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PECULIARITIS OF ZOOPLANKTON EXISTENCE IN THE SMALL THERMOKARST LAKES OF THE LENA DELTA

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Small thermokarst lakes (polygons) are the most common water pools of the Lena Delta showing the highest values of the zooplankton abundance and biomass, and low species diversity; 35 species were identified. The seasonal and interannual variations in the total abundance and biomass largely depend on the specific life cycles of the common crustacean species and the duration of favorable temperature conditions in a certain year. Usually two-three peaks of quantitative characteristics of zooplankton may be recorded in summer season in the polygons. The first maximum of the abundance and biomass connects with Cyclopoida, which start to reproduce in the beginning of the ice-free period. Some Cyclopoida species spend winter diapause in the form of frozen-into-ice elder copepodite stages. Their reproduction coincides with ice melting. The second peak of the abundance and biomass observed in the middle summer links with reproduction of Calanoida and Cladocera species and third one – with repeated partenogenetic reproduction of Cladocera. The latter are able to produce 2-3 generations their active lifetime. Calanoida species from the studied area are characterized by one generation per year. Wintering occurs at the stage of latent eggs.

PERENNIAL VARIATIONS OF ZOOPLANKTON IN THE PELAGIAL OF LAKE BAIKAL DURING GLOBAL WARMING

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In the XXth century, the planet warming resulted in a rise of the upper water layers in Baikal, especially from the 1970s (Shimaraev et al., 2002). Survey of the lake during May-June and September, 1961-1995 allowed us to outline the tendencies of perennial changes in the zooplankton composition dominated by cryophilic copepods *Epischura baicalensis*.

In spring, epischura number and biomass grows in a 0-50 m layer. This phenomenon may be caused by a positive effect of temperature increase during previous summer.

In September, epischura and rotifer number decrease in the 0-50 m layer. However, this causes no decrease in the total zooplankton biomass due to the growth of thermophilic cyclop and cladoceran number. In 1971-2003, when the temperature in May-September became 1.4°C higher, average epischura biomass fell to 18%, and that of cyclops and cladocerans rose to 19%. Trend to epischura abundance decrease was 2,7 thous. specimens per 1 m^3 and – 18,6 mg/m^3 per 1°C respectively. Positive trend of the total cyclop and cladoceran abundance change was 1.3 thous. specimens per 1 m^3, and + 34 mg/m^3 in terms of average May-September growth of temperature by 1°C respectively.

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ASSESSMENT OF UTILIZATION DEGREE FOR SUBSTANCE AND ENERGY IN AQUATIC ECOSYSTEMS

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Complex studies of aquatic ecosystems include: studies of spatial and temporal variability in concentrations of organic and mineral forms of nutrients, concentrations of the major biochemical constituents of dissolved and particulate organic matter (OM) (proteins, carbohydrates, lipids, nucleic acids), and rates of the OM production and degradation as well as of nutrient regeneration.

Assessment of rates for the OM degradation and nutrient regeneration in aquatic ecosystems is based on measurements of enzymatic activity for various hydrolases (phosphatase, protease) and for the electron transport system (ETS). Regeneration rates and turnover time of phosphates and nutrient are calculated based on measurements of the activity of alkaline phosphatase and common proteases, respectively, while rates of oxygen uptake and the total OM turnover in the aquatic ecosystems are calculated with the activity of the ETS enzymes.

Comparison of rates for reactions catalyzed by the above mentioned hydrolases and rates for reactions catalyzed by the ETS enzymes and the turnover rates for phosphorus, nitrogen, and carbon allows us to assess the degree of the OM utilization in the syntrophy of aquatic ecosystems.

We have performed biohydrochemical monitoring of various lake and marine ecosystems both in the southern seas and northern seas in various seasons.

REGULARITIES OF FORMATION OF THE PRIMARY PRODUCTION OF PHYTOPLANKTON IN LAGOONS (ON EXAMPLE OF THE CURONIAN AND VISTULA LAGOONS OF THE BALTIC SEA)

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The Curonian and Vistula Lagoons are enclosed freshwater and brackish water basins, connected to the Baltic Sea by narrow straits. It is the largest coastal lagoons of the Baltic Sea. During resent decades, substantial anthropogenic changes occurred in the lagoons itself and their drainage areas. This work presents the results of research that were carried out between March and November 2001-2004. Measurements were conducted one-two times per month at 5-7 stations in every lagoon. Regularities of temporal and spatial changes of primary production and mineralization of organic matter, phytoplankton biomass, chlorophyll "a" and nutrients (phosphorus, nitrogen) concentrations in the Curonian and Vistula Lagoons are considered. The estimation of biological production and the trophic status of lagoons are carried out and the major factors, which define a level of biological production in lagoons, are determined. Is shown, that on the most part of water area Curonian Lagoon the strong summer warming-up of water (higher 20°C) in a combination with freshwater, slow-flow velocity and high concentrations of phosphorus creates of conditions for hyperblooms of Cyanobacteria (*Aphanizomenon flos-aquae, Microcystis aeruginosa*). In the Vistula Lagoon hydrodynamic activity (high-flow velocity) and brackish water prevent from long intensive development of Cyanobacteria. The least values of primary production, chlorophyll and nutrients concentrations are occurred in the part near the Baltic Strait. The Curonian Lagoon can be regarded as hypertrophic water body, whereas the Vistula Lagoon can be regarded as an eutrophic water body. The relationship between production of phytoplankton and fish yield is considered. The analysis of use primary production in the trophic web is carried out; in particular, the biological preconditions of the low ratio fish yield to annual primary production are considered.

PRIMARY PRODUCTION AND CHLOROPHYLL CONCENTRATION AS INDICATORS OF BIOLOGICAL PRODUCTION IN WATERS OF THE CANARY UPWELLING

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There were analyzed the long-term data on primary production (PP) and chlorophyll "a" concentrations, which were obtained during 13 research cruises in the area of Canary Upwelling (16-36° N; 6-18° W) in 1994-2004. Regularities of spatial distribution of waters of the different trophic status in this area are considered. The highest values of PP and chlorophyll were observed in zone of all-the-year-round upwelling (21-24° N) and in zone of intensive coastal upwelling and location of Senegalese-Mauritanian front (to the south 21° N). Contact of these zones results in formation a continuous highly productive zone with the waters of eutrophic and hypertrophic status from 24 to 19° N, in the summer time.

Southward of the Senegalese-Mauritanian front coastal upwelling is almost absent, and the waters oligotrophic and mesotrophic status predominate. Northward of 24° N, the zones of intensive development of phytoplankton and high PP have rather local character, and their distribution may change yearly. For all the area the regularity of gradual transition from eutrophic and hypertrophic waters in a coastal zone, to mesotrophic and oligotrophic waters, in places of penetration on a shelf of oceanic waters, was observed.

Southward of 21° N the spatial distribution of PP and chlorophyll corresponds to surface concentration of phosphate and temperature of water. The excellent equations relating surface chlorophyll to the average and integrated PP ($R^2 = 0.64\text{-}0.81$), average and integrated chlorophyll in a layer of photosynthesis and a layer of 0-100 m ($R^2 = 0.64\text{-}0.91$) are derived. These equations allowed to calculate a level and spatial distribution depth-integrated values of PP and chlorophyll in all surveys since 1984 to 2004. These dependencies confirm possibility of calculations of the depth-integrated values of PP and chlorophyll using shipboard or satellite measurements of the surface chlorophyll.

ROLE OF MATERNAL EFFECTS OF PHOTOPERIOD CHANGES IN DAPHNIA'S SEASONAL ADAPTATIONS

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We present statistically confirmed data on effect of brief (15 min/5 day) photoperiod changes on life cycle parameters in genetically absolutely identical *Daphnia pulicaria*'s clone cultivated in alternative (from 12 to 16 hours and from 16 to 12 hours) diurnal light rhythms. In each photoperiod part of daphnids were grown in high level food conditions(1 mg C/l) while others were treated with changed in two generations from good (1 mg C/l) to low (0.3 mg C/l) food conditions. Several important for life span parameters like neonate size, neonate survivorship, maturation time, the first clutch size, resting egg (ephippia) forming were traced in these *Daphnia* within 4 month.

