Pontharpinia longirostris, Eohaustorius eous eous, Pontoporeia affinis, Eogammarus schmidti, Atylus collingi, Pontharpinia robusta, Anonyx nugax, and Westwoodilla sp.* The average apmphipod biomass is 42.7 g/m^2 and does not differ substantially from the data of 2001. The most significant changes in amphipod biomass occur at depths of 15 – 20 m (Table 7; Figures 13 – 14). For example, the average biomass is 110.9 g/m^2 in the range 11 – 15 m but already decreases to 22.5 g/m^2 in the range 16 – 20 m.

The nature of the spatial distribution of amphipod biomass in the Piltun Area has similar tendencies in 2001 and 2002 – a zone of increased biomass is associated with the southern and central parts of the area (Figure 16). According to data from 2001, the zone of increased biomass there extended through the range of 5 – 15 m, while 2002 collections covered only the deepest part of the zone – from 11 to 15 m. In the collections of both 2001 and 2002, 7 species of amphipods have the maximum frequency of occurrence (from 60 to 90%) and biomass (more than g/m^2) there: *Pontoporeia affinis, Anisogammarus pugettensis, Westwoodilla sp., Pontharpinia longirostris, Eohaustorius eous eous, Eogammarus schmidti* and *Pontharpinia robusta.*

Cumaceans (*Cumacea*). According to materials from 2001, the average cumacean biomass in the range 5 – 30 m is 17.1±3.5 g/m^2 at a frequency of occurrence in the water area of 26%. Substantial variations in cumacean biomass occur with an increase in the depth.

A similar pattern can be traced in the materials from 2002. The cumacean biomass is 5.35 g/m^2 in the range 11 – 15 m and increases to 48.89 g/m^2 at a depth of 30 m (Table 7; Figure 14). The average biomass is 10.95 ±2.8 g/m^2. The maximum cumacean colony density of 24,882 to 37,640 spec./m^2 with biomass from 84 to 113 g/m^2 is observed at depths of 30 – 32 m. Biomass varies in opposite directions for amphipods and cumaceans – amphipod biomass decreases with depth, while cumacean biomass increases. The sharpest changes are observed in the range 20 – 25 m (Figure 14). The maximum cumacean colony densities are observed in a zone of mass development of flat sea urchins in the range 25 – 30 m (Figures P1.5 and P1.6). In the 2002 collections, the frequencies of occurrence of cumacean *Diastilis bidentata* and flat sea urchin *Echinarachnius parma* are 44% and 45%, respectively.

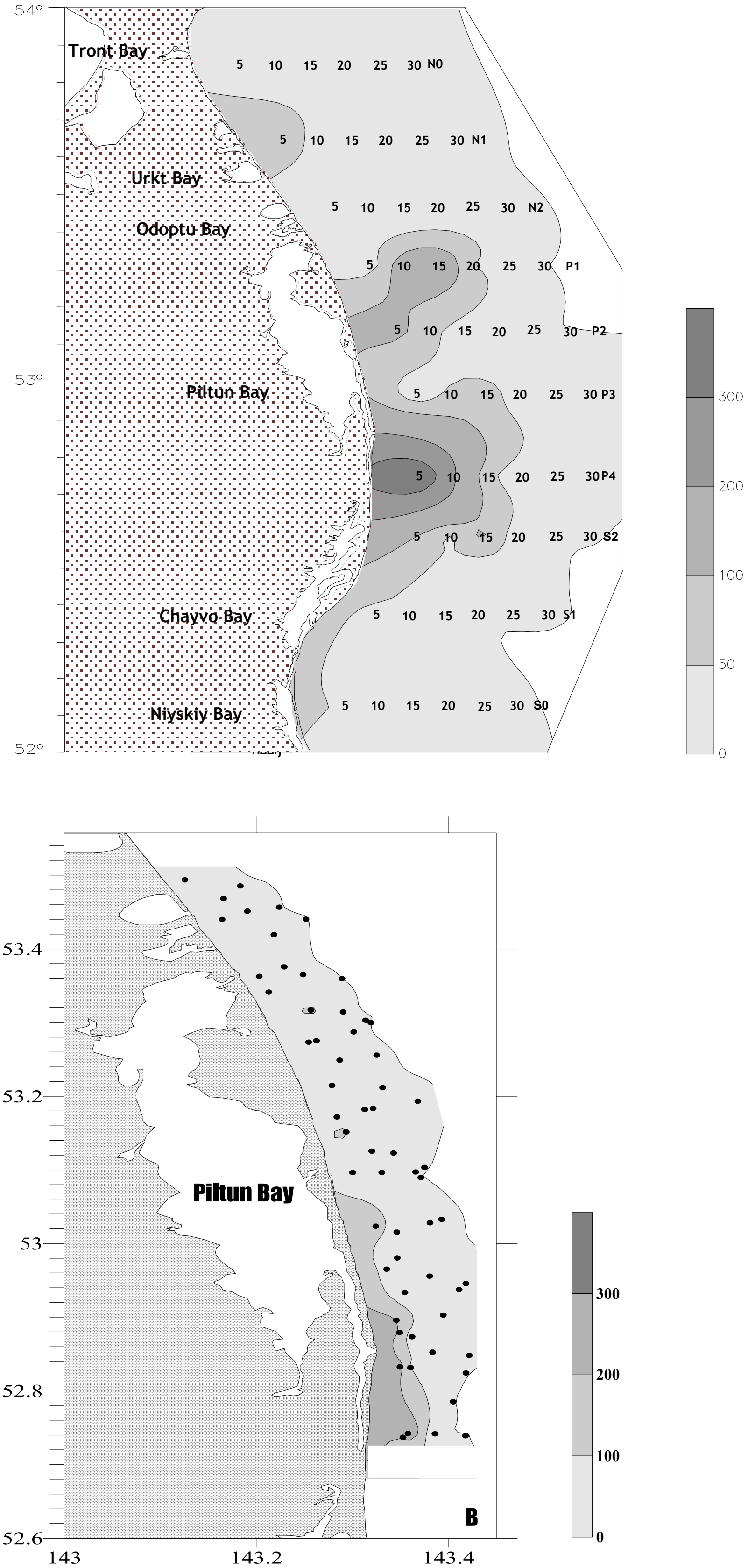

Figure 16. Amphipod biomass distribution (B; g/m^2) according to materials of 2001 (top) and 2002 (bottom) in the Piltun Area.

As in the materials from 2001, no clear relationship is observed between the numbers and biomass of flat sea urchins and cumaceans in the samples. Flat sea urchins and cumaceans are encountered together at most of the stations. At the same time, flat sea urchins + cumaceans or only flat sea urchins or only cumaceans may be found in individual samples at the same station. The number of samples with cumaceans but without flat sea urchins does not exceed 5% of the total number of samples in the range 20 – 30 m. This attests to the intrinsic patchiness in the distribution of flat sea urchins and cumaceans.

Bivalve mollusks (*Bivalvia*). According to data from 2001, only three species had a frequency of occurrence higher than 25% in the area of Piltun Bay, and all these species were also dominant in terms of biomass: *Siliqua alta, Macoma lama* and *Megangulus luteus* (= *Peronidia lutea*; the mollusk is more widly known under that name). For the area as a whole, the biomass of *Bivalvia* increases somewhat from 5 m to 10 – 15 m, with a subsequent decrease at depths greater than 20 m. The averge biomass value for bivalve mollusks for the entire area at depths of 11 – 30 m was 103.2±25.15 g/m^2.

According to materials from 2002, the averge biomass of bivalve mollusks in the range 11 – 30 m is 40.36±8.81 g/m^2; the proportion of mollusks in the total benthos biomass decreases with an increase in depth (Table 7; Figure 13). The four species *Megangulus luteus* (frequency of occurrence P = 56%), *Macoma lama* (P = 45%), *Siliqua alta* (P = 31%) and *Spisula voyi* (P = 21%) constitute the basis for bivalve mollusk biomass.

The spatial distribution of bivalve mollusks in the Piltun Area is similar in nature for 2001 and 2002 (Figure P1.7). Areas of increased biomass have a spotty distribution and are associated with the southern, middle and northern parts of the area.

4.1.2. Size composition of common species of amphipods

Amphipods are the most used prey type in the diet of gray whales (Chapter 4.4). It is thought that the particular features of the filter apparatus of the whales condition the existence of a threshold amphipod body size, below which the amphipods cannot be used for food. This threshold is from 6 mm (Nerini 1984a, Rice and Wolman 1973) to 8 mm (Nerini 1984b). In addition, analysis of the size composition of amphipods makes it possible to assess the nature of the replenishment of amphipod colonies with young.

The size composition of six common species from the area of Piltun Bay was analyzed in 2001 based on small samples (from 200 to 400 specimens): *Ampelisca eschrichti, Anonyx nugax pacificus, Pontoporeia affinis, Protomedeia fasciata, Pontharpinia longirostris* and *Anisogammarus pugettensis.* It was noted that the presence of a significant proportion of young individuals was characteristic of all species, which attested to the absence of any permanent impact on the amphipod colonies (Fadeev 2002).

Based on the materials from 2002, the size composition of was analyzed in accordance with the Statement of Work for the common species of amphipods from the Piltun and Offshore areas and from gray whale Feeding Sites. A total of 9875 specimens of nine species of amphipods were measured. In addition to the species typical of the Intermediate Area, common species of amphipods of the Offshore Area were studied: *Ampelisca eschrichti, Anonyx nugax pacificus, Photis reinchardi, Onissimus krassini* and *Eogammarus shmidti.*

The results of amphipod morphometry are presented in Table 8, and distribution histograms are shown in Figure 17 and in Appendix 1 (Figures P1.8 – P1.11). After the body length distribution histograms had been plotted, the proportion of individuals with a body length exceeding the threshold of 6 mm was determined for each species. The proportions of individuals with a body length greater than 6 mm were as follows: *Eogammarus schmidti* – 100% (n = 195), *Pontoporeia affinis* – 96% (n = 1255), *Anisogammarus pugettensis* – 95% (n = 200), *Ampelisca eschrichti* – 94% (n = 2225), *Onissimus krassini* – 83% (n = 455), *Anonyx nugax pacificus* – 81% (n = 2400), *Protomedeia fasciata* – 62% (n = 2390), *Pontharpinia longirostris – 58%* (n = 590). The only species in whose sampling individuals with a body length <6 mm were prevalent (83%) was *Photis reinchardi.* This species has a high frequency of occurrence and a large population in the Offshore Area in the zone of colonies of *Ampelisca eschrichti.* Hence, most of the common species of amphipods have a significant (>80%) proportion of individuals larger than 6 mm, i.e., are available as food for whales.

4.1.3. Set of species in areas of increased benthic biomass

As mentioned above, a good match is observed in the spatial distribution of areas of increased biomass of food groups within the Piltun Area according to data from 2002 and 2001 (Figures 15, 16 and P1.7). The clearest coincidence is observed in the southern part of Piltun Bay, where the areas of increased biomass occupy depths of 5 to 15 m (Fadeev 2002). In other parts of the Piltun Area, the areas of increased biomass are located at depths of 5 – 12 m, which did not allow mapping them according to the materials from 2002 (the minimum sampling depth was 11 m).

For analysis of the quantitative abundance of benthos in the areas of increased biomass, 16 stations (48 samples) with a prevalence of potential benthic prey – amphipods, isopods and bivalve mollusks – were selected. All these stations are in the range 11 – 15 m, with an average depth of 13.8±0.6 m. The averaged benthos composition (for the 16 stations) in areas of increased biomass is shown in Table 9.

Tabel 8. Statistical characteristics of the size composition of common species of amphipods.

Characteristic	*Ampelisca eschrichti*		*Anonyx pacificus*		*Pontoporeia affinis*		*Protomedeia fasciata*	
	2001	2002	2001	2002	2001	2002	2001	2002
Average, mm	11.38	13.79	10.32	10.72	9.21	10.68	7.35	7.16
Standard error	0.43	0.31	0.33	0.28	0.75	0.24	0.09	0.18
Min	4	3	3	2.5	3	3	2	2
Max	30	31	29	35	19	17	16	16
N, specimens	210	2015	200	2200	220	1035	400	1690

Characteristic	*Anisogammarus pugettensis*	*Pontharpinia longirostris*	*Photis reinchardi*	*Onissimus krassini*	*Eogammarus shmidti*
	2001	2002	2002	2002	2002
Average, mm	13.6	6.92	4.83	11.39	17.08
Standard error	0.41	0.21	0.22	0.59	0.74
Min	5	2	1.5	1.5	6
Max	28	16	5	28	29
N, specimens	200	590	455	465	195

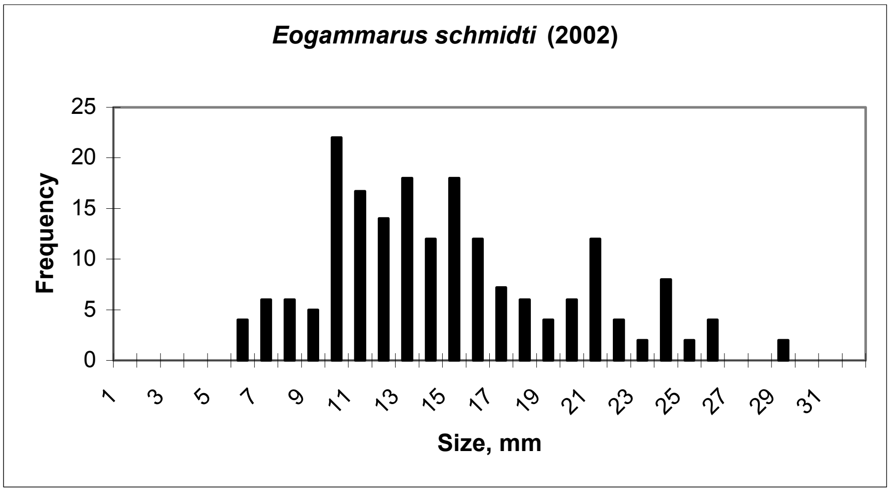

Figure 17. Distribution of body sizes (mm) of amphipod *Eogammarus schmidti*.

Within the benthos assemblage, three groups have a 100% frequency of occurrence: amphipods, isopods and bivalve mollusks. Polychaetes are encountered at 81% of the stations. Amphipods account for 51% of the biomass and 68.5% of the population of the benthos assemblage, while the other three groups account for 40% of the biomass and 21% of the population.

More than 95% of the amphipod biomass is made up of the four species *Pontharpinia longirostris, Eohaustorius eous eous, Pontoporeia affinis* and *Eogammarus schmidti.* All these species also have a high frequency of occurrence at depths of 5 – 10 m (Fadeev 2002). The isopod biomass is made up primarily of *Synidotea cinerea* (97%). Three species account for 95% of the bivalve mollusk biomass: *Megangulus luteus, Siliqua alta* and *Spisula voyi.*

4.1.4. Comparison to control test zone

Stations C1S-C5N (Figure P1.1, Figure 1) were planned as a control test zone for the stations of the Piltun Area. All these stations are located at depths of 32 – 51 m to the east of the stations of the Piltun Area. At the same time, it follows from the materials of 2002 and 2001 that the sections of the Piltun Area which are richest in potential gray whale prey and most interesting from the point of view of the gray whale diet are located at depths of 5 – 10(15) m. Areas where flat sea urchins *E. parma*, which are not suitable for food, are prevalent are located at depths greater than 15 – 20 m. The control test zone C1S-C5N only confirms this – flat sea urchins are prevalent at all the stations, with an average biomass of more than 450 g/m^2 (Table P4.2).

It is of greater interest to consider stations located to the south in a similar range of depths as control stations for the Piltun Area. These might be the nearshore stations at depths of up to 15 m in the area of Chayvo Bay (Intermediate Area) and the control stations Cb1-Cb4 in the Chayvo Bay – Niyskiy Bay area. Figure 17.1 shows the variation in the average biomass of amphipods, isopods and the flat sea urchin *E. parma* at stations located in the coastal zone from Piltun Bay to Niyskiy Bay, i.e., in a north-south direction. The northernmost stations have the greatest abundance of potntial benthic prey and correspond to the stations in the southern part of Piltun Bay (Table 9). These stations are followed by 4 nearshore stations of the Intermediate area (Chayvo Bay; Figure 18) and 4 stations in the area from Chayvo Bay to Niyskiy Bay (Figure 1). The highest biomass values for amphipods and isopods are observed in the southern part of Piltun Bay and at a station between Piltun Bay and Chayvo Bay (st. 1- -1). The sharpest drop in amphipod and isopod biomass is observed at stations in the northern and central parts of Chayvo Bay (st. 1- -2 and st. 2- -2). Moving farther to the south, the crustacean biomass is minimal. Hence the most substantial changes in the benthic prey biomass are observed in the middle part of the Chayvo Bay. A similar trend has been observed in the materials from 2001 (Fadeev 2002).

Table 9. Quantitative abundance of potential gray whale prey in areas of increased biomass in the Piltun Area.

Characteristic	Taxonomic Group											
	Amphipoda		*Isopoda*		*Bivalvia*		*Polychaeta*		Rest		Totals	
	A	B	A	B	A	B	A	B	A	B	A	B
Medium	3117	121.34	586	42.66	189	40.52	192	13.3	416	23.62	4548	240.86
St. error	725	13.04	134	7.27	93	10.19	84	2.35	110	11.6	777	32.08
St. error, %	23.3	10.9	22.9	17.9	49.2	23.9	43.7	17.7	26.4	9.8	17.1	13.3
Minimum	98	32.3	10	2.39	5	12.3	0	0.01	0	0	360	71.32
Maximum	9460	329.83	1880	97.4	1540	113.33	1180	35.93	1442	152.72	11870	542.49
N, samples	48		48		48		48		48		48	

Notes: groups that account for less than 10% of the average biomass (Cumacea, Decapoda, Echinodermata, Gastropoda) are combined in the "Rest" column.

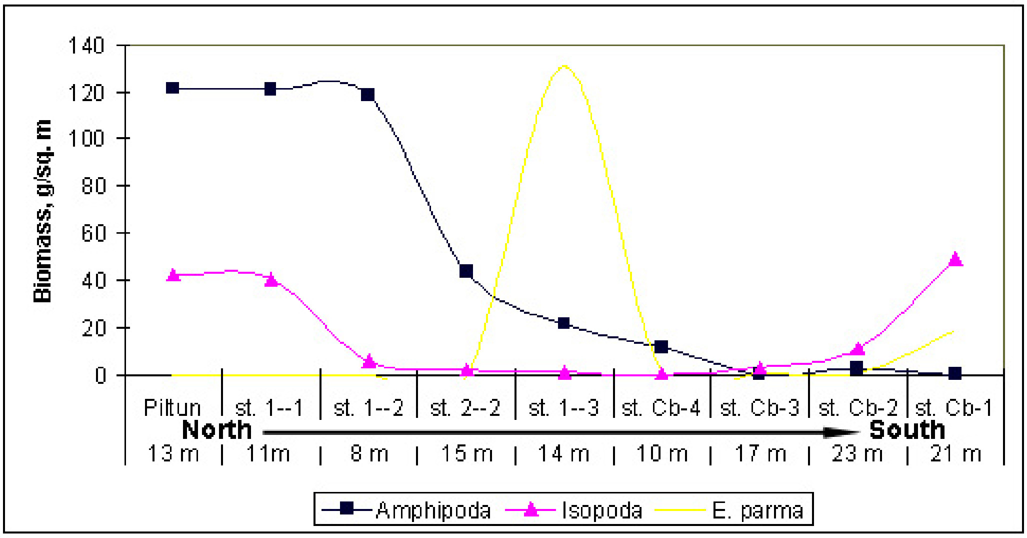

Figure 17.1. Variation in biomass of 3 macrobenthos groups at nearshore stations in the area Piltun Bay – Niyskiy Bay.

Stations: **Piltun** – stations of the southern part of the Piltun Area;

st.1- -1, st.1- -2, st.2- -2, st.1- -3 – stations of the Intermediate Area (Chayvo Bay);

st.Cb-4, st.Cb-3, st.Cb-2, st.Cb-1 – sttions in the Chayvo Bay – Niyskiy Bay area.

4.2. Intermediate Area

4.2.1. Quantitative abundance and distribution of benthos

A diagram of the 2002 stations completed in 2002 in the Intermediate Area is shown in Figure 18. There were 13 stations completed in the area (39 bottom grab samples) at depths of 8 to 23 m, with an average collection depth of 17.2±1.3 m. The average benthos biomass for the entire area is 422.14±106.15 g/m^2 (n=13). As in the Piltun Area, substantial changes in benthos occur with an increase in depth (Table 10, Figure 19). The amphipod biomass decreases sharply from 119.5±12.01 g/m^2 at a depth of 10 m to 0.37 g/m^2 at 25 m. The biomass of flat sea urchins increases with depth and reaches maximum values at depths of 20 – 25 m (up to 420 g/m^2).

4.2.2. Benthos assemblages

Analysis of the benthos composition indicates significant irregularity. Classification of 13 stations in regard to the benthos composition and the biomass of individual groups make it possible to distinguish 3 benthos assemblages (Figure 20):

1. Shallow-water assemblage (three stations, average depth 11.3±2.0 m) with prevalence of amphipods at an average biomass of 94.2±25.3 g/m^2. The assemblage includes the same amphipod species as in the Piltun Area in the range 11 – 15 m, isopods *Synidotea cinerea* with a biomass of 40.6 g/m^2, and bivalve mollusks. Hence the materials of 2002 confirm the conclusion that relatively high biomass of potential gray whale prey extends south of Piltun Bay to Chayvo Bay (Fadeev 2002). The amphipod assemblage includes stations 1- -1, 1- -2 and 2- -2 (Figure 18).

2. Assemblage with prevalence of individual *Ascidia vegae* (four stations, average depth 20±1.6 m). The assemblage occupies sections in the southern part of the area and constitutes a boundary with the Offshore Area (stations 3- -2, 3- -3, 4- -3 and 5). The biomass of the dominant species averages 507±55.4 g/m^2; cumaceans and marine worms are encountered in small numbers here.

3. Assemblage with prevalence of flat sea urchins *E. parma* (six stations, average depth 18±1.4 m). In includes stations 1- -3, 2- -1, 2- -3, 3- -1, 4- -1 and 4- -2 (Figure 18). The biomass of flat sea urchins averages 291.3±106.1 g/m^2.

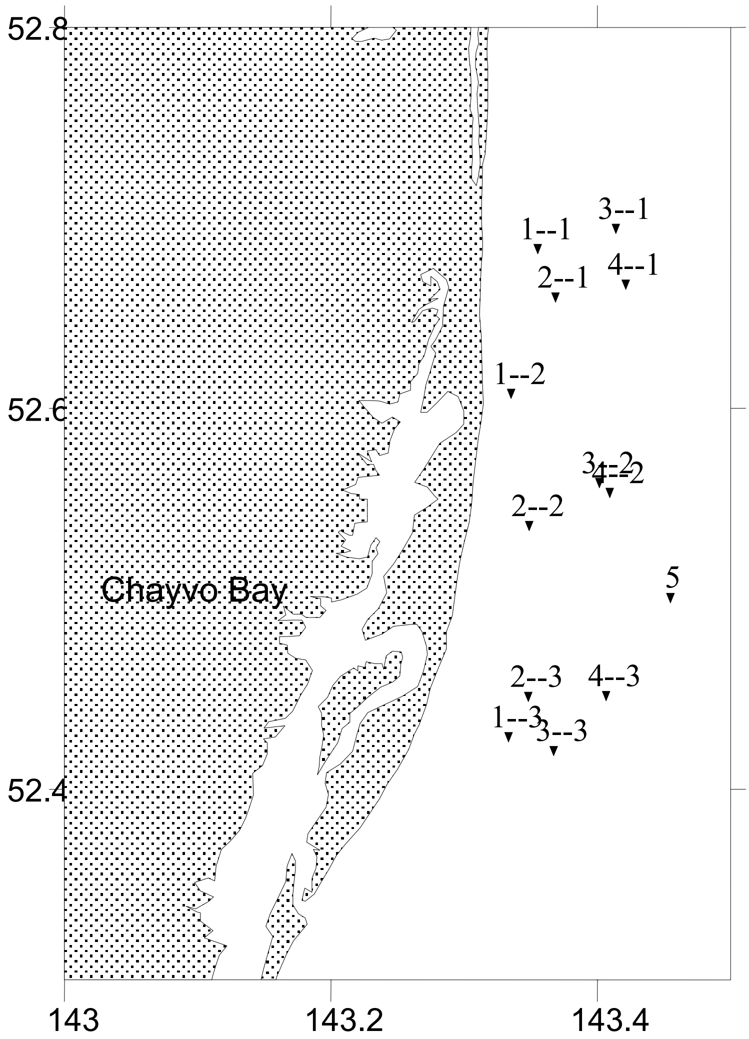

Figure 18. Diagram of the locations of stations in the **Intermediate Area.**

Table 10. Distribution of macrobenthos biomass (g/m^2) in the Intermediate Area according to materials of 2002 field studies.

Group	Frequency of occurrence	Depth				Average biomass	Standard error
		10 m	15 m	20 m	25 m		
Amphipoda	100	119.52	24.89	5.5	0.37	37.57	12.01
Bivalvia	100	17.12	4.58	4.3	9.9	8.06	3.31
Polychaeta	96.2	1.56	10.36	34.29	14.95	17.78	6.99
Cumacea	84.6	16.35	0.18	19.34	10.75	11.81	6.48
Echinoidea	61.5	0	113.42	420.19	253.54	233.47	107.25
Isopoda	50	23.29	1.28	0.54	0	6.28	3.09
Ascidia	46.2	0	10.94	155.27	196.89	110.88	59.54
Actiniaria	30.8	0	0	16.35	6.84	7.13	3.47
TOTAL		177.84	165.65	655.78	493.24	422.14	106.15

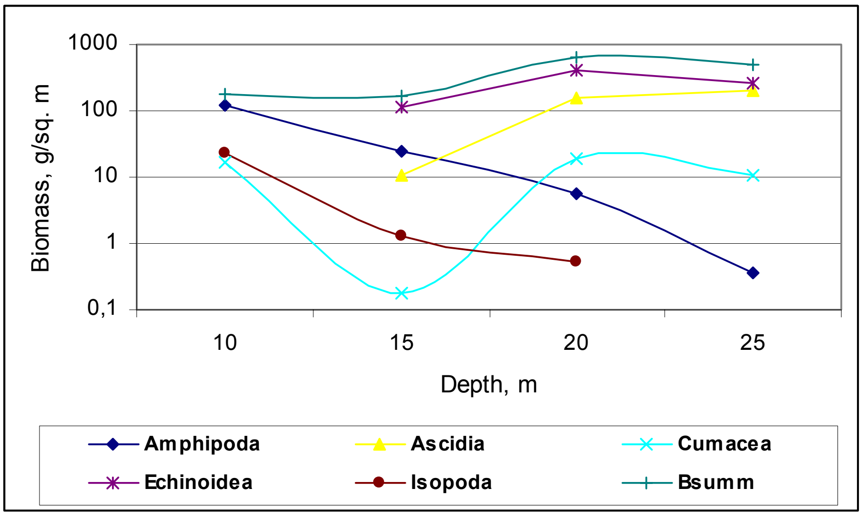

Figure 19. Variation in the biomass of taxonomic groups with depth in the Intermediate Area.

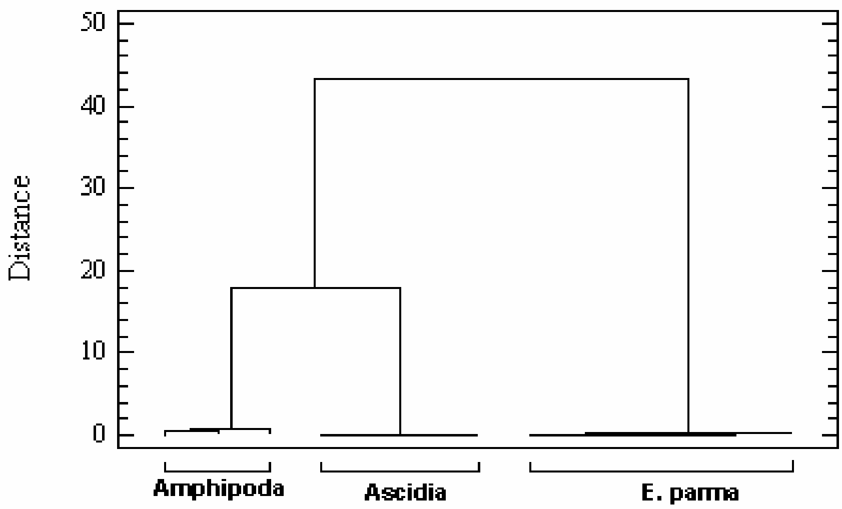

Figure 20. Three faunal assemblages of the Intermediate Area.

The two latter assemblages are encountered in a patchy distribution in the area with a assemblage bottom microrelief and active hydrodynamics. According to data of an echometric profile made in the area of the assemblages, one can assume that the *Ascidia* assemblage is associated with relief elevations made up of grains of varying grain size with an addition of exposed detritus. The *E. parma* assemblage occupies more level relief areas.

4.2.3. Comparison to control test zone

Stations C1 – C3 (Figure P1.2, Figure 1) were planned as a control test zone for the Intermediate Area. These stations are situated east of the area in the range 24 – 33 m, average depth 37 m. The average depth of the stations of the Intermediate Area is 17.2±1.3 m. There is little value in the information produced by comparing stations from areas differing so much in depth. It is more logical to consider stations C1 – C3 as a control test zone for the Offshore Area, since they are in a similar depth range and are located north of this area. Stations Cb1 – Cb4 (Figure P1.3, Figure 1), located south of the Intermediate Area in a similar depth range, can serve as control stations for the Intermediate Area. Data on the abundance of benthos at these stations are given in Table P4.6.

Analysis indicates that sharp variations in the abundance of benthos occur in the nearshore zone south of the Intermediate Area. Amphipods with an average biomass of 94.2±25.3 g/m^2 and isopods *Synidotea cinerea* with a biomass of 40.6 g/m^2 are prevalent in the benthos shallow-water assemblage of the Intermediate Area. The average total benthos biomass at the control stations is 90.9 g/m^2; the amphipod biomass decreases to 3.7 g/m^2 , and the isopod biomass decreases to 15.9 g/m^2.

The similar nature of the variation in the abundance of benthos in the middle part of Chayvo Bay – Niyskiy Bay area was observed previously based on materials from 2001 (Fadeev 2002).

4.3. Offshore Area

4.3.1. Quantitative abundance and distribution of benthos

There were 36 stations (113 bottom grab samples) in the Offshore Area at depths of 20 to 60 m (average depth 37±1.6 m, n=36). A diagram of the locations of the stations and the planned control test zone is shown in Figure 21 and Figure P1.3.

There are sandy bottoms in most of the Offshore Area: well-sorted fine-grained sand – 13 stations; and sand of varying grain size (medium and fine) – 10 stations. Poorly sorted mixed gravel and sand bottoms with an addition of exposed detritus (see section 3.2) were observed at 13 stations.

There were 20 benthos taxonomic groups recorded in the collections; they differ substantially in the frequency of occurrence at the stations (Table 11).

Table 11. Frequency of occurrence of benthos taxonomic groups in the Offshore Area.

Frequency of occurrence (P,%) taxonomic groups, n=36							
P>50%		P = 25-50%		P = 10-25%		P<10%	
Group	P, %	Group	P, %	Group	P, %	Group	P, %
Amphipoda	100	*Gastropoda*	44.4	*Nemertinea*	22.2	*Caprellida*	9.7
Cumacea	97.2	*Hydroidea*	29.2	*Decapoda*	22.2	*Bryozoa*	6.9
Bivalvia	93.1	*Echinoidea*	26.4	*Sipuculida*	20.8	*Balanus*	6.9
Polychaeta	90.3			*Mysidacea*	19.4	*Isopoda*	6.9
Actinia	59.7			*Holoturoidea*	15.3	*Ophiuroidea*	5.6
						Ascidiacea	2.8
						Pantopoda	2.6

The groups with a frequency of occurrence greater than 50% form the basis of the benthos biomass through the water area of the Offshore Area: amphipods, cumaceans, bivalve mollusks, marine worms and sea anemones. Also significant are groups with a low frequency of occurrence in regard to the overall area but which form local sections with very high biomass – flat sea urchins *E. parma*. For the Offshore Area as a whole, these taxonomic groups account for 94% of the average total benthos biomass – 1052.8±104.8 g/m^2 (n=36). The characteristics of quantitative abundance of benthos for the Offshore Area are given in Table 12.

Data on all 36 stations of the Offshore Area were used in calculating the average biomass values for the benthos groups listed in Table 12. It must be taken into consideration, however, that benthos of the area is not homogeneous, and both groups potentially used in the diet of whales and groups not included in the whale diet are present.

