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Statistical structure of biooptical parameters of the surface layer at the Japan and Okhotsk seas

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Satellite ocean color data from Sea-viewing Wide Field-of-view Sensor (SeaWiFS) are used. Investigation area is the Japan Sea and the Sea of Okhotsk. SeaWiFS level 2 data were analyzed for 2000-2005 years. 2-dimensional correlation functions of normalized water-leaving radiances (nLw) at wavelength 412, 443, 490 nm were calculated in floating (step 100 km) spatial circle (radius 50 km) window. Values of the correlation function on level 0.7 of maximum were fitted by ellipse function (named as correlation ellipse). Obtained correlation ellipses were plotted on geographical map. Daily and monthly map with correlation ellipses were made. Ellipses orient along nLw's field anisotropy. Ellipses are closed to circle in the case of isotropic nLw fields. Ellipses orientation shows common direction of currents. The anisotropy is high at the shelf regions and longer axis of ellipse generally directed along coastline. The anisotropy is low at the open part of investigating seas due to absence of strong steady currents. Regions with similar statistical structure were selected using such ellipse parameters as angle of inclination, extinction coefficient and one of the axis. In these regions similar hydro physical processes takes place. With the help of obtained correlation ellipses it is possible to conduct fast optimal interpolation of satellite data.

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Zooplankton and marginal filters of estuarine systems of Primorye

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Estuaries are transitive zones between fresh-water and oceanic systems. Also, hydrological data show they are marginal filters where large amounts of organic and inorganic substances settle. The mechanism of sedimentation is a difficult physical and chemical process and is connected, mainly, with changes in salinity. However it also has a biological component, involving zooplankton.

The concentration and species composition of zooplankton are unequal along the whole length of estuarine systems. Two zones (external and internal) are identified by different parameters, and the last one – includes three parts of the estuary (upper, middle and lower). The extent of each site depends on riverbed structure.

In the upper part of the internal estuary, zooplankton community structure is dominated by rotifers, both by biomass and by number. The freshwater fauna of planktonic animals dominates. Closer to the middle part, the quantity of cladocera increases and copepods also become numerous. An abundance of brackish water zooplankton species appears. The lower zone of the internal estuary is characterized by the highest concentration of copepods, mainly particle filtering organisms. In this region there is a mixture of brackish water species with a great variety of sea species. Outside of the internal estuary, the biomass and numbers of planktonic animals sharply declines by one - two orders of magnitude.

Thus, the estuarine system by itself is a marginal filter and most of its suspended particles are filtered by planktonic organisms and settled as fecal pellets.

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Distribution of macrozoobenthos at the North-East Sakhalin Island shelf in 2003-2004

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399 benthic species were found at the North-East Sakhalin Island shelf and slope in 2003-2004. Average benthos biomass varied from 499.2 to 1035.0 g/m², average density varied from 2212.6 to 12691.0 ind/m². The

highest biomass was observed on fine and medium sands, at the depth range 28-94 meters. Six faunal groups had the highest quantitative parameters: Polychaeta, Bivalvia, Amphipoda, Echinoidea, Actiniaria, and Cumacea. Cluster analysis detected the following bottom communities: *E. parma*, Actiniaria, Amphipoda, *D. bidentata*+Amphipoda, Spongia+Ascidia+Hydrozoa. Communities of *E. parma* and Actiniaria were found on the fine and medium sands at 200 meters depth along the coast. Communities of Amphipoda and Cumacea were situated in the south part of study area on the silty sands, at a depth of 90 meters. Sessile suspended feeders were situated in gravel sediment in the north part of study area at depths of 100-200 meters. Benthos of the North-East Sakhalin Island shelf in 2003 and 2004, as in the past years, were characterized by high species composition and high quantitative abundance.

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Influence of seasonal and interannual environmental changes on the structure of zooplankton community of Aniva Bay and adjacent deep-water area (1987-2005)

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The study region is the northern part of La Perouse Strait and the southern deep-water part of the Okhotsk Sea. During 1987-2005, 29 surveys were conducted by a standard scheme of stations. A total of 880 zooplankton samples were collected using Juday nets (0,1 m², 0.112 mm) in the layer 100-0 (bottom-0) m. A frontal zone between subtropical and subarctic water masses, seasonal upwellings and anticyclonic eddies occur in the study region. Significant species diversity and total biomass fluctuations are common for zooplankton of this region.