We found that vector of photoperiod changes (grown or declining) was important for *Daphnia* switching from parthenogenesis to gamogenesis. This possibly was a result of maternity effect in transmitting of information on photoperiod in the chain of generations (Alekseev, Lampert 2001) and could explain how the crustaceans recognize spring and fall conditions with the same day length. Direction of photoperiod changes was also important for survival and neonate dry weight in *D. pulicaria.* Our results mean that *Daphnia* population even being at the same day length can distinguish spring from fall and adjust its life history parameters in accordance with seasonal needs by screening the direction of photoperiod change.

This study was partly supported by a fellowship from Max-Planck-Society and the grant N 04-04-49-164 from The Russian Foundation for Basic Researches

THE TROPHIC STRUCTURE OF THE ARAL SEA ECOSYSTEM UNDER CONDITIONS OF ECOLOGICAL CRISIS

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The Aral Sea is exposed to unexampled anthropogenic pressure. As a consequence of wide-ranging acclimatization efforts the trophic relationships in the water body have been changed. Since the first half of the 1970s acclimatized species began to dominate in zooplankton, zoobenthos and ichtyofauna. Since 1961 as a result of the river drain regulation salinization has occurred. Most of the indigenous species of animals and plants became extinct due to increasing salinization.

Initially, the Aral Sea ecosystem was characterized by a preferred macrophytal production of primary organic matter against a background of high water lucidity and low concentration of biogenic matter in the water column. Being an antipode of ecosystems of the southern seas and the Ocean, the Aral Sea ecosystem was characterized by combination of intense detritic and extremely impaired pasture food chains.

In the 1980s alteration of the structural-functional relationships of the ecosystem due to transformation of the intrinsic circulation of biogenic matter is occurred. The increase of the biogenic matter concentration in the water column led to the drastic increase of primary organic production by phytoplankton and to reinforcement of the pasture food chain. It became equal to the detritic chain or even stronger. Since the beginning of the 1980s the Aral Sea ecosystem, according to the primary organic matter formation has become closer to the ecosystems of Russian southern seas.

LONG-TERM MONITORING OF MACROZOOBENTHOS IN THE OPEN PART OF LAKE PSKOVSKOYE-CHUDSKOYE (PEIPSI)

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In the history of studies of Lake Pskovskoye-Chudskoye zoobenthos one can distinguish two main periods of investigations (expeditions and a period of regular permanent studies) as well as three main directions (faunistic, production-fishery and assessment of anthropogenic impact on macrozoobenthos).

A short overview of the studies' results is made and a list of references is given for each of the main directions of macrozoobenthos studies in Lake Pskovskoe-Chudskoye. The structure of Lake Pskovskoye-Chudskoye macrozoobenthos monitoring system in Russian territorial waters after introduction of Russian-Estonian state border at the waterbody is described. Main directions of current macrozoobenthos studies are characterized.

APPLICATION OF PHYSIOLOGICAL METHOD FOR ASSESSING PRODUCTION OF AMPHIPODS IN BOREAL LAKE KRIVOYE (RUSSIA)

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The physiological method of determination of production based on the interrelationship between the rate of energy metabolism and the growth rate was used for modeling of growth curves of two species of amphipods, *Monoporeia affinis* Lindstr. and *Gammarus lacustris* Sars, and comparison them with the data on growth of amphipods obtained at field study. The link between the oxygen consumption rate (Q, ml h^{-1}) and mass (W, mg of wet weight) was expressed in the equations for *M. affinis* $Q = 0.0006W^{0.59}$ (8 °C) and *G. lacustris*

$Q = 0.0013W^{0.57}$ (18 °C). At modeling of the growth curve the necessity to use a priory value of growth efficiency coefficient $K_{2\,max}$ restricts the using of this method. The calculations have shown that the maximal coincidence of physiological curve of growth to that of obtained at natural supervision of size-frequency distribution can be attained considering some requirements: the curve of growth should reflect the real maximal size of individual in a population, the duration of life cycle and the term of achievement of breeding size by individual.

SEASONAL PHENOTYPES OF *DAPHNIA*: ADAPTATION TO DIFFERENT ENVIRONMENTS

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Life-history and physiology of post-diapause and directly developing offspring in *Daphnia* were compared to determine life-history pattern of offspring origins, establish the basic traits governing pattern distinction, and assess the consequences of differing life-history strategy for relative fitness. Females exiting diapause showed elevated metabolic activity and different biochemical composition. Under rich food, they grew faster during juvenile development and were larger at maturation than parthenogenetic females. Female origins during early maturity differed in resource allocation strategy. A greater allocation to progeny in offspring exiting diapause, however, resulted in increased progeny numbers and higher relative fitness only under high food. In contrast, parthenogenetic females exhibited higher relative fitness across limited food concentrations and larger starvation resistance. We conclude that the life-history strategy of post-diapause females in *Daphnia* is adapted to predictable optimal conditions, whereas parthenogenetic females are adapted to unpredictably varying environment. *Daphnia* have evolved two alternative seasonal phenotypes matching environmental conditions in which they occur, and perform in accordance with predictions of seasonal polyphenism. Due to higher metabolic activity, which must lead to increased resource acquisition when nutrition is plentiful, and probably is associated to larger allocation to progeny, post-diapause females are superior to directly developing offspring under high food, which is predictable during early season when hatching from diapausing eggs occurs, but inferior under limiting food, which is expected later in the season. In seasonal climate, the adjustment of resource acquisition with respect to resource availability and predictability may be a general evolutionary trend for multivoltine organisms resulting in a seasonal polyphenism.

THE EUPHOTIC LAYER STOCKS OF NUTRIENTS AND CHLOROPHYLL AND ASSESSMENT OF THE PHYTOPLANKTON PRODUCTION IN THE BERING AND OKHOTSK SEAS

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Long-term surveys in the Bering and Okhotsk seas (1990-1998) allowed us to determine the eupothic layer stocks of nutrients and chlorophyll in various seasons and to assess the phytoplankton production rates (PP).

Before the onset of the vegetation period the eupothic layer stocks of nitrogen, phosphorus, and silicon total 300-2500 μM, 40-200 μM, and 450-6000 μM, respectively. Nitrogen stocks are in a relative deficit.

In spring the maximum chlorophyll "a" content (up to 300 mg/m^2) and the maximum PP (> 10 g C/м^2 day^{-1}) are observed at the melting ice edge. Then 45% of the annual phytoplankton production is developed with the winter nutrient stocks.

In summer the maximum PP (> 1 g C/м^2 day^{-1}) occurred in areas of the continental slope and at the periphery of cyclonic eddies and upwellings, where the chlorophyll "a" content generally exceeds 50 mg/m^2. By the end of summer the euphotic layer nutrient stocks are depleted (their concentrations do not exceed 0.5 μM P, 5 μM N и 10 μM Si).

In autumn during cooling and vertical mixing of the water column phytoplankton continues its intensive production: the chlorophyll content in the upper layer 30-50 mg/m^2 and the oxygen saturation of waters >100%.

ANALYSES OF THE PHYTOPLANCTON'S STRUCTURE OF THE SHALLOW HIGHLY EUTROPHIC LAKE NERO ACCORDING FUNCTIONAL CLASSIFICATION

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The qualitative and quantitative studies of the phytoplankton, concentration of inorganic nitrogen and phosphate in the water column its seasonal and spatial variation have been studied in open part of the large shallow high eutrophic Lake Nero over 1987–89 and 1999–2004, excluding 2001. According functional classification of the freshwater phytoplankton by Reynolds and all (2002), structure of assemblages was changed in last century towards the way **H2 – J – (H1 – M – S) – S1.** The predominant species in last "*Planktotrichetum*" group changed at last 10-15 years. *Limnothrix redekei* are more abundant previous dominant *Pseudoanabaena limnetica* and *Planktothrix agardhii* increased for dominant position. Variations in the relative biomass of dominant species in Lake Nero were evaluated in the context of environmental conditions and total biomass using factor analyses. The first pair of factor analyses variables explained 71% in the 1987-89 years and 58% in the 1999-03 of the variation in the species-environmental data set. The first variable was strongly correlated with underwater irradiance (Secchi depth), the ratio of Secchi: total depth and the total biomass in all data. So irradiance was the major force controlling community structure. The second variable strongly correlated with biogenic elements n in 1999-03 and with temperature in 1987-89 years. The problem of stability and development Lake Nero will be discussed with using structural and functional data of phytoplankton.