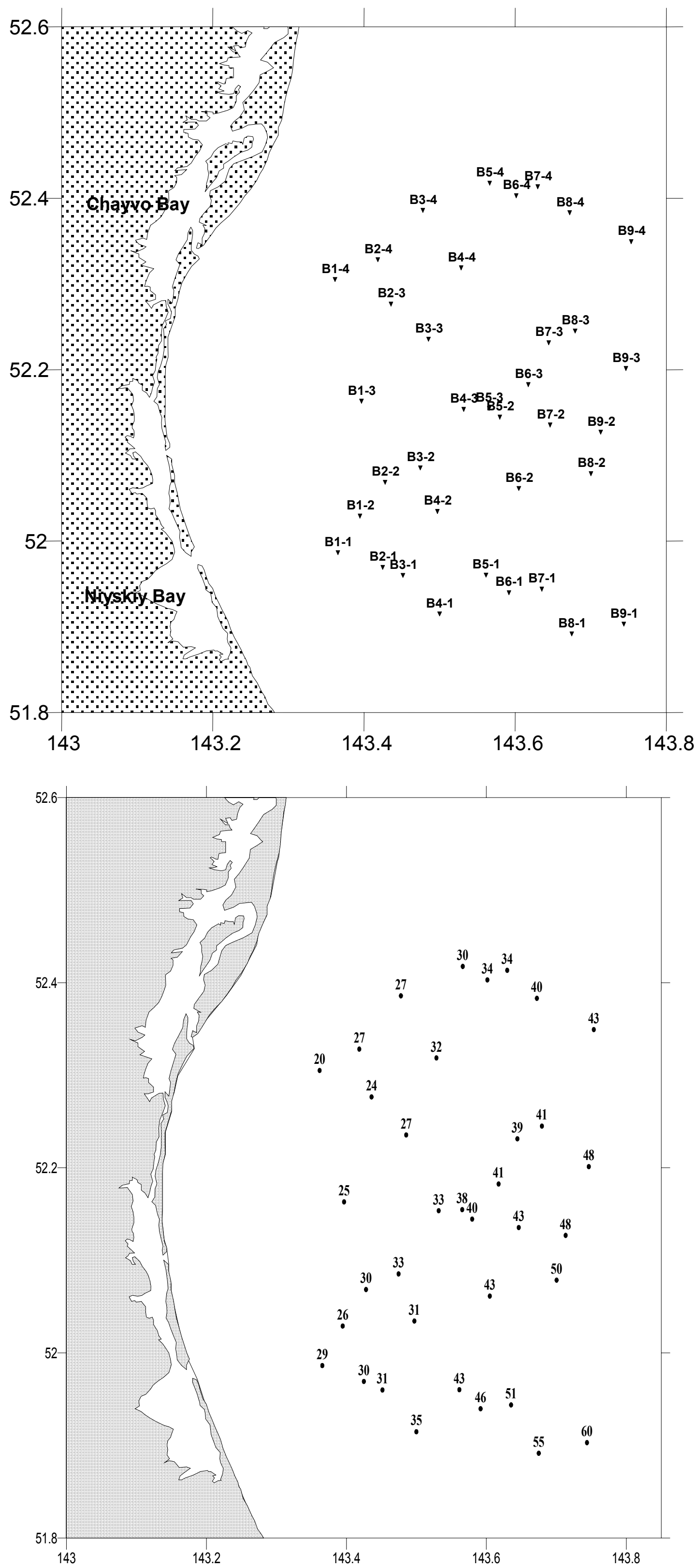

Figure 21. Diagram of the locations of stations in the Offshore Area (top) and the depths (m) of individual stations (bottom).

Table 12. Distribution of macrobenthos biomass (g/m^2) in the Offshore Area based on materials of field studies in 2002 (36 stations).

Characteristic	Taxonomic Group						Average biomass for area
	Amphipoda	*Actinia*	*Bivalvia*	*Echinoidea*	*Cumacea*	*Polychaeta*	
Average biomass	437.12	149.21	147.49	129.78	82.13	40.11	1052.77
St. error	56.2	37.92	44.34	47.87	18.73	10.76	104.78
Proportion in average biomass, %	41.5	14.2	14	12.3	7.8	3.8	100%
Minimum	3.5	0	0.1	0	0	0.9	65.6
Maximum	1312.7	902	1445.1	1124.5	477.2	298.9	2570.1
Frequency of occurrence (P, %)	100	59.7	93.1	26.4	97.2	90.3	

4.3.2. Benthos assemblages

Cluster analysis was used to discover irregularities in the distribution of benthos – the 36 stations were grouped according to similarity of the quantitative ratios of benthos taxonomic groups. The classification results are presented in a dendrogram (Figure 22). Three benthos assemblages differing in the biomass ratios of the groups (Table 13) can be distinguished in the Offshore Area:

I. Assemblage with prevalence of flat sea urchins *E. parma*. Average depth – 30.8±3.1 m (7 stations). Flat sea urchins with an average biomass of more than 640 g/m^2 (70% of the total biomass) are prevalent at all stations.

This assemblage was described in the Intermediate Area based on materials from 2002 and in the Piltun Area at depths greater than 20 m based on data from 2002 and 2001. In the Offshore Area, it occupies the northern part at depths of 20 to 43 m. An assemblage with prevalence of Ascidia (sea anemones), as seen in the Intermediate Area, was observed at one station (st. B3-4) here as well (the station is located not far from st. 5 of the Intermediate Area, which is associated with this assemblage).

II. Assemblage with prevalence of cumaceans *D. bidentata* and amphipods *Ampelisca eschrichti.* Average depth – 28.2±1.4 m (4 stations). The average biomass is 538.6±143.3 g/m^2, and the dominant species account for more than 90% of the biomass (cumaceans – 61%; and amphipods – 31%). The assemblage is distributed in patches at depths of 25 to 31 m, primarily in the western part of the area. Amphipod *Ampelisca eschrichti* is a subdominant species with biomass of 167 g/m^2. The distribution of cumaceans was considered in describing the Piltun Area (section 4.1.1), also based on the materials from 2001 (Fadeev 2002).

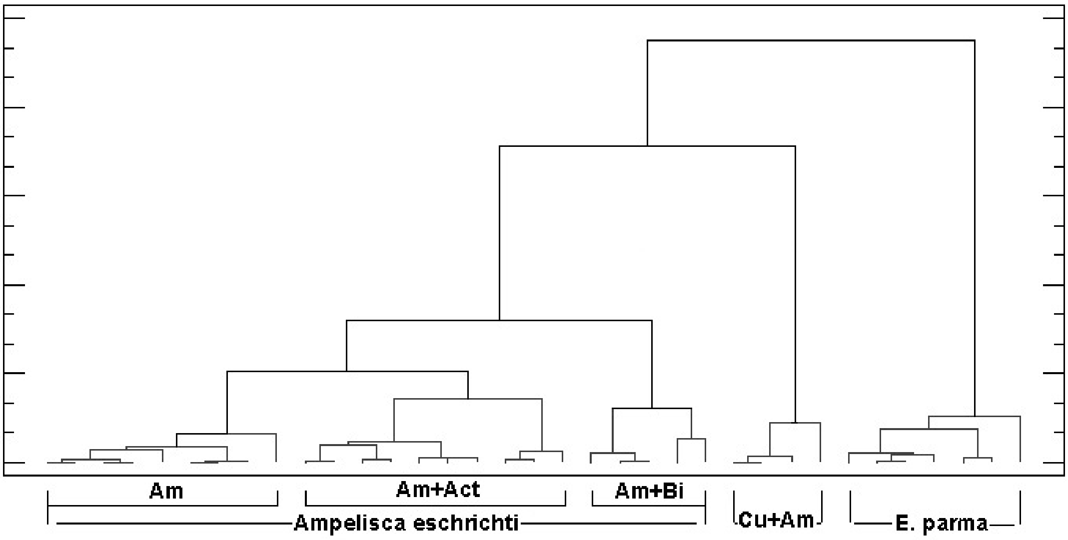

Figure 22. Dendrogram of the similarity of Offshore Area stations in regard to benthos structure. For description of assemblages and groupings, see section 4.3.2. and Table 12.

Table 13. Quantitative characteristics of Offshore Area benthos assemblages.

Characteristic	Taxonomic Group						Average biomass
	Amphipoda	*Actinia*	*Bivalvia*	*Echinoidea*	*Cumacea*	*Polychaeta*	
	I. Assemblage *Echinarachnius parma* (E. parma)						
Average biomass	85.26	50.57	37.89	641.2	74.93	18.51	917.88
St. error	36.81	31.2	14.77	135.08	42.13	9.91	167.13
Proportion in average biomass, %	9.3	5.5	4.1	69.9	8.2	2	100%
	II. Assemblage *Diastilis bidentata* + *Amphipoda* (Cu+Am)						
Average biomass	167.45	0	19.33	0	327.9	4.6	538.56
St. error	65.85	0	17.33	0	83.08	2.81	143.3
Proportion in average biomass, %	31.1	0	3.6	0	60.9	0.9	100%
	III. Assemblage *Ampelisca eschrichti*						
Average biomass	610.0	195.32	231.77	6.65	40.93	49.72	1180.78
St. error	28.93	112.25	135.31	4.24	14.68	24.53	157.41
Proportion in average biomass, %	51.7	16.5	19.6	0.5	3.5	4.2	100%
	III.1. Grouping *Ampelisca eschrichti* + *Bivalvia varia* (Am+Bi)						
Average biomass	559.18	151.75	502.35	0	22.7	33.45	1563.6
St. error	124.28	96.73	84.47	0	11.56	8.7	394.7
	III.2. Grouping *Ampelisca eschrichti* + *Actiniaria* (Am+Ac)						
Average biomass	654.1	364.8	94.16	7.62	29.56	107.88	1309.09
St. error	99.2	90.93	38.96	7.62	11.76	35.57	230.37
	III.3. Grouping *Ampelisca eschrichti* (Am)						
Average biomass	611.41	26.39	92.59	1.78	69.97	17.78	867.18
St. error	114.09	13.63	34.84	1.78	9.94	3.93	155.04

III. Assemblage with prevalence of amphipod *Ampelisca eschrichti.* Average depth – 41±1.8 m (23 stations). The assemblage occupies most of the Offshore Area. The average biomass is 1180±157 g/m^2; the biomass of the dominant group – amphipods – reaches 610 g/m^2 (52% of the total biomass). Among the amphipods, sharply dominant in regard to frequency of occurrence, colony density and biomass is *A. eschrichti.* Its biomass makes up 96-99% of the total amphipod biomass at certain stations.

It follows from the dendrogram (Figure 22) that the *Ampelisca* assemblage make up three groups (groupings). High quantitative abundance of the amphipod *A. Eschrichti* is common to them. However, there are a number of additional groups with high abundance in the groupings (Table 13).

In **grouping III.1** (**Am+Bi**), with an average benthos biomass of 1563 g/m^2, the *Ampelisca* amphipod biomass is 560 g/m^2, while the biomass of the subdominant group – bivalve mollusks (*Spisula sachalinensis*, *S. voyi)* – is 502 g/m^2, at 100% frequency of occurrence of amphipods and bivalve mollusks. The average depth of occurrence of the grouping is 40±4.4 m.

In **grouping III.2 (Am+Ac)**, the average benthos biomass is 1309 g/m^2. The biomass of the dominant *Ampelisca* species reaches 654 g/m^2, while that of the subdominant *Actinia* group at 100% frequency of occurrence is 365 g/m^2. The grouping was observed at 10 stations at depths of 34 to 50 m, with an average of 43.3±1.5 m.

For **grouping III.3 (Am)**, sharp prevalence of amphipod *A. Eschrichti* over the other groups is characteristic. The *Ampelisca* biomass is 611 g/m^2, with an average biomass for the whole grouping of 867 g/m^2. Classified in the grouping are nine stations in a range from 26 to 60 м, with an average of 38.8±3.8 m.

All three groupings have a patchy distribution within the zone of dominance of *A. eschrichti,* which could be the result of local hydrological conditions or of the distribution of bottom sediments (Figures 8-10). The following species are dominant in regard to biomass in the benthos assemblages: flat sea urchins *Echinarachnius parma*, cumaceans *Diastilis bidentata*, amphipods *Ampelisca eschrichti*, and bivalve mollusks *Spisula sachalinensis*, according to the type of feeding, are classified as mobile microplankton eaters that filter seabed water and are associated with hydronamically active sections of the shelf. A high microplankton concentration in the seabed water and the presence of steady bottom currents that facilitate the transfer of microplankton are necessary conditions for their existence. Active natural hydrodynamics promotes the transfer of larvae from existing sestonophage colonies to new areas and result in a patchy (spotty) distribution.

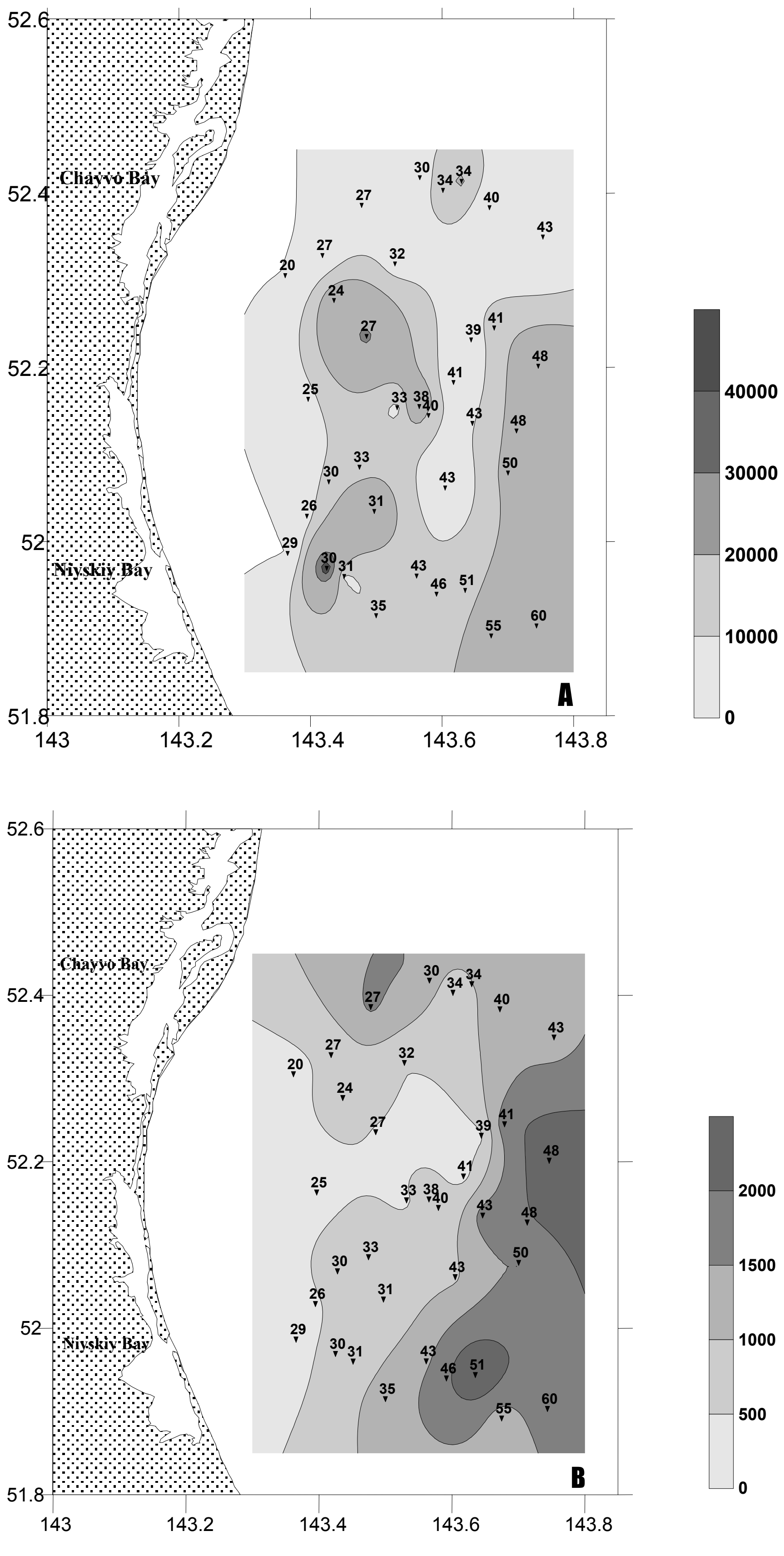

Figure 23. Distribution of overall colony density (A, spec./m^2) and biomass (B, g/m^2) of benthos in the Offshore Area. Hereinafter: number near the stations refer to depth, m.

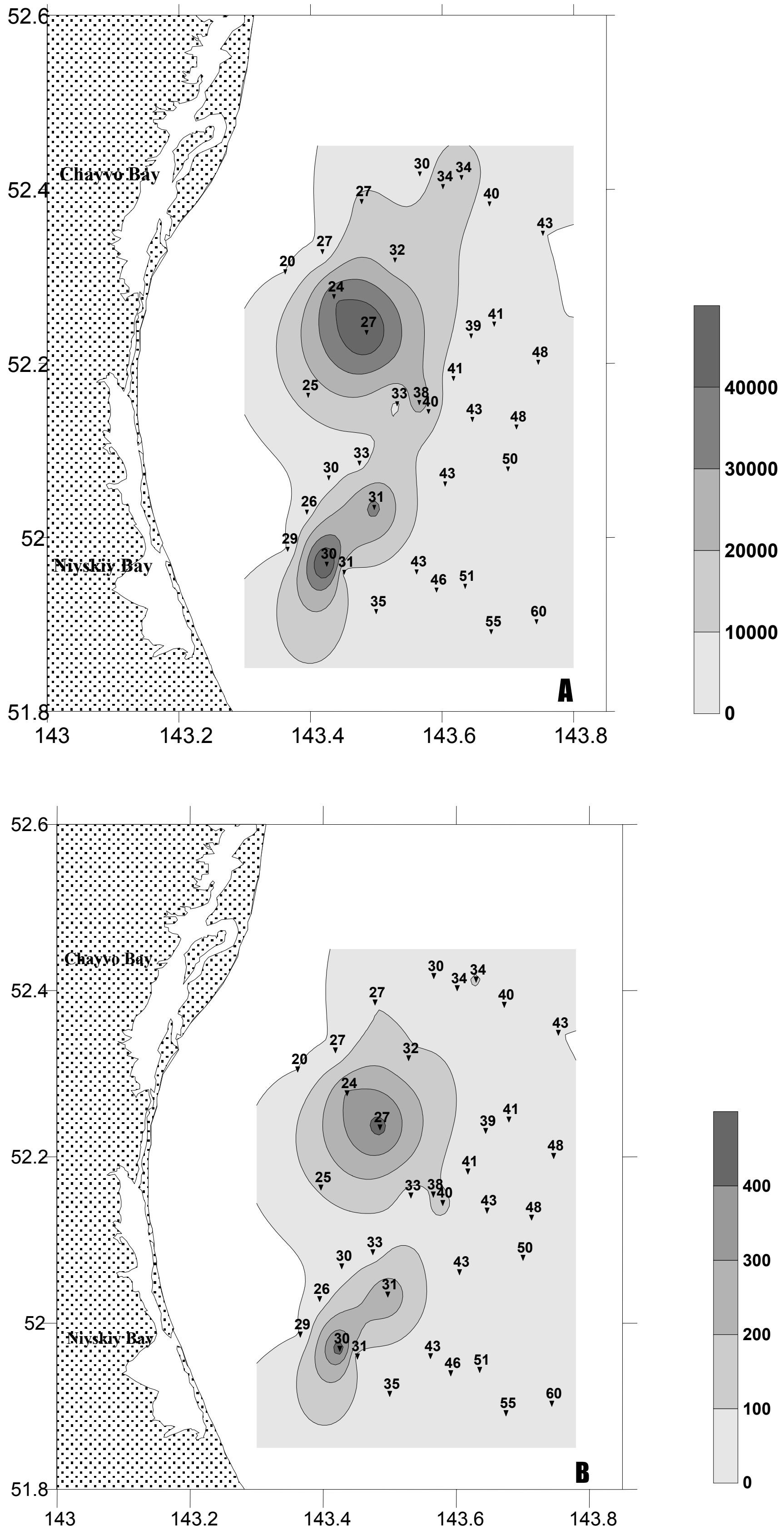

Figure 24. Distribution of colony density (A, spec./m^2) and biomass (B, g/m^2) of cumaceans in the Offshore Area.

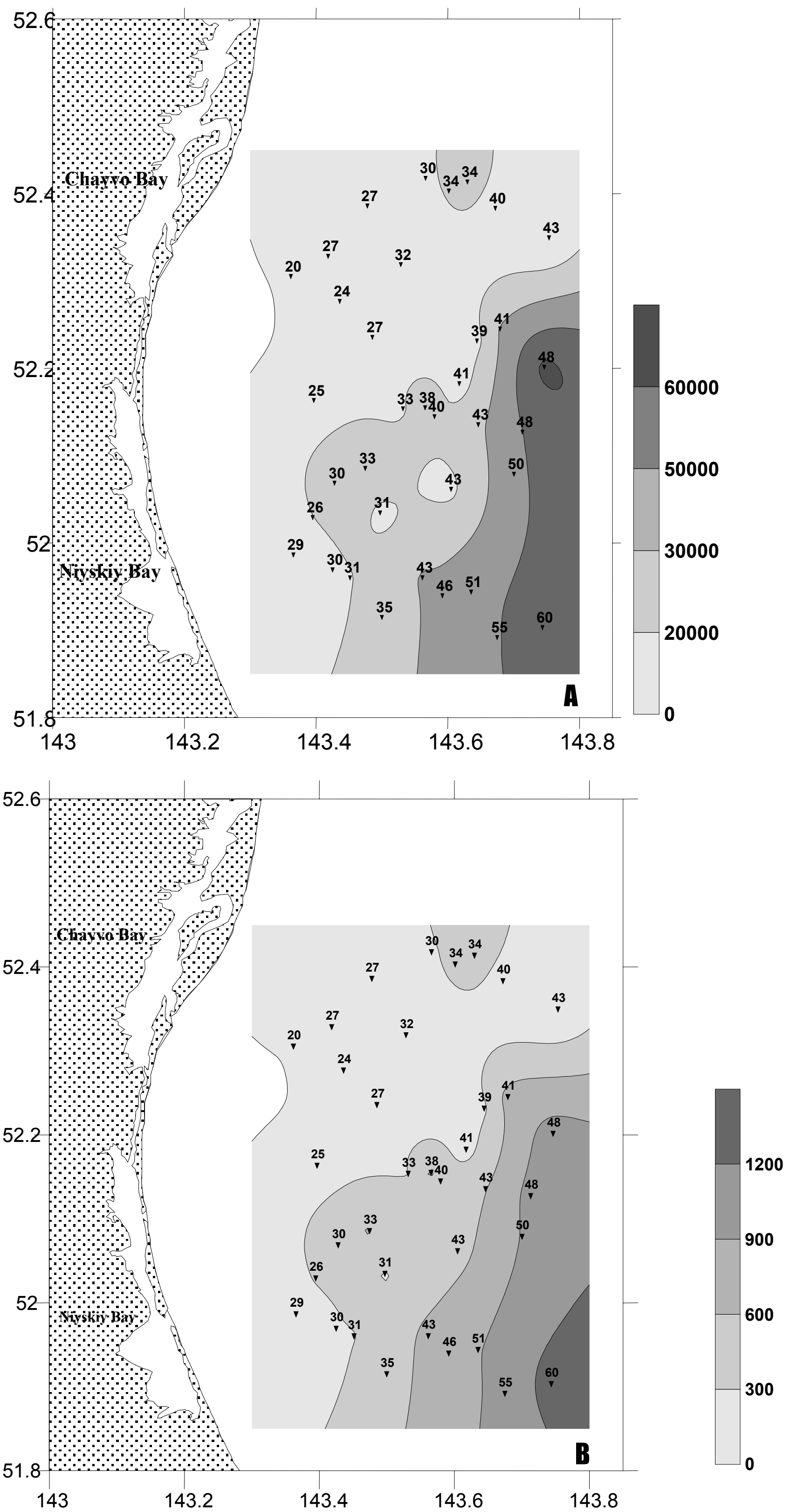

Figure 25. Distribution of colony density (A, spec./m^2) and biomass (B, g/m^2) of Amphipods in the Offshore Area.

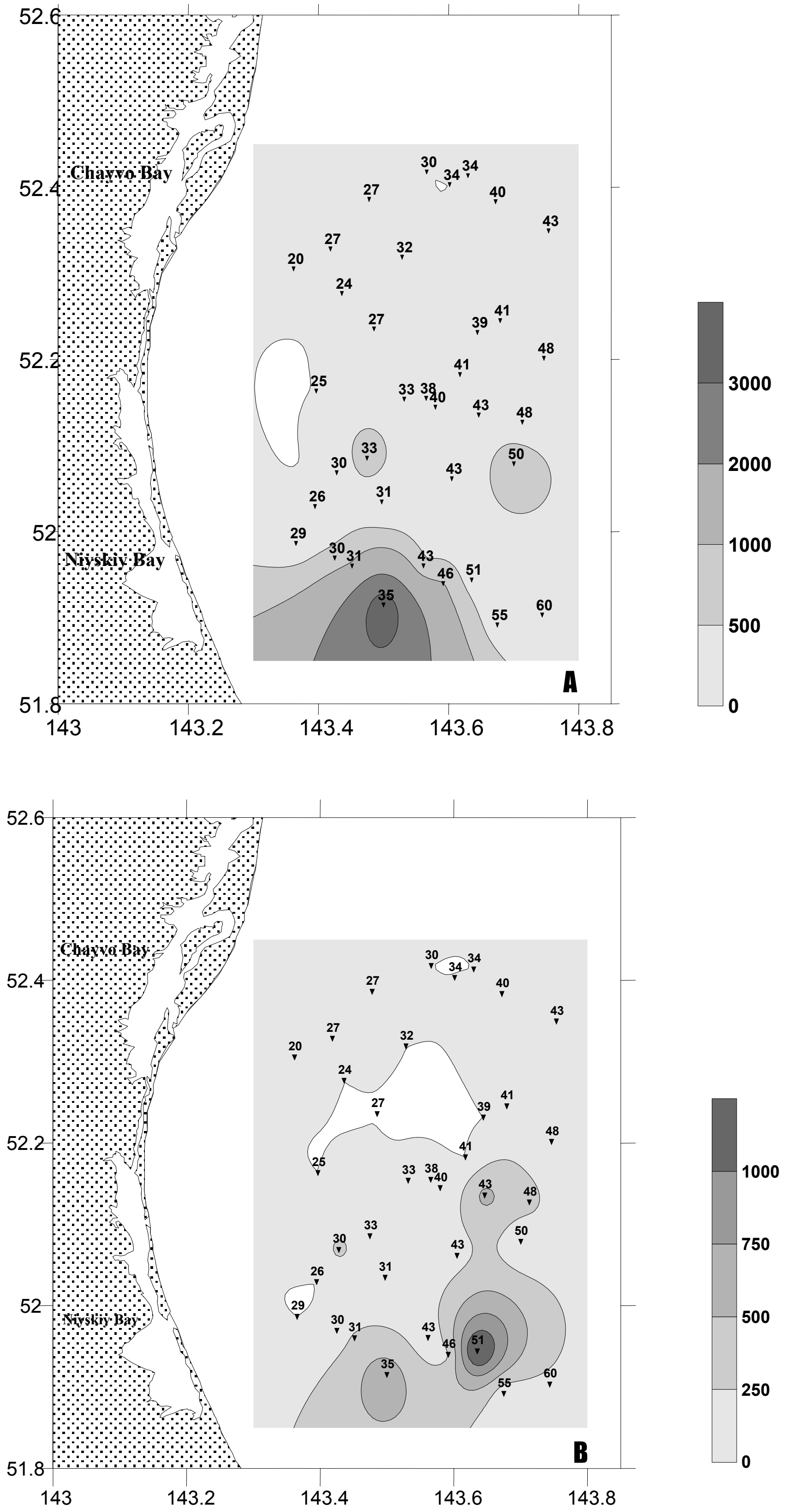

Figure 26. Distribution of colony density (A, spec./m^2) and biomass (B, g/m^2) of bivalve mollusks in the Offshore Area.

Patchiness in the spatial distribution of benthos in the Offshore Area can be traced clearly in the diagrams of colony density and biomass of the basic taxonomic groups (Figures 23-26; Figures P1.12 – P1.15).

A tendency toward an increase in benthos biomass moving toward the eastern part of the water area (as the depth increases) is observed for the Offshore Area as a whole; this tendency is conditioned by an increase in amphipod biomass with an increase in depth (Figures 23(B) and 25(B)). The total benthos colony density is distributed in more of a patchy pattern (Figure 23(A)) due to the spotty arrangement of clusters of cumaceans (Figure 14(A)), which make a basic contribution to the overall benthos population. Clusters of cumaceans are associated with the eastern part of the Offshore Area (Figure 24(B)), and the biomass in the clusters reaches 400 g/m^2. Bivalve mollusks also form patchily distributed clusters (Figures 26(A) and (B)). However, mollusks achieve the greatest quantitative abundance values in the southern part of the Offshore Area. A patchy distribution is also characteristic of other benthos groups – Polychaete and Actinia (Figures P1.12 – P1.13).

Areas with prevalence of *Ampelisca* amphipods are of the greatest interest for assessing the potential gray whale food supply.

Amphipod assemblage *Ampelisca eschrichti*. The dominant species of the assemblage – *Ampelisca eschrichti* (Amphipoda, Gammaridea, Ampeliscidae) – is a mobile sestonophage-filter and lives in tubes partially sunk into the bottom (Photo 4). The density of the tubes can reach several tens of thousands per square meter of the sea bottom. According to our data, the tube density averages 13,000±1800 spec./m^2 within the *Ampelisca* assemblage in the Offshore Area and varies from 120 to 42,000 spec./m^2. Dense clusters of tubes which extend 10-15 cm above the bottom surface form a unique “forest” of tubes – or tube mats. The *Ampelisca* tube mats stabilize the sediments in the presence of strong bottom currents and create the conditions for a habitat for other animals. The assemblage of amphipod species living in *Ampelisca* tube mats can reach 13 species. In addition, the tubes use Actinia and hydroids as a substrate. Hence *Ampelisca eschrichti* represents a typical keystone species. Tube mats of Polychaete *Onuphis shirikishinaiensis* perform a similar function in the Piltun Area (Fadeev 2002).

The *Ampelisca* amphipods are widespread in the Northern Pacific. According to data from various authors, the population and biomass of *Ampelisca* vary within significant limits. In the area of the North Kuril Islands the average biomass of *Ampelisca macrocephala* in a like community is 31.8 g/m^2 at an average colony density of 960 spec./m^2 (Table 77 in Kuznetsov 1964). At depths of 19 to 155 m off Eastern Sakhalin, in the *Ampelisca eschrichti* community, the average biomass of the dominant species is 220.05 g/m^2, with a colony desntiy of 1713.4 spec./m^2 (Table 7 in Koblikov

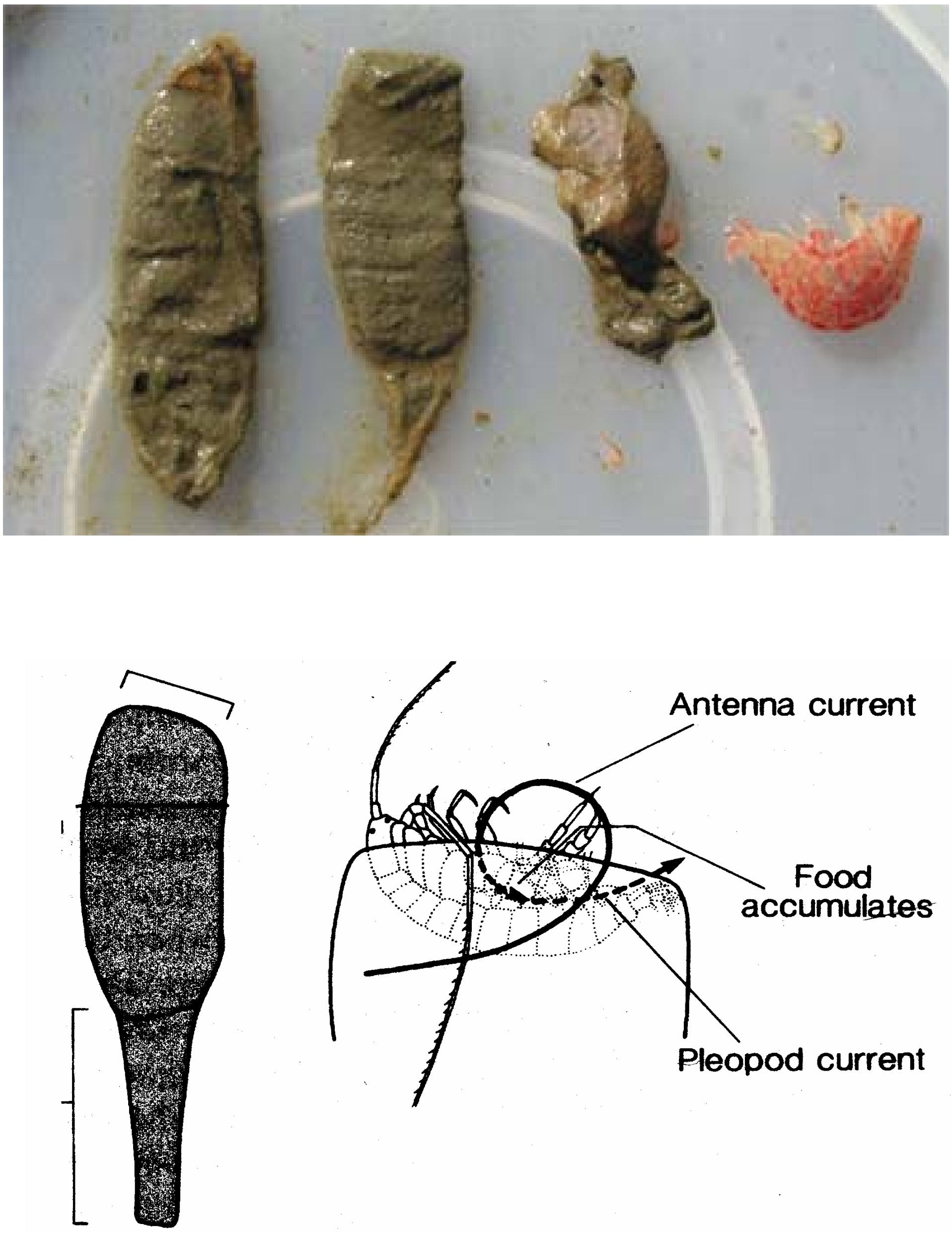

Photo 4. Tubes of *Ampelisca eschrichti* amphipods from the Offshore Area (top) and a diagram of ampeliscid amphipod feeding (per Mills 1967).