From the results of research in 1987-1995, Aniva Bay and the adjacent deep-water area were determined as the most productive subregions around Sakhalin Island. In Aniva Bay the cold-water euphausiid *Thysanoessa raschii* (*Th. inermis* in the extremely cold period) was found to be dominant in spring. The highest-density zone of euphausiid aggregations coincided with the northern periphery of the quasi-stationary anticyclonic eddy A1. In autumn, the cold-water (CW) medium-size copepods (*Pseudocalanus minutus*, *Ps.newmani*, *Acartia longiremis*) dominated as usual. However, during a significant positive SST anomaly, the moderately-cold-water neritic copepod *Centropages abdominalis* prevailed by biomass. On the whole, zooplankton biomass in autumn was significantly lower compared to the spring.

The cold-water copepod *Metridia okhotensis* prevailed by biomass in the deep-water area. The densest aggregations of this species occurred near the southern boundary of an anticyclonic eddy, which existed eastward of the southern Sakhalin coast. The cold-water plankters: euphausiid *Th. inermis*, copepod *Metridia okhotensis*, and chaetognath *Sagitta elegans* dominated (total biomass was about 1400 mg/m³) during the periods with low ice formation, a depressed state of the warm currents system and a deficit of atmospheric warm inflow. Higher zooplankton biomasses are common for periods with negative anomalies of water temperature in the layers of 50-100 and 100-200 m.

In autumn, minimum biomass of the cold-water group is common for periods with almost zero values of geostrophic transport, calculated by observations on the common transect between Cape Aniva – Cape Dokuchaev. A great percentage of the moderately-cold-water forms *Euphausia pacifica* and *Calanus plumchrus* is also common for these periods. The copepods *Pseudocalanus minutus* and *Ps. newmani* prevailed (22%) in the plankton along with the warm-water *Calanus pacificus* which constituted more than 7% of the total biomass. The relatively low biomass level (332 mg/m³) proves the relationship between productivity and reduced heat content of the water layers of 50-100 m ($r = 0.58$) and 100-200 m ($r = 0.86$) in the study area.

From the results obtained during 2001–2005 in Aniva Bay, it was concluded:

- a) substitution of large cold-water euphausiids and chaetognaths for copepods of the same ecological group (*Pseudocalanus minutus*, *Ps. Newmani* and *Acartia longiremis*) in the Aniva Bay zooplankton community took place in the spring period, and total zooplankton biomass in spring decreased significantly;
- b) along with the gradual rise of SST, there was an intense increase in development of the neritic copepod complex, which resulted in shifting the annual maximum of total biomass dynamics to the autumn period;
- c) south - boreal, subtropical and tropical copepod species increased in biomass in Aniva Bay waters, and their distribution was observed up to the northern coast of the bay;
- d) zones with high concentration of euphausiids *Thysanoessa raschii* and *Th. inermis* were observed to be formed in late autumn – winter.

By the results of recent observations in the deep-water part of the Okhotsk Sea, the following features have been noted:

a) both a spring and autumn decrease in total zooplankton biomass due to the euphausiid *Thysanoessa inermis*, the chaetognath *Sagitta elegans*, and the copepod *Metridia okhotensis*.

b) a portion of the warm-water species common for the Soya Current increased up to 14% of the total zooplankton structure in late autumn. (In November, the biomass of these species reached 65% of the total zooplankton biomass at some stations located in the southern Kuril waters).

According to the satellite data, there is a trend for SST to increase in spring, summer and autumn periods in the deep-water part of the Okhotsk Sea. Changes in zooplankton communities under the influence of oceanographic factors will be discussed.