BIODIVERSITY OF BENTHIC ANIMAL COMMUNITIES AND FUNCTIONING OF THE NEVA ESTUARY ECOSYSTEMS UNDER ANTHROPOGENIC STRESS

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Ecosystems of the Neva Bay and the eastern part of Gulf of Finland, apparently like all estuary ecosystems situated in industrially developed regions, are characterized by impact of the two major factors responsible for biodiversity of animal communities, salinity and anthropogenic impact. Salinity is a simple factor directly influencing the structure of animal communities; pollution is a multicomponent factor including different impacts.

Statistical analysis was conducted to evaluate the impact of the environmental factors on the structural and functional characteristics of zoobenthos.

Results of multiregression analysis show that the number of bottom species in the Neva Bay is determined largely by toxic pollution (heavy metals, oil products and mercury in water and bottom sediments) and to a lesser extent by primary production of phytoplankton.

Results of multiregression analysis also show that values of Shannon's species diversity index for benthic animals in the Neva Bay are determined equally by values of primary production and chlorophyll a concentrations.

Analysis of the factors influencing the values of production of benthic animal communities shows that production of benthic animal communities in the Neva Bay increases with growing chlorophyll concentration. Toxic pollution did not have a suppressive impact on production values of benthic animals.

Species richness of benthic animal communities in the eastern part of the Gulf of Finland depended largely on primary production values. It is shown that the number of species declines with an increase of primary production, depth and salinity.

THE FACTORS OFREGULATION OF PLANKTON CRUSTACEANS ABUNDANCE DYNAMICS IN THE SALMON LAKE AZABACHYE

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Juvenile sockeye salmon (*Oncorhynchus nerka* Walbaum) and its' competitors for the food – threespine stickleback (*Gasterosteus aculeatus* Linne) and Asian smelt (*Hypomesus olidus* Pallas), use to feed in the Lake Azabachye. The food preference for these fishes is plankton crustaceans *Cyclops scutifer* Sars and *Daphnia galeata* Sars, whereas the crustaceans feed on the diatom species *Aulacoseira subarctica* (Kutz.) Simonsen.

Population analysis has revealed that the *C. scutifer* birth rate in the summer-autumn months strongly depends on the removal up of egg-bearing females by plankton-eaters and the temperature of water, in the periods of raising abundance of cyclops it also depends on trophic conditions. Under a high density of *C. scutifer* fecundity of females goes decreasing. Reproduction of *D. galeata* is mostly determined by food supply. Under the deficiency of food daphnias get exposed to a high mortality.

It should be suggested, that in the mesotrophic Lake Azabachye a sustainable state of plankton crustacean populations is provided by a temperate pressure of plankton-eating fishes and by sufficient amount of food resources (forage diatoms).

ECOLOGICAL STATE OF SOME RIVERS OF THE SANKT-PETERSBURG REGION

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The aim of the study was evaluation of anthropogenous impact on an ecological condition of four small rivers (Okhta, Dudergofka, Tchernaya and Sestra) using parameters of two biological communities. Composition, structure and quantitative characteristics of zoobenthos and phytoperiphyton in rivers were investigated in 1999-2002y.y. The upper waters of rivers were rather pure, but downstream, the rivers become polluted. As a rule, in the polluted areas sharp decrease in species riches, simplification of community's structure (low values of Shennon index) and domination of tolerant species were observed. Values of calculated biotic indexes corresponded to a level of pollution. Saprobic index according the phytoperiphyton changed from 0.7 up to 3.6; Trent biotic index - from 7 up to 1, saprotaxobic index - from 1.7 and up to 3.4, and Baluschkina index - from 0.63 up to 9.83. Distribution of quantitative parameters of phytoperiphyton in different rivers did not demonstrate marked regularities. Values of zoobenthos biomass in the polluted zones were always higher than those in the pure water, but participation of this community in destruction processes have relatively decreased. According to phytoperiphyton and zoobenthos Tchernaya and Okhta were defined as the most polluted rivers. Thus, structural - functional parameters of both investigated communities well reflect a degree of pollution of river waters.

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THE ROLE OF RESTING STAGES IN THE ECOLOGY OF COASTAL MARINE PLANKTON

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Notwithstanding freshwater planktonologists had always considered that species absent from the water column wait for better conditions as resting stages in the sediments, only recently the same solution has been proposed to explain the temporary absence of species from coastal marine plankton.

The cyst assemblages in the bottom mud (up to hundreds millions m^{-2}) in confined coastal environments constitute true "marine seed banks". What is still not clear is if their high abundance in confined environments is correlated with higher densities of active stages there, or with more suitable conditions for their storage.

Morphology of resting stages in many cases is different from the corresponding active stages. Most of them show a sculptured envelope which has been interpreted as an adaptation to the resting period which they pass in the marine bottoms.

A role in the rest length could be played by active individuals: in a copepod species the egg diapause is initially regulated by the mother. The rest length is an unexplored field yet, but 80 years were attributed to a dinoflagellate viable cyst from the North Adriatic. The persistence over long times in the environment must be due to a defence capacity not simply based on the envelope. A passive immunity, with antibiotic activities, has been demonstrated in *Artemia* cysts. Even disinfectants are unable to inhibit their germination.

From an ecological point of view, plankton communities of coastal confined environments show higher resilience than previously suspected. The recruitment for these communities comes from sediments and not from adjacent areas, according to the proposed "Supply Vertical Ecology".

More and more marine ecologists are looking for cysts worldwide, often finding them as an unexpectedly important component of the benthic-pelagic coupling, like in submarine canyons, where they represent one of the most important fractions of POM.

An analysis of undisturbed sediment layers can give fundamental historical re-constructions of plankton community dynamics, giving also suggestions about climatic changes.

FEEDING STRATEGIES AND GROWTH RATES OF SOME AMPHIPODS AT DIFFERENT CONDITIONS

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The amphipods are an important link of food webs of lakes and estuaries and available food source for fish. The present study focuses on feeding ecology of gammaridean amphipods *Gammarus lacustris, Gammaracanthus loricatus, Pontogammarus robustoides* and *Gmelinoides fasciatus* from some lakes of White Sea basin and Neva Estuary of Baltic Sea. Food spectrum based on gut content analysis, feeding rates at different food items and food availabilities, ratio between physiological and ecological feeding rates, food electivity and role of these species in food webs of aquatic ecosystem are discussed. In conditions of studied ecosystems all amphipod species are typical omnivorous animals using mixed feeding strategy and proving as a grazer, collector-gatherers and predator. Change of feeding strategy during ontogenesis was found for all studied species. Besides, significant differences in food spectrum were recorded between species and between different months. Somatic growth rates of amphipods kept on different diets (animals, algae and mixed) at constant temperature 20 °C were evaluated. The growth rate indicating sufficiency of nutritional value of different diets for amphipod fitness was the highest in the case of mixed diet which can be considered as optimal feeding strategy for consumer fitness.

STRUCTURAL AND FUNCTIONAL PECULIARITIES OF FRESHWATER ECOSYSTEMS OF THE RUSSIAN FAR EAST

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The freshwater ecosystems of the Russian Far East are located in the monsoon climate zone and belong to a particular group of biological systems where the natural phenomena (floods, droughts, freezing, extremely biogenic load, etc.) dominate in the regulation processes within the system. In spite of that the biota of region water systems has the big species diversity and biomass.

It was shown that in the flood-land lakes the primary production rate of the plankton depends on the value of their flowing and the length of the not floods period. Conditions of big floods the flowing of these lakes get broken, in the central part of them the not flowing zones are forming where we can see extreme high growth algae's. After floods the not flowing zones disappear and the concentration of the chlorophyll "a" in the plankton will be reduced to minimum values. It was found that annual fish production in the lakes is connected with the average annual plankton chlorophyll "a" concentration and increases by certain limit of the chlorophyll mass (60-80 mg chlorophyll "a" per m^3). Effect of the secondary pollution is caused by exceeding of the noted limit.