1983). In gray whale feeding grounds in the area of the Chukotka Peninsula, the colony density of the amphipod assemblage with prevalence of ampeliscids reaches 12,000 spec./m^2 at a biomass of more than 600 g/m^2 (Makarov 1937). In other Feeding Sites of the gray whales, the abundance figures for ampeliscids reach 22,000 spec./m^2 and 941 g/m^2 (Nerini 1983) 10,603 spec./m^2 (coastal waters of Alaska; (Stoker 1981), and more than 40,000 spec./m^2 (coastal waters of Canada; (Oliver 1983, Carruthers 2000, Dunham & Duffus 2001, 2002)). In some areas of the Gulf of California, the density of ampeliscids reaches 150,000 spec./m^2 (Oliver 1983).

Materials of 2002 from the Offshore Area (Table 13) make it possible to conclude that the values for the quantitative abundance of *Ampelisca eschrichti* are high. The colony density and biomass of *Ampelisca* are comparable here, and in some cases they exceed the values from other highly productive gray whale feeding grounds.

The size composition of *Ampelisca* was analyzed based on materials from 2001 and 2002 (Figure 27; Table 8). The average body length was 11.38±0.43 mm in 2001 and 13.78±0.31 mm in 2002; in the analysis, 94% of the individuals had a body size larger than 6 mm, which supports the suitability of the *Ampelisca* colonies in the Offshore Area as food for gray whales.

In the Piltun Area, according to materials from 2001 (Fadeev 2002) a pattern was observed in the density distribution of cumaceans and amphipods. With an increase in the depth, the density of amphipods decreases, while the density of cumaceans increases. An inverse relationship is also observed in the Offshore Area. The colony density of ampeliscids and cumaceans varies in opposite directions (curves in Figure 28); a tendency toward an increase in the density of amphipods and a decrease in the density of cumaceans with depth is observed (trend lines in Figure 28). Both *Ampelisca* and cumaceans are sestonophage-filters. Competition for the food supply results in a spatial boundary between clusters of *Ampelisca eschrichti* amphipods and *Diastylis bidentata* cumaceans.

4.3.3. Comparison to control test zone

We shall consider stations C1 – C3 as a control test zone. The stations are in a depth range similar to the stations of the Offshore Area and are located to the north (Figure 1). Benthos at the <u>control stations</u> varies substantially in composition (Table P4.4). At station C1, which is farthest to the north from the Offshore Area, flat sea urchins (288 g/m^2) and cumaceans (205 g/m^2) are dominant. This station is classified as belonging to the flat sea urchin assemblage, which is widespread at greater depths in the Intermediate and Piltun Areas. In the Offshore Area, this assemblage occupies the northern part. Benthos at stations C-2 and C-3, which are located not far from the stations of the Offshore Area, is similar to the <u>*A. eschrichti* assemblage</u> (see section 4.3.2). The *Ampelisca* biomass at station C-2 reaches 756 g/m^2. Hence this assemblage with prevalence of *Ampelisca* in the form of local spots can be encountered north of the Offshore Area.

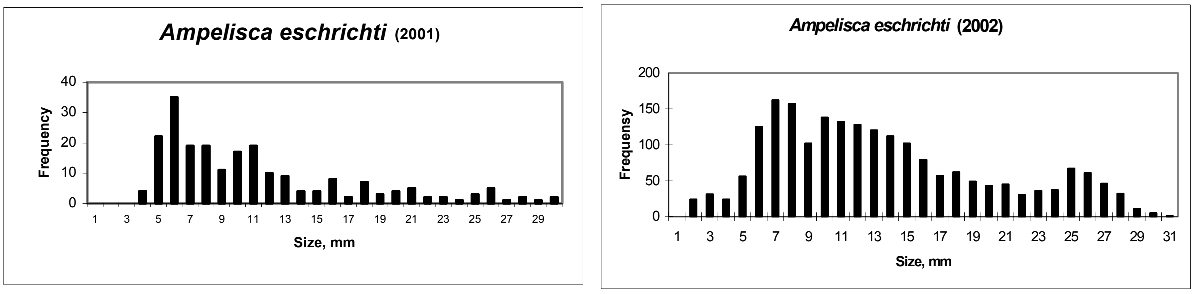

Figure 27. Size composition of amphipod *Ampelisca eschrichti* in 2001 and 2002.

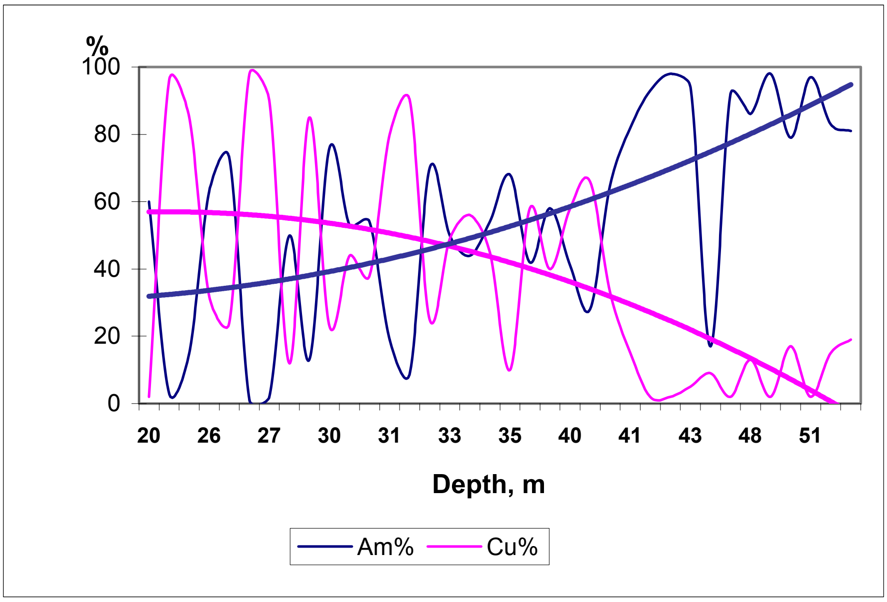

Figure 28. Variation of the propositions of amphipods (Am, %) and cumaceans (Cu, %) in the total benthos colony density by depth in the Offshore Area.

4.4. Gray whale feeding sites

Bottom grab collections were made during the expedition period in 2002 at gray whale Feeding Sites. The following approach was used in performing the work. First, gray whales were found during vessel-based surveys. Then, the locations of gray whale Feeding Points in the Piltun and Offshore areas were determined while the whales were being photographed from a zodiac. The coordinates of the points where a feeding whale entered the water and emerged at the surface after diving were recorded. The coordinates of the midpoint between the entry and exit points were determined. The coordinates were transmitted to the ship. After the whale left the feeding point, bottom grab collections were performed from the ship. A total of 46 stations (161 bottom grab samples) were processed. In the Piltun Area, 21 stations at gray whale Feeding Points; 25 stations were processed in the Offshore Area.

Individual gray whale **Feeding Points** make up local **Feeding Sites**. From one to three feeding gray whale individuals were observed in each of the Feeding Sites. A diagram of the locations of seven sites is shown in Figure 29.

Within the Piltun Area, three Feeding Sites (Piltun Feeding Site: **PFA-1, PFA-2** and **PFA-3**) and an individual Feeding Point – **FP-08** – can be distinguished. In the Offshore Area, 4 Feeding Sites (Offshore Feeding Site: **OFA-1, OFA-2, OFA-3, OFA-4**) and an individual Feeding Point – **FP-06** – can be distinguished. Data on the abundance of benthos at the Feeding Sites are given in Table P4.6. Characteristics of the bottom sediments in feeding grounds are considered in section 3.3.

4.4.1. Whale Feeding Sites in the Piltun Area

Characteristics of quantitative abundance of benthos were calculated for each of the 3 Feeding Sites (Table 14). Collections of 2002 were performed in the depth range 11-30 m, and the greatest abundance of forage benthos was observed at depths of 11 – 15 m (Table 9). Whale Feeding Sites were located at depths of 8 to 24 m. Although feeding whales were observed at shallower depths as well (minimum depth – 3 m), it was not possible to perform bottom grab collections at depths less than 8 m for technical reasons: these areas were too shallow to be sampled using Van Veen grab from the main vessel. The use of small and light Ponar grab from a zodiac was unfeasible in most cases, because high currents compressed sandy bottom to the condition of a near-asphalt density. Ponar grab usually bounced off the surface of the sediment.

Table 14. Benthos colony density (A, spec./m^2) and biomass (B, g/m^2) in gray whale Feeding Sites in the Piltun Area.

Benthos group	Area	PFA-1		PFA-2		PFA-3		FP-08		Average	
	Depth	16.8±2.5 м		11.2±1.1 м		12.2±0.9 м		14 m			
	P, %	A	B	A	B	A	B	A	B	A	B
Amphipoda	100	1256	113.1	4454	71.27	3401	75.3	6757	141.9	3967	100.4
Isopoda	100	416	40.68	422	20.62	137	22.1	150	16.65	281	25
Bivalvia	76	24	84.79	38	44.8	406	62	67	11.25	133	50.7
Polychaeta	69	46	29.64	18	18.74	12	3.18	3	0.05	19	12.9
Cumacea	64	50	1.27	17	0.14	371	5.66	30	0.53	117	1.9
Gastropoda	25	1	4.08	5	15.92	2	0.12	10	3.51	4	5.9
Echinoidea	20	7	75.87	3	55.34	1	18.9	0	0	2	37.5
TOTAL		1800	349.4	4957	226.8	4330	187	7017	173.9	4526	234.4

As in the areas of maximum abundance of forage benthos in the Piltun Area (section 4.1.3, Table 9), amphipods and isopods have the highest frequency of occurrence (100%) in the Feeding Sites. The biomass for these groups has similar values. Hence benthos in the gray whale Feeding Sites in the Piltun Area is similar in composition and quantitative abundance to the areas of increased benthic biomass at sampling stations.

We shall analyze the locations of gray whale Feeding Sites in the Piltun Area (Figure 27) and the distribution of biomass of amphipods, isopods and bivalve mollusks according to data from 2001 and 2002 (Figures 15 and 16 and Figure P1.7). Whale Feeding Sites are located in areas (spots) of high biomass of these groups. The areas of high abundance of amphipods and isopods have been well mapped from the data of 2001 and 2002.

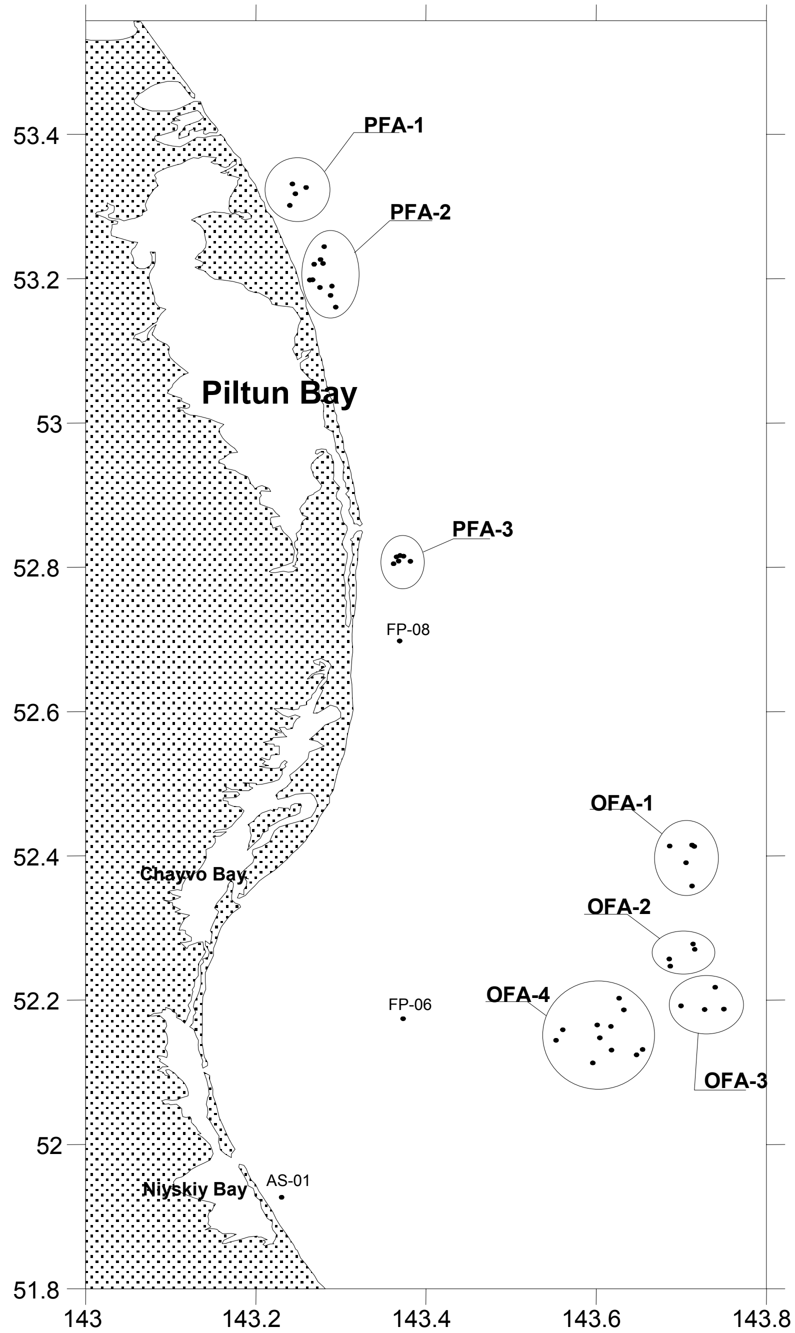

Figure 29. Diagram of the locations of gray whale Feeding Sites.

PFA – Piltun Area Feeding Sites;
OFA – Offshore Area Feeding Sites.

4.4.2. Whale Feeding Sites in the Offshore Area

Quantitative characteristics of four gray whale Feeding Sites in the Offshore Area are shown in Table 15. All the areas are located in a depth range of 33 to 46 meters. The gray whale Feeding Sites have high biomass figures (from 906 to 1585 g/m^2), with an average of 1228 g/m^2. All the benthos mass groups and species of the Offshore Area have 100% frequency of occurrence in all the Feeding Sites: amphipods *Ampelisca eschrichti,* cumaceans *Diastilis bidentata*, bivalve mollusks, Polychaete and Actinia. The average amphipod biomass for all the Feeding Sites is 590 g/m^2, with a colony density of more than 25,000 spec./m^2. The proportion of amphipod *Ampelisca eschrichti* in the total amphipod biomass varies from 82% to 95%. Other amphipod species also have a high frequency of occurrence: *Anonyx nugax, Protomedeia fasciata* and *Eogammarus schmidti*.

Table 15. Benthos colony density (A, spec./m^2) and biomass (B, g/m^2) in gray whale Feeding Sites in the Offshore Area.

Benthos group	Area	OFA-1	OFA-2	OFA-3	OFA-4	FP-06	Average	
	Depth	43.8±0.6 м	41.7±0.5 м	41.8±3.1 м	41.0±0.6 м	38 m		
	P, %	B	B	B	B	B	A	B
Amphipoda	100	300.6	317	718.8	1032.6	579.3	25611	589.7
Cumacea	100	84.2	69.3	54.3	70.5	164.6	13061	88.6
Bivalvia	100	279.5	86.3	332.2	129.2	31.9	65	171.8
Polychaeta	100	40.4	9.9	29.3	29.5	25.7	443	27
Actinia	100	529	368.3	180.5	272.8	98.2	223	289.8
Gastropoda	56	0.5	0.2	18.7	6.2	45.7	9	14.3
Decapoda	56	12.9	27.3	26.2	29.3	0	9	19.2
TOTAL		1295.4	906.9	1401.9	1585.8	951.7	39487	1228.3

All the benthos groups observed in the whale Feeding Sites are mass groups in the biota of the Offshore Area and are part of the composition of benthos assemblages and groupings (Table 13).

Cluster analysis was used to assess the similarity of the benthos structure (ratios of biomass of mass groups) in whale Feeding Sites and benthos groupings of the Offshore Area. Data on the biomass of taxonomic groups in five whale Feeding Sites and four benthos assemblages of the Offshore Area were selected as classification objects. A dendrogram of the similarity of benthos assemblages of the Offshore Area and the gray whale Feeding Sites in this area is shown in Figure 30.

One can see from the dendrogram that the grouping *Ampelisca eschrichti + Actiniaria* (**Am+Ac**) and the Feeding Sites **OFP-1** и **OFP-**2 were combined into a single group in regard to benthos structure similarity. It follows that these Feeding Sites have the greatest similarity in the benthos structure with just this grouping. In other words, the whales fed within an area with prevalence of *Ampelisca* and *Actinia*.

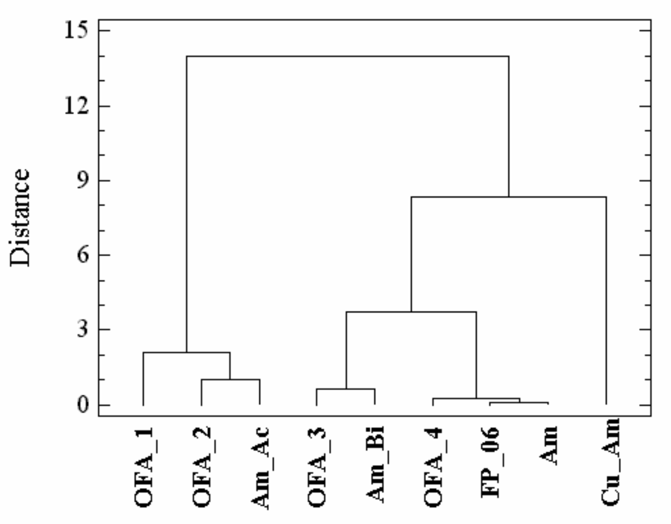

Figure 30. Dendrogram of the similarity of benthos assemblages of the Offshore Area and whale Feeding Sites.

The second group is formed by the grouping *Ampelisca eschrichti + Bivalvia varia* (**Am+Bi**) and the feeding site **OFA-3**; i.e., the benthos structure of this area is most similar to the structure of the grouping of *Ampelisca* and bivalve mollusks. Whales were feeding in this area in a zone of prevalence of *Ampelisca* and bivalve mollusks.

The third group is formed by a grouping with prevalence of *Ampelisca eschrichti*, feeding site **OFA-4** and Feeding Point **FP-06**. The structures of these areas are most similar to each other. In this case, the whales were actually feeding in areas of the Offshore Area with a sharp prevalence of *Ampelisca*.

Tubes and fragments of *Ampelisca* washed out of the mouth of a whale in surfacing and *Ampelica* fragments in gray whale fecal matter (Photos 5 and 6) serve as definite proof of the whales' feeding on the amphipod *A. eschrichti*.

None of the whale Feeding Sites in the Offshore Area have essential similarity to the structure of the benthos cumacean assemblage *Diastilis bidentata + Ampelisca eschrichti*; i.e., no feeding of gray whales was recorded in areas where cumaceans are prevalent, nor was any case recorded of whales' feeding in a zone where flat sea urchins *Echinarachnius parma* are prevalent.

The data obtained can be considered indirect confirmation of the use of the gray whales' use of Actinia and bivalve mollusks as food objects in the Offshore Area. Although Actinia have relatively high caloric value (Appendix 2 in Fadeev 2002), it is improbable that gray whales specifically target them as prey. More likely, they consume Actinia (or Bivalvia) as a bycatch in the areas dominated by Ampelisca.

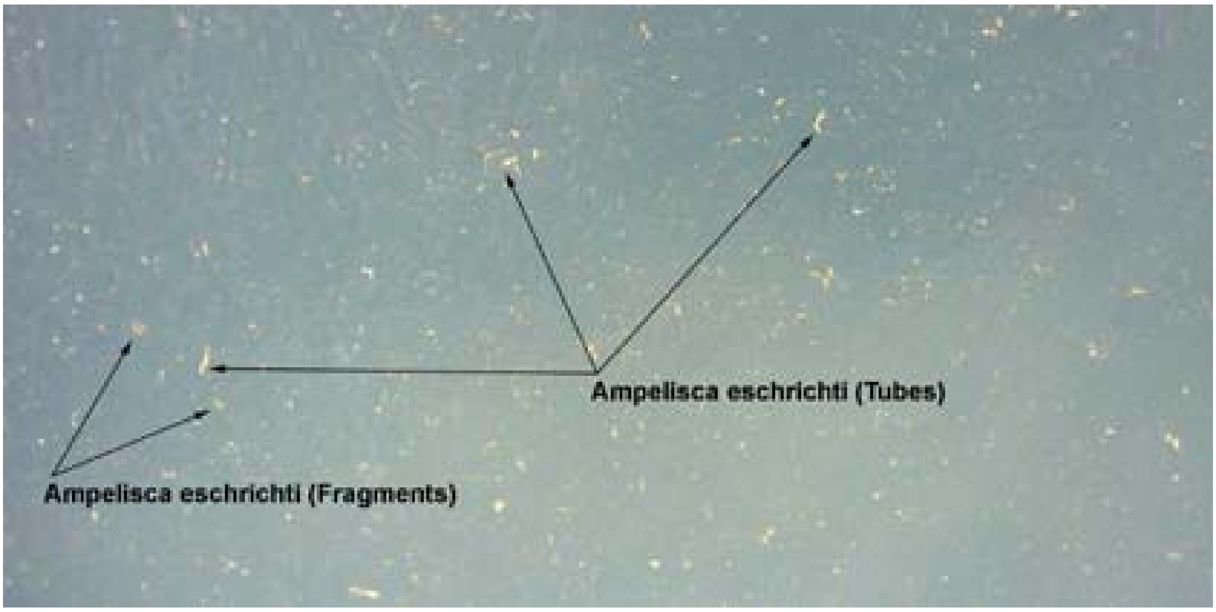

Photo 5. Empty tubes and fragments of amphipod *Ampelisca eschrichti* washed from the mouth of a gray whale in surfacing. Offshore Area. Depth 39 m.

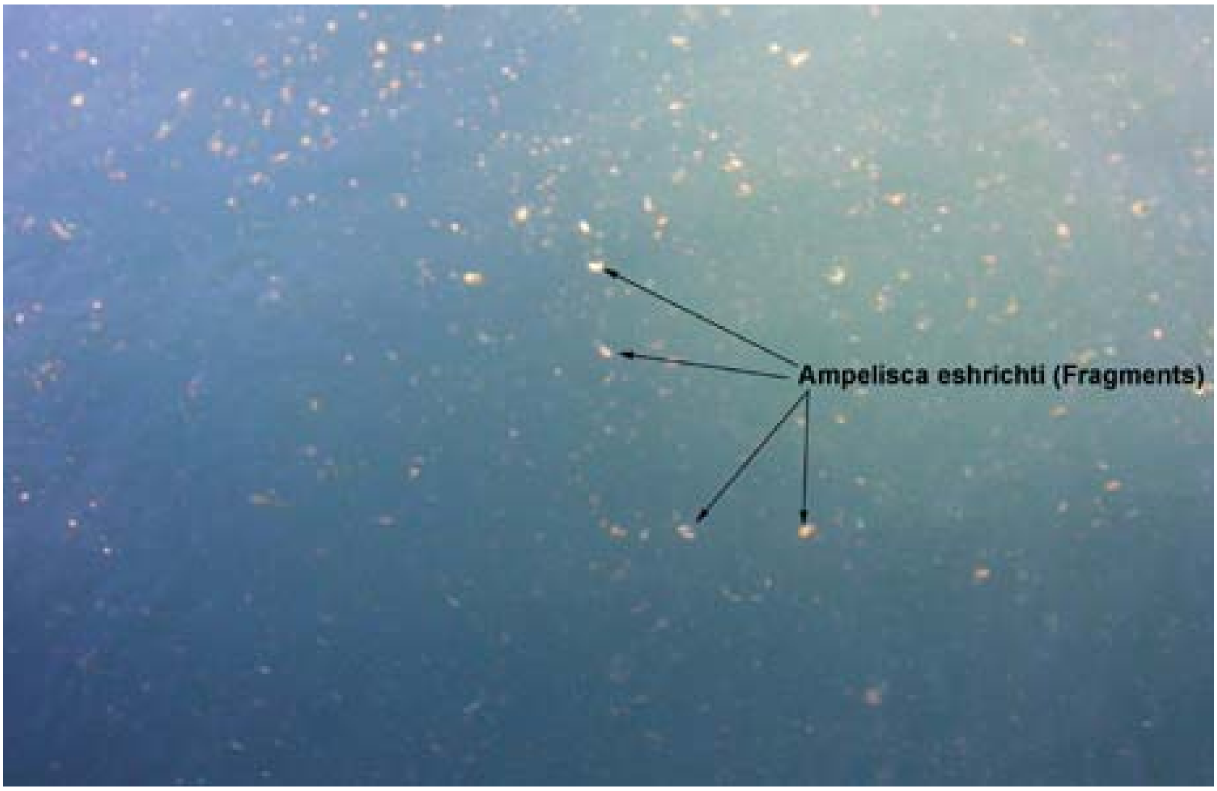

Photo 6. Gray whale fecal material (fragments of amphipod *Ampelisca eschrichti*). Offshore Area.

CONCLUSION

1. Bottom grab collections of benthos performed in September-October 2002 in the coastal waters of Northeastern Sakhalin in the section between Odoptu Bay and Niyskiy Bay served as material for the study. The benthos studies were conducted in three areas: Nearshore, Intermediate (Chayvo Bay) and Offshore (section with depths of 30 – 60 m, far from the shoreline in the Chayvo Bay – Niyskiy Bay area) and three Control Test Zones (Figure 1). In addition, benthos collections were performed at 46 gray whale Feeding Sites in the Piltun and Offshore areas. The Piltun Area corresponds to a previously known gray whale feeding ground in the coastal waters near Piltun Bay. Benthos survey studies were performed in 2001 on 5 transects in a depth range of 5 – 30 m (Fadeev 2002). The Offshore Area is a gray whale feeding area discovered by specialists in 2001 as a result of vessel-based observations and aerial surveys. Benthos studies were conducted in the area for the first time in 2002.

Bottom grab collections were performed at 170 stations (539 samples), and of these collections were performed in an epibenthic net at 84 stations (177 samples). The combined material for further analysis was made up of 170 stations and 716 samples.

2. The epibenthic net and two bottom grab models (Van Veen and the lightweight Petite Ponar Grab model) were used in benthos collection. Comparison of the collecting capacity of the two bottom grab models demonstrated the unsatisfactory operation of the lightweight Ponar Grab model at depths greater than 10 m. Further use of this model is advisable only at shallow depths at whale Feeding Sites.

Comparison of collections with an epibenthic net and with the Van Veen bottom grab at the same stations indicated that the epibenthic collections not only fail to provide additional information but also seriously distort assessments of the abundance of epibenthic species. In the Piltun Area, the colony density of mass epibenthic species assessed from collections with the epibenthic net was from 2 to 1000 times lower (198 times lower, on the average) than in the bottom grab collections. The discrepancy in assessments of the same species amounted to a factor of 600 (maximum factor 6800) at stations in the Offshore Area. The unsatisfactory operation of the epibenthic net was the result of relief features in the Piltun Area and significant currents in the Offshore Area. Further use of this sampler is not advisable.

3. The average temperature of the surface water layer during the study period was as follows: 12.01±0.19 °C in the Piltun Area, 10.31±0.23 °C in the Offshore Area, and 9.6±0.26 °C at the whale Feeding Sites. The scope of temperature fluctuations in the Nearthore Area was smaller than in 2001. A sport of relatively colder water is mapped in the area of the north part of Piltun Bay, as in 2001.

4. Granulometric analysis of 165 samples of bottom sediments indicated that prevalence of sand fractions is characteristic of all three areas. Sands (fine – 40%; medium – 35%) are prevalent at 75% of the stations, and another 18% of the stations have mixed sands of varying grain size. The proportion of the fine-grained sand fraction is in excess of 60% at most of the stations.

As a result of classification of 165 stations according to 10-fraction soil composition, 3 groups of sediments were distinguished in the areas studied: **A** – well-sorted fine-grained sands; **B** – medium-sorted sands of varying grain size (a mixture of fine and medium sands); **C** – poorly sorted gravel bottoms with an addition of pebbles, sand of varying grain size and exposed detritus. The compositions of groups of bottom sediments in the Piltun Area described according to data from 2002 matches the results of 2001 well.

5. The bottom sediments at gray whale Feeding Sites were investigated at 46 stations. Sandy bottoms (fine sands – 53% of the stations; medium sands – 38%; mixture of fine and medium – 9%) were prevalent at al the Feeding Sites in the Piltun Area. Whale Feeding Sites are also associated with sanding bottoms in the Offshore Area; fine-gravel bottoms with an addition of sand of varying grain size were observed at only two stations (9% of the total number of stations).

6. The quantitative distribution of benthos was studied at 60 stations in a depth range of 11 to 35 m (average collection depth 20.4±0.8 m) in the Piltun Area in 2002. In 2001, 30 stations were processed within the Piltun Area at depths of 5 – 30 m; of these, 10 stations were in the range 5 – 10 m. Therefore, only stations in the same depth range of 11 – 30 m were used to compare the results of 2002 and 2001.

The average biomass for the area in the range 11 – 35 m in 2002 was 481.5 g/m^2 at a colony density of more than 6600 spec./m^2. As in 2001, the flat sea urchin *Echinarachnius parma* has the greatest proportion in the total biomass. Similar trends are observed in the distribution of total benthos biomass and biomass of mass groups from the materials of 2002 and 2001. The compositions of common species of crustaceans (amphipods and isopods) and bivalve mollusks, which potentially play the main role in the diet of gray whales, are also similar.

The biomass of amphipods and isopods is at a maximum in the range 11 – 15 m and does not differ significantly from the data of 2001. Analysis of the size compsition of nine common species of amphipods (9875 specimens were measured) demonstrated that the proportion of individuals with body sizes larger than 6 mm is from 58 to 100% for different species. Hence most of the individuals of the common species are available as food for whales.

Based on the materials of 2002 and 2001, similarity is observed in the spatial distribution of areas of increased biomass of benthos forage groups in the Piltun Area. The clearest match is observed in the southern part of Piltun Bay, where the areas of increased biomass according to data from 2001 are at depths of 2 to 15 m. At an average benthos biomass of 241 g/m^2 there, benthos forage groups account for about 90% of the biomass. High values of amphipod and isopod biomass are preserved in areas farther south as well (as far as the northern part of Chayvo Bay). The sharpest decrease in amphipod and isopod biomass of the groups occurs in the nearshore area of the middle part of Chayvo Bay. A similar trend was observed in the materials from 2001 (Fadeev 2002).

7. The benthos composition in the Intermediate Area is not homogeneous. According to the quantitative proportions of taxonomic groups, three benthos assemblages can be distinguished here. The shallow-water assemblage (average depth 11.3±2.0 m) with prevalence of amphipods and isopods has a set of species and abundance characteristics similar to the areas of increased biomass of forage benthos in the southern part of Piltun Bay. The shallow-water benthos assemblage is widespread in the northern part of Chayvo Bay. The main bottom areas in the Intermediate Area at depths greater than 15 m are occupied by flat sea urchin and individual Ascidia assemblages. There are practically no benthos forage groups in either assemblage, and they have no value for whale feeding.