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Distribution of the large-sized boreopacific gonatid squid (*Gonatopsis borealis*) in the northwestern Pacific Ocean and adjacent marine areas

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The boreopacific, or northern gonatid squid (*Gonatopsis borealis*) is widely distributed in the North Pacific Ocean and its marginal seas and basins, including the Okhotsk and Bering seas, and the Gulf of Alaska. This muscular nektonic squid is an active pelagic predator, and is a major component in the North Pacific pelagic food webs due to its very high abundance. Two size groups, or cohorts of this squid have been distinguished based on size at maturity: small-sized and large-sized. Spatial and temporal distribution patterns of individuals classified as the large-sized cohort have been analyzed basing on the extensive data collected in multiple research expeditions of TINRO-Centre from 1984 through 2004 in the North Pacific Ocean and its marginal seas. In the offshore oceanic areas, the squid at various ontogenetic stages occurred almost all the year round, being highly abundant in summer and autumn, and being rare in winter and spring. Distribution of the large-sized *G. borealis* spanned vast oceanic region to the north of the Subarctic Boundary between approximately 145°-170°E, and 36°-46°N. Besides, the squid was occasionally captured in the southeastern Okhotsk Sea in spring. Two peaks of abundance of early ontogenetic stages and juveniles (mantle length (ML) ranging from 11-120 mm) were present, one large peak in June-July in the area of the West Wind Drift, and another smaller peak in October-November somewhat northerner. Larger individuals (ML>120 mm), including maturing and sexually mature (ML of about 250-300 mm), occurred from May to December mainly in the western part of the surveyed area. The occurrence of various ontogenetic stages of the large-sized *G. borealis* in the northwestern Pacific Ocean suggests that life cycle of this highly abundant pelagic cephalopod species is associated with subarctic oceanic waters.

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Adaptation mechanisms of gray sea urchins and *Laminaria* coexistence

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In nature, sea urchins and *Laminaria* inhabit the same environments, although sea urchins consume *Laminaria*. As sea urchins are valuable fishery targets and their marketable qualities depend on *Laminaria* abundance, the TINRO-centre investigated relationships between “sea urchins and *Laminaria*” at the biochemical level. It was observed that sea urchins and *Laminaria* produced a complex of biological and biochemical protective factors during different parts of their life cycles, allowing them to coexist.

Thus, “group” sprouting of zoospores is typical for *Laminaria* as it is connected with the peculiarities of egg cell fertilization. As a result, a great density of juvenile sprouts (up to 5 th. sp./m²) is formed and they prevent each other for further growth. During this period of the sea urchin life cycle, activation of feeding occurs, and they fall upon *Laminaria* sprouts and thin them out providing the required favorable density for further algae growth. *Laminaria* sprouts don't contain inhibitors for sea urchin feeding. When *Laminaria* thalli reach reproductive maturity, the inhibitors are synthesized and push sea urchins away. At the same time sea urchins are spawning and their feeding activity falls, decreasing sea urchin attraction to *Laminaria*. After zoospore dissemination in

Laminaria thalli, inhibitors are destroyed and they again become available for sea urchins. This is favorable for *Laminaria* because it results in bottom purification from its old thalli and it allows for zoospore settling on pure substratum.

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Phenomenon “Isoyake” along the Far Eastern coast and the methods of control

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The stocks of commercial brown algae *Laminaria japonica* Aresch in the coastal Japan Sea are in a depressed condition lately. This was first observed at the seaside of Japan in the early sixties, where the phenomenon of a significant decrease of large brown algae and its replacement by less valuable seaweed types was called “Isoyake”. This phenomenon has spread to the coast of the Russian Far East Seas during recent years as well. At present there is a reduction in *Laminaria* fields, which are being replaced by the Corallinaceae family. A large portion of the hard stone substratum where the *Laminaria* grew before has already been occupied with crustose coralline algae.

As a result of experimental and industrial work in diverse places of the Primorye coast, TINRO has developed inexpensive and effective biotechnologies of recultivation of destroyed areas using methods of mariculture and amelioration to restore conditions for harvest of algae and for sea urchin feeding.