The distribution of hydrobionts in the rivers corresponds of the River Continuum Concept. In the upper parts of river systems the plankton is absence. The development of the benthos in this case is determined by the allochthonous organic matter input, while fish ration is defined with the amount of terrestrial invertebrates that come at the stream surface. In the potamal zone the flows of energy are defined mainly by the primary production value and are similar to those for the stable water reservoirs. The regular consequence of low and high water periods influences favourably the general ecological situation in such rivers. The long term absence of the floods excites the eutrophication of lotic systems.

SPECIFIC FEATURES OF THE FUNCTION "DRAINAGE AREA–VOZHE LAKE" SYSTEM

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The influence of vast drainage system on the subsystem Vozhe Lake was studied. The investigations are connected with ascertaining of functional role of "soil – water – lake sediments – biota" chain for migration, transformation and accumulation of elements. Analysis of long-term data (1964–2004) of soil and water chemical composition shows the significance of soil for formation of matter flows. Correlation of the distribution of heavy metals content in "soil – water – sediments" links is observed. The fish accumulated heavy metals selectivity. The lake's chemical processes and community changes are dependent upon the features of tributaries net, the variety of soil, high content of the carbonates and mineral forms of biogenic elements, and anthropogenic transformation of drainage area. As result the eutrophication of Vozhe Lake has trend to the acceleration. At the same time owing to "barrier" role of soil the stabilization of pH water is observed. Transformation of Vozhega River valley is the main reason of vulnerability of the lake ecosystem to human impact. Drainage area is divided into three soil zones distinguished of biogenic elements concentration and the active reaction (pH) of soil. Different influences of matter flows on trophic levels of the lake community are discussed.

THE ROLE OF MICROBENTHIC ORGANISMS IN THE PRODUCTIVITY OF WATER BOVE THE LITTORAL OF LAKE BAIKAL (ECOLOGICAL TEST SITE BEREZOVY)

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Plankton and benthos studies in the littoral zone allowed to define their interrelations. Correlation was found between: 1) phytoplankton and ice algae, 2) some dimensional and taxonomic benthic groups. While the contribution of planktonic producers varied critically not only from season to season but year to year, the role of microphytobenthos in the productivity of water did not change interannually. Dramatic seasonal variations of microphytobenthos related to the species biology and abiotic factors was registered. During ice-cover period the portion of bottom algae in phytoplankton biomass does not exceed 10%, whereas in the open-water period – 40-60%. In contrast to algae, the share of benthic ciliates in plankton is small: 3-5% (spring), 17-18% (summer-autumn). Benthic ciliates of ice bottom and epibionts of ice aufwuchs were the principal contributors in spring, and ciliates dwelling on macrophytes and coarse sand – in summer. Benthic rotifers and crustaceans share in zooplankton biomass depends on the season/year. During high-productive year, their portion is negligible in ice-cover time, because the coastal zone up to the water edge is occupied by developing spring complex of pelagic rotifers and *Epischura*; benthic rotifers, cyclopes, harpacticids, ostracods, gammarids, nematods were abundant on ice bottom and its aufwuchs. During low-productive year *Epischura* dominates, whereas micro- and mesozoobenthos are few in number.

SPECIES DIVERSITY OF ZOOPLANKTON COMMUNITY IN THE BRACKISH-WATER LAKE BOLSHOY VILUY

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The lake Bolshoy Viluy had not been studied until 1999. A complex studying of the lake's ecosystem was initiated on building salmon hatchery. This shallow-water (maximum depth - 7.5 meters) lake is communicated to Avachinski Bay through a 50 meters channel, results in water salination up to 5-22 ‰. Dynamism of abiotic parameters (temperature and salinity) causes two times increased species diversity of plankton and benthos fauna, consisting of fresh-water and marine species. The benthos consists of Nematoda, Oligochaeta, mites, Gastropoda and Bivalvia plenty developing and abundant in mid water. The plankton consists of 18 species of Rotifera. The community of inferior crustaceans is also quite diversified and includes 8 representatives of Copepeda and 4 of Cladocera. The Copepeda representation includes 5 species of Calanoida: *Limnocalanus macrurus, Leptodiaptomus sp., Eurytemora affinis, Epischura sp., Acartia clausi*; 2 species of *Harpacticoida — Tachidius incisipes, Limnocletodes behningi*; 1 species of parasite copepods — Ergasilus sp. The Cladocera representation is: *Daphnia sp., Chydorus sphaericus, Podonevadne trigona, Pleopsis polyphemoides.* Superior crustaceans are represented by one species *Lamprops korroensis.*

The extensive species diversity and the abundance of invertebrate fauna in the lake Bolshoy Viluy make the lake profitably different from the other brackish-water lakes of Kamchatka (Nerpichye, Laguna Anana).

EXPERIENCE IN PREDICTION OF WATER BODY PRODUCTIVITY ON THE BASIS OF GEOGRAPHICAL FACTORS

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Abiotic factors influencing value of primary production in lakes are closely connected to geographical zoning, which includes latitude, longitude and altitude. The geographical zoning can be considered as the integrated factor summing influence of climatic and edaphic conditions on productivity of water ecosystems.

The major edaphic factor is phosphorus export from drainage area. The intensity of phosphorus export depends on primary production of ground ecosystems, which is controlled by external conditions - temperature, precipitation and evaporation (Isachenko, 1953; Rosenzweig, 1968; Straškraba, 1980).

For investigation how the geographical factors influence productivity of water bodies it was developed the mass-balance model. The model consists of two submodels. The first one intended for estimation of the total phosphorus contents and water colour in lakes of a humic zone. Entrance parameters are geographical coordinates, lake morphometry, hydraulic loading, precipitation and mean annual temperature of air.

The outlet parameters of submodel 1 are entrance parameters of submodel 2 intended for prediction of biomass and annual production of phytoplankton, macrophyte, epiphyte and phytobenthos (producers), bacterioplankton and bacteriobenthos (reducers), prey and predatory zooplankton, zoobenthos, planktivorous, benthivorous and predatory fishes (consumers). The biotic entrance parameters in submodel 2 are the rate of biomass turnover and efficiency of use of the energy consumed by organisms for growth.

In the whole the structure of model represents the hierarchically constructed system of relationships between the factors, which directly or indirectly influence value of primary production, and production heterotrophic organisms of different trophic levels.

MICROALGAE CELLS SHAPE INDEX AS A NEW CRITERION FOR ADAPTATION TO ENVIRONMENTAL CONDITONS

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Evolutionary the variability of aquatic environmental conditions favoured changes in the algae shape as well as different adaptations that increased organisms' buoyancy. During seasonal successions the structure of microalgae planktonic community changes, and species of a certain shape start prevailing at each stage, which agrees with the idea of successive replacement in time of one algae group by another that differ in systematic position and physiologic status. To quantify these changes we have suggested a shape index, which shows the degree of proximity of a single cell shape to a sphere: $\omega = S_1/S$.

On the basis of sampling in the Sevastopol Bay reliable differences of the shape index have been obtained for the community of all Bacillariophyceae and Dinophyceae species. This index was considerably smaller for the diatoms algae which depend on the water viscosity to a greater extent than peridineas (correspondingly: 0,68+0,009 and 0,90+0,014).

By calculating the mean shape index for the community we can judge about the community status. To illustrate the index informative capacity for adaptations, the phytoplankton community index (without taking into account small flagellate forms) has been calculated for four habitats differing in the degree of water salinity: the Black River water reservoir (0,2 ‰), Inkerman (10,48 ‰), the Cape (16,73 ‰) and the hypersaline Chersonese area (over 200 ‰). The values of the shape index (respectively 0,65; 0,85; 0,90; 0,97, all values + 0,02) increased with raising the salinity. Small round cells with high specific level of metabolism predominated in the microalgae community of the saline waters, which is evidence for simplification of the structure (low diversity), whereas oblong cells of diatom algae (as *Pseudonitzschia inflatula*) predominated in the fresh waters of the studied reservoir.

The advantage of the proposed index lies in the fact that it changes from zero to one and does not depend on the cell size. It can be used for comparing various phytoplankton communities on spatial-temporal scales and as an index of algae adaptation to changing environmental conditions.

The research has been carried out with the support of the International grant INTAS-03-51-61-96.