8. In the Offshore Area there were 36 bottom grab stations (113 samples) at depths of 20 to 60 m (average depth 37±1.6 m). The average total biomass for the entire area (including areas occupied by flat sea urchins) is 1052.8±104.8 g/m^2. Amphipods, cumaceans, bivalve mollusks, marine worms and Actinia are prevalent (more than 50%) in regard to frequency of occurrence. The incidence of flat sea urchins is less than 5%.

In the Offshore Area, three basic assemblages can be distinguished according to the benthos structure. The flat sea urchin assemblage, which is common at depths greater than 15 – 20 m in the Piltun and Intermediate areas. The assemblage of cumaceans *Diastilis bidentata* and amphipods *Ampelisca eschrichti* (average depth 28.2±1.4 m) with an average biomass of 538 g/m^2. The *Ampelisca* biomass is 167 g/m^2.

From the point of view of assessing the gray whale food supply in the Offshore Area, the assemblage of amphipod *Ampelisca eschrichti* is of the greatest interest. The average total biomass of the assemblage is 1180 g/m^2, and the amphipod biomass is 610 g/m^2. The proportion of *Ampelisca* in the total amphipod biomass is 96%. The assemblage occupies most of the area of the Offshore Area. Persistent variations are observed in the composition of the assemblage and the abundance of individual groups. There are three groups with a patchy distribution in the area which can be distinguished: *Ampelisca* + *Actinia*, *Ampelisca* + bivalve mollusks, and a grouping with a sharp prevalence of *Ampelisca* over other groups. The *Ampelisca* biomass in the areas occupied by these groupings varies from 560 to 649 g/m^2. The colony density of *Ampelisca eschrichti* averages 13,000±1800 spec./m^2 and varies from 120 to 42,000 spec./m^2.

Sections of the shelf with prevalence of amphipods-ampeliscids are a classic example of gray whale feeding grounds. Such areas have been thoroughly studied in the Bering and Chukotka seas and the Western Pacific. Comparison of the data obtained on the abundance of *Ampelisca eschrichti* in the Offshore Area to published data on the abundance of ampeliscids in other areas makes it possible to conclude that the *Ampelisca* colony density and biomass in the Offshore Area are comparable to and in some cases exceed the abundance characteristics in other Feeding Sites (section 4.3.2).

9. Bottom grab collections were performed in 2002 at 46 gray whale <u>Feeding Sites</u> in the Piltun and Offshore areas. The whale Feeding Sites make up seven <u>local Feeding Sites</u>. From one to three feeding whales were observed in each area. There were three local Feeding Sites identified in the Piltun Area and four in the Offshore Area.

The average biomass in whale Feeding Sites in the <u>Piltun Area</u> is 234.4 g/m^2. The forage benthos proportion reaches 93% of the total biomass. The locations of whale Feeding Sites in the Piltun Area are a good match with the locations areas (spots) of high forage benthos biomass according to data of 2002 and 2001.

In the <u>Offshore Area</u>, four whale Feeding Sites are located at depths of 33 to 45 m.

The average biomass is 1228 g/m^2; *Ampelisca* accounts for up to 560 g/m^2. Analysis of the similarity of the benthos structure in the four Feeding Sites and of benthos groupings of the Offshore Area indicates that gray whales feed in two areas within the *Ampelisca* + Actinia grouping and one area within the *Ampelisca* + bivalve mollusk grouping. One whale feeding site and one Feeding Site correspond to the monodominant *Ampelisca* grouping in regard to benthos structure. None of the whale Feeding Sites in the Offshore Area match the benthos structure of the cumacean + *Ampelisca* assemblage, nor was a single case of feeding in a zone of the sea urchin *Echinarachnius parma* assemblage recorded.

The data obtained can be considered indirect proof of the use of Actinia and bivalve mollusks as food objects in the Offshore Area.

Hence, as a result of the studies performed in 2002 on benthos and the gray whale food supply in the Offshore Area, a highly productive feeding ground with prevalence of the amphipod *Ampelisca eschrichti* was observed for the first time for the Sea of Okhotsk.

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APPENDICES 1 - 5

TO FINAL REPORT

BENTHOS AND PREY STUDIES
IN FEEDING GROUNDS OF THE OKHOTSK-KOREAN
POPULATION OF GRAY WHALES

APPENDIX 1

ADDITIONAL FIGURES

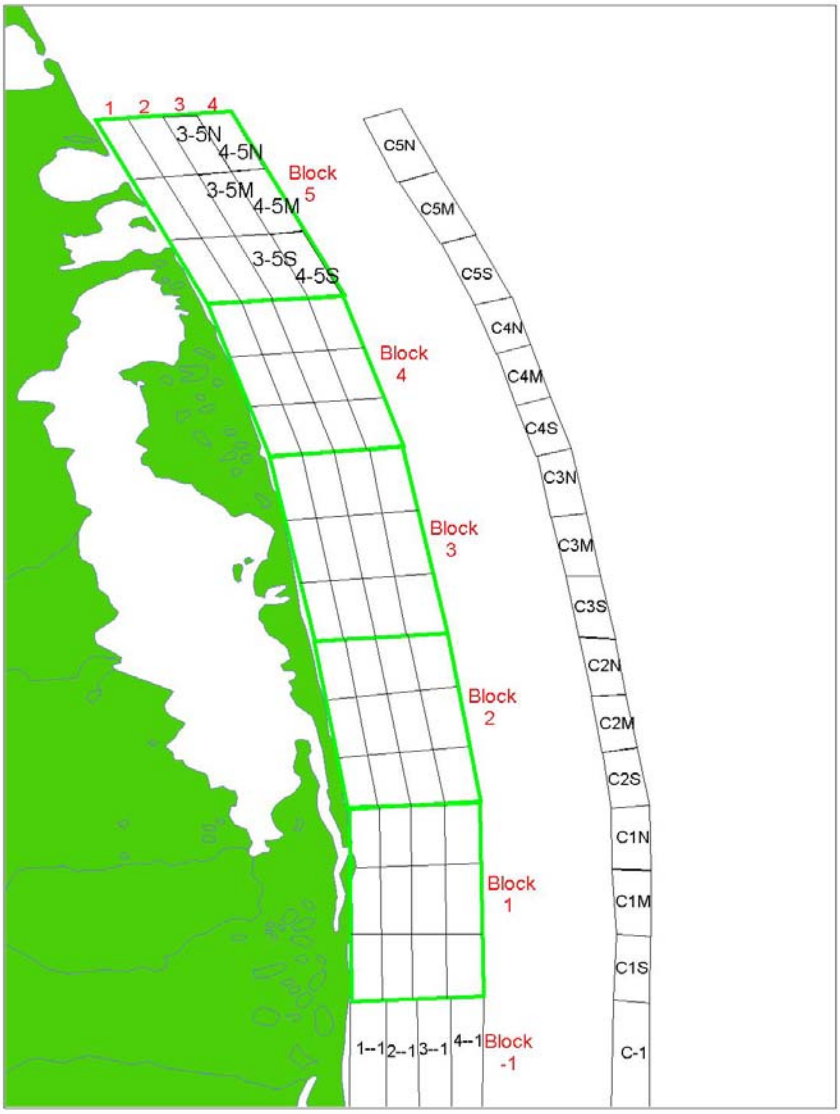


Figure P1.1. Diagram of unit locations of in the Piltun Area and the control test zone.

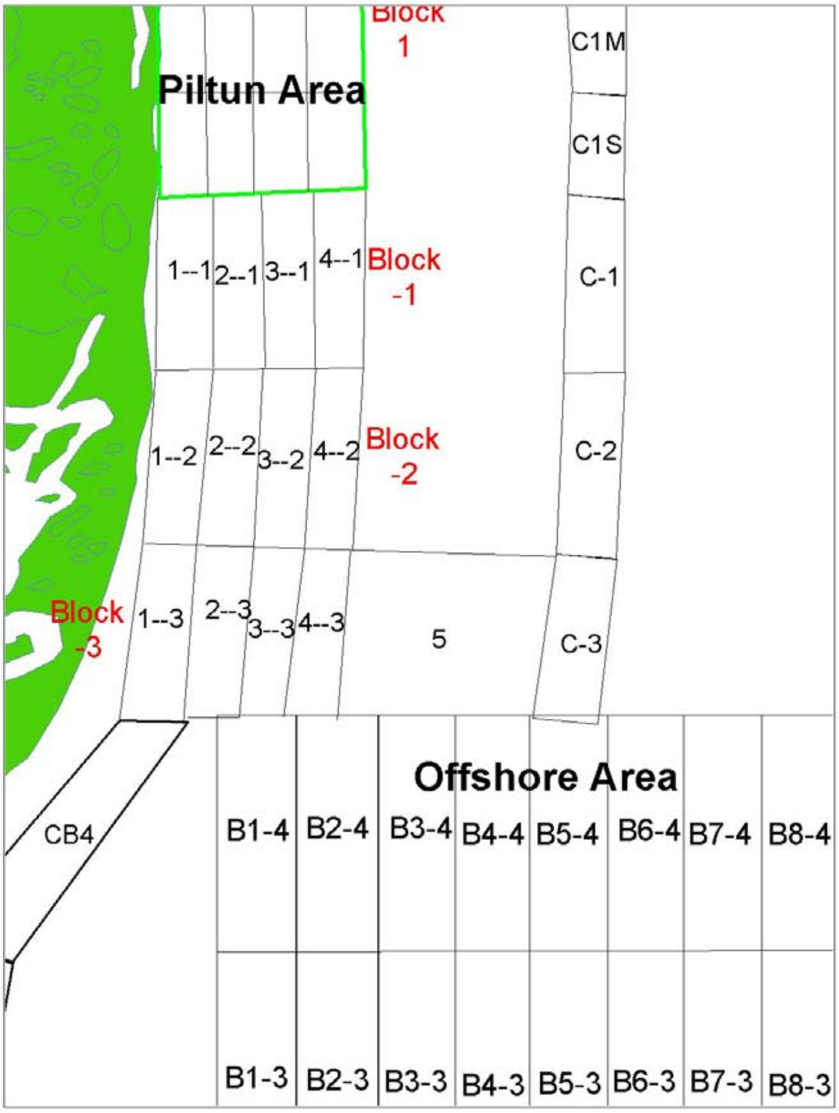


Figure P1.2. Diagram of unit locations in the Intermediate Area.

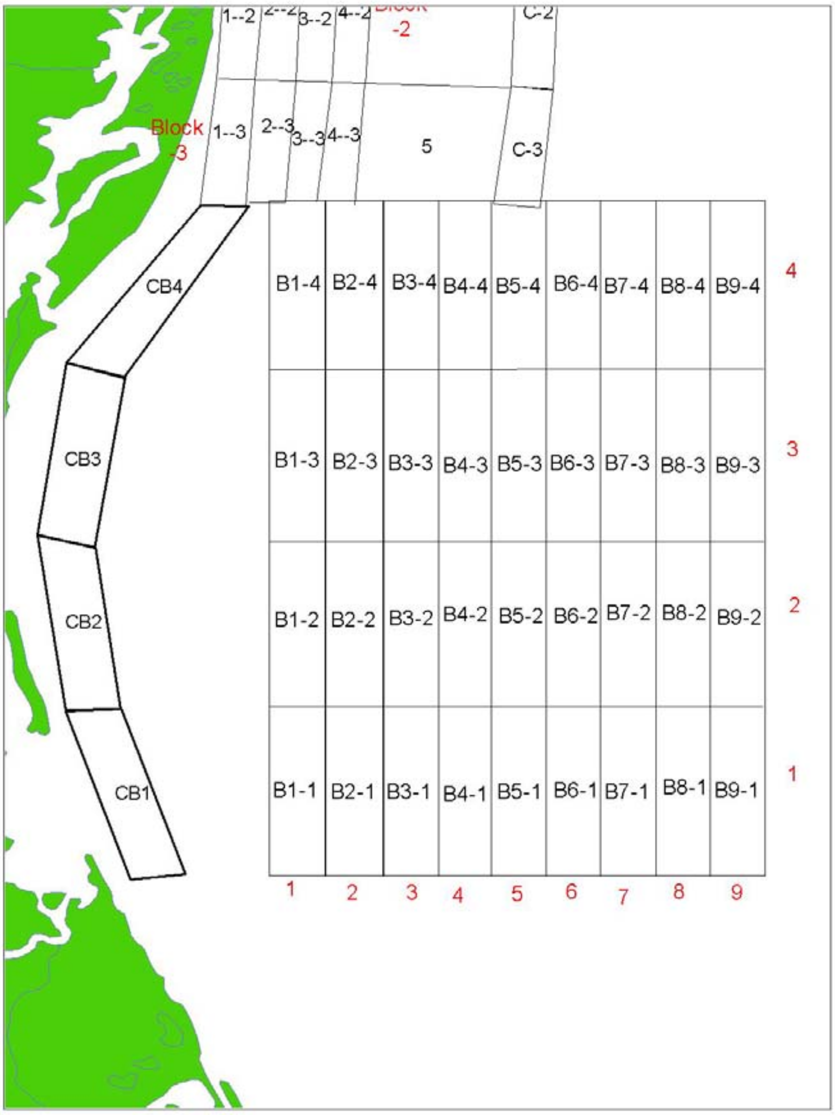


Figure P1.3. Diagram of locations in the Offshore Area and the control test zone.

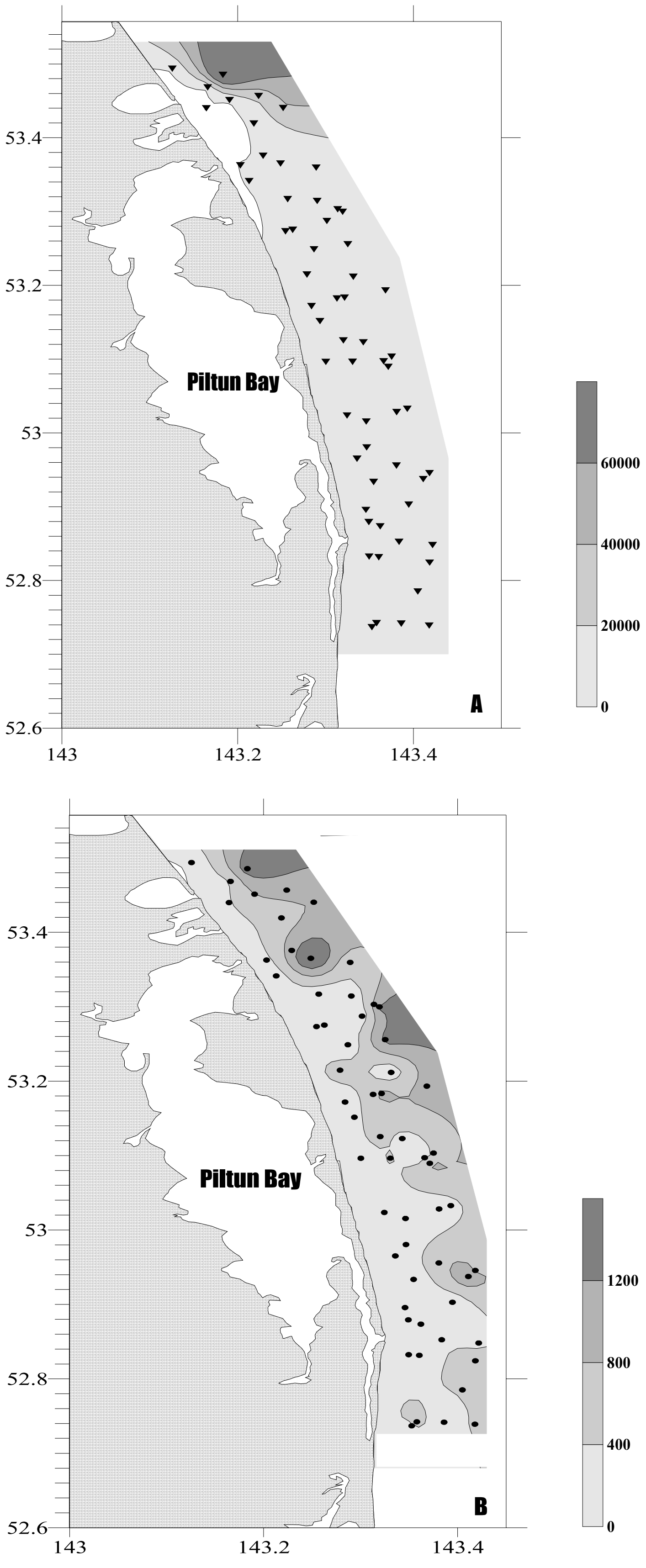


Figure P1.4. Distribution of overall colony density (A; spec./m^2) and biomass (B; g/m^2) of macrobenthos in the Piltun Area.

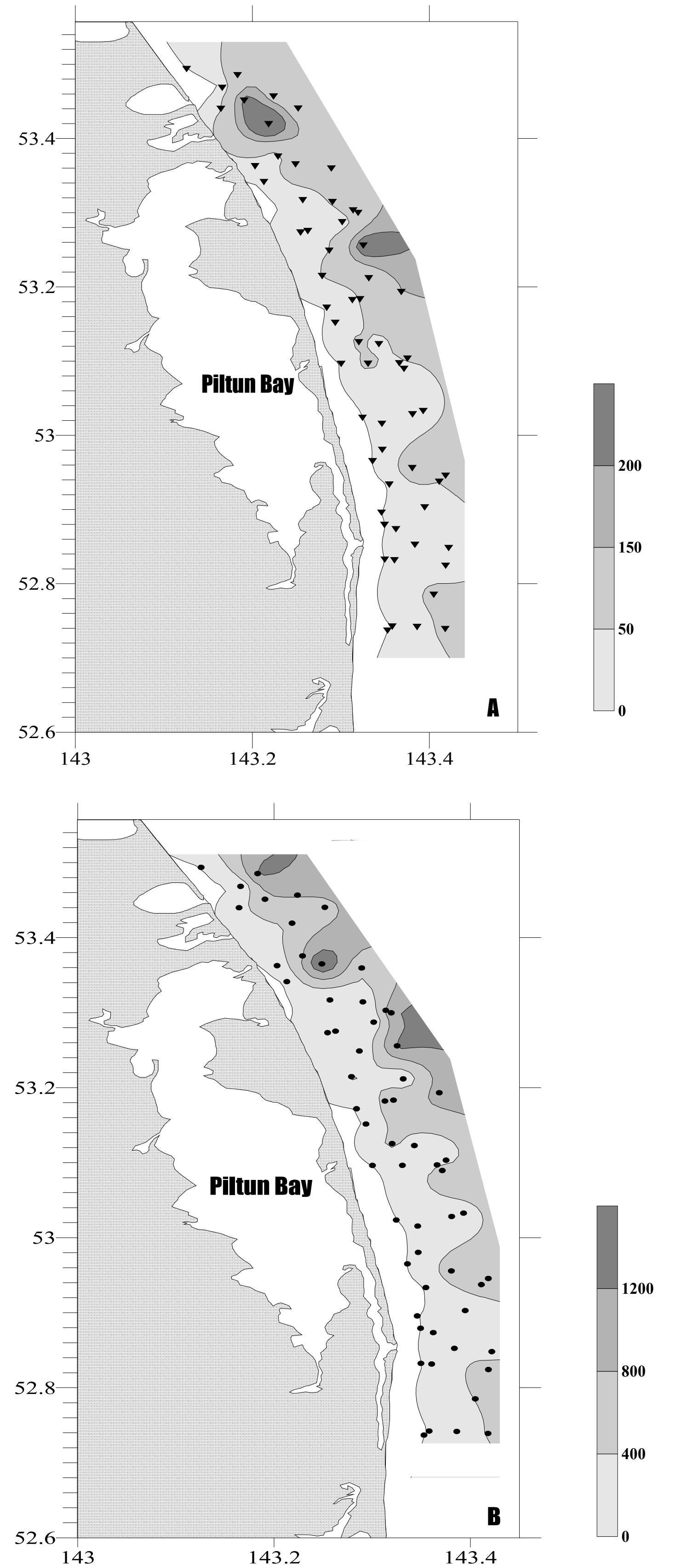


Figure P1.5. Distribution of colony density (A; spec./m^2) and biomass (B; g/m^2) of flat sea urchins *Echinarachnius parma* in the Piltun Area.

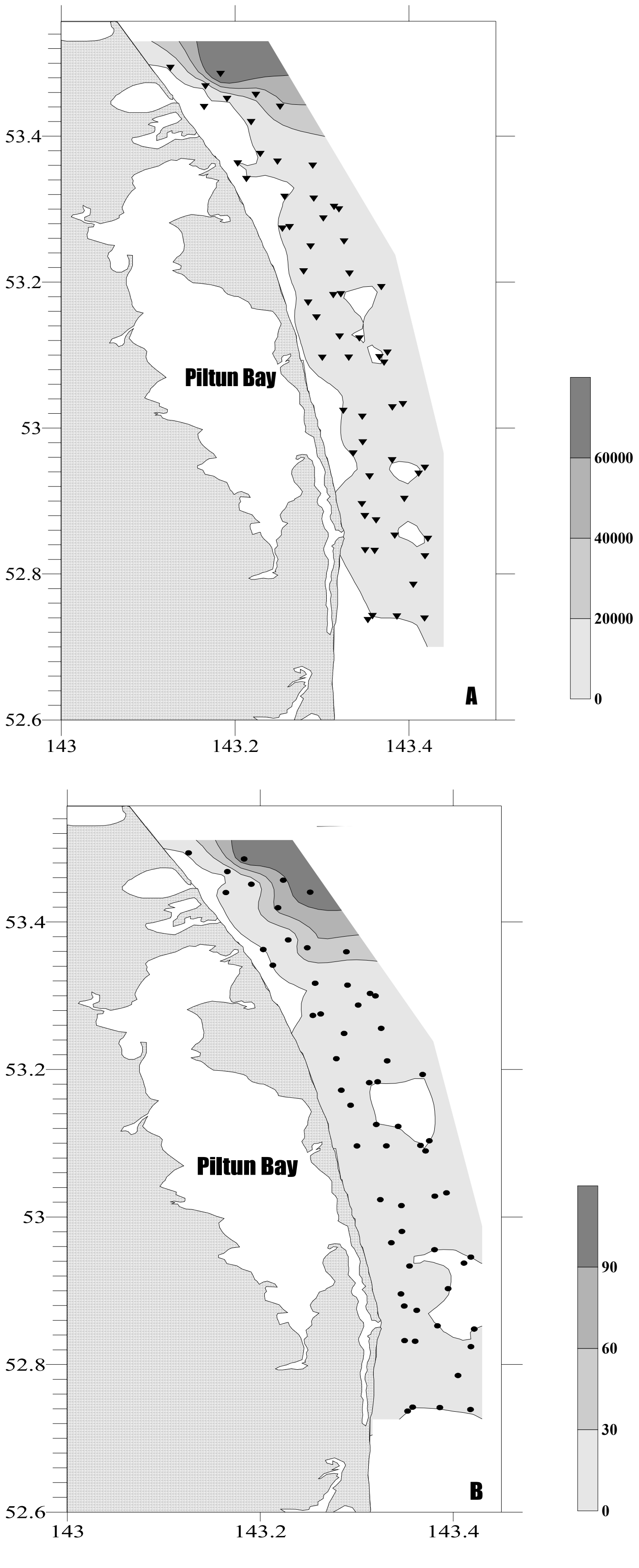


Figure P1.6. Distribution of colony density (A; spec./m^2) and biomass (B; g/m^2) of cumaceans in the Piltun Area .

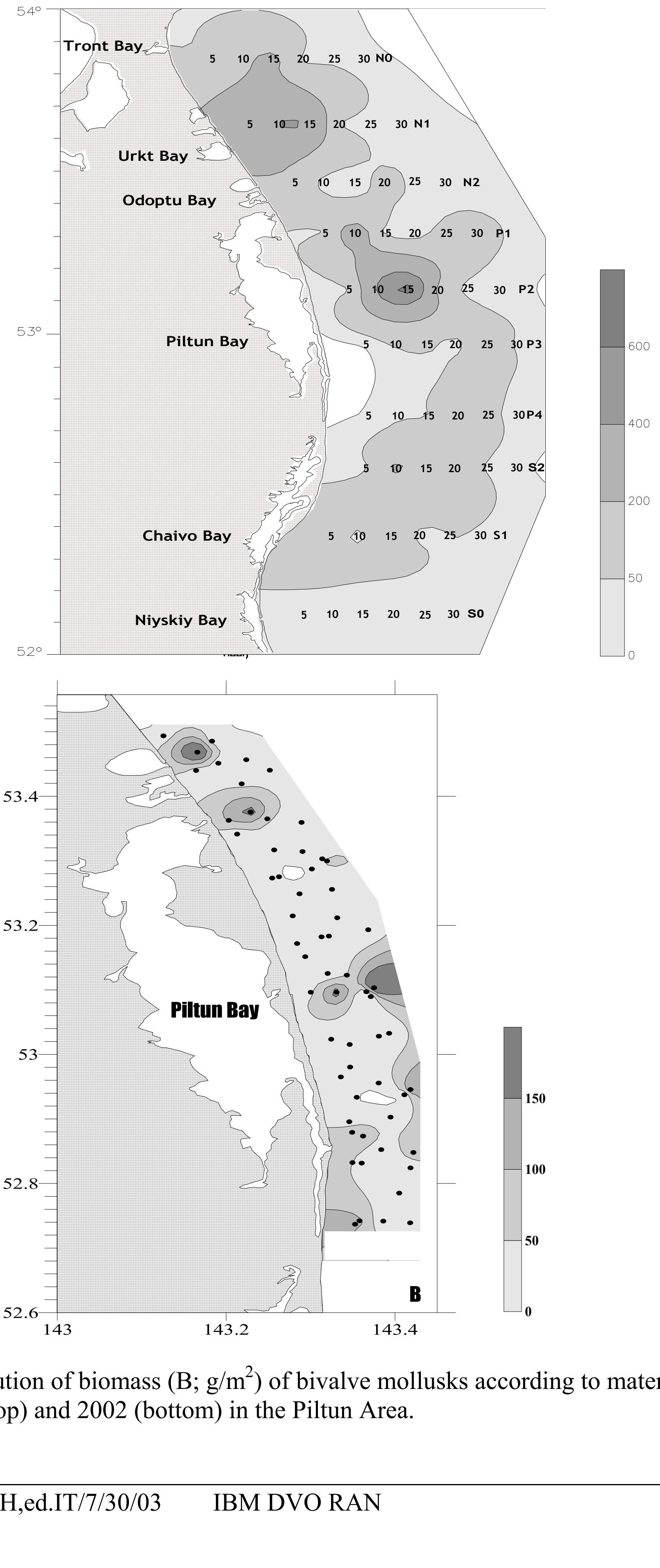
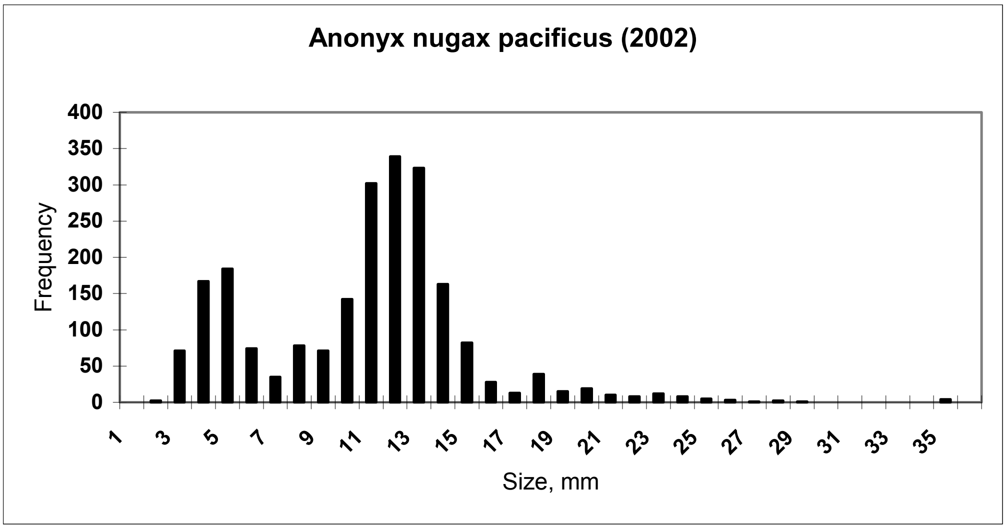
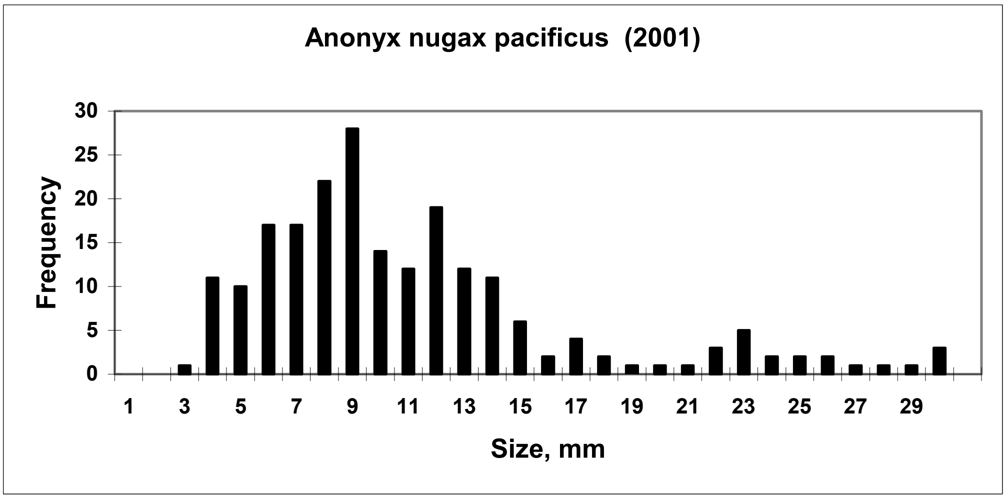


Figure P1.7. Distribution of biomass (B; g/m^2) of bivalve mollusks according to materials of 2001 (top) and 2002 (bottom) in the Piltun Area.





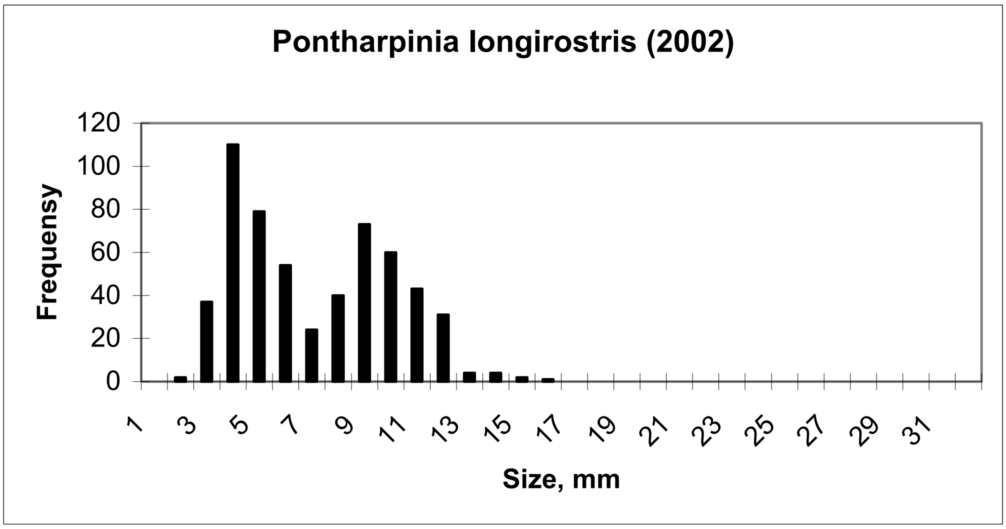
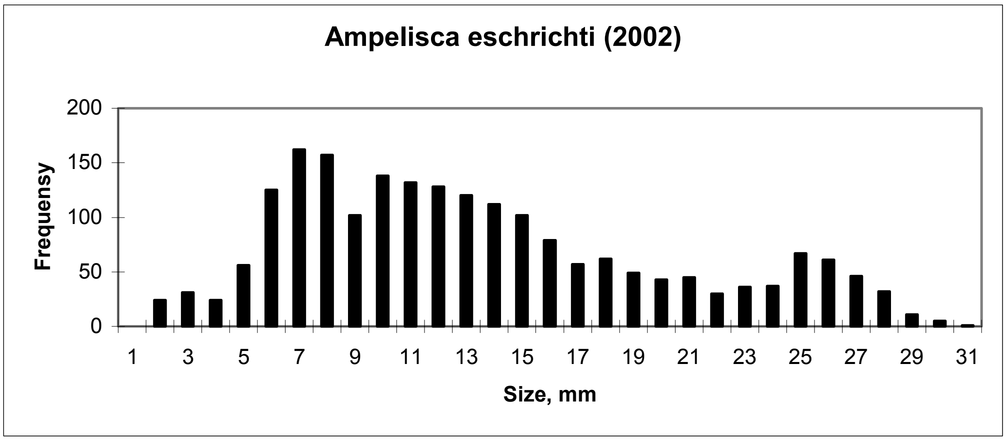
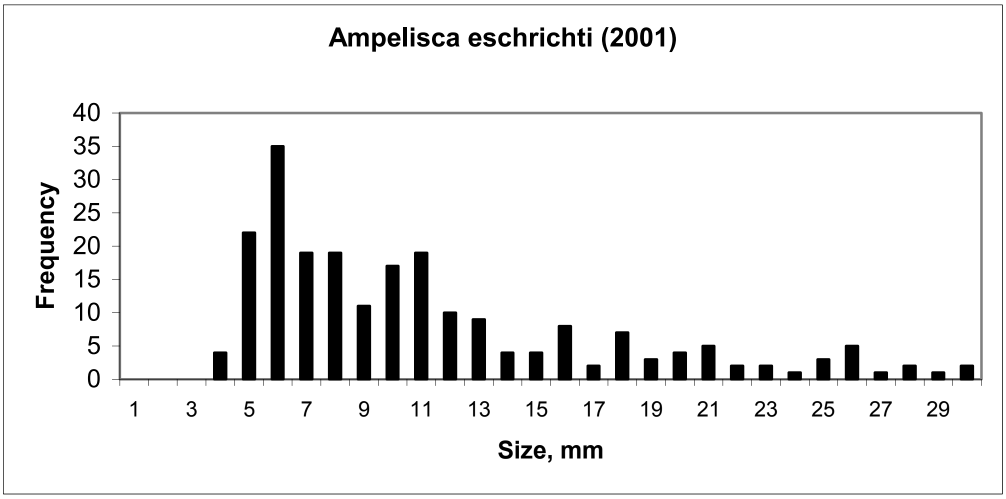


Figure P1.8. Histograms of the distribution of the size composition of common amphipod species.