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Intra-annual characteristics of the copepod community related to the ecosystem in the southern waters of Korea

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Zooplankton communities are influenced strongly by variation of the physical environment and by ecosystem indicators in their habitats. Intra-annual variability of zooplankton biomass is caused by the seasonal changes of oceanographic conditions and the occurrence of a frontal zone in the southern waters of Korea. We estimated intra-annual variability of copepods and the role of ecosystem indicators based on the bimonthly oceanographic survey during April 2004-February 2005. A total of 133 zooplankton taxa were recorded in southern waters of Korea in the present study. Copepods are the most dominant group accounting for 19.4-90.1% in April, and 43.4-91.1% in August, 2004 of the total zooplankton community analyzed during the study period. Seasonal differences in the zooplankton distribution were mainly influenced by divergence formed at a boundary line formed by currents of opposing directions, consisted of the South Korean Coastal Waters (SKCW) and the Yellow Sea Coastal Waters (YSCW). Of the 8 corresponding species of southern waters of Korea, *Acartia negiligens*, *Eucalanus mucronatus*, *Lucicutia flavicornis*, *Cosmocalanus darwinii* are oceanic species; *Acrocalanus gracilis*, *Paracalanus aculeatus*, *Euchaeta rimana*, *Paraeuchaeta concinna* are neritic species. Oceanic copepods, *Eucalanus subtenuis*, *Eucalanus crassus* only appeared along the Yeosu-Geoje coast in August but they appeared in most areas in October.

During these surveys, the oceanographic condition in August, 2004 was strongly affected by the thermal front between the cold water masses off Yeosu-Geoje and the Tsushima warm current in the southern waters of Korea. Chlorophyll-a showed high density in the mid southern coastal area and western area of Jeju Island Anchovy eggs were distributed offshore with high density in the frontal area between coastal cold water and the warm current off southern area of Korea. We will discuss relationships between anchovy spawning grounds and occurrence area, species composition and size distribution of oceanic copepods. Species composition of oceanic copepods was compared with the results in 1980's and we will discuss the effects of long-term climate change and ecosystem regime shifts.

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A study on the self-regulatory ecosystem management system in Korea

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The Korean government encouraged fishermen to establish a 'Self-regulatory management community' in order to prevent illegal fishing operations, to enhance and protect their fishing grounds, and to jointly manage their fishery resources for themselves. As of 2005, a total of 310 units of the communities had joined this program. The inshore self-regulatory community management system is designed to manage fisheries resources in inshore waters of Korea. The fishing patterns of inshore waters are diverse, and include boat fisheries, shellfish or seaweed culture fisheries, village cooperative fisheries, and diver fisheries. It is desirable that the management of these fisheries is implemented by local self-regulatory communities using an ecosystem-based precautionary approach. However, the present condition of fisheries resources in this inshore system is depleted or overexploited. Therefore, in addition to managing and conserving the resources, the enhancement of the depleted resources and restoration of suitable environmental conditions of the ecosystem are essential. We selected the hen clam, *Macra chinensis*, which was a target species in the self-regulatory community in Busan city, to demonstrate an example of the practice in the self-regulatory management system to provide management guidance. We collected samples of the hen clam from November 2004 to August 2005 to estimate biomass and ecological characteristics, including growth parameters, survival rate, and natural and fishing mortalities. Acceptable biological catch (ABC) was also estimated under the harvest strategies. Finally, suitable management plans were suggested for this community management system

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Changes in diet compositions of finless porpoise (*Neophocaena phocaenoides*) by growth in the west coast of Korea

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Prey organisms in the stomach of finless porpoises which were incidentally caught from 2001 to 2005 off the west coast of Korea were analyzed. A total of 24 species, including 8 fishes, 13 crustaceans and 3 cephalopods were identified as prey organisms, proving that the finless porpoise is a carnivorous feeder on a variety of prey. Prey organisms of finless porpoise were analyzed by IRI (Index of Relative Importance). The index showed that fish was the major prey item of finless porpoise, followed by crustaceans and cephalopods. Specimens were classified into seven groups by length in order to estimate the pattern of IRI with porpoise growth. Diet composition by group showed that finless porpoise fed on small animals such as crustaceans in the younger stages, but they switched their prey from crustaceans to more fish and cephalopods as they grew larger. The diversity (H') and the evenness (J') of the diet were also estimated.