EMBRYONIC DIAPAUSE OF A FRESHWATER CRUSTACEAN *POLYPHEMUS PEDICULUS* (L.), BRANCHIOPODA.

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In waters of Yaroslavl region laying of resting eggs in *P. pediculus* populations occurs daily from May to October. Eggs leave the female's body being in the state of physiological rest and keep it at 0-30^{0}C for several weeks or several years, depending on the environmental conditions, the inborn rhythm and rate of egg development. The latter is stipulated by the length of the day-time during the period of egg stay in the female's brood chamber. The stage of reactivation occurs in early spring at 1-6^{0}C, and lasts from 20 days to 5 months, till eggs acquire a certain "sum of cold", necessary for termination of the physiological rest, and recovery of their metabolism and development. The length of this period depends on the rate of egg development, conditions and duration of the physiological rest. The stage of organogenesis and emerging of young occurs in spring at 2 to 8^{0}C under certain environmental conditions. Its duration depends on temperature, rate of egg development and their state after termination of the physiological rest.

The embryonic diapause of the species is genetically determined, occurs under the impact of a complex of exogenous and endogenous factors, the latter being of greater importance.

MIXOTROPHIC CILIATES IN SMALL LAKES OF THE NATIONAL PARK "SAMARSKAYA LUKA"

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During 2001-2002 years in several small eutrophic lakes of the Samarskaja Luka were detected 30 species of mixotrophic ciliates, such as *Prorodon viridis, Frontonia leucas, Euplotes diadaleos, Histiobalantium natans, Vorticella chlorostiogma, Stentor amethystinus* etc.

In karst stratified Lake Bezdonnoe vertical distribution of plankton mixotrophic ciliates was found. They formed maximum in the epilimnion at the beginning of stratification (May); in the midpoint of a metalimnion – during resistant stratification (June-August). At the beginning of intermixing mixotrophes get down to the upper boundary of hypolimnion and, during homothermy – near to the bottom. In general, mixotrophic ciliates were found under microaerobic and anaerobic conditions in photic zone, and only under aerobic conditions in aphotic zone.

Reliable correlations of the abundance of mixotrophic ciliates with the content of DOC ($k=+0,51$; $p<0,05$); total chlorophyll «a» ($k=+0,76$); with the number of bacteria ($k=+0,59$) and Euglenida ($k=+0,78$) were established. The contribution of mixotrophic ciliates in total number of plankton ciliates was up to 99,5%, in periphyton ciliates - up to 89%. Chlorophyll «a» of ciliate's symbionts made up 1-51% total chlorophyll «a» in different research lakes. This fact must be taken into account in phytoplankton biomass calculation via the content of chlorophyll «a» in eutrophic lakes.

DYNAMICS OF THE POPULATION OF CHYDORUS SPHAERICUS (O.F. MULLER) IN THE PELAGIAL OF EUTROPHIC LAKE

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In the work seasonal and interannual dynamics of the population of *Chydorus sphaericus* in pelagial of Lake Pskovskoye in 1994–2003 has been analysed.

Lake Pskovskoye (708 km^2, mean depth – 3.8 m) is a southern and the most shallow and highly eutrophic part of Lake Pskovskoye-Chudskoye (Peipsi) system.

Population dynamics of *C. sphaericus* possessing wide environmental flexibility in the pelagial of the lake features abrupt rises coinciding with the development of blue-green algae. Correlation analysis shows strong dependence of mean seasonal numbers and biomass of *C. sphaericus* on the biomass of blue-green algae ($r=0.9$).

In the years when specific weight of blue-green algae comprised 50–55% of the total biomass of phytoplankton (average annual - 37%), mean seasonal numbers of *C. sphaericus* amounted to 60-80 thousand ind./m^3 (1996, 2002).

In the period when water blooms occur (i.e. July-September) numbers of *C. sphaericus* in certain samples amounts to 400-600 thousand ind./m^3.

Thus the results of our investigation confirm the significance of *C. sphaericus* as an indicator of the trophic status of a waterbody and quantitative characteristics of the population of *C. sphaericus* allow describing Lake Pskovskoye as a eutrophic type waterbody.

ZOOPLANKTON CHEMICAL COMMUNICATION: SIGNAL "HUNGER!"

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It is universally recognized that chemical communication is one of the factors that determine zooplankton dynamics. There are numerous empirical data but no attempts of their generalization.

We have formulated a working hypothesis based on the scientific sources of information and data we collected that at least part of such called 'density effect' of zooplankton could be described as succession of the following events:

the retrogression of food because of high density of the population;

the period of hunger;

the secretion of special information-carrying substances to inform other individuals of the population;

decrease in fertility of individuals etc.

The secretion processes might take a lot of time or to be space expanded.

For verification of hypothesis a number of experiments on *Moina macrocopa* and other 7 species of Cladocera (natural and laboratory cultivated) were set up by the scheme with full division of 'donors' and 'recipients'. Both were used in sets of 'donors' and 'recipients'.

The *Moina macrocopa* female individuals with embryos ('donors' and 'recipients') demonstrated no decrease of posterity amount as a result of placement to 'hunger' water. Embryos neither resolve nor perish on a mass scale. But the influence of that water to the quality of posterity is evident: the dispersion of growing up speed and fertility of young zooplankton individuals increased several times as many.

VIABILITY OF DORMANT EMBRYOS OF CALANOID COPEPODS RETRIEVED FROM SEDIMENT TRAPS AND FROM SEDIMENTS IN VICTORIA HARBOR (HONG KONG)

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The distribution and abundance of viable resting eggs of calanoid copepods were determined a) in the field using sediment traps and b) in the laboratory by the presence of nauplii hatched from the sediments of Victoria Harbor (Hong Kong). The sediment traps revealed a distinct seasonal pattern of copepod resting eggs sinking to the sea bottom. Sediment cores to a depth of 30 cm that were sliced at 1.0 cm intervals showed that most viable resting eggs occurred near the sediment surface. The number of viable eggs decreased with sediment depth, although resting eggs remained viable as deep as 16 cm pending on the stations. The horizontal distribution of viable resting eggs ranged from 1.4×10^3 to 2.74×10^3 m^{-2} with remarkable seasonal fluctuations. An accumulation of viable resting eggs that can persist for an extended period of time provided evidence for the existence of a calanoid egg bank (predominantly of *Acartia pacifica*) in the seabed of Victoria Harbor (Hong Kong).

ASSESSING ANTHROPOGENIC EUTROPHICATION EFFECTS BY HOLISTIC ECOSYSTEM APPROACH

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Eutrophication is acknowledged as one of the most common problems in aquatic systems and which can be due to natural as well as anthropogenic causes. At the descriptive level we know rather well the phenomena, symptoms and consequences of eutrophication. At the process level we are partly successful in simulating the relation between causes and consequences and to explore future developments. At the species structure level, however, we largely fail to predict the developments when nutrient levels or other environmental conditions in estuaries and coastal environments change. This is a major lack of knowledge because the EU member states are forced to develop management plans, environmental action plans, ecological quality standards and monitoring programs to improve water quality and to protect our aquatic ecosystems and to monitor the developments.

There is restricted knowledge about the predictability of the behaviour of ecological communities under stable as well as varying conditions. The importance of external disturbances on the diversity is only emerging. Based on this, the question arises whether the development of applicable ecological standards is anyway possible at the moment. Central questions are whether one should focus on the functioning of the system, its structure or the integration of both, whether one should choose for a holistic approach or focus on selected parts (conventional indicator species or other types of indicators). In addition to process oriented simulation models the process and structure oriented Ecological Network Analysis may be a challenging approach to meet the above EU requirements. It is, however, not at all evident what would be the best monitoring strategy for aquatic systems so that the water quantity and the quality as well as the ecological quality can be assessed.