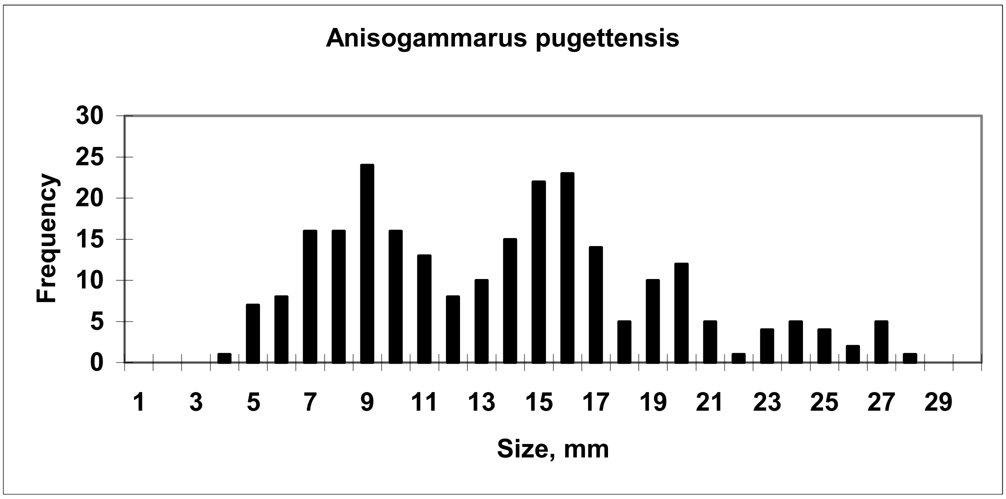
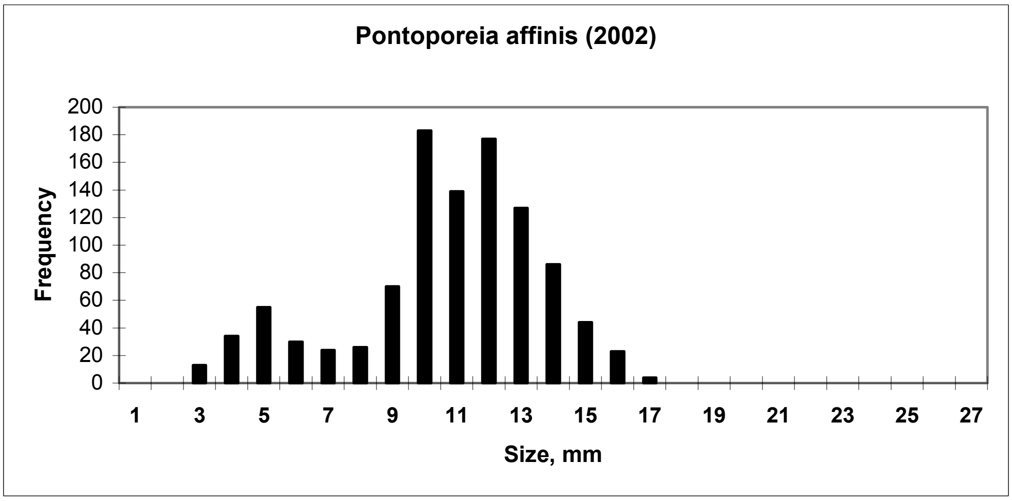
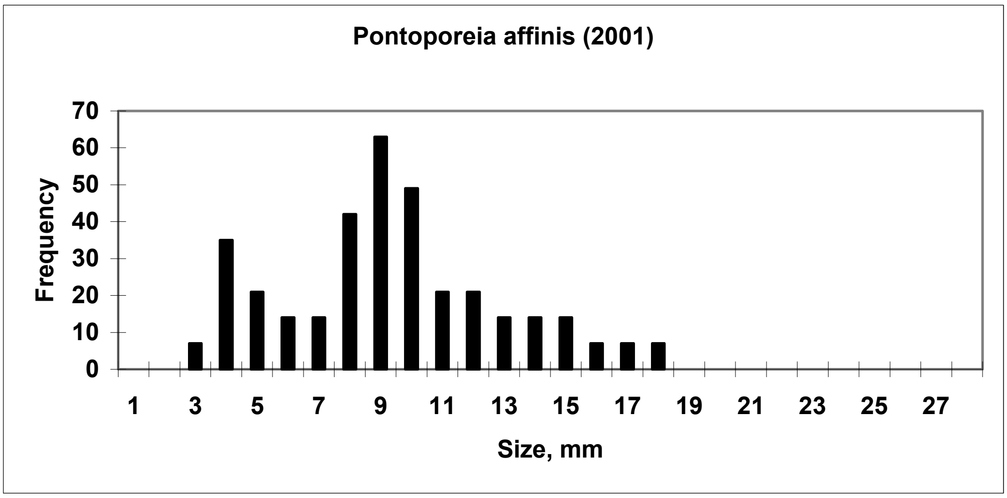


Figure P1.9. Histograms of the distribution of the size composition of common amphipod species.





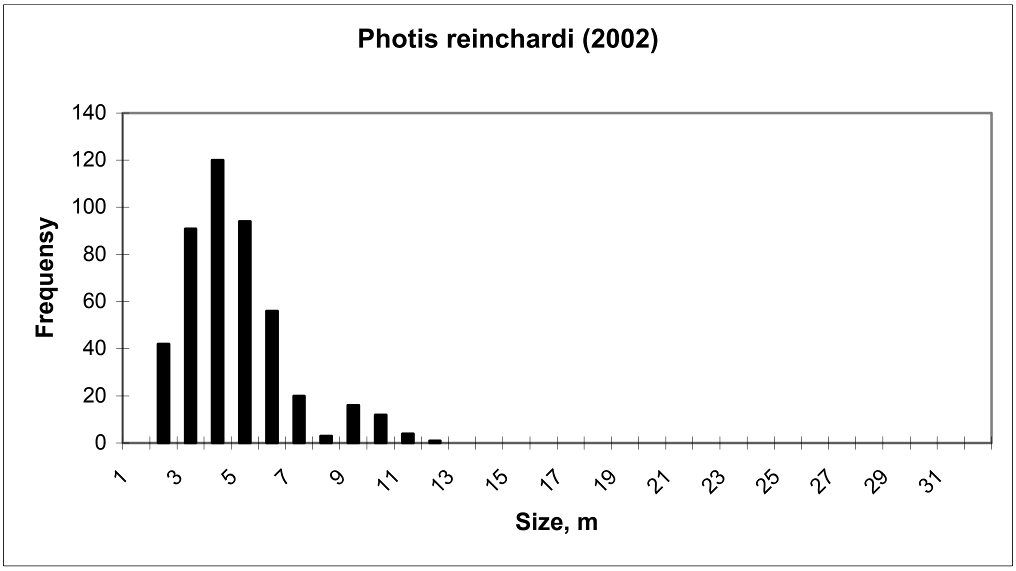
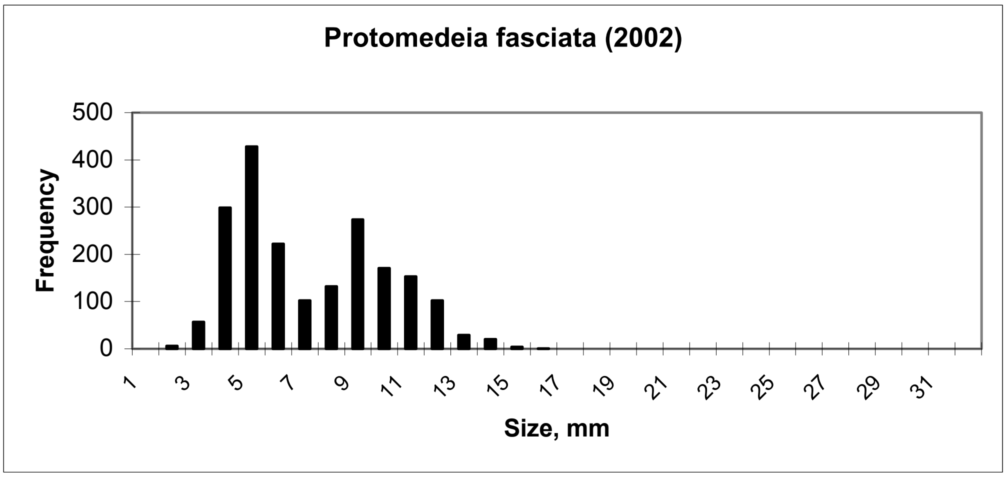
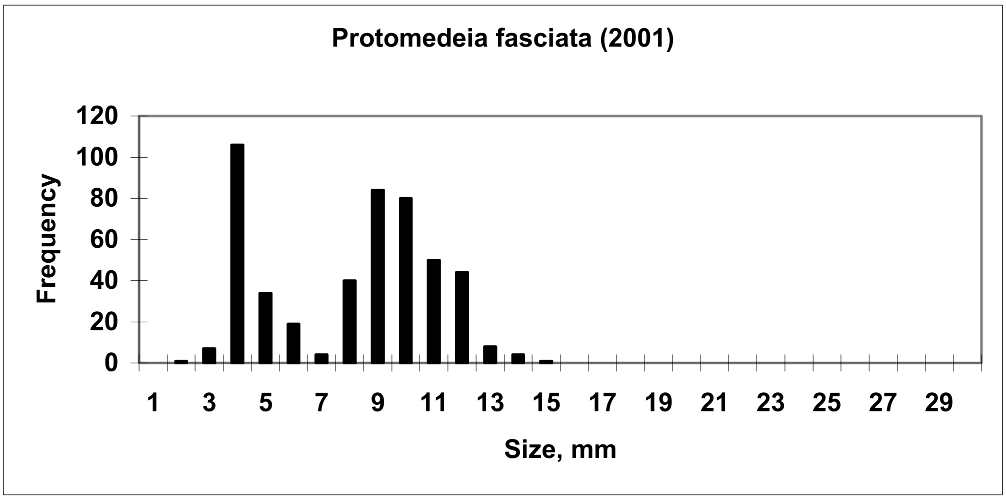


Figure P1.10. Histograms of the distribution of the size composition of common amphipod species.





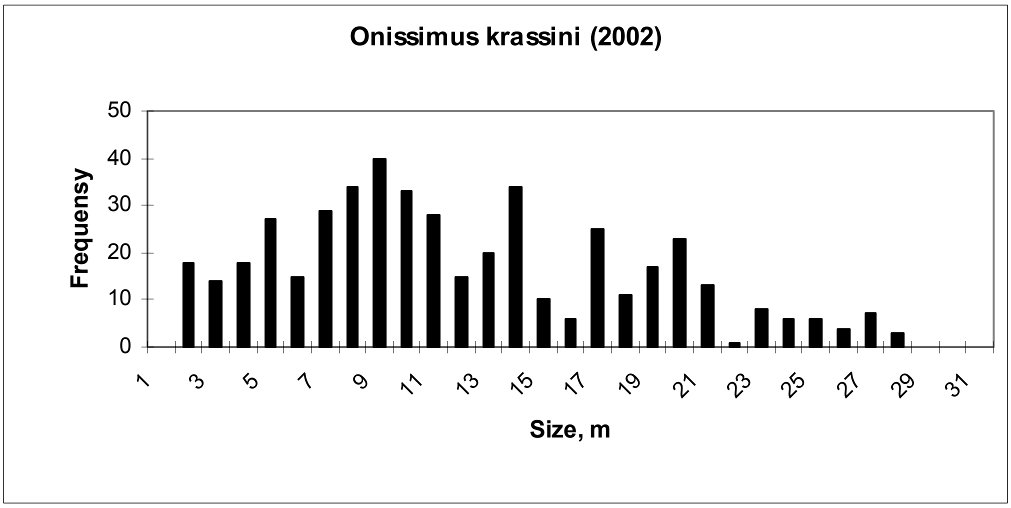


Figure P1.11. Histograms of the distribution of the size composition of common amphipod species.

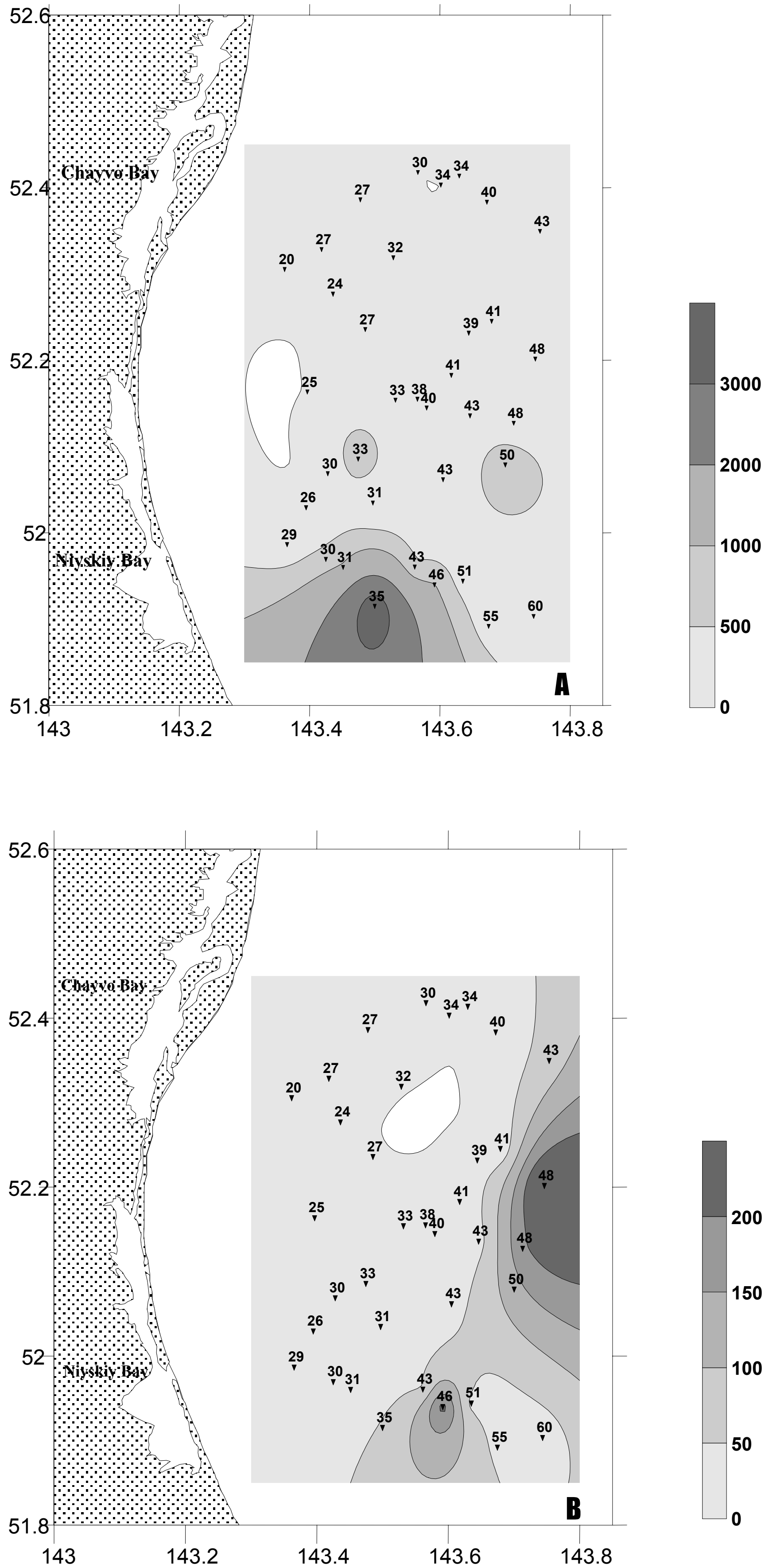
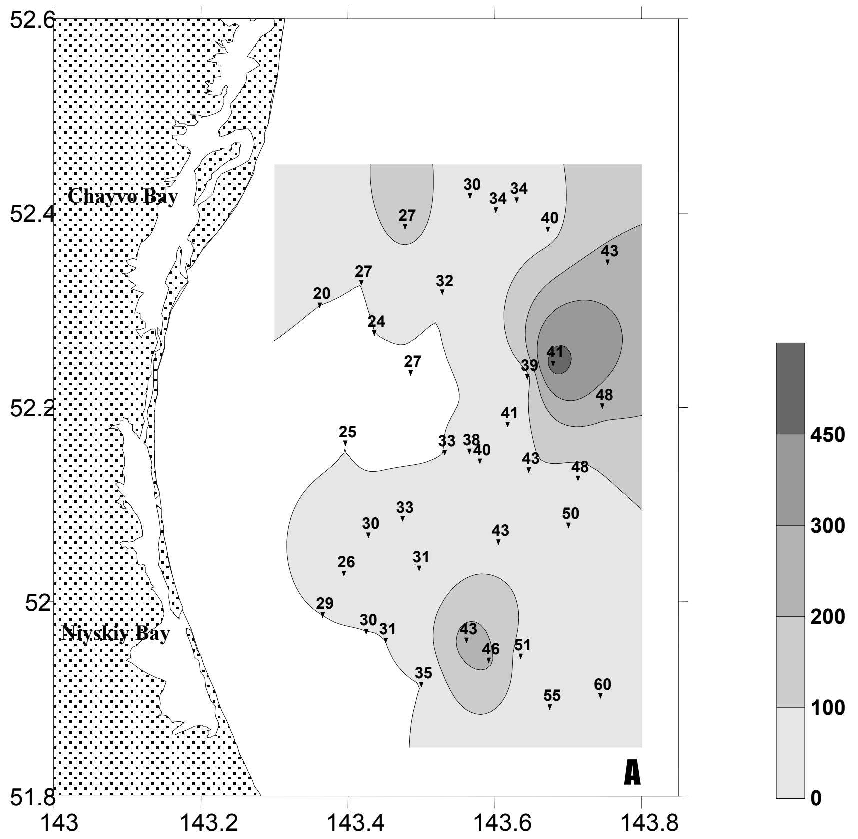


Figure P1.12. Distribution of colony density (A; spec./m^2) and biomass (B; g/m^2) of *Polychaeta* marine worms in the Offshore Area.



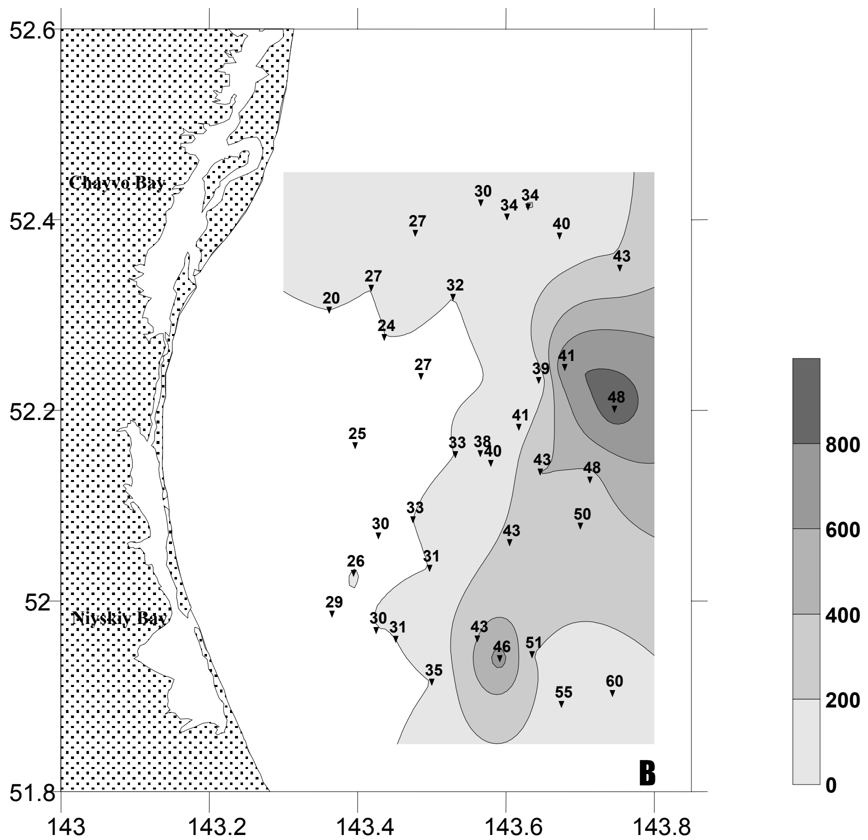


Figure P1.13. Distribution of colony density (A; spec./m^2) and biomass (B; g/m^2) of Actinia in the Offshore Area.

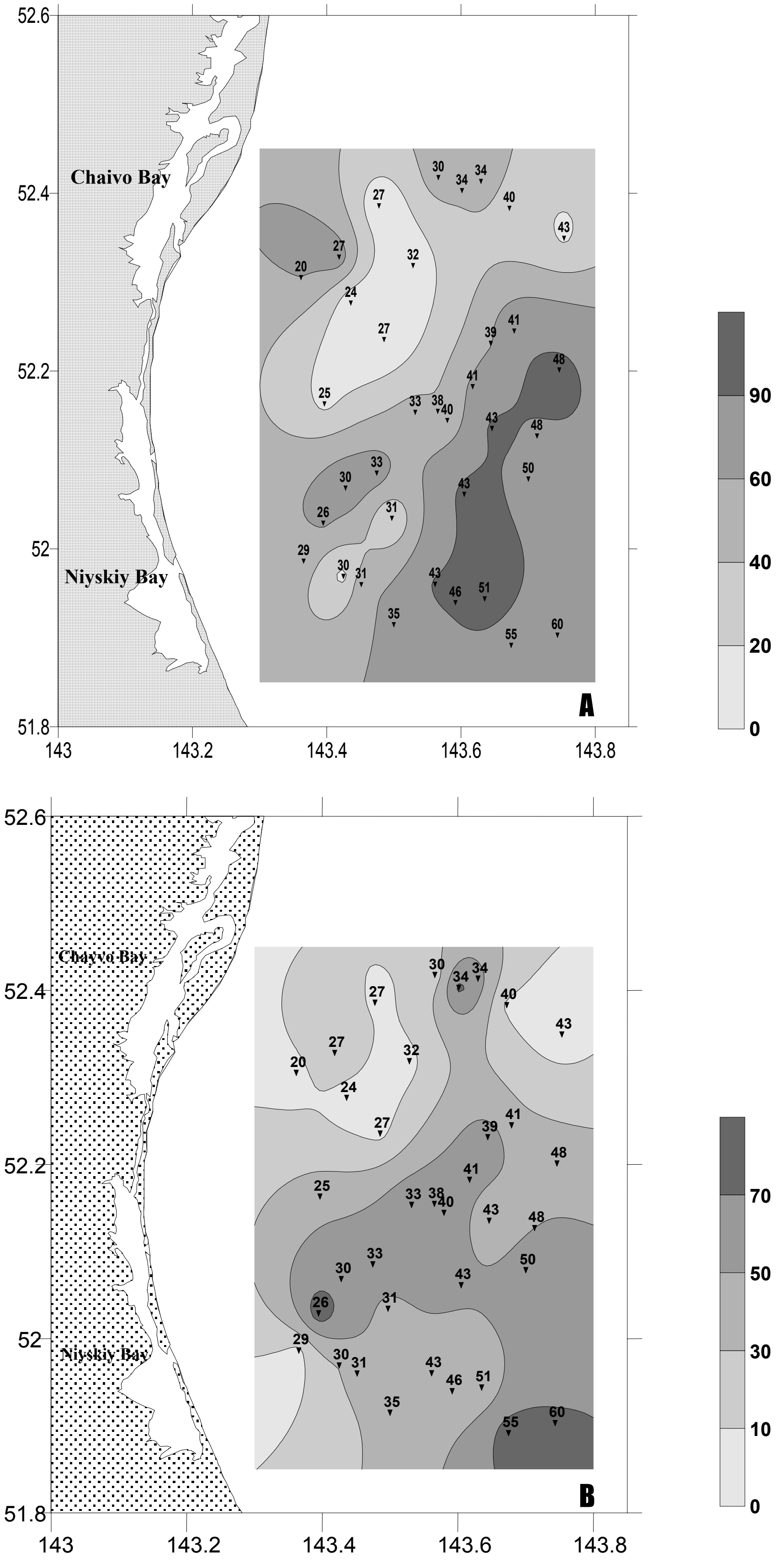
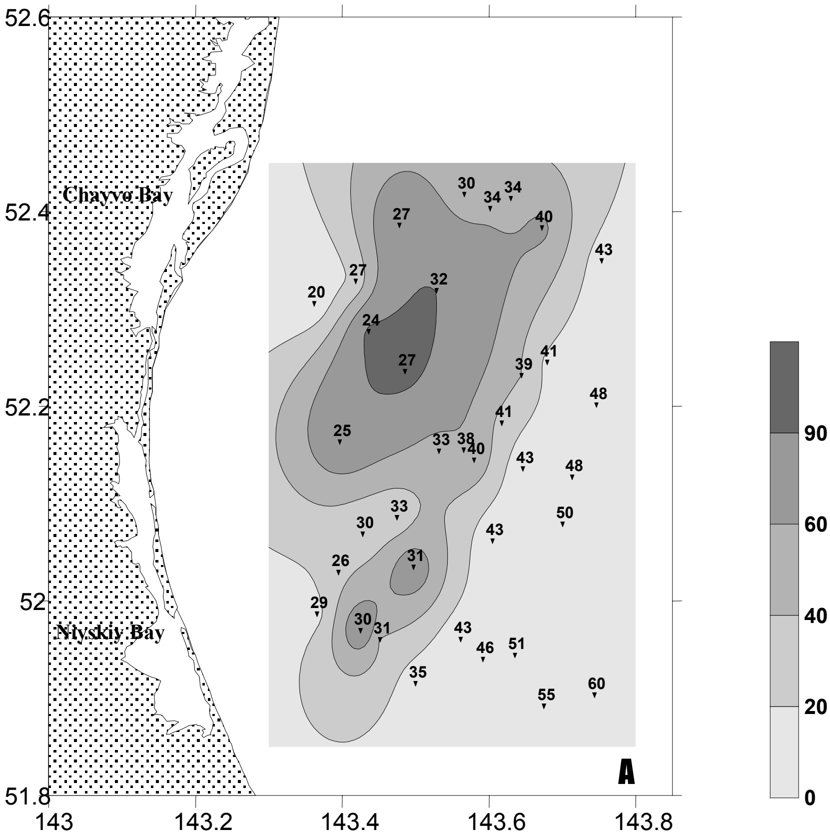


Figure P1.14. Proportion of amphipods in total benthos colony density (A, %) and biomass (B, %) in the Offshore Area.



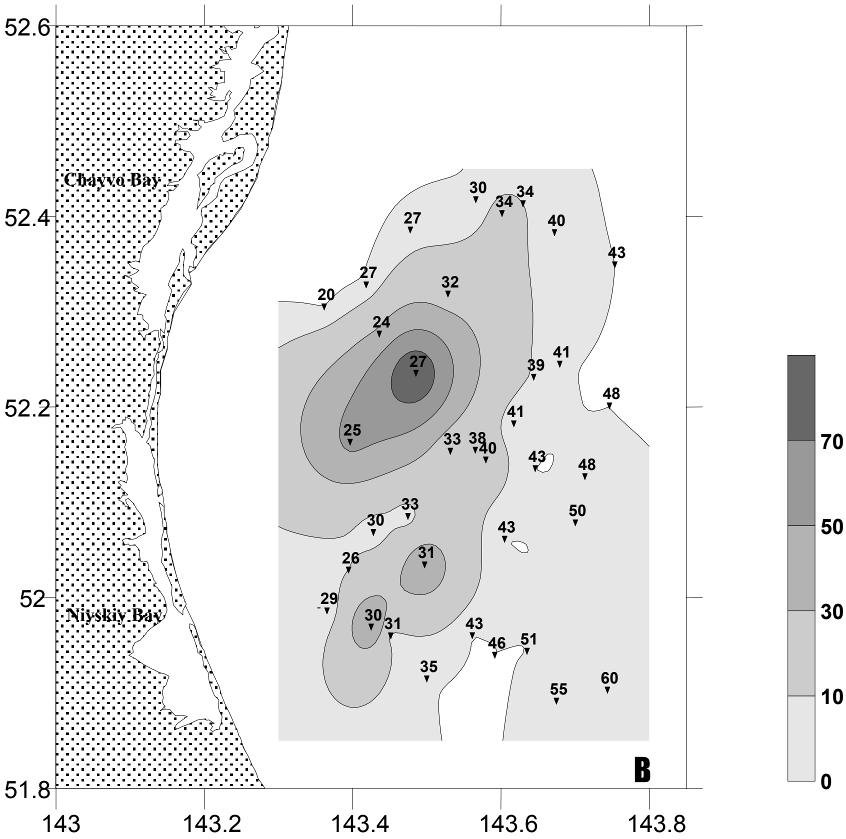


Figure P1.15. Proportion of cumaceans in total benthos colony density (A, %) and biomass (B, %) in the Offshore Area.

APPENDICES 2- 5

APPENDIX 2. Granulometric composition of bottom sediments.