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Measures for sea urchin stock preservation under their active fishing

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One-year old gray urchins (*Strongylocentrotus intermedius*) as well as black urchins (*S. Nudus*) are intensively caught in the coastal Primorye (north-western part of the Japan Sea), resulting in a tendency of total stock decrease. At some sites all sea urchins have been caught. In this connection, it is necessary to develop a complex of measures that could maintain the stability of existing sea urchin populations and also favor the increase of their stocks. Evidently there is a need to conduct pre-fishing season assessment surveys of sea urchin stocks in order to calculate the optimum catch rate for each population and to create a system of protective measures for preservation of sea urchin settlement.

Because of this, FSUE TINRO-centre conducted extensive studies of coastal Primorye in 1996 – 2005 including an assessment of sea urchin settlements, condition of food supply, distribution and abundance of juveniles, and possibilities of replacement of *Laminaria* fields for sea urchin feeding. Analyzing these studies determined the

basic directions in management activities for increasing the stocks of this valuable hydrobiont in every concrete site all over the coastal Primorye.

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Some features of the main macrozoobenthic groups on the Okhotsk Sea shelf along the northeastern Sakhalin Island

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Macrozoobenthic studies on the Okhotsk Sea shelf have been conducted in August 2002 according to the "Monitoring applied-research program of water biological resources and their habitat in regions of development of hydrocarbon fields on the northeastern Sakhalin shelf". The obtained quantitative indices, being compared with the results of researches carried out by TINRO-Center in 1977 (Koblikov, 1982) on the Okhotsk Sea shelf of Sakhalin Island, revealed some peculiarities in biomass distribution of the main macrozoobenthic groups for a great time interval.

Earlier, it was reported that in general the macrozoobenthos biomass had not changed much during the 25-year period, and its main biomass-forming groups remained the same (Pecheneva *et al.*, 2005). Some increase in zoobenthos biomass for such a great period was found from the TINRO-Center survey (Shuntov *et al.*, 2003). Echinoderms (mainly, *Echinarachnius parma*) remain a dominant group among macrozoobenthic organisms. The insignificant decline in biomass of this group was recorded (from 248,4 g/m² to 206,0 g/m²). In August 2002, the second place among the main macrozoobenthic groups was occupied by bivalves with the mean biomass 63,1 g/m², that is almost twice as much compared to 1977. Crustaceans occupied the third place, and their mean biomass increased a little from 52,6 to 56,4 g/m². The mean biomass of polychaetes practically has not changed; it constituted 5% (4,9% in 1977) of the total benthos biomass.

A significant increase in bivalves biomass, compared to the other macrozoobenthic groups, is connected, perhaps, with the decline in abundance of commercial crab species (mainly, snow crab *Opilio*), for which bivalves are one of the basic nutritional component.

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Monitoring of processes of dissolved organic matter production by phytoplankton using optical spectroscopy methods

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The processes of Dissolved Organic Matter (DOM) production by phytoplankton were investigated with the help of features of Laser-Induced (532nm) seawater Fluorescence (LIF) spectra (measured by ship-born fluorometer) and leaving-water radiance spectra (measured by SeaWiFS). The LIF spectra were used for calculation of such bio-optical parameters as chlorophyll-a concentration (labeled as C) and intensity of DOM fluorescence (labeled as Q). The functional relationship between these bio-optical parameters was analyzed. More than 100 thousand LIF spectra measured at the different regions of Ocean (including northwest Pacific) were used for the analysis. It was shown that a linear relation between C and Q is observed for some stages of evolving phytoplankton communities and for some seawater cases. Joint application of the linear relation parameters and ocean color satellite measurements is suggested for, first, identification and classification of phytoplankton communities, second, investigation of various processes influencing phytoplankton community condition. Also, investigation of the functional relationship is used for determination of the rate of DOM production by phytoplankton. Analyses of water-leaving radiance spectra were made in a similar manner assuming that these spectra were under the influence of chromophoric DOM and not fluorescence DOM. Lastly, LIF and satellite analyses were compared.