FOOD WEB STRUCTURE OF THE ZOOPLANKTON IN LAKES OF THE VOLGA-KAMA STATE NATURAL RESERVE

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The trophic structure of communities is caused by both natural and anthropogenic factors. The purpose of this work was to study the structure of trophic groups in zooplankton communities of lakes of different types of the Volga-Kama state natural reserve. Eleven small lakes were investigated from 1998 to 2002. Results have shown that the trophic structure of zooplankton communities is more complex in meso- and meso-eutrophic lakes. The general number of genera decreased in eutrophic lakes, in comparison with mesotrophic lakes. A reduction in the number of filtrators genera, and in the amount of connections was also observed. The further increase of the trophic status caused the cut down of the food chain, the disappearance of crustaceans - obligate predators and resulted in the further reduction of the number of connections in the community. A positive correlation was found between the researched parameters and the components of ions structure of waters and the morphometrical characteristics of lakes. A negative correlation was observed between the parameters describing the trophic status of lakes and the amount of biogenous and organic matters.

THE NEW CONCEPT OF MICRO-PERIPHYTON: IN VIEW OF THE ORGANISM DIMENSIONS

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The new concept of the micro-periphyton with the regards to the organism dimensions was advanced. Micro-periphyton (micro-fouling) would be defined as community of aquatic organisms at the interface boundary: "solid body-water", which living in hydrodynamic boundary layer limits on account of minor (up to several millimetres) dimensions. In addition micro-periphyton is the step of biofouling community development for which all components of them are placed in the boundary layer limits. The macro-periphyton is correspondingly the community of attached aquatic organisms with dimensions that more than hydrodynamic boundary layer dimensionality.

SELFPURIFICATION PROCESSES IN LAKE LADOGA DURING DIFFERENT STAGES OF ANTHROPOGENIC IMPACT

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The process of self purification has essential impact on the water quality formation in basins. Even without xenobiotic input, the intensive accumulation of organic matter (both allochthonous and autochthonous) with no active mineralization leads to the eutrophication followed by all its negative consequences. The level of water self purification can be estimated by the analyzing of production – destruction processes. Lake Ladoga, the largest fresh-water reservoir in Europe, is the source of industrial and municipal water supply. Hence, the water quality of the lake is of primary importance. Large depths, complicated morphometry, thin euphotic zone (less than 10% of the water mass) all result in peculiarities of the chemical processes. First years of investigations in Lake Ladoga clearly indicated the oligotrophic conditions within the large part of the lake. The oligotrophic state had continued up to 70-th years of the last century, suggesting a balance between production and destruction processes. The most pronounced changes of ecosystem structure were expressed in 1976-1983 when anthropogenic eutrophication was accelerated due to increase of biogenic load. The average phosphorous concentration during this period raised up to 27 $\mu g\ l^{-1}$ (in contrast to 10 $\mu g\ l^{-1}$ at the beginning of 70-th). Values of primary production became rather high and essential annual variations among summer seasons were recorded. The summer averages varied from 150 to 1100 mg C $m^{-2}\ d^{-1}$. The activity of bacterioplankton raised up and the values of CO_2 heterotrophic assimilation attained maximum values for all period of observation on the lake. This period was also characterized by total organic carbon decrease accompanied by high bacterioplankton activities. Hence, the lake had not reached the level of other trophic state, which could be expected under that high anthropogenic impact. The last decade is a period of stabilization and even some improve of the Lake Ladoga ecological situation, which is reflected in the production / destruction ratios.

NON-PREDATORY MORTALITY OF CRUSTACEAN ZOOPLANKTON AND ITS POSSIBLE CAUSES IN A SMALL SIBERIAN RESERVOIR

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Non-predatory specific mortality (NPSM) of two dominant zooplankton species, *Daphnia longispina* (in one year *Daphnia cucullata*) and *Cyclops vicinus*, was estimated in the small reservoir during 1997-2000 sampling seasons on the basis of a new direct method: live/dead sorting and sediment trap measurements. To distinguish between live and dead organisms, samples were vitally stained with aniline blue (Seepersad & Crippen, 1978) and fixed with 10% formalin. Simultaneously measured ecological factors, such as water temperature, pH, dissolved oxygen, biomass of cyanobacteria, diatoms, greens and euglens, levels of polyunsaturated fatty acids of ω3 family, б-linolenic (ALA) and eicosapentaenoic (EPA), were considered as possible causes of mortality using multivariant canonical correlation analysis. Water toxicity and infestation of crustaceans by microalgal epibionts were discarded on the basis of another set of study of the reservoir. As found, the best predictor of *Daphnia* mortality was EPA level, negatively correlated with NPSM value. About 50% of variance of NPSM could be attributed to this factor. ALA level and biomass of green algae also tended to contribute negatively to mortality of *Daphnia*. Nevertheless some part of variance of *Daphnia* mortality and practically all variance of *Cyclops* NPSM stay unexplained and needs future investigations.

FEEDING STRATEGIES OF PELAGIC FISH IN LAKE BAIKAL

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Characteristics of the feeding strategies of Baikal pelagic fish has been provided for the first time when comparing their food spectra with the composition of zooplankton. It has been found that closely related *Comephorus* species existing in terms of a restricted number of essential food organisms use intraspecific prey groups as their feeding resources. It allows each species to broaden the food niche and provide dynamic feeding relations during a year: 1) individual niches of the young and mature specimens can be narrow and alike (group specialization); 2) the fish may be generalists consuming the whole spectrum of intraspecific prey group without any signs of predominance; 3) specimens of the same species may be clearly different by the prey items of certain size.

BIOLOGICAL SUMMER AND TYPES OF THERMAL STRUCTURE IN LAKES OF NORTHWESTERN RUSSIA

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The water temperature is one of the main factors that govern the rate of biological processes in reservoirs (Bogorov, 1954; Vinberg, 1983; Golubkov, 2000). Nevertheless, simple and widely available relationships to evaluate the thermal state of reservoirs are still absent. Generalized from long-term (1945-1989) observational data on water temperature at stations of the Hydrometeorological Service network that describe reservoirs of different types in northwestern Russia (60 lakes), empirical relationships of the thermal regime on various geographical factors are established. It is shown that dates of onset, completion and total length of "biological summer" that is the period during which the upper-layer temperature is higher than 10°C, depend mainly on zonal factors and weather conditions. The length of biological summer is about 80 days in lakes of Kola Peninsula, 100-120 days for the territory of Karelia, and 120-160 days in reservoirs located southward of 60°N. The expressions that allow quantitatively classifying the deep lakes (epi-, meta- and hypolimnion present), lakes with "average" depth (epi- and metalimnion present) and lakes with unstably existing thermal stratification, are received for the region in consideration.

HOW MANY ROTIFER SPECIES LIVE IN A LAKE AND IS THAT OF ANY ECOLOGICAL IMPORTANCE?

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An aim of the study based on short- and long-term investigations carried out in 15 Masurian lakes was to test the hypothesis that number of rotifer species found in a lake is dependent on the status of the water body and indicates good condition of lake waters. An alternative hypothesis is that the number of species is the same in all types of lakes and depends exclusively on research effort paid to the taxonomic studies. Results of the studies showed no significant impact of number of investigations (if there were all possible habitats involved) on number of species met in the lakes. Both in short- and long-term studies only few, and usually littoral species were common for all the studied lakes. Most of rotifer species were limited in their occurrence to one or two lakes. A detailed and seasonal study of rotifer communities in a mesotrophic lake Kuc revealed that from 161 species found in the lake 13% were restricted to pelagial, 17% to bottom sands and sediments (psammon and pelon communities) and 34% to macrophyte beds. Only 9% of rotifer species were observed in all the studied sites. Because studies covering all the habitats are scarce, real number of rotifer species occurring in a lake is unknown. Thus, no one of the two hypotheses could be confirmed with data on species structure of rotifer communities. Until the appropriate investigations are done, any conclusions derived from number of rotifer species in particular lakes will be unjustified.

SEASONAL DEVELOPMENT OF HARPACTICOIDS (HARPACTICOIDA, COPEPODA) IN THE EUROPEAN RUSSIAN NORTH-EAST

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The data on harpacticoids fauna of the European Russian North-East have been received during over thirty years of study of zoobenthos and zooplankton in different-type water-bodies of the White Sea, Barents Sea, and Kara Sea basins.

The study region was identified for 27 Harpacticoida species. Summer collections included all 27 species and egg-bearing females of most of them. Spring (April, May) collections saw 6 species of harpacticoids with only one of them reproducing. Autumn months (September, October) saw 8 species with one of them reproducing too.