Item	Number	Station	Area	Coordinates (decimal form)		Depth, m	Tempera-ture	Bottom type										Soil code
								Peb	**Grc**	**Grm**	**Grf**	**Sc**	**Sm**	**Sf**	**Ac**	**Af**	**Pec**	
								Size of prevalent fraction, mm										
				Longitude	Latitude			> 10	10-5	5-2	2-1	1-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.01	< 0.01	
1	1	1-1M	Piltun Area	143.349582	52.83249	15	14	2.40	0.00	0.00	0.00	0.20	12.90	**78.70**	3.60	2.20	0.00	Sf
2	2	1-1N	Piltun Area	143.349259	52.87929	12	13	0.00	0.00	0.10	0.05	12.10	**85.87**	1.88	0.00	0.00	0.00	Sm
3	3	1-1S	Piltun Area	143.352704	52.73691	11	14	0.85	0.00	0.22	1.56	5.04	**51.38**	38.02	1.07	1.86	0.00	Sm
4	4	1-2M	Piltun Area	143.335835	52.96516	14	12	0.40	0.00	2.40	12.10	22.60	**48.10**	11.40	0.10	2.50	0.40	Sm
5	5	1-2N	Piltun Area	143.324451	53.02358	14	13	1.30	0.00	0.00	8.30	8.00	**55.80**	25.20	0.20	0.60	0.60	Sm
6	6	1-2S	Piltun Area	143.345854	52.89577	12	13	0.00	0.00	3.59	7.24	6.49	40.85	40.89	0.61	0.33	0.00	Sf+Sm
7	7	1-3M	Piltun Area	143.293593	53.15153	15	14	0.00	0.00	1.50	10.40	9.70	31.80	44.30	1.20	1.10	0.00	Sf+Sm
8	8	1-3N	Piltun Area	143.283996	53.17189	14	13	0.00	0.00	0.99	10.85	26.18	**53.15**	6.94	1.19	0.70	0.00	Sm
9	9	1-3S	Piltun Area	143.300262	53.09636	11	12	0.70	0.00	0.10	4.10	8.10	**65.80**	19.90	0.60	0.70	0.00	Sm
10	10	1-4M	Piltun Area	143.254526	53.27328	15	14	0.00	0.00	0.00	2.11	0.36	3.32	**94.21**	0.00	0.00	0.00	Sf
11	11	1-4N	Piltun Area	143.213048	53.34135	15	14	0.60	0.00	0.00	0.50	2.90	**60.90**	33.70	0.20	0.60	0.60	Sm
12	12	1-4S	Piltun Area	143.278827	53.21466	17	14	0.42	0.03	1.27	9.58	13.95	**41.00**	32.61	0.31	0.53	0.30	Sm+Sf
13	13	1-5M	Piltun Area	143.164338	53.43991	17	14	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Peb
14	14	1-5N	Piltun Area	143.12566	53.49365	12	15	0.40	0.00	0.20	0.60	0.30	5.20	**91.30**	0.40	0.30	1.30	Sf
15	15	1-5S	Piltun Area	143.20306	53.36265	15	14	0.00	0.00	0.40	2.60	1.30	15.80	**77.90**	0.30	1.70	0.00	Sf
16	16	2-1M	Piltun Area	143.360566	52.83161	17	14	1.89	0.00	0.59	3.37	5.40	**47.38**	37.81	1.70	1.86	0.00	Sm+Sf
17	17	2-1N	Piltun Area	143.362171	52.87348	14	14	0.00	0.00	0.80	8.10	11.80	**58.80**	19.10	0.80	0.60	0.00	Sm
18	18	2-1S	Piltun Area	143.35797	52.74227	11	15	0.00	0.00	0.00	8.8	16.5	**67.26**	6.94	0.5	0.00	0.00	Sm
19	19	2-2M	Piltun Area	143.346834	52.98044	17	14	0.00	0.00	0.03	0.10	0.31	10.07	**87.02**	2.11	0.36	0.00	Sf
20	20	2-2N	Piltun Area	143.346336	53.01548	16	14	0.00	0.00	0.10	0.05	0.10	5.52	**92.13**	1.43	0.67	0.00	Sf
21	21	2-2S	Piltun Area	143.354685	52.93359	17	14	0.00	0.00	0.00	0.50	0.66	42.32	**55.19**	0.53	0.80	0.00	Sf+Sm
22	22	2-3M	Piltun Area	143.320261	53.12546	18	10	0.00	0.00	0.05	0.06	0.27	35.57	**62.74**	0.87	0.44	0.00	Sf+Sm
23	23	2-3N	Piltun Area	143.31292	53.18217	21	10	0.17	0.00	1.27	6.73	9.58	24.30	**55.55**	1.45	0.80	0.15	Sf
24	24	2-3S	Piltun Area	143.330709	53.09645	22	10	0.00	0.00	0.00	0.09	0.31	19.46	**79.41**	0.64	0.09	0.00	Sf
25	25	2-4M	Piltun Area	143.262627	53.27529	20	10	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Peb
26	26	2-4N	Piltun Area	143.256871	53.31691	22	10	0.90	0.00	0.00	1.40	2.10	11.00	**81.80**	0.20	0.80	1.80	Sf
27	27	2-4S	Piltun Area	143.286881	53.24888	21	10	1.10	2.90	11.50	22.60	10.20	8.90	41.50	0.20	0.60	0.50	Sf+Grf
28	28	2-5M	Piltun Area	143.19071	53.45115	25	11	0.00	0.00	0.00	0.36	7.14	**51.12**	40.84	0.54	0.00	0.00	Sm
29	29	2-5N	Piltun Area	143.165888	53.4683	13	11	0.40	0.00	9.00	38.30	29.30	21.20	1.40	0.10	0.30	0.00	Sc
30	30	2-5S	Piltun Area	143.22899	53.37565	21	11	0.40	0.00	0.00	0.70	1.40	22.90	**73.30**	0.40	0.90	0.00	Sf
31	31	3-1M	Piltun Area	143.404989	52.785158	18	11	0.65	0.00	22.20	24.65	32.68	11.29	7.69	0.48	0.36	0.00	Sm+Sc
32	32	3-1N	Piltun Area	143.383669	52.852514	18	11	0.00	0.00	3.70	14.10	26.40	46.50	8.20	0.40	0.70	0.00	Sm
33	33	3-1S	Piltun Area	143.386107	52.741740	17	11	0.80	0.00	0.80	3.20	4.40	**67.20**	22.20	0.60	0.80	0.00	Sm

Item	Number	Station	Area	Coordinates (decimal form)		Depth, m	Tempera-ture	Bottom type										Soil code
								Peb	Grc	Grm	Grf	Sc	Sm	Sf	Ac	Af	Pec	
								Size of prevalent fraction, mm										
				Longitude	Latitude			> 10	10-5	5-2	2-1	1-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.01	< 0.01	
34	34	3-2M	Piltun Area	143.380663	52.955727	23	11	0.70	0.00	0.00	0.40	0.30	4.20	**93.00**	0.40	0.30	0.70	Sf
35	35	3-2N	Piltun Area	143.380929	53.028266	26	11	2.07	0.00	17.82	26.15	34.24	12.18	3.15	2.23	2.16	0.00	Sc+Grf
36	36	3-2S	Piltun Area	143.394717	52.902879	20	11	0.00	0.00	0.00	3.10	6.00	**55.60**	34.20	1.10	0.00	0.00	Sm
37	37	3-3M	Piltun Area	143.342961	53.122872	21	11	0.00	0.00	0.00	2.80	4.10	**61.10**	30.30	0.80	0.90	0.00	Sm
38	38	3-3N	Piltun Area	143.321665	53.183351	25	11	0.00	0.00	0.00	0.13	1.69	36.85	**60.42**	0.91	0.00	0.00	Sf+Sm
39	39	3-3S	Piltun Area	143.366044	53.097132	27	12	0.00	0.00	10.07	6.11	10.11	24.02	49.21	0.30	0.18	0.00	Sf
40	40	3-4M	Piltun Area	143.301507	53.287312	25	12	0.00	0.00	0.70	1.20	2.01	11.94	**82.19**	0.94	1.02	0.00	Sf
41	41	3-4N	Piltun Area	143.290428	53.314381	27	11	0.90	0.00	0.20	0.30	0.30	7.90	**89.00**	0.50	0.90	0.00	Sm
42	42	3-4S	Piltun Area	143.331526	53.211715	29	11	0.00	0.00	0.00	0.30	0.40	11.60	**84.70**	0.30	2.70	0.00	Sf
43	43	3-5M	Piltun Area	143.218360	53.419300	25	11	0.00	0.00	0.00	1.97	2.43	6.66	**87.19**	1.75	0.00	0.00	Sf
44	44	3-5N	Piltun Area	143.183251	53.485408	28	11	0.68	0.00	0.00	0.40	0.19	11.90	**84.70**	1.46	0.67	0.00	Sf
45	45	3-5S	Piltun Area	143.248712	53.365021	25	10	0.40	0.00	0.80	2.20	2.00	7.40	**85.70**	0.20	0.90	0.40	Sf
46	46	4-1M	Piltun Area	143.418357	52.824279	19	11	0.88	0.00	1.27	1.03	0.42	15.16	**80.13**	0.71	0.40	0.00	Sf
47	47	4-1N	Piltun Area	143.421778	52.848146	22	11	0.57	0.00	0.00	0.00	1.00	22.92	**74.34**	0.35	0.82	0.00	Sf
48	48	4-1S	Piltun Area	143.417931	52.739054	23	11	0.00	3.04	2.16	2.06	12.18	33.18	42.18	3.04	2.16	0.00	Sf+Sm
49	49	4-2M	Piltun Area	143.418292	52.945652	24	12	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Peb
50	50	4-2N	Piltun Area	143.393035	53.032761	24	12	0.60	0.00	0.13	0.47	0.33	3.97	**92.40**	0.83	0.40	0.87	Sf
51	51	4-2S	Piltun Area	143.411170	52.937506	26	12	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Peb
52	52	4-3M	Piltun Area	143.375201	53.103360	23	12	1.55	0.00	0.00	0.04	0.19	11.90	**84.00**	1.46	0.67	0.19	Sf
53	53	4-3N	Piltun Area	143.368296	53.193241	28	12	0.80	0.00	0.00	0.00	0.10	7.20	**82.30**	3.00	6.60	0.00	Sf
54	54	4-3S	Piltun Area	143.371336	53.089591	26	12	0.00	0.00	0.14	0.16	0.22	20.45	**78.35**	0.52	0.16	0.00	Sf
55	55	4-4M	Piltun Area	143.319393	53.299786	28	12	0.89	0.28	2.49	6.21	8.10	36.93	41.77	1.41	1.56	0.36	Sf+Sm
56	56	4-4N	Piltun Area	143.313809	53.303104	28	11	1.31	0.00	0.00	0.11	0.72	44.50	**50.45**	0.74	0.69	1.48	Sf+Sm
57	57	4-4S	Piltun Area	143.325376	53.255766	24	11	0.70	0.00	0.00	5.80	0.80	9.90	**81.40**	0.60	0.80	0.00	Sf
58	58	4-5M	Piltun Area	143.251726	53.440361	32	11	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Peb
59	59	4-5N	Piltun Area	143.223846	53.456644	30	11	0.00	0.00	0.42	0.14	0.11	11.94	**85.20**	1.62	0.57	0.00	Sf
60	60	4-5S	Piltun Area	143.289257	53.359529	35	10	2.56	10.22	8.13	12.14	22.13	19.68	20.32	4.82	0.00	0.00	Scmf
61	1	5	Intermediate	143.454816	52.500345	22	11	2.16	5.34	9.12	5.45	16.21	**50.68**	7.43	3.48	0.13	0.00	Grf
62	2	1--1	Intermediate	143.355249	52.683550	11	10	0.16	27.84	6.84	**50.35**	1.71	0.22	12.18	0.18	0.52	0.00	Grf+P
63	3	1--2	Intermediate	143.335216	52.607569	8	11	0.00	1.58	0.80	0.16	0.00	13.50	**83.55**	0.41	0.00	0.00	Sf
64	4	1--3	Intermediate	143.333307	52.427297	14	11	0.00	0.00	0.13	0.18	1.02	15.27	**82.77**	0.62	0.01	0.00	Sf
65	5	2--1	Intermediate	143.368555	52.658197	15	9	1.00	0.00	0.00	0.00	0.20	19.10	**77.50**	0.40	0.90	0.90	Sf
66	6	2--2	Intermediate	143.348891	52.538230	15	9	0.00	0.00	0.00	0.60	1.40	15.60	**80.40**	1.00	1.00	0.00	Sf
67	7	2--3	Intermediate	143.348190	52.448530	17	11	0.00	1.90	2.50	4.80	2.50	17.20	**69.80**	0.30	1.00	0.00	Sf
68	8	3--1	Intermediate	143.413926	52.694193	23	13	1.70	0.00	0.00	5.30	5.50	**54.10**	31.80	0.60	0.70	0.30	Sm
69	9	3--2	Intermediate	143.401561	52.560787	23	10	0.60	5.00	12.14	14.30	26.42	23.64	17.20	0.10	0.60	0.00	Sm

Item	Number	Station	Area	Coordinates (decimal form)		Depth, m	Tempera-ture	Bottom type										Soil code
								Peb	**Grc**	**Grm**	**Grf**	**Sc**	**Sm**	**Sf**	**Ac**	**Af**	**Pec**	
								Size of prevalent fraction, mm										
				Longitude	Latitude			> 10	10-5	5-2	2-1	1-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.01	< 0.01	
70	10	3--3	Intermediate	143.367269	52.420093	19	9	0.00	0.00	0.95	4.71	8.13	37.86	45.16	1.91	1.28	0.00	Sf+Sm
71	11	4--1	Intermediate	143.421274	52.664900	19	12	2.60	0.00	0.00	0.40	0.30	32.00	**63.00**	0.10	0.80	0.80	Sf
72	12	4--2	Intermediate	143.409372	52.555511	21	13	0.00	0.00	10.50	19.90	17.60	37.00	13.80	0.80	0.40	0.00	Sm
73	13	4--3	Intermediate	143.406577	52.448866	16	11	0.00	0.00	0.00	2.00	13.90	**60.50**	22.30	0.40	0.90	0.00	Sm
74	1	B1-1	Offshore	143.365554	51.986309	29	8	0.40	0.00	0.00	1.30	2.50	**64.10**	30.00	0.30	0.50	0.90	Sm
75	2	B1-2	Offshore	143.394707	52.029020	26	12	0.00	0.00	0.00	11.74	11.51	32.13	42.76	1.86	0.00	0.00	Sf+Sm
76	3	B1-3	Offshore	143.396640	52.163170	25	10	0.00	0.00	0.00	0.64	22.90	40.53	31.93	3.35	0.65	0.00	Sm+Sf
77	4	B1-4	Offshore	143.361703	52.305157	20	9	0.60	0.00	1.20	8.80	9.30	37.50	41.80	0.10	0.70	0.00	Sf+Sm
78	5	B2-1	Offshore	143.424941	51.969138	30	9	0.90	0.00	0.00	0.50	4.00	**66.50**	26.80	0.40	0.90	0.00	Sm
79	6	B2-2	Offshore	143.428029	52.068464	30	11	0.00	0.00	5.09	26.51	19.40	44.42	4.44	0.14	0.00	0.00	Sm+Grf
80	7	B2-3	Offshore	143.435902	52.276554	24	11	2.20	1.02	0.13	0.09	20.49	27.59	46.91	0.82	0.46	0.29	Sf
81	8	B2-4	Offshore	143.418398	52.328226	27	9	0.93	0.00	0.58	0.23	10.23	24.73	**57.85**	1.04	4.41	0.00	Sf
82	9	B3-1	Offshore	143.451520	51.959954	31	9	1.13	0.00	0.57	8.82	26.10	41.24	19.30	1.03	1.36	0.45	Sm+Sc
83	10	B3-2	Offshore	143.474577	52.085328	33	11	0.00	0.00	0.00	2.10	5.20	**78.40**	13.30	0.40	0.60	0.00	Sm
84	11	B3-3	Offshore	143.485428	52.235477	27	13	0.00	0.00	0.00	0.13	20.63	35.29	40.74	3.21	0.00	0.00	Sf+Sm
85	12	B3-4	Offshore	143.477876	52.385795	27	10	0.00	1.00	9.70	14.70	14.90	41.30	16.80	1.60	0.00	0.00	Sm
86	13	B4-1	Offshore	143.499987	51.914824	35	9	0.50	0.00	0.30	0.60	1.40	11.20	**84.20**	0.30	0.50	1.00	Sf
87	14	B4-2	Offshore	143.497120	52.034420	31	12	0.00	0.00	0.57	0.36	0.89	6.41	**85.97**	3.44	2.36	0.00	Sf
88	15	B4-3	Offshore	143.531857	52.153591	33	13	0.00	0.00	3.60	6.20	5.50	**48.50**	32.80	1.30	2.10	0.00	Sm
89	16	B4-4	Offshore	143.528610	52.318687	32	9	0.00	0.00	0.08	0.37	2.96	44.83	**51.47**	0.24	0.05	0.00	Sf+Sm
90	17	B5-1	Offshore	143.561441	51.960239	43	10	0.50	0.00	4.70	11.10	25.20	26.00	31.10	0.10	0.40	0.90	Sm
91	18	B5-2	Offshore	143.579712	52.144540	40	11	1.80	0.00	3.60	6.80	4.50	24.40	**55.20**	1.70	1.00	1.00	Sf
92	19	B5-3	Offshore	143.565492	52.154761	38	10	0.00	0.00	3.90	24.20	28.40	38.20	4.10	0.80	0.40	0.00	Sm+Sc
93	20	B5-4	Offshore	143.566316	52.417602	30	10	0.00	1.70	5.31	**54.30**	14.88	20.80	1.15	0.73	1.13	0.00	Grf
94	21	B6-1	Offshore	143.591770	51.939664	46	7	0.56	0.00	9.06	5.95	4.58	12.86	**65.57**	0.88	0.54	0.00	Sf
95	22	B6-2	Offshore	143.604940	52.061357	43	11	0.60	0.00	0.70	1.80	1.60	9.20	**84.40**	0.50	0.60	0.60	Sf
96	23	B6-3	Offshore	143.617488	52.182485	41	10	0.60	0.00	0.90	10.40	25.40	**51.50**	10.10	0.50	0.60	0.00	Sm
97	24	B6-4	Offshore	143.601473	52.402975	34	9	4.80	0.00	0.00	1.20	1.10	15.90	**69.10**	4.30	2.40	1.20	Sf
98	25	B7-1	Offshore	143.635301	51.943814	51	11	0.00	0.00	0.00	0.11	0.27	35.57	**62.74**	0.87	0.44	0.00	Sf+Sm
99	26	B7-2	Offshore	143.646280	52.135429	43	11	0.00	0.00	0.17	0.98	1.62	23.22	**72.60**	0.86	0.55	0.00	Sf
100	27	B7-3	Offshore	143.644337	52.231330	39	11	0.00	0.00	0.00	0.05	0.66	42.37	**56.31**	0.53	0.08	0.00	Sf
101	28	B7-4	Offshore	143.629807	52.413373	34	12	0.00	0.00	0.04	0.51	1.87	44.03	**53.25**	0.26	0.04	0.00	Sf
102	29	B8-1	Offshore	143.674903	51.891577	55	12	1.00	0.00	0.00	0.00	0.50	**50.10**	47.40	0.10	0.90	0.00	Sm
103	30	B8-2	Offshore	143.700379	52.078588	50	11	0.00	0.00	0.26	0.17	0.56	25.18	**73.00**	0.66	0.17	0.00	Sf
104	31	B8-3	Offshore	143.679377	52.245054	41	10	0.00	0.00	0.00	0.69	2.78	20.47	**73.95**	2.11	0.00	0.00	Sf
105	32	B8-4	Offshore	143.672226	52.383069	40	12	0.50	0.00	1.20	2.50	12.00	**65.60**	16.90	0.10	0.60	0.60	Sm

Item	Number	Station	Area	Coordinates (decimal form)		Depth, m	Tempera-ture	Bottom type										Soil code
								Peb	**Grc**	**Grm**	**Grf**	**Sc**	**Sm**	**Sf**	**Ac**	**Af**	**Pec**	
								Size of prevalent fraction, mm										
				Longitude	Latitude			> 10	10-5	5-2	2-1	1-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.01	< 0.01	
106	33	B9-1	Offshore	143.743787	51.903031	60	10	0.00	0.00	0.39	0.31	0.27	3.36	**92.37**	1.93	1.37	0.00	Sm
107	34	B9-2	Offshore	143.713314	52.126962	48	9	0.60	0.00	0.60	4.50	14.10	**66.70**	12.60	0.30	0.60	0.00	Sm
108	35	B9-3	Offshore	143.746424	52.201253	48	8	0.00	0.00	0.00	0.30	0.70	3.70	**91.70**	1.60	2.00	0.00	Sf
109	36	B9-4	Offshore	143.753558	52.349330	43	11	0.00	0.00	0.00	0.70	1.00	22.90	**74.10**	0.40	0.90	0.00	Sf
110	1	C-1	Control Area	143.566841	52.700232	24	11	0.00	0.00	4.30	45.55	32.12	12.60	3.19	2.24	0.00	0.00	Grf+Sc
111	2	C1M	Control Area	143.569464	52.516928	33	11	0.70	0.00	2.60	6.10	14.90	**53.90**	20.20	0.20	0.70	0.70	Sm
112	3	C1N	Control Area	143.544581	52.443179	32	12	0.00	0.00	0.80	6.30	4.00	**59.50**	27.50	1.30	0.60	0.00	Sm
113	4	C1S	Control Area	143.583809	52.760651	32	12	0.00	25.35	**58.75**	14.85	1.05	0.00	0.00	0.00	0.00	0.00	Грк
114	5	C-2	Control Area	143.569464	52.516928	33	11	0.69	0.00	0.08	2.37	**66.06**	28.18	1.43	0.70	0.49	0.00	Sc+Sm
115	6	C2S	Control Area	143.573136	52.895487	33	10	0.00	2.60	20.10	18.30	13.50	32.90	11.40	0.80	0.40	0.00	Sm
116	7	C-3	Control Area	143.544581	52.443179	30	12	0.58	0.71	1.73	4.83	11.96	**50.00**	29.18	0.32	0.67	0.02	Sm
117	8	C4N	Control Area	143.461027	53.342254	53	10	0.00	0.00	0.05	0.07	0.43	32.56	**65.94**	0.65	0.30	0.00	Sf
118	9	C5M	Control Area	143.393322	53.432158	53	9	1.00	0.00	0.50	11.90	30.60	**51.70**	3.40	0.30	0.30	0.30	Sm
119	10	C5N	Control Area	143.365562	53.477972	55	8	0.00	0.00	0.30	8.00	4.20	**50.50**	34.90	1.00	1.10	0.00	Sm
120	11	C5S	Control Area	143.423979	53.375884	51	11	0.00	0.00	15.45	**50.12**	32.18	1.49	0.76	0.00	0.00	0.00	Грк
121	12	Cb1	Control Area	143.236006	51.982942	21	11	0.00	0.00	0.00	0.33	2.55	**56.60**	39.33	0.70	0.49	0.00	Sm
122	13	Cb2	Control Area	143.218797	52.085791	23	11	0.60	0.00	3.00	6.40	20.50	**61.10**	6.90	0.10	0.70	0.70	Sm
123	14	Cb3	Control Area	143.193971	52.155156	17	12	0.00	0.00	1.42	2.40	5.64	**64.12**	26.17	0.20	0.05	0.00	Sm
124	15	Cb4	Control Area	143.280744	52.372778	10	12	0.00	0.00	0.40	3.20	18.30	**58.80**	17.80	0.60	0.90	0.00	Sm
125	1	AS-01	Feeding Point	143.23029	51.92679	12	11	0.00	0.00	0.00	**58.51**	3.51	35.90	0.78	0.60	0.70	0.00	Grm+Sm
126	2	B6-2-2	Feeding Point	143.59608	52.11298	41	10	0.60	0.30	4.40	18.50	19.60	45.50	10.10	0.20	0.30	0.50	Sm
127	3	FP-01	Feeding Point	143.61811	52.13082	45	12	0.30	0.00	0.10	2.70	32.60	**51.20**	11.90	0.20	0.70	0.30	Sm+Sc
128	4	FP-02	Feeding Point	143.68641	52.41362	44	12	0.00	0.00	3.60	8.90	19.10	**53.60**	12.50	2.30	0.00	0.00	Sm
129	5	FP-03	Feeding Point	143.55287	52.14435	38	12	0.00	0.00	4.80	7.00	23.40	**56.00**	6.60	1.60	0.60	0.00	Sm+Sc
130	6	FP-04	Feeding Point	143.62700	52.20267	40	11	0.00	0.00	0.70	4.00	24.10	**61.50**	7.30	0.70	1.70	0.00	Sm+Sc
131	7	FP-05	Feeding Point	143.56081	52.15897	40	11	0.00	0.00	0.17	0.17	**53.84**	26.83	15.21	3.48	0.30	0.00	Sc
132	8	FP-06	Feeding Point	143.37305	52.17432	38	11	0.00	0.00	6.40	6.80	10.50	38.40	36.50	0.80	0.60	0.00	Sm+Sf
133	9	FP-07	Feeding Point	143.63261	52.18657	41	11	0.90	0.00	0.00	0.00	0.11	31.14	**66.27**	0.58	0.53	0.47	Sf
134	10	FP-08	Feeding Point	143.36901	52.69785	14	10	0.00	0.00	0.00	1.29	1.90	3.71	**91.40**	1.70	0.00	0.00	Sf
135	11	FP-09	Feeding Point	143.28943	53.18960	16	10	1.85	0.00	0.00	0.07	0.38	22.95	**67.72**	2.44	3.22	1.37	Sf
136	12	FP-10	Feeding Point	143.27600	53.22650	12	9	0.00	0.00	1.00	10.90	16.40	**63.90**	6.90	0.90	0.00	0.00	Sm
137	13	FP-11	Feeding Point	143.28033	53.24433	17	9	0.70	0.00	0.20	0.40	0.40	2.50	**92.90**	1.70	0.60	0.60	Sf
138	14	FP-12	Feeding Point	143.26854	53.21993	13	13	0.00	2.50	2.30	8.30	17.20	**67.80**	0.30	1.00	0.60	0.00	Sm
139	15	FP-13	Feeding Point	143.26338	53.19812	8	9	0.00	0.00	0.10	5.00	10.50	**61.10**	21.90	0.60	0.80	0.00	Sm
140	16	FP-14	Feeding Point	143.26676	53.19839	8	9	0.73	0.00	0.00	0.71	0.31	1.50	**92.68**	2.77	0.89	0.41	Sf
141	17	FP-15	Feeding Point	143.27536	53.18775	8	9	0.00	0.00	0.30	1.00	5.40	**64.30**	27.70	0.60	0.70	0.00	Sm

Item	Number	Station	Area	Coordinates (decimal form)		Depth, m	Tempera-ture	Bottom type										Soil code
								Peb	Grc	Grm	Grf	Sc	Sm	Sf	Ac	Af	Pec	
								Size of prevalent fraction, mm										
				Longitude	Latitude			> 10	10-5	5-2	2-1	1-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.01	< 0.01	
142	18	FP-16	Feeding Point	143.28790	53.17677	8	10	0.50	0.00	0.00	0.30	0.10	11.40	**76.50**	5.00	6.20	0.00	Sf
143	19	FP-17	Feeding Point	143.29392	53.16048	8	10	0.78	0.00	0.00	0.45	0.18	1.15	**94.34**	2.57	0.53	0.00	34
144	20	FP-18	Feeding Point	143.24300	53.33117	21	10	1.90	0.00	3.72	22.70	35.28	32.56	1.70	0.76	1.38	0.00	Sm+Sc
145	21	FP-19	Feeding Point	143.24652	53.31762	16	10	0.00	0.00	6.80	23.30	26.90	35.90	4.30	0.70	2.10	0.00	Sm+Sc
146	22	FP-20	Feeding Point	143.23993	53.30145	14	10	0.60	0.00	2.70	1.40	2.20	15.80	**72.60**	2.20	2.50	0.00	Sf
147	23	FP-21	Feeding Point	143.25913	53.32632	24	10	1.53	0.00	0.00	0.04	0.27	23.38	**72.67**	0.89	0.73	0.49	Sf
148	24	FP-22	Feeding Point	143.27901	53.22103	13	10	0.00	0.40	3.30	14.00	26.40	47.50	7.40	1.00	0.00	0.00	Sm
149	25	FP-23	Feeding Point	143.61737	52.16359	40	10	0.70	0.00	0.10	1.10	19.40	**56.90**	20.60	0.40	0.80	0.00	Sm
150	26	FP-24	Feeding Point	143.65460	52.13165	43	10	0.00	0.20	0.23	6.70	**63.33**	25.72	3.82	0.00	0.00	0.00	Sc
151	27	FP-25	Feeding Point	143.64748	52.12420	43	10	1.22	3.72	3.19	**49.80**	24.74	12.56	2.10	0.76	1.38	0.53	Grf+Sc
152	28	FP-26	Feeding Point	143.60132	52.16560	39	9	0.00	0.00	0.80	13.90	52.40	20.90	10.90	0.50	0.60	0.00	Sc
153	29	FP-27	Feeding Point	143.60427	52.14782	40	11	0.00	0.00	0.00	0.00	2.86	44.76	**50.53**	1.85	0.00	0.00	Sf+Sm
154	30	FP-28	Feeding Point	143.72750	52.18700	33	9	0.00	0.00	0.20	2.00	7.10	**53.30**	35.80	0.90	0.70	0.00	Sm
155	31	FP-29	Feeding Point	143.75010	52.18762	48	9	0.50	3.10	9.50	13.60	21.10	44.10	6.90	0.10	0.60	0.50	Sm+Sc
156	32	FP-30	Feeding Point	143.69976	52.19210	43	9	0.00	0.00	8.09	10.70	31.57	34.89	14.53	0.22	0.00	0.00	Sf+Sm
157	33	FP-31	Feeding Point	143.73991	52.21785	43	9	0.90	0.00	0.00	3.80	4.40	**61.50**	27.70	0.10	0.80	0.80	Sm
158	34	FP-32	Feeding Point	143.71272	52.41500	43	9	4.90	23.12	24.28	17.67	4.04	2.08	**8.95**	4.18	7.54	3.24	Sf
159	35	FP-33	Feeding Point	143.71530	52.41308	43	9	0.41	4.10	18.20	17.20	**56.40**	0.30	0.70	1.79	0.46	0.44	Sm
160	36	FP-34	Feeding Point	143.70567	52.39046	43	10	0.40	0.00	0.20	9.70	20.90	**62.10**	5.90	0.50	0.30	0.00	Sm
161	37	FP-35	Feeding Point	143.71273	52.35820	46	6	6.98	19.40	2.88	**51.95**	4.04	2.08	11.13	4.00	7.54	0.00	Grf
162	38	FP-36	Feeding Point	143.68715	52.24710	41	6	0.33	0.00	0.00	20.63	11.83	0.41	**61.35**	4.84	0.61	0.00	Sf
163	39	FP-37	Feeding Point	143.68592	52.25700	41	6	0.00	0.00	0.70	5.10	18.40	**67.10**	6.80	1.90	0.00	0.00	Sm
164	40	FP-38	Feeding Point	143.71588	52.27037	43	6	0.00	0.00	0.03	0.30	2.55	**56.06**	39.87	0.70	0.49	0.00	Sm
165	41	FP-39	Feeding Point	143.71391	52.27782	42	6	1.47	0.00	2.66	4.36	19.40	**53.56**	16.92	0.80	0.83	0.00	Sm
166	42	FP-40	Feeding Point	143.36183	52.80477	9	6	0.00	0.00	0.01	0.06	0.13	3.87	**93.37**	1.49	1.07	0.00	Sf
167	43	FP-41	Feeding Point	143.36783	52.80850	11	10	0.50	0.00	0.10	1.70	19.20	**64.20**	13.10	0.10	0.60	0.50	Sm
168	44	FP-42	Feeding Point	143.36950	52.81633	11	11	0.00	0.00	0.11	1.28	0.76	2.63	**92.51**	2.71	0.00	0.00	Sf
169	45	FP-43	Feeding Point	143.37367	52.81533	13	11	0.40	0.00	0.00	0.38	0.25	0.76	**95.51**	1.36	0.71	0.63	Sf
170	46	FP-44	Feeding Point	143.38167	52.80817	15	11	1.96	0.00	0.00	0.00	0.00	18.21	**77.77**	0.46	0.41	1.19	Sf
171	47	FP-45	Feeding Point	143.36533	52.81433	14	11	0.00	0.00	0.60	4.50	7.60	**61.40**	24.60	0.60	0.70	0.00	Sm

APPENDIX 3. Taxonomic list of benthic and nectobenthic species found in the study area.