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Southward biomass transport of major subarctic copepods by Oyashio current

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In order to see how much biomass of the four major subarctic copepods (*Neocalanus cristatus*, *Neocalanus flemingeri*, *Neocalanus plumchrus*, *Eucalanus bungii*) is transported to the mixed water region (MWR) by the southwestward Oyashio current, we estimated their annual transport by integrating seasonal observation data off the east coast of Japan. In each season from spring of 2001 to winter of 2002, hydrographic observations were made on a repeat section called the Oyashio intensive observation line off Cape Erimo (OICE), which extends southeastward from the southeast coast of Hokkaido Island. A vertical multiple plankton sampler (VMPS) was used to sample the planktons in four layers above 500 m depth and conductivity-temperature-depth sensor (CTD) data were analyzed to calculate geostrophic currents referred to 1500 m depth. Combining VMPS and CTD data and integrating with time and space, we estimated the net southwestward carbon mass of these four copepods across OICE to be 6.9×10^5 tons per year. Based on the results of other experiments deploying isopycnal floats in the Oyashio current, at least 5.9×10^5 tons of them are considered to traverse the Oyashio front southward to reach MWR, where these deeply-migrating copepods cannot reproduce in the surface layer because of its warm temperature. This suggests that most of the transported copepods are eventually consumed as prey in the food chain in intermediate layers of the MWR.

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Zooplankton distribution along a transect off Sakhalin Island during early summer 2005

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Plankton sampling was undertaken in association with oceanographic measurements along a transect roughly at the 1000 m contour off Sakhalin Island during early summer 2005. The NORPAC net-collected zooplankton assemblage was dominated by calanoid copepods. The distribution pattern of zooplankton did not necessarily match that of ambient chlorophyll, although the overall abundance declined at northern stations. The subsurface chlorophyll maximum tended to be more prominent at stations located further off the coastline, and the contribution of near pico size fraction (< 5 μ m) appeared to be larger at these stations. At one station where the zooplankton abundance was far higher than elsewhere, chlorophyll concentration was also highly elevated with the contribution of smaller cells lower. Hydrographic control may well have been one of the major determinants of this case. Zooplankton distribution in this region at the time of investigation must be a product of interactions between hydrography and the distribution of potential food organisms.

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Seasonal dynamics of species composition and community structure of neritic copepods in Amursky Bay (Peter the Great Bay, Sea of Japan)

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The north-western part of the Sea of Japan, where Amursky Bay as part of Peter the Great Bay is situated, could be characterized by biogeographical heterogeneity of its planktonic fauna due to its proximity to the transition zone between temperate and subtropical North-western Pacific regions. Species composition and dynamics of neritic copepods in Amursky Bay adequately reflect the geographical position of the study region and indicate changes of hydrological seasons. During the investigation (mid May – beginning November 1991), 14 species of pelagic neritic copepods (Calanoida and Cyclopoida) were recorded. *Acartia aff. clausi*, *Tortanus discaudatus* and *Pseudodiaptomus marinus* occurred in the plankton throughout the entire period of research, the other species had more marked seasonality in their presence in the plankton. Analysis of structure and

dynamics of the copepod community revealed 3 periods. During the first period (mid May – June), the neritic copepod community consisted of boreal species only, where *Acartia hudsonica* was dominant and *T. discaudatus*, *Centropages abdominalis* – subdominant. Community diversity was low (Shannon-Wiener index 1.1-1.2). The second period (July – end of August) is marked by the appearance of subtropical species, dominated by *Acartia pacifica*, as well as the presence of boreal ones. The diversity values were the highest (up to 1.76). The third period (end of August – beginning of November) showed the predominance of subtropical copepods with the most abundant being *Oithona brevicornis*. The diversity index was the lowest (0.9). These results help to understand the terms and conditions (temperature and salinity) controlling seasonal dynamics of neritic copepods in the north-western part of the Sea of Japan.

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Structure and distribution of zooplankton of Sakhalin Bay and Academy Bay (Sea of Okhotsk)

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In July 2003 in Sakhalin Bay and Academy Bay, representatives of 9 basic hydrobiological groups of holoplankton, 9 taxa of benthopelagic organisms, 9 taxa of meroplankton and an ichthyoplankton taxon were sampled. In all, 51 species were identified: Copepoda 30, Coelenterata 7, Ctenophora 3, Euphausiacea, Cladocera, Chaetognatha, Hyperiid, Pteropoda, Appendicularia and Mysidacea 1-2 species for each. Some species (Ctenophora, jellyfishes, copepods) were observed for the first time in this area and in the Sea of Okhotsk. The eastern part of Sakhalin Bay is characterized by significant taxonomic riches and the greatest index of biodiversity. The least diversity was near the Amur Estuary and in the northwest part of Sakhalin Bay.