The rivers of mountain taiga, geographically remote from each other, have been subjected to long-term investigation of seasonal dynamics of harpacticoids populations. In the rivers benthos crustaceans dominating species were determined for seasonal development stages. The highest abundance of the crustaceans belonged to July or August-September without reference to annual climate conditions. The terms for egg-bearing females of most numerous monocyclic species depended on geographical position of a particular water-body. The ontogenetic development rate varied within one and the same species by temperature regime.

Abundance of harpacticoids in a tundra lake differentiated in years with contrasting temperature regime.

The species inhabiting in temporary water-bodies was experimentally found for a broad diapason of tolerant temperatures.

PREDATORY IMPACT OF A NEW INVADER *MNEMIOPSIS LEIDYI* ON ZOOPLANKTON COMMUNITY IN THE CASPIAN SEA AND THE BIOCONTROL METHOD FOR ITS ABUNDANCE

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The impact of the invasive ctenophore *Mnemiopsis leidyi* on the zooplankton community of the Caspian Sea was quantified from food consumption and other major physiological rates (i.e. respiration and reproduction) coupled with the field data on population structure.

In the Caspian Sea the effect of ctenophores on zooplankton community during the first years of the invasion was the most tremendous as compared to all other studied seas. These ctenophores could consume the available stock of zooplankton during 3-8 days in winter-spring months and practically during one day in summer. The computed critical ctenophore biomass that does not affect (decrease) abundance of mesozooplankton in the Caspian Sea is to be about 4 g m^{-3} or 120 g m^{-2} if the most of ctenophores occur in the upper 30 m layer. As it is clear from the monitoring data, the *M. leidyi* biomass in summer in different regions of the Caspian Sea is far in excess of this value. Such high pressure of ctenophore would continue resulting in dramatic decrease of non-gelatinous zooplankton biomass, loss of some species and as a consequence further drops in pelagic fish stocks.

The possibility of introduction of another ctenophore *Beroe ovata* feeding on *Mnemiopsis* as biocontrol agent will be discussed.

PRIMARY PRODUCTION OF THE OCEAN

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The state of primary production studies in the ocean as well as up-to-date methods of the calculation including the satellite data will be discussed. According to the results of the biooptical modeling photosynthetic fixation of carbon by phytoplankton in the World Ocean amounts $45\text{-}50 \cdot 10^9$ tons of organic carbon per year. About one third of the fixed carbon quantity is exported from the photosynthetic zone to the deepest layers.

Variability in the total and exported phytoplankton production is strongly connected with nutrient flow from the deepest layers to the euphotic zone and with trophic structure of the plankton community that influence atmospheric CO_2 concentration as well as fish production. Global estimation of primary production has been based on the assumption that the photosynthetic parameters of phytoplankton in some water types are the same on average. The results of recent studies in the Atlantic Ocean and the Black Sea have shown that the mesoscale variation of these parameters in the photosynthetic layer is rather high and is to be taken into consideration in the bio-optical models. The spatial and temporal variability of quantum yield of photosynthesis and specific light absorption by phytoplankton is discussed. It is shown that both of these parameters are the functions of chlorophyll concentration and change opposite.

The obtained relationships can be consider as a base for taking into account the photosynthetic parameters variability and physiological ground of the new version algorithms to calculate the primary production from satellite data.

STRUCTURAL INDEX DYNAMICS OF ROTIFER COMMUNITIES IN STRATIFIED LAKES

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The comparative analysis of the Shannon indices, the species richness, the dimentional and trophic structure of the rotifer communities and the population structure of individual species in view of temperature variation in the vertical water column during temperature stratification (June–August) was carried out in four stratified lakes of Belarusan Poozerie. The data of treated sedimented samples of 2000-2004 were used.

The Shannon index increased with a temperature rise in Lake South Volos (mesotrophic with oligotrophic features) and Lake North Volos (mesotrophic) (3.9–25 ^{0}C, n=72, R^2 =0.4601 and 6.8-25 ^{0}C, n=45, R^2 =0.1028, respectively. Two trend lines are noted in Lake Dolgoe (mesotrophic with developing bottomside oxygen deficit): a sharp index increase from 0.5 to 1.9 (n=20, R^2=0.6663) took place in the range of 5-10 ^{o}C and a slight index increase from 1.3 to 2.0 happened in the range of 10-25 ^{0}C. In Lake Kruglik (hypoxia by the bottom), the Shannon index irregularly varied from 0.5 to 2.2 in the range of 4.3-7.8 ^{0}C and with a temperature rise (14-25 ^{0}C) the trend was negative.

The fraction of predatory rotifers (genera *Polyarthra, Synchaeta, Ploesoma, Asplanchna)* in the total density is maximal in Lake South Volos and minimal in Lake Kruglik. The specialist species of genus *Ascomorpha* prefer mesotrophic lakes. Some generalist species (*Keratella cochlearis, Filinia terminalis*) form morphofunctional subpopulations in epi-, meta- and hypolimnion.

The possibility of some index use for water quality assessment is discussed.

BIOSYSTEMS PRODUCTIVITY IN TOXIC ENVIRONMENT

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On the basis of methodology of the productive-energetic approach the questions of biosystems (organisms, populations and communities) productivity under conditions of water pollution by heavy metals are considered for the first time. The following interconnections were revealed: the general laws of environment pollution influence on specific growth rate and accumulation of energy; efficiency of substance and energy transformation; size of the energy, saved in biomass, on unit of its accessible flow; ratio between sizes of the energy, saved in biomass, and level of breath. Is also shown, that even the insignificant increase of heavy metals' level in water causes essential fluctuations of meaning of all bioproductive parameters of biosystems. The general laws of these fluctuations were investigated at a different level of water pollution.

The essential infringements of biosystems energetic balance structure in toxic environment, general laws of change of entrophy in bio- and ecosystems under conditions of a various level of toxic pressure are established, the relative sensitivity of bioproductive parameters to action of heavy metals is established. The essential infringements of matter-energetic processes in conditions of environment pollution are revealed, the changes entrophy in these conditions are considered.

The established laws allow to define a real meanings of bioproductional parameters in conditions of toxic pollution of environment.

CONSIDERABLE ADDITION OF THE NEW SPECIES AND GENERA OF TINTINNOIDES TO THE TAXONOMIC LIST AS THE CONSEQUENCE OF THE CHANGES IN THE ECOLOGICAL STRUCTURE OF THE BLACK SEA PLANKTONIC COMMUNITY

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The conventional list of the Black Sea shell infusorians totals 25 species belonging to four families and nine genera. Since 2002 and up to now there have been recorded 8 (a third of the total number) new for this kind of water reservoir species of tintinnoides, including one that was unknown to the science before. *Eutintinnus lusus-undae* Entz, 1885, is the most numerous and widely spread species. It appears in summer months and dominates in samples showing the highest activity in this season. At the same time, some aboriginal species were not recorded for the research period. It tells about some serious transformations in the taxonomic structure of the Black Sea shell infusorian community, which relate to the change of the ecological capacity of the ecosystem affected by the powerful environmental factors including the evident anthropogenic impact not only on the coastal areas (where our researches have been mainly carried out), but also on the climatic changes, the temperature regime in particular. In 2001, in July the Sevastopol Bay water temperature reached the abnormally high values (28°C).

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ROLE OF DIFFERENT MICROORGANISMS IN THE PRIMARY PRODUCTION OF CYANOBACTERIAL COMMUNITIES OF HYPERSALINE SIVASH-LAGOONS

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Cyanobacterial communities (mats) constitute benthonic microorganisms populations dominated by phototrophic bacteria, among which cyanobacteria are the main organic matter producers and are responsible for mat structure. A vertical structure can be distinguished as a consequence of creation of physico-chemical gradients within a mat and the physiological characteristics of microflora.

The productivity of halophilic cynobacterial communities from the beach lagoons of Sivash Lake was shown to vary over a wide range (from 8 to 380 mg C/h.m^2) and to be governed by photosynthesis in the upper cyanobacterial layers. Anoxygenic photosynthesis accounted for no more than 20% of the total. Chlorophyll *a* content was not an absolute indicator of mat productivity, since its photosynthetic activity differed at different times of year and depended on weather conditions. Maximum mat productivity (380 mg C/h.m^2) accompanied by maximum chlorophyll content (2 g/m^2) was observed in lagoons with a salinity of 16%. Total mat growth averaged 1 mm/year. A halophilic cyanobacterial mat is a high-productivity biological system in which the productive component dominates. Production and destruction processes become equilibrated after sharp changes - increases or decreases in lagoon salinity.