Item	Species number	Taxon/Species name	Code
		Actiniaria – sea anemone*	
1	1	*Epiactis lewisi*	Act
		Amphipoda – amphipods	
2	1	*Acanthostepheia behringiensis*	Am
172	2	*Acanthostepheia malmgreni*	Am
3	3	*Ampelisca eschrichti*	Am
173	4	*Ampelisca eoa*	Am
4	5	*Anisogammarus pugettensis*	Am
174	6	*Anisogammarus schmidti*	Am
5	7	*Anonyx kurilicus*	Am
6	8	*Anonyx nugax pacificus*	Am
7	9	*Anonyx ochoticus*	Am
8	10	*Anonyx sp.*	*Am*
9	11	*Atylus collingi*	Am
10	12	*Bathymedon obtusifrons*	Am
11	13	*Bathymedon tilessii*	Am
175	14	*Bathymedon langsdorfi*	Am
12	15	*Boeckosimus derjugini*	Am
176	16	*Boeckosimus simus*	Am
177	17	*Byblis erythrops*	Am
13	18	*Caprella cristibrachium*	Am
14	19	*Eogammarus schmidti*	Am
15	20	*Eohaustorius eous eous*	Am
16	21	*Ericthonius tolly*	*Am*
178	22	*Harpiniopsis kobjakovae*	Am
179	23	*Hippomedon denticulatus orientalis*	Am
17	24	*Ischyrocerus chamiossi*	Am
18	25	*Ischyrocerus elongatus*	Am
19	26	*Ischyrocerus krascheninnikovi*	Am
20	27	*Ischyrocerus sp.*	*Am*
180	28	*Lembos arcticus*	Am
21	29	*Maera loveni*	*Am*
22	30	*Melita sp.*	*Am*
23	31	*Melitoides makarovi*	Am
24	32	*Metopa clypeata*	Am
25	33	*Metopa layi*	Am
26	34	*Metopa majuscula*	Am
27	35	*Metopa sp.*	*Am*
28	36	*Metopa spitzbergensis*	Am
29	37	*Monoculodes crassirostris*	Am
30	38	*Monoculodes sp.*	*Am*
31	39	*Monoculodes zernovi*	Am

Item	Species number	Taxon/Species name	Code
181	40	*Onisimus krassini*	Am
32	41	*Orchomene gurjanovae*	Am
33	42	*Orchomenella japonica*	Am
34	43	*Orchomenella pinguis*	Am
35	44	*Parapleustes tricuspis*	Am
182	45	*Parapleustes vasinae*	Am
183	46	*Paronesimus barentsi*	Am
36	47	*Photis baekmannae*	Am
37	48	*Photis reinchardi*	Am
38	49	*Photis sp.*	*Am*
39	50	*Pleusymtes sp.*	*Am*
40	51	*Pleusymtes vasinae*	Am
41	52	*Pontharpinia longirostris*	Am
42	53	*Pontharpinia nasuta*	Am
43	54	*Pontharpinia robusta*	Am
44	55	*Pontoporeia affinis*	Am
45	56	*Protomedeia macrocarpa*	Am
46	57	*Protomedeia microdactila*	Am
47	58	*Protomedeia popovi*	Am
48	59	*Protomedeia fasciata.*	*Am*
49	60	*Psammonyx kudrjaschovi*	Am
50	61	*Rhachotropis oculata*	Am
51	62	*Synchelidium gurjanovae*	Am
52	63	*Wecomedon minusculus*	Am
184	64	*Wecomedon wirketis*	Am
53	65	*Weswoodilla sp.*	*Am*
54	66	*Weswoodilla sp.1*	*Am*
		Ascidiacea – ascidians	
185	1	*Ascidia vegae*	Asc
55	2	*Pelonaia corrugata*	Asc
		Bivalvia – bivalve mollusks	
56	1	*Arvella japonica*	Bi
57	2	*Arvella manshurica*	Bi
58	3	*Crenella decussata decussata*	Bi
59	4	*Hiatella arctica*	Bi
60	5	*Liocyma fluctuosa*	Bi
61	6	*Macoma balthica*	Bi
62	7	*Macoma calcarea*	Bi
63	8	*Macoma lama*	Bi
64	9	*Macoma middendorffi*	Bi
65	10	*Macoma sp.*	Bi
66	11	*Mactromeris polynyma = Spisula voji*	Bi
67	12	*Megangulus luteus = Peronidia lutea*	Bi
68	13	*Musculus niger*	Bi

Item	Species number	Taxon/Species name	Code
69	14	*Mya (Mya) priapus*	Bi
70	15	*Mya sp.*	Bi
71	16	*Mysella planata*	Bi
72	17	*Mysella gurjanovae*	Bi
73	18	*Mysella kurilensis*	Bi
74	19	*Panomya sp. (juv.)*	Bi
75	20	*Serripes groenlandicus*	Bi
76	21	*Siliqua alta*	Bi
186	22	*Spisula sachalinensis*	Bi
77	23	*Tridonta borealis*	Bi
78	24	*Tridonta montaqui*	Bi
79	25	*Tridonta rollandi*	Bi
80	26	*Vilasina vernicosa*	Bi
81	27	*Yoldia (Cnesterium) seminuda*	Bi
82	28	*Yoldia (Yoldia) myalis*	Bi
		Cirripedia – cirripedes*	
83	1	*Chthamalus dalli*	Ci
84	2	*Solidobalanus hesperius*	Ci
85	3	*Balanus cariosus*	Ci
		Cumacea – cumaceans	
86	1	*Diastylis bidentata*	Cu
87	2	*Diastylopsis dowsoni*	Cu
88	3	*Lamprops quadriplicata*	Cu
		Decapoda – decapod crustaceans	
89	1	*Hyas coarctatus (juv.)*	De
90	2	*Pagurus ochotensis*	De
91	3	*Pagurus pubescens*	De
92	4	*Crangon septemspinosa*	De
93	5	*Telmessus cheiragonus*	De
		Echinoidea – sea urchins	
94	1	*Echinarachnius parma*	Ech
		Euphausiacea – krill	
95	1	*Thysanoessa raschii*	Euph
		Gastropoda – gastropod mollusks	
96	1	*Buccinum middendorffi*	Ga
97	2	*Buccinum percrassum*	Ga
98	3	*Buccinum sakhalinense*	Ga
99	4	*Cryptonatica clausa*	Ga
100	5	*Cryptonatica janthostoma*	Ga
101	6	*Cylichna consobrina*	Ga
102	7	*Lunatia pallida*	Ga
103	8	*Neptunea bulbacea*	Ga
104	9	*Piliscus radiatus*	Ga
105	10	*Pseudolimesus nassula*	Ga

Item	Species number	Taxon/Species name	Code
106	11	*Solariella obscura intermedia*	Ga
		Hydroidea – hydroids*	
107	1	*Abietinaria thujarioides*	Hy
108	2	*Calicella syringa*	Hy
109	3	*Campanularia volubilis*	Hy
110	4	*Halecium reversum*	Hy
111	5	*Lafoea fruticosa*	Hy
112	6	*Obelia longissima*	Hy
113	7	*Sertularella plumosa*	Hy
114	8	*Sertularella similis*	Hy
115	9	*Sertularella tricuspidata*	Hy
116	10	*Sertularella gigantea*	Hy
117	11	*Sertularia similis*	Hy
118	12	*Thuiaria breitfussi*	Hy
119	13	*Thuiaria cylindrica*	Hy
120	14	*Thuiaria gonorhiza*	Hy
121	15	*Thuiaria triserialis*	Hy
		Isopoda – isopods	
122	1	*Saduria entomon*	Is
123	2	*Synidotea bicuspida*	Is
124	3	*Synidotea cinerea*	Is
		Mysidacea – opossum shrimp	
125	1	*Tenagomysis orientalis*	My
		Ophiuroidea – brittle stars	
126	1	*Ophiura sarsi*	Oph
127	2	*Stegophiura nodosa*	Oph
		Pantopoda – pantopods	
128	1	*Nymphon striatum*	Pa
		Polychaeta – marine worms (bristle worms)	
129	1	*Ampharete acutifrons*	Po
130	2	*Ampharete goesi*	Po
131	4	*Arabella iricolor*	Po
132	5	*Autolytus prismaticus*	Po
133	6	*Capitella capitata*	Po
134	7	*Chaetozone setosa*	Po
135	8	*Chone teres*	Po
136	9	*Cistenides granulata*	Po
137	10	*Cistenides soldatovi*	Po
138	11	*Demonax fullo*	Po
139	12	*Eteone longa*	Po
140	13	*Eumida sanguinea*	Po
141	14	*Euzonus sp.*	*Po*
142	15	*Glycera capitata*	Po
143	16	*Glycinde armigera*	Po

Item	Species number	Taxon/Species name	Code
144	17	*Goniada maculata*	Po
145	18	*Harmothoe imbricata*	Po
146	19	*Idanthyrsus armatus*	Po
147	20	*Lumbrineris bifurcata*	Po
148	21	*Lumbrineris japonica*	Po
149	22	*Lumbrineris minuta*	Po
150	23	*Lumbrineris sp.*	*Po*
151	24	*Magelona sachalinensis*	Po
152	25	*Melinna cristata*	Po
153	26	*Nephtys caeca*	Po
154	27	*Nephtys ciliata*	Po
155	28	*Nephtys longosetosa*	Po
157	29	*Onuphis iridescens*	Po
158	30	*Onuphis shirikishinaiensis*	Po
159	31	*Ophelia limacina*	Po
160	32	*Pectinaria sp.*	*Po*
161	33	*Phyllodoce groenlandica*	Po
162	34	*Potamilla torelli*	Po
163	35	*Praxillella praetermissa*	Po
164	36	*Scalibregma inflatum*	Po
165	37	*Scoloplos armiger*	Po
166	38	*Spio filicornis*	Po
167	39	*Spiophanes bombyx*	Po
168	40	*Travisia forbesii*	Po
169	41	*Travisia sp.*	*Po*
		Sipunculida – peanut worms	
170	1	*Phascolosoma japonicum*	Si
187	2	*Phascolosoma margaritacea*	Si
		Spongia – sponges*	
171	1	*Halichondria panicea*	Sp
		Pisces – fish	
	1	***Ammodytes hexapterus***	***Pi***

The sign "*" indicates taxa of attached epibenthic hydrobionts living on hard bottoms. The species found in the collections of 2002 are numbered in boldfact in the "Item" column.

APPENDIX 4.

Table P4.1. Quantitative characteristics of benthos (colony density - A, spec./m^2; biomass - B, g/m^2) at stations **in the Piltun Area**[1] **.**

Taxonomic group	Station (depth, m)											
	1-1M (12)		1-1N (15)		1-1S (11)		1-2M (14)		1-2N (14)		1-2S (12)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	4370	246.9	9460	202.17	7620	183.3	4490	79.16	1660	136.52	5260	210.71
Bivalvia	1540	52.85	120	92.81	140	112.4	70	34.93	40	22.11	80	15.94
Cumacea	460	6.41	1400	32.37	0	0	0	0	20	0.25	730	17.7
Decapoda	10	4.67	0	0	0	0	0	0	0	0	0	0
Echinoidea	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	0	0	10	3.38	10	2.9	10	0.37	0	0	10	0.4
Isopoda	630	97.4	700	16.9	110	17.53	450	19.83	340	64.45	260	15.17
Polychaeta	0	0.01	110	15.43	180	12.8	90	14.47	160	14.44	10	0.8
Rest	0	0	70	0.64	50	0.59	60	0.14	70	0.14	40	0.07
Total	**7010**	**408.24**	**11870**	**363.70**	**8110**	**329.50**	**5170**	**148.90**	**2290**	**237.91**	**6390**	**260.79**

Taxonomic group	Station (depth, m)											
	1-3M (15)		1-3N (14)		1-3S (11)		1-4M (15)		1-4N (15)		1-4S (17)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	2230	114.57	2540	59.2	1160	43.66	659	16.48	600	28.22	2120	63.39
Bivalvia	32	43.07	310	0.59	80	34.93	32	12.82	10	7.09	110	43.07
Cumacea	1100	2.2	360	3.88	630	16.15	235	2.64	10	0.33	790	8.81
Decapoda	20	14.93	0	0	0	0	10	1.07	10	7.74	30	3.57
Echinoidea	12	30.13	0	0	0	0	38	318.97	6	45.52	52	446.63
Gastropoda	0	0	10	26.77	0	0	0	0	0	0	0	0
Isopoda	560	64.23	860	48.06	230	20.8	96	9.07	100	19.17	50	8.93
Polychaeta	1180	35.93	56	11.85	10	1.67	42	3.5	10	16.89	140	11.67
Rest	0	0	20	4.44	50	0.07	0	0	0	0	0	0
Total	**5134**	**305.10**	**4156**	**154.79**	**2160**	**117.28**	**1112**	**364.55**	**746**	**124.96**	**3292**	**586.07**

Taxon	Station (depth, m)											
	1-5M (17)		1-5N (12)		1-5S (15)		2-1M (17)		2-1N (14)		2-1S (11)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	325	13.88	10	4.35	100	14.19	1980	84.2	770	32.27	6770	329.83
Bivalvia	36	14.41	10	10.37	150	105.87	20	25.67	98	102.92	130	113.33
Cumacea	960	7.91	10	0.34	30	0.16	760	3.62	320	1.23	0	0
Decapoda	10	0.2	12	0.89	10	0.03	10	1.4	20	7.4	0	0
Echinoidea	44	320.5	0	0	20	150.8	6	18.84	5	45.32	0	0
Gastropoda	0	0	10	4.28	0	0.31	0	0	0	0	10	8.2
Isopoda	120	13.17	1910	38.2	140	9.83	1570	46.76	1880	90.17	890	61.47
Polychaeta	12	4.64	10	0.58	110	5.23	60	13.26	50	16.89	10	29.07
Rest	0	0	0	0	26	2.01	0	0	0	0	60	0.59
Total	**1507**	**374.70**	**1972**	**59.01**	**586**	**288.43**	**4406**	**193.75**	**3143**	**296.20**	**7870**	**542.49**

[1] Data on the ominant groups of benthis organisms are shaded.

Table P4.1 continued.

Taxonomic group	Station (depth, m)											
	2-2M (17)		2-2N (16)		2-2S (17)		2-3M (18)		2-3N (21)		2-3S (22)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	45	14.2	98	58.24	220	18.43	440	22.09	328	28.41	1580	78.53
Bivalvia	10	2.67	46	29.3	0	0	0	0	34	58.24	80	191.08
Cumacea	620	5.62	260	1.98	40	0.06	0	0	0	0	170	2.02
Decapoda	2	0.4	20	14.57	0	0	0	0	20	1.94	40	12.97
Echinoidea	9	64.8	9	44.08	0	0	61	520.23	32	479.56	68	75.59
Gastropoda	0	0	0	0	0	0	5	0.95	10	8.49	0	0
Isopoda	870	36.76	780	28.47	80	47.67	210	13.6	310	17.64	880	59.95
Polychaeta	80	73.26	60	15.08	20	5.16	34	3.43	42	4.04	130	30.71
Rest	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1636**	**197.71**	**1273**	**191.7**	**360**	**71.32**	**750**	**560.3**	**776**	**598.32**	**2948**	**450.85**

Taxonomic group	Station (depth, m)											
	2-4M (20)		2-4N (22)		2-4S (21)		2-5M (25)		2-5N (13)		2-5S (21)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	490	29.13	1110	119.93	110	9.68	280	59.45	490	72.83	230	16.43
Bivalvia	0	0	10	1.18	12	4.94	20	16	32	278.1	30	180.3
Cumacea	1340	18.51	20	0.01	560	13.16	10	0.01	110	1.94	120	0.1
Decapoda	0	0	10	0.14	0	0	0	0	0	0	10	0.95
Echinoidea	30	306.17	0	0	48	72.54	230	710.1	0	0	10	766.04
Gastropoda	10	1.59	0	1.17	0	0	10	0.6	0	0	10	13.93
Isopoda	70	9.97	20	6.96	40	3.43	80	8.03	490	25.77	60	4.1
Polychaeta	48	48.48	210	14.11	34	4.48	100	8.95	46	1.94	500	6.33
Rest	0	0	360	2.09	0	0	10	0.3	0	0	100	7.41
Total	**1988**	**413.85**	**1740**	**145.59**	**804**	**108.23**	**740**	**803.44**	**1168**	**380.58**	**1070**	**995.59**

Taxonomic group	Station (depth, m)											
	3-1M (18)		3-1N (18)		3-1S (17)		3-2M (23)		3-2N (26)		3-2S (17)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	240	1.62	110	4.5	50	3.28	230	9.98	50	5.18	1310	28.4
Bivalvia	20	12.19	20	3.4	10	4.7	1120	7.67	70	0.2	5790	15.66
Cumacea	510	2.08	0	0	10	0.06	0	0	10	0.06	30	0.02
Decapoda	0	0	0	0	0	0	0	0	0	0	20	3.27
Echinoidea	68	410.23	44	310.34	20	121.12	94	660.45	20	139.4	20	3.11
Gastropoda	20	0.98	15	33.33	0	0	0	0	10	22.17	40	3.66
Isopoda	20	1.96	180	22.53	90	10.1	310	24.63	124	11.53	0	0
Polychaeta	40	2.28	50	6.49	50	6.55	60	19.17	40	18.04	70	12.66
Rest	10	0.21	0	0	0	0	30	0.86	0	0	80	1.57
Total	**928**	**431.55**	**419**	**380.59**	**230**	**145.81**	**1844**	**722.76**	**324**	**196.6**	**7360**	**68.35**

Table P4.1 continued.

Taxonomic group	Station (depth, m)											
	3-3M (21)		3-3N (25)		3-3S (27)		3-4M (25)		3-4N (27)		3-4S (29)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	1470	31.72	430	21.53	120	4.13	128	3.2	200	3.93	300	2.15
Bivalvia	10	43.37	0	0	0	0	310	0.59	20	16.46	40	32.4
Cumacea	0	0	0	0	0	0	360	7.21	380	5.54	370	5.51
Decapoda	0	0	0	0	20	0.85	0	0	10	0.48	0	0
Echinoidea	31	165.68	58	890.4	30	75.94	0	0	60	79.9	80	15.8
Gastropoda	0	0	20	12.83	0	0	10	60.1	0	0	0	0
Isopoda	10	1.47	10	22.36	10	13.63	10	2.39	0	0	0	0
Polychaeta	50	11.55	20	14.4	30	17.93	860	11.85	60	5.97	60	4.65
Rest	0	0	0	0	0	0	10	1.13	20	0.43	40	1.48
Total	**1571**	**253.79**	**538**	**961.52**	**210**	**112.48**	**1688**	**86.47**	**750**	**112.71**	**890**	**61.99**

Taxonomic group	Station (depth, m)											
	3-5M (25)		3-5N (28)		3-5S (29)		4-1M (19)		4-1N (22)		4-1S (23)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	780	13.85	445	7.975	230	5.96	10	3.47	50	15.06	280	4.01
Bivalvia	38	34.55	12	21.46	12	60.01	210	0.71	170	91.63	30	4.08
Cumacea	2011	70.41	111250	123.75	1280	59.37	0	0	10	0.14	60	0.1
Decapoda	0	0	10	3.03	0	0	20	5.42	6	0.87	0	0
Echinoidea	320	415.28	112	1298.23	156	1745.89	20	656.83	20	150.87	65	435.87
Gastropoda	0	0	0	0	5	8.35	10	1.37	10	0.31	0	0
Isopoda	120	2.49	112	3.845	180	5.72	0	0	0	0	20	3.26
Polychaeta	42	9.96	67	28.835	38	8.15	20	5.61	40	13.39	70	19.07
Rest	0	0	0	0	0	0	320	0.44	50	1.37	0	0
Total	**3311**	**546.54**	**112008**	**1487.12**	**1901**	**1893.45**	**610**	**673.85**	**356**	**273.64**	**525**	**466.39**

Taxonomic group	Station (depth, m)											
	4-2M (24)		4-2N (26)		4-2S (26)		4-3M (23)		4-3N (28)		4-3S (26)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	300	29.67	140	14.25	160	6.08	140	3.41	740	16.86	0	0
Bivalvia	10	154.83	80	0.33	0	0	30	276.43	0	0	0	0
Cumacea	0	0	10	0.01	0	0	0	0	0	0	0	0
Decapoda	20	10.1	0	0	50	189.53	30	6.29	0	0	0	0
Echinoidea	74	523.76	27	231.54	49	654.21	70	171.73	148	945.65	108	876.8
Gastropoda	10	15	5	2.27	10	78.53	25	38.9	0	0	30	8.47
Isopoda	20	0.43	30	16.85	30	23.13	30	33.17	10	8.09	10	1.06
Polychaeta	190	7.2	50	8.99	0	0	10	4.38	0	0	20	11.58
Rest	0	0	40	0.25	80	23.63	20	1.36	10	0.85	0	0.18
Total	**624**	**740.99**	**382**	**274.49**	**379**	**975.11**	**355**	**535.67**	**908**	**971.45**	**168**	**898.09**

Table P4.1 continued.

Taxonomic group	Station (depth, m)											
	4-4M (28)		4-4N (28)		4-4S (24)		4-5M (32)		4-5N (30)		4-5S (35)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	0	0	65	6.34	30	7.98	56	1.6	12	0.46	0	0
Bivalvia	640	62.38	45	25.65	10	20.49	0	0	30	34.56	0	0
Cumacea	140	2.13	50	0.5	0	0.06	37640	112.92	24882	84.6	1770	38.93
Decapoda	0	0	0	0	0	0	0	0	30	11.29	10	1.23
Echinoidea	86	1128.5	112	790.9	260	1331.53	87	694.35	108	827.14	98	403.56
Gastropoda	10	67.7	0	0	40	4.8	0	0	0	0	0	0
Isopoda	0	0	20	0.28	10	19.74	20	0.3	0	0	0	0
Polychaeta	110	16.78	40	8.48	10	3.09	30	2.45	60	9.28	40	3.93
Rest	50	1	0	0	10	0.21	0	0	0	0	0	0
Total	**1036**	**1278.49**	**332**	**832.15**	**370**	**1387.9**	**37833**	**811.62**	**25122**	**967.33**	**1918**	**447.65**

Table P4.2. Quantitative characteristics of benthos (colony density - A, spec./m^2; biomass - B, g/m^2) at stations of the **Piltun Area control test zone.**

Taxonomic group	Station (depth, m)											
	C1m (33)		C1n (32)		C1s (32)		C2s (33)		C4n (51)		C5m (53)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	2663	38.13	636	10.53	2440	35.38	280	14.11	113	9.73	13	0.47
Actiniaria	66	21.34	253	90.43	693	77.63	293	99.33	38	29.03	0	0
Bivalvia	26	0.13	16	49.24	23	0.73	7	7.88	10	3.98	23	18.73
Cumacea	13175	23.81	553	2.25	290	1.35	123	1.12	213	4.17	0	0
Decapoda	0	0	0	0	0	0	10	0.35	0	0	3	5.77
Echinoidea	50	20.97	43	267.44	40	139.5	35	187.33	53	774.07	115	1301.4
Gastropoda	3	0	0	0	7	23.7	3	15.03	0	0	0	0
Hydroidea	0	1.3	0	1.94	0	0.11	0	6.98	0	0	0	0
Isopoda	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	173	31.13	150	27.78	130	47.6	30	6.94	23	16.04	7	1.39
Rest	46	5.23	0	0.53	0	0	3	0.6	0	0	0	0
Total	**16202**	**142.04**	**1651**	**450.14**	**3623**	**326.00**	**784**	**339.67**	**450**	**837.02**	**161**	**1327.76**

Taxonomic group	Station (depth, m)			
	C5n (55)		C5s (51)	
	A	B	A	B
Amphipoda	170	3.12	176	0.53
Actiniaria	3	1.41	156	95.03
Bivalvia	13	16.25	20	10.47
Cumacea	0	0	39	0.6
Decapoda	3	3.13	0	0
Echinoidea	63	701.27	13	217.75
Gastropoda	3	0.82	0	0
Hydroidea	0	4	0	48.36
Isopoda	10	0.65	0	0
Polychaeta	43	22.15	65	26.85
Rest	10	0.98	20	0.05
Total	**318**	**753.78**	**489**	**399.64**

Table P4.3. Quantitative characteristics of benthos (colony density - A, spec./m^2; biomass - B, g/m^2) at stations of the **Intermediate Area.**

Taxonomic group	Station (depth, m)											
	1--1 (11)		1--2 (8)		1--3 (14)		2--1 (15)		2--2 (15)		2--3 (17)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	1607	120.87	1480	118.17	770	21.73	393	9.31	1230	43.63	260	1.01
Actiniaria	0	0	0	0	0	0	0	0	0	0	20	32.7
Ascidia	0	0	0	0	10	8.57	3	12.87	3	11.37	0	0
Bivalvia	70	27.55	23	6.69	37	0.28	13	0.44	17	13.02	20	3.66
Cumacea	420	9.53	1360	23.16	3	0	0	0	43	0.55	13	0.08
Decapoda	0	0	0	0	0	0	0	0	0	0	0	0
Echinoidea	0	0	0	0	57	130.6	27	209.67	0	0	43	138.4
Gastropoda	0	0	0	0	0	0	0	0	3	0.07	7	0.35
Isopoda	377	40.64	737	5.93	20	1.26	3	0.17	120	2.41	40	2.15
Polychaeta	43	1.9	90	1.22	43	12.43	30	7.76	110	10.9	140	21.09
Total	**2517**	**200.49**	**3690**	**155.17**	**940**	**174.87**	**469**	**240.22**	**1526**	**81.95**	**543**	**199.4**

Taxonomic group	Station (depth, m)											
	3--1 (23)		3--2 (23)		3--3 (19)		4--1 (19)		4--2 (21)		4--3 (16)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	33	0.53	100	0.4	483	7.2	147	0.78	13	0.04	1	13
Actiniaria	17	17.28	0	0	20	32.7	0	0	0	0	0	0
Ascidia	0	0	180	484.93	147	621.09	0	0	0	0	0	0
Bivalvia	30	38.8	3	0.07	27	5.42	20	5.13	3	0.07	5	3
Cumacea	23	0.07	107	0.26	17	0.16	57	0.1	77	0.19	0	77
Decapoda	3	0.9	0	0	0	0	0	0	0	0	0	0
Echinoidea	43	200.77	13	0.44	0	0	57	255.4	1287	812.9	255	1287
Gastropoda	3	37.6	0	0	7	0.35	0	0	0	0	0	0
Isopoda	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	50	40.73	20	5.13	123	22.66	7	0.4	93	9.47	0	93
Total	**202**	**336.68**	**423**	**491.23**	**824**	**689.58**	**288**	**261.8**	**1473**	**822.7**	**261**	**1473**

Taxonomic group	Station (depth, m)	
	5 (22)	
	A	B
Amphipoda	130	0.51
Actiniaria	3	10.07
Ascidia	127	302.63
Bivalvia	10	0.66
Cumacea	18310	42.46
Decapoda	0	0
Echinoidea	0	0
Gastropoda	0	0
Isopoda	3	0
Polychaeta	87	4.45
Total	**18670**	**360.78**

Table P4.4. Quantitative characteristics of benthos (colony density - A, spec./m^2; biomass - B, g/m^2) at **control stations of the Intermediate Area.**

Taxonomic group	Station (depth, m)					
	C-1 (24)		C-2 (33)		C-3 (30)	
	A	B	A	B	A	B
Actiniaria	0	0	17	12.54	210	34.6
Amphipoda	507	2.02	12603	756.1	1387	22.07
Bivalvia	493	1.38	67	31.77	30	70.9
Cumacea	68400	204.73	9160	197.67	8130	17.2
Decapoda	10	0.54	20	0.81	0	0
Echinoidea	43	288.33	0	0	33	3.17
Gastropoda	50	21.81	7	34.4	3	0.82
Holoturioidea	0	0	3	0.2	0	0
Hydroidea	0	0	0	0.37	0	0
Isopoda	0	0	1470	88.95	0	0
Polychaeta	47	1.92	91	105.03	77	51.79
Sipunculida	0	0	0	0	20	0.88
Total	**69550**	**520.73**	**23411**	**1227.84**	**9890**	**201.43**

Table P4.5. Quantitative characteristics of benthos (colony density - A, spec./m^2; biomass - B, g/m^2) at stations of the **Southern Area (Offshore Area).**

Taxonomic group	Station (depth, m)											
	B1-1 (29)		B1-2 (26)		B1-3 (25)		B1-4 (20)		B2-1 (30)		B2-2 (30)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	250	3.5	9800	330.7	2450	85.4	650	14.9	9100	282.7	17800	563.2
Actiniaria	0	0	20	0.5	0	0	0	0	0	0	0	0
Bivalvia	20	0.5	460	1.12	0	0.3	20	62	60	71.2	10	297.9
Cumacea	60	0.5	5100	39.8	14000	112.1	0	0	59300	477.2	5600	44.4
Decapoda	10	48.6	20	0.3	10	0.2	300	2.6	110	1.3	60	13.7
Echinoidea	0	0	0	0	0	0	55	236.3	0	0	0	0
Gastropoda	20	0.6	20	5.1	0	0	0	0	20	41.9	0	0
Holoturioidea	0	0	0	0	0	0	0	0	0	0	0	0
Hydroidea	0	0.5	0	0.8	0	0	0	0	0	0	0	5.7
Nemertina	0	0	0	0	0	0	0	0	20	0.3	0	0
Polychaeta	140	11.4	140	15.5	10	1.1	50	3.2	700	12.9	30	17.4
Sipunculida	0	0	0	0	0	0	0	0	0	0	0	0
Rest	0	0	0	0	0	0	10	0.2	0	0	0	0
Total	**500**	**65.6**	**15560**	**393.82**	**16470**	**199.1**	**1085**	**319.2**	**69310**	**887.5**	**23500**	**942.3**

Table P4.5 continued.

Taxonomic group	Station (depth, m)											
	B2-3 (24)		B2-4 (27)		B3-1 (31)		B3-2 (33)		B3-3 (27)		B3-4 (27)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	1280	25.4	5500	187.7	9700	293.3	18300	620.1	750	25.4	270	133.1
Actiniaria	0	0	0	0	0	0	10	0.1	0	0	140	94.9
Ascidiacea	0	0	0	0	0	0	0	0	0	0	670	1108.3
Bivalvia	10	0.3	30	99.3	60	294.41	30	141.6	0	0.3	50	120.3
Cumacea	39000	312.1	1850	14.8	7020	56.2	6600	52.7	52130	437.8	11750	98.7
Decapoda	25	0.2	10	4.6	75	14.3	0	0	12	0.2	0	0
Echinoidea	370	566.7	75	288.6	0	0	0	0	0	0	0	0
Gastropoda	0	0	0	0	20	24.2	0	0	0	0	0	0
Holoturioidea	0	0	0	0	10	7.2	0	0	0	0	0	0
Hydroidea	0	0	0	1.9	110	0.3	140	166.7	0	0	0	0
Nemertina	0	0	0	0	30	0.3	0	0	0	0	0	0
Polychaeta	10	1.1	30	5.8	1090	13.3	900	24.7	10	1.1	60	11.3
Sipunculida	0	0	0	0	0	0	0	0	0	0	30	13.6
Rest	0	0	20	12.5	0	0	0	0	0	0	0	0
Total	**40695**	**905.8**	**7525**	**615.35**	**18115**	**703.1**	**25980**	**1005.9**	**52902**	**464.8**	**12970**	**1580.2**

Taxonomic group	Station (depth, m)											
	B4-1 (35)		B4-2 (31)		B4-3 (33)		B4-4 (32)		B5-1 (43)		B5-2 (40)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	13750	467.9	8100	276.3	8600	290.5	1280	25.4	21000	685.2	10600	352.8
Actiniaria	0	0	0	0	0	0.1	0	0	250	400.3	0	0
Bivalvia	560	678	10	5.5	0	4.8	0	0.3	60	108.7	10	23
Cumacea	2100	17.7	33850	284.3	8400	62.6	13340	112.1	540	4.4	14950	125.6
Decapoda	0	0	10	0.1	0	18.3	0	0	20	153.9	0	0
Echinoidea	0	0	0	0	0	0	128	396.7	0	0	0	0
Gastropoda	10	4.1	10	21.7	10	22.5	0	0	0	0.5	0	0
Holoturioidea	60	35.6	0	0	0	0	0	0	10	5.2	0	0
Hydroidea	0	0	0	11.5	0	11.5	0	0	0	0	0	0
Nemertina	40	1.8	0	0	0	0	0	0	0	0.5	0	0
Polychaeta	3640	55.7	50	3.3	80	6.1	10	1.1	590	52.3	80	8.7
Rest	0	0	16	0.1	20	0.1	0	0	10	0.6	0	0
Total	**20170**	**1261.1**	**42046**	**602.8**	**17110**	**416.5**	**14778**	**535.8**	**22490**	**1416.3**	**25640**	**510.1**

Taxonomic group	Station (depth, m)											
	B5-3 (38)		B5-4 (30)		B6-1 (46)		B6-2 (43)		B6-3 (41)		B6-4 (34)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	19600	666.4	7400	251.5	21600	737	7920	496.8	6200	208.1	11220	382.3
Actiniaria	20	80.4	60	52.4	220	695.5	60	237.7	30	125.7	0	0
Bivalvia	20	134.3	20	0.1	250	212.9	40	155.3	10	0.5	10	1
Cumacea	27320	105.2	6260	38.6	310	4	70	1.3	3210	13.9	14350	85.3
Echinoidea	0	0	155	978	0	0	0	0	0	0	10	16
Gastropoda	6	0.3	0	0	0	0	0	0	10	0.3	10	18.5
Holoturioidea	0	0	30	9.4	10	22.2	0	0	0	0	0	0
Hydroidea	0	1.4	0	34.1	0	0	0	1.2	0	0	0	0
Nemertina	10	9.4	0	0	70	3.5	0	0	0	0	0	0
Polychaeta	30	21	0	28.7	1030	220.2	0	35.5	120	9.2	0	0.9
Sipunculida	0	0	0	0	20	7.7	0	0	0	0	0	0
Total	**47006**	**1018.4**	**13925**	**1392.8**	**23520**	**1903.3**	**8090**	**927.8**	**9580**	**357.7**	**25600**	**504**

Table P4.5 continued.