Zooplankton were placed into four groups. Group 1 is located in a southeast part of Sakhalin Bay; its basis is made with *Eurytemora herdmanni*, *Pseudocalanus newmani*, larvae Bivalvia, *Acartia hudsonica*, *Evadne nordmanni*, and *Podon leuckarti*. Group 2 is located in the center of Sakhalin Bay; its basis is made with *Jaschnovia tolli*, *Pseudocalanus minutus*, *Pseudocalanus newmani*, *Oithona similis*, *Calanus glacialis*, appendicularians, larvae Polychaeta, Bivalvia and Cirripedia. Group 3 is located in a northwest part of Sakhalin Bay; the basis is made with larvae Cirripedia, *P. newmani*, *Oithona similis*, *Acartia longiremis*, and *Thysanoessa raschii*. Group 4 is located in Academy Bay; the basis is made with larvae Cirripedia, *Pseudocalanus acuspes*, *P. newmani*, *P. minutus*, and *E. herdmanni*. The structure and spatial distribution of groupings corresponded to the salinity structure of the water. Distribution patterns of species-indicators (Cladocera, *Eurytemora asymmetrica*, *Eurytemora pacifica*, *Sinocalanus tenellus*, *Acartia hudsonica*, *Tortanus derjugini*) indicated the flow of waters from the Amur Estuary to Sakhalin Bay occurred in a northeast direction, and in the center of the gulf there is a local circulation. These circulation patterns have been confirmed with satellite information.

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Variability of chlorophyll-a concentration caused by wind upwelling in Peter the Great Bay in the autumn of 2003

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Chlorophyll-a concentration is one of the basic parameters of water bioproductivity. High bioproductivity is observed usually in the areas of upwelling. The highest values of the wind upwelling index at the northwest coast of the Japan Sea are observed in September and October. Variability of the wind parameters and chlorophyll-a concentration was investigated in detail for the autumn of 2003 on the base of the satellite data on ocean color obtained by SeaWiFS scanner and the metadata set from NCEP (National Center for Environmental Prediction) of the GSFC DAAC (Goddard Space Flight Center; Distributed Active Archive Center). The data were processed through the SeaDAS 4.6 software to construct fields of chlorophyll-a concentration and wind rate and direction. Preliminary analysis of these fields has shown chlorophyll-a concentration increases during periods of southwest or northwest wind strengthening to 8-10 m/s or more. The blooming starts over shallow areas and then spreads over deep areas of Peter the Great Bay.

PICES XIV BIO_Poster-2335

Influence of organically enriched river run-off on the symbiotic community of scallops and polychaete worms

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Communities of scallop *Patinopecten* (= *Mizuhopecten*) *yessoensis* and polychaete worm *Polydora brevipalpa* inhabiting neighboring sites in Peter the Great Bay (Sea of Japan) were compared. Site 1 was a sand bottom in an unpolluted part of the bay, and site 2 was an organically enriched muddy sand bottom that was under the influence of Tuman River discharge. Temperature and salinity regimes of the near bottom water layer were similar at both sites. However, oxygen, phosphorus and carbon, and food potential for species of each community were different. It was found that the shells of the scallops sampled from muddy sand were more eroded than shells of individuals collected from the sand substrate. A statistically significant negative correlation between the degree of shell bioerosion and scallop shell height was observed. The bioerosion adversely affected scallop growth. Scallops from the muddy bottom sediments grew significantly slower than those from sand.

Food sources of scallops and polychaetes were determined using fatty acids as biochemical markers. Distribution of fatty acid markers in the scallop lipids reflected the dominance of flagellates and diatoms in their food. Odd-chained and branched fatty acids associated with benthic bacteria were mostly present in polychaetes indicating a significant contribution of bacteria to the polychaete diet. At site 2, enriched by organic matter, food potential for polychaetes was higher than at site 1. Thus, organic enrichment of the bottom sediments near the river estuary has an unequal influence on the different elements of the benthic community, being a boon for some species and an adverse factor for others. In turn, the consequences of interactions between species in the community may change under river run-off.

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