Taxonomic group	Station (depth, m)											
	B7-1 (51)		B7-2 (43)		B7-3 (39)		B7-4 (34)		B8-1 (55)		B8-2 (50)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	26400	883.6	18300	591.9	7500	251.5	17300	589.3	29500	984	27000	914
Actiniaria	60	203.1	90	403.9	60	52.4	70	215	10	56.5	60	326.1
Bivalvia	120	1445.1	30	592.3	20	0.1	20	0.4	130	41	50	32.9
Cumacea	330	3.5	1030	13.4	5260	38.6	14410	106.9	5320	45	6080	55.6
Decapoda	0	0	0	0	0	0	0	0	0	0	10	0.9
Echinoidea	0	0	0	0	0	0	25	68.6	0	0	0	0
Gastropoda	0	0	20	78.2	0	0	10	1.3	10	21.3	18	1.6
Holoturioidea	0	0	0	0	30	9.4	0	0	0	0	0	0
Hydroidea	0	0.8	0	9.6	0	34.1	0	0	0	1.1	0	13.4
Nemertina	0	0	0	0	0	0	0	0	20	0.5	20	1.1
Polychaeta	280	34	0	30.8	0	28.7	30	5.5	210	39.5	1000	131.4
Sipunculida	0	0	0	0	0	0	0	0	30	6.9	10	11.6
Rest	0	0	0	0	0	0	0	0	140	12.2	0	0
Total	**27190**	**2570.1**	**19470**	**1720.1**	**12870**	**414.8**	**31865**	**987**	**35370**	**1208**	**34248**	**1488.6**

Taxonomic group	Station (depth, m)											
	B8-3 (41)		B8-4 (40)		B9-1 (60)		B9-2 (48)		B9-3 (48)		B9-4 (43)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	20800	706.8	2660	88.3	34800	1312.7	29800	988	42375	1017.3	120	3.6
Actiniaria	536	795.1	60	78.1	30	99.9	60	328.5	230	902	230	223.5
Bivalvia	83	156.3	120	61	20	188.4	40	326.5	20	10.1	20	42.2
Cumacea	3900	35.2	6230	46.4	8230	69.1	4830	39.7	70	1.6	70	0.5
Decapoda	13	26.1	0	0	0	0	0	0	0	76.9	0	0
Echinoidea	17	99.1	210	1124.5	0	0	0	0	0	0	127	897.6
Gastropoda	0	0	0	0	10	5.4	8	59.4	10	8.6	10	0.4
Holoturioidea	0	0	0	0	0	0	0	0	0	0	0	0
Hydroidea	0	0	0	0	0	0.7	0	2.2	0	14.8	0	0
Nemertina	0	0	0	0	0	0	0	0	38	1.3	0	0
Polychaeta	80	8.4	10	16.3	0	26.2	0	189.2	120	298.9	120	73.4
Sipunculida	0	0	0	0	30	5.7	20	10.8	32	9.9	0	0
Rest	6	6.7	46	0.2	30	97.3	10	0.1	41	9.4	10	0.2
Total	**25435**	**1833.7**	**9336**	**1414.8**	**43150**	**1805.4**	**34768**	**1944.4**	**42936**	**2350.8**	**707**	**1241.4**

Table P4.6. Quantitative characteristics of benthos (colony density - A, spec./m^2; biomass - B, g/m^2) at **control stations of the Offshore Area.**

Taxonomic group	Station (depth, m)							
	Cb-1 (21)		Cb-2 (23)		Cb-3 (17)		Cb-4 (10)	
	A	B	A	B	A	B	A	B
Amphipoda	23	0.18	190	2.55	103	0.44	523	11.65
Bivalvia	17	85.89	60	3.41	13	0.09	90	61.99
Cumacea	7	0.1	7	0.05	27	0.25	5067	47.15
Decapoda	0	0	3	0.25	0	0	0	0
Echinoidea	7	18.83	0	0	0	0	0	0
Gastropoda	3	0.05	0	0	0	0	30	3.42
Holoturoidea	0	0	0	0	3	0.86	0	0
Hydroidea	0	0.25	0	0.22	0	0.02	0	0.11
Isopoda	42	49.23	10	11.09	3	3.33	0	0
Polychaeta	0	8.57	673	45.15	0	4.82	133	3.77
Total	**99**	**163.1**	**943**	**62.72**	**149**	**9.81**	**5843**	**128.1**

Table P4.6. Quantitative characteristics of benthos (colony density - A, spec./m^2; biomass - B, g/m^2) at stations of the в **gray whale Feeding Points.**

Taxonomic group	Station (depth, m)											
	FP-01 (45)		FP-02 (44)		FP-03 (38)		FP-04 (40)		FP-05 (40)		FP-06 (38)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	10606	496.91	15996	325.83	6550	176.33	12796	265.21	47800	508.73	31163	579.27
Bivalvia	16	0.58	226	430.13	23	24.9	26	8.63	53	3.75	40	31.87
Cumacea	2716	31.47	16326	78.16	8850	40.32	23696	203.97	38920	132.97	33147	164.62
Polychaeta	356	53.97	766	38.51	3	39.6	150	4.2	956	7.56	223	25.73
Gastropoda	0	0	3	0.03	6	34.93	0	0	0	0	7	45.73
Actiniaria	46	144.1	890	942.97	10	24.53	36	53.53	0	0	23	98.23
Isopoda	3	0.03	0	0	0	0	0	0	0	0	0	0
Nemertina	3	0.21	6	1.47	0	0	3	0.87	20	0.11	7	6.27
Decapoda	0	0	0	0	3	0.22	0	0	0	0	0	0
Holoturioidea	6	14.6	60	59.27	0	0	0	0	0	0	0	0
Echinoidea	0	0	0	0	0	0	0	0	0	0	0	0
Hydroidea	70	1.14	0	0	0	7.07	0	0.05	0	0.22	0	0
Sipunculida	0	0	0	0	0	0	0	0	0	0	0	0
Ascidia	0	0	0	0	0	0	0	0	0	0	0	0
Cirripedia	0	0	0	0	0	0	0	0	0	0	0	0
Total	**13822**	**743.01**	**34273**	**1876.37**	**15445**	**347.9**	**36707**	**536.46**	**87749**	**653.34**	**64610**	**951.72**

Taxonomic group	Station (depth, m)											
	FP-07 (41)		FP-08 (14)		FP-09 (16)		FP-10 (12)		FP-11 (17)		FP-12 (13)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	28060	785.63	2193	141.9	680	41.11	1893	131.47	380	25.53	1570	72.22
Bivalvia	46	110.25	67	11.25	13	41.5	76	13.46	50	104.43	3	10.33
Cumacea	2123	18.17	30	0.53	0	0	23	0.23	0	0	23	0.23
Polychaeta	880	18.15	3	0.05	10	2.09	6	0.1	50	6.64	0	0
Gastropoda	10	1.28	10	3.51	0	0	13	7	6	48.37	0	0
Actiniaria	170	348.15	0	0	0	0	0	0	0	0	0	0
Isopoda	0	0	150	6.65	393	18.14	213	22.33	406	21.9	573	22.67
Nemertina	33	0.41	0	0	0	0	0	0	0	0	0	0
Decapoda	3	0.14	0	0	0	0	0	0	0	0	0	0
Holoturioidea	0	0	0	0	0	0	0	0	0	0	0	0
Echinoidea	0	0	0	0	10	264.6	0	0	23	553.43	0	0
Hydroidea	0	0	0	0	0	0	0	0	0	0	0	0
Sipunculida	0	0	0	0	0	0	0	0	0	0	0	0
Ascidia	0	0	0	0	0	0	0	0	0	0	0	0
Cirripedia	3	0.17	0	0	0	0	0	0	0	0	0	0
Total	**31328**	**1282.35**	**2453**	**163.89**	**1106**	**367.44**	**2224**	**174.59**	**915**	**760.3**	**2169**	**105.45**

Table P4.6 continued.

Taxonomic group	Station (depth, m)											
	FP-13 (8)		FP-14 (8)		FP-15 (8)		FP-16 (8)		FP-17 (8)		FP-18 (21)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	440	40.1	876	46.29	1042	53.21	1266	66.87	680	45.53	1716	154.7
Bivalvia	16	51.3	22	52.09	12	34.64	15	12.74	0	0	13	2.87
Cumacea	23	0.28	15	0.15	20	0.2	0	0	0	0	100	4.7
Polychaeta	10	1.11	20	2.91	10	1.67	13	2.22	50	6.64	93	97
Gastropoda	0	0	2	16.12	0	5.37	0	0	0	0	6	16.3
Actiniaria	0	0	0	0	0	0	0	0	0	0	0	0
Isopoda	193	11.14	457	20.9	474	20.57	341	19.87	211	12.9	593	53.13
Nemertina	0	0	0	0	0	0	0	0	0	0	0	0
Decapoda	0	0	0	0	0	0	0	0	0	0	0	0
Holoturioidea	0	0	0	0	0	0	0	0	0	0	0	0
Echinoidea	0	0	27	184.48	2	61.49	3	81.99	0	0	0	0
Hydroidea	0	0	0	0	0	0	0	0	0	0	0	0
Sipunculida	0	0	0	0	0	0	0	0	0	0	0	0
Ascidia	0	0	0	0	0	0	0	0	0	0	0	0
Cirripedia	0	0	0	0	0	0	0	0	0	0	0	0
Total	**682**	**103.93**	**1399**	**322.94**	**1560**	**177.15**	**1638**	**183.69**	**941**	**65.17**	**2521**	**328.7**

Taxonomic group	Station (depth, m)											
	FP-19 (16)		FP-20 (14)		FP-21 (24)		FP-22 (13)		FP-23 (40)		FP-24 (43)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	940	98.07	1340	111.14	1030	88.37	2833	146.5	8480	533	34163	581.49
Bivalvia	36	84.45	0	0	50	251.83	43	4.14	60	438.38	73	675.62
Cumacea	0	0	103	0.38	0	0	50	0.3	20	0.6	4666	33.06
Polychaeta	63	18.77	0	0	30	2.79	0	0	1040	111.6	1370	29.34
Gastropoda	0	0	0	0	0	0	6	0.14	0	0	6	0.23
Actiniaria	0	0	0	0	0	0	0	0	340	1273.7	70	239.49
Isopoda	336	44.52	316	26.53	420	38.54	446	14.61	0	0	0	0
Nemertina	0	0	0	0	0	0	0	0	90	32.39	26	0.19
Decapoda	13	0.07	0	0	0	0	3	0.01	50	118.4	20	60.49
Holoturioidea	0	0	0	0	0	0	0	0	30	66.46	13	3.32
Echinoidea	10	168	0	0	0	0	0	0	0	0	0	0
Hydroidea	0	0	0	0	0	0	0	0	0	0	0	4.73
Sipunculida	0	0	0	0	0	0	0	0	0	0	0	0
Ascidia	0	0	0	0	3	29.47	0	0	0	0	0	0
Cirripedia	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1401**	**414.6**	**1759**	**138.05**	**1551**	**545.75**	**3381**	**165.7**	**10110**	**2574.53**	**40407**	**1627.96**

Table P4.6 continued.

Taxonomic group	Station (depth, m)											
	FP-25 (43)		FP-26 (39)		FP-27 (40)		FP-28 (33)		FP-29 (48)		FP-30 (43)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	21560	512.93	26053	665.13	20273	472.3	31476	697.4	40286	927.53	25963	750.83
Bivalvia	93	51.45	23	72.94	16	34.32	50	381.05	60	506.8	50	16.41
Cumacea	6613	62.27	32660	78.96	32616	78.89	7180	62.72	9183	83.4	1183	15.15
Polychaeta	1016	22.7	670	17.67	236	21.5	1216	26.22	1553	34.9	40	34.53
Gastropoda	33	27.34	23	2.39	20	2.12	26	2.51	30	3.33	10	63.4
Actiniaria	100	190.51	136	335.39	156	391.42	60	166.03	70	220.8	123	334.9
Isopoda	0	0	0	0	0	0	0	0	0	0	0	0
Nemertina	10	1.17	33	5.49	16	3.85	46	5.59	53	7.43	0	0
Decapoda	10	9.17	26	66.97	26	67.5	23	40.94	23	54.47	20	9.45
Holoturioidea	0	0	40	14.9	0	0	43	15.7	53	20.9	0	0
Echinoidea	0	0	0	0	0	0	0	0	0	0	0	0
Hydroidea	0	0.36	0	0	0	2.07	0	2.37	0	3.13	0	0.91
Sipunculida	0	0	6	0.03	0	0	6	0.03	6	0.03	0	0
Ascidia	0	0	0	0	0	0	0	0	0	0	0	0
Cirripedia	0	0	0	0	0	0	0	0	0	0	0	0
Total	**29435**	**877.9**	**59670**	**1259.87**	**53359**	**1073.97**	**40126**	**1400.56**	**51317**	**1862.72**	**27389**	**1225.58**

Taxonomic group	Station (depth, m)											
	FP-31 (43)		FP-32 (43)		FP-33 (43)		FP-34 (43)		FP-35 (46)		FP-36 (41)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	45603	499.43	17203	293.87	116	22.23	10440	341.87	5790	108.83	13026	410.33
Bivalvia	33	424.63	206	370.1	13	41.2	53	275.72	106	245.87	33	34.37
Cumacea	10893	55.8	13453	61.54	6	0.08	5023	47.91	666	3.09	11686	230.23
Polychaeta	1050	21.57	770	58.03	43	54	170	20.23	36	33.46	13	17.53
Gastropoda	6	5.7	3	0.03	0	0	20	2.12	0	0	3	0.34
Actiniaria	6	0.07	796	130.37	276	246.27	256	235.92	333	283.5	156	205.93
Isopoda	0	0	0	0	0	0	0	0	0	0	0	0
Nemertina	23	0.23	6	1.47	0	0	10	1.17	0	0	0	0
Decapoda	0	0	0	0	0	0	23	5.8	6	47.4	6	11.51
Holoturioidea	0	0	60	59.27	0	0	3	2.94	0	0	0	0
Echinoidea	0	0	0	0	0	0	0	0	0	0	0	0
Hydroidea	156	111.14	0	0	0	0	0	0	0	0	0	0
Sipunculida	0	0	0	0	0	0	0	0	0	0	0	0
Ascidia	0	0	0	0	0	0	0	0	0	0	0	0
Cirripedia	0	0	0	0	0	0	0	0	26	5.33	0	0
Total	**57770**	**1118.57**	**32497**	**974.68**	**454**	**363.78**	**15998**	**933.68**	**6963**	**727.48**	**24923**	**910.24**

Table P4.6 continued.

Taxonomic group	Station (depth, m)											
	FP-37 (41)		FP-38 (43)		FP-39 (42)		FP-40 (9)		FP-41 (11)		FP-42 (11)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	10853	416.47	5706	94.67	10993	346.4	12093	109.83	1776	40.3	2413	93
Bivalvia	53	67.63	30	151.87	66	91.3	276	14.19	230	30.5	213	10.92
Cumacea	230	36.67	1243	11.32	730	11.96	1223	15.43	290	5.21	136	2.51
Polychaeta	13	9.24	103	7.48	0	5.22	3	0.21	0	1.51	13	2.02
Gastropoda	3	0.34	0	0	0	0	3	0.11	3	0.09	0	0
Actiniaria	246	248.77	400	631.87	430	386.6	0	0	0	0	0	0
Isopoda	0	0	0	0	0	0	153	9.14	136	7.77	203	12.6
Nemertina	0	0	0	0	0	0	0	0	0	0	0	0
Decapoda	3	35.27	26	27.11	3	35.27	0	0	0	0	0	0
Holoturioidea	0	0	3	3.33	0	0	0	0	0	0	0	0
Echinoidea	0	0	6	71.37	0	0	0	0	0	0	0	0
Hydroidea	0	0	0	0	0	0	0	0	0	0	0	0
Sipunculida	0	0	0	0	0	0	0	0	0	0	0	0
Ascidia	3	19.97	0	0	3	9.45	0	0	0	0	0	0
Cirripedia	0	0	0	0	0	0	0	0	0	0	0	0
Total	**11404**	**804.36**	**7517**	**999.02**	**12225**	**886.2**	**13751**	**148.91**	**2435**	**85.38**	**2978**	**121.05**

Taxonomic group	Station (depth, m)							
	FP-43 (13)		FP-44 (15)		FP-45 (14)		B6-2-2 (41)	
	A	B	A	B	A	B	A	B
Amphipoda	2690	126.67	1413	75.97	2172	98.55	5900	147.63
Bivalvia	620	22.08	86	21.02	306	18.01	0	0
Cumacea	523	10.2	33	0.56	230	4.42	1396	12.82
Polychaeta	20	2.29	10	0.57	14	1.63	0	0
Gastropoda	6	0.51	0	0	2	0.17	0	0
Actiniaria	0	0	0	0	0	0	60	279.67
Isopoda	206	16.33	93	8.42	167	12.45	3	0.06
Nemertina	0	0	0	0	0	0	0	0
Decapoda	0	0	0	0	0	0	0	0
Holoturioidea	0	0	3	0.01	0	0	0	0
Echinoidea	0	0	0	0	0	0	3	0.01
Hydroidea	0	0	0	0	0	0	0	0
Sipunculida	0	0	0	0	0	0	1396	11.43
Ascidia	0	0	0	0	0	0	0	0
Cirripedia	0	0	0	0	0	0	6	0.67
Total	**4065**	**178.08**	**1638**	**106.55**	**2891**	**135.23**	**8764**	**452.29**

APPENDIX 5.

Table P5.1. Quantitative characteristics of epibenthic collections (colony density - A, spec./m^2; biomass - B, g/m^2) at stations of the **Piltun Area.**

Taxonomic group	Station (depth, m)											
	1-1M (12)		1-1N (15)		1-1S (11)		1-2M (14)		1-2N (14)		1-2S (12)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	57	2.57	609	25.93	7	0.26	48	2.23	17	0.94	325	14.15
Isopoda	25	0.9	92	2.3	8	0.25	59	3.46	120	6.47	28	1.53
Cumacea	1	0	0	0	0	0	0	0	0	0	0	0
Mysidacea	1	0	0	0	0	0	0	0	0	0	3	0.07
Decapoda	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	0	0	0	0	0	0	0	0	1	2.01	0	0
Bivalvia	7	0.05	0	0	0	0	0	0	0	0	0	0
Pisces	0	0	1	0.03	0	0	0	0	0	0	0	0
Total	**91**	**3.52**	**702**	**28.3**	**15**	**0.5**	**107**	**5.69**	**138**	**9.4**	**356**	**15.8**

Taxonomic group	Station (depth, m)											
	1-3M (15)		1-3N (14)		1-3S (11)		1-4M (15)		1-4N (15)		1-4S (17)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	35	1.42	76	3.25	61	2.23	59	4.15	200	11.6	48	2.22
Isopoda	72	1.78	144	3.26	67	2.5	115	4.46	229	6.51	187	5.03
Cumacea	4	0.07	0	0	0	0	0	0	0	0	1	0.01
Mysidacea	0	0	3	0.18	7	0.13	0	0	0	0	0	0
Decapoda	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	3	0.01	0	0	0	0	0	0	0	0	0	0
Pisces	0	0	0	0	0	0	0	0	0	0	0	0
Total	**114**	**3.28**	**223**	**6.69**	**135**	**4.86**	**174**	**8.61**	**429**	**18.1**	**236**	**7.26**

Taxon	Station (depth, m)											
	1-5M (17)		1-5N (12)		1-5S (15)		2-1M (17)		2-1N (14)		2-1S (11)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	1	0.03	3	0.1	111	7.06	5	0.27	69	3.84	59	2.22
Isopoda	48	3.49	115	6.52	156	3.66	39	1.87	84	5.33	43	1.76
Cumacea	0	0	0	0	0	0	0	0	0	0	0	0
Mysidacea	5	0.17	0	0	3	0.05	0	0	1	0	3	0.04
Decapoda	1	1.39	0	0	0	0	1	1.55	0	0	0	0
Gastropoda	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	0	0	0	0	0	0	0	0	0	0	0	0
Pisces	0	0	0	0	0	0	0	0	0	0	0	0
Total	**55**	**5.08**	**118**	**6.62**	**270**	**10.8**	**45**	**3.69**	**154**	**9.17**	**105**	**4.02**

Table P5.1 continued.

Taxonomic group	Station (depth, m)											
	2-2M (17)		2-2N (16)		2-2S (17)		2-3M (18)		2-3N (21)		2-3S (22)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	3	0.11	0	0	5	0.15	1	0.04	1	0	5	0.21
Isopoda	67	4.4	19	1.2	68	3.63	55	3.13	59	3.32	45	3.24
Cumacea	0	0	0	0	0	0	0	0	1	0	0	0
Mysidacea	0	0	0	0	3	0.01	0	0	0	0	4	0.47
Decapoda	0	0	1	0.95	0	0	0	0	0	0	4	8.68
Gastropoda	0	0	0	0	3	0.06	0	0	0	0	0	0
Bivalvia	0	0	0	0	0	0	0	0	0	0	0	0
Pisces	0	0	0	0	0	0	0	0	0	0	0	0
Total	**70**	**4.51**	**20**	**2.15**	**79**	**3.85**	**56**	**3.17**	**61**	**3.32**	**58**	**12.6**

Taxonomic group	Station (depth, m)											
	2-4M (20)		2-4N (22)		2-4S (21)		2-5N (13)		2-5S (21)		3-1N (18)	
	A	B	A	A	B	A	A	B	A	B	A	B
Amphipoda	0	0	0	0	77	5.09	3	0.12	4	0.57	0	0
Isopoda	153	9.05	11	1.08	25	0.93	17	1.69	4	0.12	33	1.7
Cumacea	8	0.01	0	0	0	0	0	0	0	0	0	0
Mysidacea	0	0	0	0	0	0	0	0	0	0	0	0
Decapoda	0	0	0	0	0	0	0	0	0	0	3	2.85
Gastropoda	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	0	0	0	0	3	0	0	0	0	0	0	0
Pisces	0	0	0	0	0	0	0	0	0	0	0	0
Total	**161**	**9.06**	**11**	**1.08**	**105**	**6.02**	**20**	**1.81**	**8**	**0.69**	**36**	**4.55**

Taxonomic group	Station (depth, m)											
	3-1S (17)		3-3N (25)		3-4M (25)		3-4S (29)		3-5N (28)		3-5S (29)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	3	0.01	0	0	81	0.42	23	0.23	35	0.39	0	0
Isopoda	36	2.54	4	0.33	3	0.09	1	0.01	0	0	8	0.7
Cumacea	0	0	0	0	27	0.38	461	1.13	7	0.02	0	0
Mysidacea	0	0	0	0	5	0.5	0	0	0	0	0	0
Decapoda	0	0	0	0	0	0	0	0	1	0.57	0	0
Gastropoda	0	0	0	0	3	0.02	0	0	0	0	4	0.53
Bivalvia	0	0	0	0	8	0.11	0	0	0	0	0	0
Pisces	3	0.01	0	0	81	0.42	23	0.23	35	0.39	0	0
Total	**39**	**2.55**	**4**	**0.33**	**127**	**1.52**	**485**	**1.37**	**43**	**0.98**	**12**	**1.23**

Table P5.1 continued.

Taxonomic group	Station (depth, m)			
	4-4M (28)		4-4N (28)	
	A	B	A	B
Amphipoda	356	3.7	64	0.45
Isopoda	0	0	0	0
Cumacea	15	0.11	3	0.02
Mysidacea	0	0	0	0
Decapoda	0	0	0	0
Gastropoda	0	0	0	0
Bivalvia	3	0.03	0	0
Pisces	0	0	0	0
Total	**374**	**3.84**	**67**	**0.47**

Table P5.2. Quantitative characteristics of epibenthic collections (colony density - A, spec./m^2; biomass - B, g/m^2) at stations of the **Control Test Zones.**

Taxonomic group	Station (depth, m)											
	C-1 (24)		C-2 (33)		C-3 (30)		C1M		C1N		C2S	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	45	0.2	196	2.01	3	0.01	52	1.59	24	0.46	97	0.38
Isopoda	0	0	0	0	0	0	0	0	0	0	0	0
Cumacea	3731	8	3932	25.72	1659	3.3	2007	24.99	148	0.12	329	1.14
Mysidacea	0	0	0	0	0	0	0	0	0	0	1	0.13
Decapoda	0	0	0	0	3	0.01	0	0	0	0	0	0
Gastropoda	1	6.08	0	0	0	0	0	0	0	0	0	0
Bivalvia	3	0.01	0	0	0	0	0	0	0	0	0	0
Pisces	0	0	0	0	0	0	0	0	0	0	0	0
Ascidia	0	0	0	0	0	0	0	0	0	0	0	0
Hydroidea	0	0	0	0	0	0	0	0.01	0	0	0	0
Actiniaria	0	0	0	0	0	0	1	0.01	0	0	0	0
Total	**3780**	**14.29**	**4128**	**27.73**	**1665**	**3.32**	**2060**	**26.6**	**172**	**0.58**	**427**	**1.65**

Taxonomic group	Station (depth, m)	
	Cb-4 (10)	
	A	B
Amphipoda	4	0.29
Isopoda	7	0.68
Cumacea	0	0
Mysidacea	0	0
Decapoda	0	0
Gastropoda	0	0
Bivalvia	0	0
Pisces	0	0
Ascidia	1	0.7
Hydroidea	0	0
Actiniaria	0	0
Total	**12**	**1.67**

Table P5.3. Quantitative characteristics of epibenthic collections (colony density - A, spec./m^2; biomass - B, g/m^2) at stations of the **Intermediate Area.**

Taxonomic group	Station (depth, m)											
	1--2 (8)		1--3 (14)		2--1 (15)		2--2 (15)		2--3 (17)		4--3 (16)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	13	0.23	0	0	9	0.38	21	0.67	0	0	13	0.03
Isopoda	41	1.04	119	7.87	36	0.67	108	2.56	57	3.31	7	0.13
Cumacea	0	0	0	0	3	0.01	5	0.03	0	0	8	0.01
Mysidacea	0	0	0	0	0	0	5	0.14	0	0	19	0.22
Decapoda	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	0	0	0	0	0	0	0	0	0	0	0	0
Pisces	0	0	0	0	0	0	0	0	0	0	0	0
Ascidia	0	0	0	0	0	0	0	0	0	0	0	0
Hydroidea	0	0	0	0	0	0	0	0	0	0	0	0
Actiniaria	0	0	0	0	0	0	0	0	0	0	0	0
Total	**54**	**1.27**	**119**	**7.87**	**48**	**1.06**	**139**	**3.4**	**57**	**3.31**	**47**	**0.39**

Table P5.4. Quantitative characteristics of epibenthic collections (colony density - A, spec./m^2; biomass - B, g/m^2) at stations of the **Offshore Area (Southern Area).**

Taxonomic group	Station (depth, m)											
	B1-3 (25)		B1-4 (20)		B2-1 (30)		B2-2 (30)		B3-1 (31)		B3-2 (33)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	16	0.02	8	0.02	273	2.26	36	0.2	164	1.53	1144	9.45
Isopoda	0	0	0	0	0	0	0	0	0	0	0	0
Cumacea	588	1.16	0	0	1063	9.44	47	0.64	124	1.4	16	0.09
Mysidacea	0	0	0	0	5	0.05	5	0.01	0	0	5	0.18
Decapoda	0	0	0	0	0	0	0	0	0	0	3	0.01
Gastropoda	4	0	4	42.16	0	0	0	0	0	0	0	0
Bivalvia	0	0	0	0	0	0	0	0	0	0	0	0
Pisces	0	0	0	0	0	0	0	0	0	0	3	0.52
Actiniaria	0	0	7	4.65	0	0	0	0	0	0	0	0
Hydroidea	0	0	0	0	0	0	0	0	0	0	0	1.57
Total	**608**	**1.18**	**19**	**46.83**	**1341**	**11.75**	**88**	**0.85**	**288**	**2.93**	**1171**	**11.82**

Taxonomic group	Station (depth, m)									
	B3-3 (27)		B4-1 (35)		B4-2 (31)		B4-3 (33)		B6-2 (43)	
	A	B	A	B	A	B	A	B	A	B
Amphipoda	428	2.53	20	0.31	35	0.54	24	0.37	16	0.19
Isopoda	0	0	0	0	0	0	0	0	0	0
Cumacea	2944	5.96	11	0.12	27	0.23	72	0.39	9	0.11
Mysidacea	0	0	0	0	0	0	0	0	7	0.03
Decapoda	0	0	0	0	0	0	0	0	0	0
Gastropoda	0	0	0	0	0	0	0	0	0	0
Bivalvia	0	0	0	0	0	0	0	0	3	0
Pisces	0	0	0	0	0	0	0	0	3	0.07
Actiniaria	0	0	0	0	0	0	0	0	0	0
Hydroidea	0	0	0	0	0	0	0	0	0	0
Total	**3372**	**8.49**	**31**	**0.43**	**62**	**0.77**	**96**	**0.76**	**38**	**0.4**

Table P5.5. Quantitative characteristics of epibenthic collections (colony density - A, spec./m^2; biomass - B, g/m^2) at stations **at gray whale Feeding Points.**

Taxonomic group	Station (depth, m)											
	FP-08 (14)		FP-09 (16)		FP-10 (12)		FP-11 (17)		FP-12 (13)		FP-13 (8)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	15	1.81	13	1.38	0	0	0	0	1715	88.48	391	25.2
Isopoda	23	1.65	57	2.27	24	1.93	111	6.08	3	0.05	4	0.51
Cumacea	0	0	0	0	0	0	0	0	0	0	0	0
Mysidacea	0	0	0	0	0	0	0	0	3	0.03	29	0.19
Decapoda	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	0	0	0	0	0	0	0	0	0	0	0	0
Pisces	0	0	0	0	0	0	0	0	0	0	0	0
Ascidia	0	0	0	0	0	0	0	0	0	0	0	0
Hydroidea	0	0	0	0.01	0	0	0	0	0	0	0	0
Actiniaria	0	0	0	0	0	0	0	0	0	0	0	0
Total	**38**	**3.46**	**70**	**3.66**	**24**	**1.93**	**111**	**6.08**	**1721**	**88.56**	**424**	**25.9**

Taxonomic group	Station (depth, m)											
	FP-14 (8)		FP-15 (8)		FP-16 (8)		FP-17 (8)		FP-18 (21)		FP-19 (16)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	15	0.99	647	31.25	253	11.07	351	25.2	3	0.14	24	2.39
Isopoda	0	0	8	0.19	3	0.02	21	0.68	7	0.9	12	1.16
Cumacea	0	0	0	0	0	0	0	0	0	0	0	0
Mysidacea	7	0.16	0	0	0	0	0	0	0	0	0	0
Decapoda	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	0	0	0	0	0	0	0	0	0	0	0	0
Pisces	0	0	0	0	0	0	0	0	0	0	0	0
Ascidia	0	0	0	0	0	0	0	0	0	0	0	0
Hydroidea	0	0	0	0	0	0	0	0	0	0	0	0
Actiniaria	0	0	0	0	0	0	0	0	0	0	0	0
Total	**22**	**1.15**	**655**	**31.44**	**256**	**11.09**	**372**	**25.88**	**10**	**1.04**	**36**	**3.55**

Taxonomic group	Station (depth, m)											
	FP-20 (14)		FP-22 (13)		FP-23 (40)		FP-24 (43)		FP-25 (43)		FP-26 (39)	
	A	B	A	B	A	B	A	B	A	B	A	B
Amphipoda	155	13.87	88	5.71	21	0.4	5	0.03	13	0.14	24	2.44
Isopoda	19	0.88	77	3.81	0	0	0	0	0	0	0	0
Cumacea	0	0	0	0	0	0	0	0	3	0	352	1.54
Mysidacea	0	0	0	0	0	0	0	0	0	0	0	0
Decapoda	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	0	0	0	0	0	0	0	0	0	0	0	0
Pisces	0	0	0	0	0	0	0	0	0	0	0	0
Ascidia	0	0	0	0	0	0	0	0	0	0	0	0
Hydroidea	0	0	0	0	0	0	0	0	0	0	0	0
Actiniaria	0	0	0	0	0	0	0	0	0	0	3	0.04
Total	**174**	**14.75**	**165**	**9.52**	**21**	**0.4**	**5**	**0.03**	**16**	**0.14**	**379**	**4.02**

Table P5.5 continued.

Taxonomic group	Station (depth, m)									
	FP-27 (40)		FP-30 (43)		FP-37 (41)		AS-01		B6-2-2	
	A	B	A	B	A	B	A	B	A	B
Amphipoda	24	1.05	12	0.38	44	0.78	12	0.25	16	0.18
Isopoda	0	0	0	0	0	0	3	0.15	0	0
Cumacea	36	0.08	0	0	108	0.5	0	0	16	0.24
Mysidacea	0	0	0	0	0	0	0	0	0	0
Decapoda	16	1.44	12	1.24	0	0	0	0	0	0
Gastropoda	0	0	0	0	0	0	0	0	0	0
Bivalvia	0	0	0	0	0	0	0	0	0	0
Pisces	0	0	4	1.99	0	0	0	0	0	0
Ascidia	0	0	0	0	0	0	0	0	0	0
Hydroidea	8	0.83	0	0	0	0	0	0	0	0
Actiniaria	0	0	0	0	0	0	0	0	0	0
Total	**84**	**3.4**	**28**	**3.61**	**152**	**1.28**	**15**	**0.4**	**32**	**0.42**