BIOMANIPULATION BYPASS THE TROPHIC CASCADE IN A SMALL RESERVOIR

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In a small recreation reservoir, where an intensive summer "bloom" of cyanobacteria occurred, during five years experiments and field observations were carried out to elaborate technical measures for ceasing of the "bloom" and restoration of water quality. Laboratory experiments and calculations, carried out on the basis of the theory of production hydrobiology revealed, that daphnids in the reservoir cannot control production of cyanobacteria, and thereby a ceasing of the "bloom" by the method of "top-down" biomanipulation according to the hypothesis of trophic cascade would be impossible. Nevertheless, a direct effect of planktivorous fish (*Carassius auratus*) on cyanobacteria was found out: during passage through intestine of the fish some cyanobacteria species (*Microcystis aeruginosa*) increased photosynthesis and growth rate more than twice. Calculations, carried out on the basis of Winberg's equations, demonstrated, that the *Carassius* population filtered the whole volume of the reservoir in about 28 days. Considering these facts, "top-down" biomanipulation, i.e., two-fold decrease of *Carassius* abundance in the reservoir by an introduction of pike and trawling, was prepared and carried out. As a resalt of the biomanipulation, realized bypass the trophic cascade, "blooming" of *M. aeruginosa* in the second half of summer disappeared. Meanwhile *Anabaena flos-aquae*, which growth was inhibited rather than stimulated by *Carassius*, had the same or even higher biomass, usually peaked in the beginning of the summer. Thereby, "blooming" of the water by different species of cyanobacteria can have different mechanisms of initiation and thereby need different measures to be ceased.

SEASONAL ADAPTATIONS OF FRESHWATER FISH TO HIGH TEMPERATURES

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As a result of research of the various levels of thermal loading on an example of some freshwater fish species in different seasons of year a number of regularities is established. Under slow heating (1-2°C/day) animals successfully acclimated to achievement of the generically certain upper level temperatures (ULT). During sharp velocity of water heating (from 4 up to 50°C/h) the initial stages of acclimation are observed or there is an infringement of fish adaptation processes, and the meanings of ULT are much lower. Thermoresistance of fishes in the summer is maximal, in the winter - is minimal, the spring and autumn observes intermediate levels of ULT. The seasonal features of ULT for warmwater, eurythermic and coldwater of fish species are revealed. Thermoresistance of freshwater fish is gradually reduced with age. The increase of temperature of an environment in the summer causes increase of digestive carbohydrases activity. In other seasons the slow heating of water raises enzymes activity, the higher velocity of heating sharply reduces the intensity of carbohydrate hydrolysis, substantially reducing the efficiency of food digestion.

AGGREGATION OF BACTERIAL PLANKTON IN DEPER RESERVOIRS

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Limited data on structural and functional indices of bacterial microcolonies and bacteria attached to various suspension particles, or aggregated bacterial plankton, was the driving force for present study. Using light and electronic microscopy we determined that average length of the bacterial colonies was 9 um while suspension particles were 16 um long during summer. The average number of bacteria per colony or particle increased proportionally to the trophicity of the reservoir. This value was 14 cells in mezotrophic Kanev reservoir, 34 cells in eutrophic Kremenchuk reservoir and 54 cells in hypertrophic parts of Dnepr-Bug estuary. The cells per colony/cells per particle ratio was 1:3, 1:2 and 1:1 respectively and the relative share of the latter decreased down the river stream. Overall, the aggregations of bacterial plankton in the reservoirs under study were 9, 21 and 18% respectively. Functional indices of aggregated bacteria exceeded that of bacterial plankton; the former plays a very important role in high trophic reservoirs. For instance, aggregated bacteria were responsible for one-third of the bacterial plankton's assimilated energy in Kremechuk reservoir and estuary, whereas for Kanev reservoir this value was only 6%. Moreover, aggregated bacteria are more ecologically effective and the speed of energy flow through it is 1.5-fold higher than that of the whole bacterial plankton.

PRIMARY PRODUCTION OF PHYTOPLANKTON IN THE NEVA ESTUARY (EASTERN GULF OF FINLAND)

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Ecosystems of estuaries differ in their properties from marine and fresh waters. They are marginal filters between continental and ocean waters. Because of it, regularities of energy flow of estuaries have some specificity. To investigate the peculiarities of production processes primary production (PP), concentration of chlorophyll "a" ($C_{Chl.}$), and total phosphorus ($P_{tot.}$) were measured in Neva Estuary in 2003–2005. The investigations were conducted in the framework of Russian State Program – "World's Ocean". The highest $C_{Chl.}$, $P_{tot.}$ and rate of PP were revealed in zone of marginal filter. Correlation between $C_{Chl.}$ and $P_{tot.}$ ($r=0.7$) was found. And relationship between these indexes can be describe by the equation $C_{Chl.}=0,15P_{tot.}1,01$. The ratio of $C_{Chl.}$ to $P_{tot.}$ in marginal filter was smaller then in freshwaters. Ratio between primary production and decomposition of organic matter was considerably lower 1.0 due to the large import of organic matters with Neva waters. Comparison of modern rate of PP with the results of earlier investigations showed the development of eutrophication process of the eastern Gulf of Finland during the last two decades. It may be attributed both to anthropogenic and natural (climatic) factors.

INFLUENCE OF ABIOTIC FACTORS AND BIOTIC INTERACTIONS ON THE FUNCTIONING OF HYPERSALINE LAKES OF THE CRIMEA

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Energy flows, biotic interaction and environmental variables were investigated in ecosystems of saline lakes/lagoons of the Crimea with salinity ranged from 24 to 250 ‰. The investigations supported by INTAS program (project no. 03-51-6541) included the estimation of primary production, chlorophyll "a", suspended matter, and total phosphorus concentration, the evaluation of composition, abundance, and biomass of planktonic and benthic organisms. Primary production (PP) of investigated lakes was very high (up to 8.6 mgC l^{-1} day^{-1}). The only exception was the most hypersaline lagoon with dense population of filtrator: *Artemia salina.* Species richness of zooplankton and zoobenthos were negative related to the salinity of the water. Most diverse fauna had the relatively low saline lagoon Bakalskoe Lake, which periodically connected with the Black Sea. Crustacea was the dominant group in this lagoon. Aquatic insects dominated in relatively low saline continental lakes. Abundance and biomass of bottom animals were negatively related to water salinity, but positively to primary production of the lakes. Biomass of planktonic animals did not depend on the salinity and primary production due to the development of dense populations of *Artemia salina* in highly saline lakes. The investigations showed the dense biotic interactions between planktonic and benthic animals at medium salinity.

LONG TERM (1970-2001) ANALYSIS OF THE POPULATION STRUCTURE OF CYCLOPOID COPEPODS IN LAKE KINNERET (ISRAEL)

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Long term (1970-2001) record of distribution data of cyclopoid copepods in Lake Kinneret indicated an averaged ratio of 2.3:2.0:1.0 between nauplii (74/L), copepodites (64.2/L) and adult (31.7/L) stages, respectively, with minor seasonal fluctuations. The population structure is therefore classified as «stable mixed age». The nauplii and 1-4 copepodite stages are herbivores whilst 5th copepodite and adults are predator.

Experimental measurements under optimal conditions indicated development time (days) of 2.8, 17, and 18 for eggs, nauplii and copepodite stages respectively. Egg production was documented as 0.9 /female/day with laying period of 45 days and life-span-84.3 days. Turnover time of the lake population was averagely computed as 37 days and monthly P/B ratios for herbivorous and predator stages-5.9 and 1.6 respectively. Based on stages duration time and field data of densities, recruitments values of eggs to nauplii, nauplii to copepodites and copepodites to adults were calculated: 4.3, 4.4, and 3.6/L/day respectively. Population dynamics parameters combined with metabolic values measured experimentally were combined in analyzing lake assemblages structure during 1970-2001.

PATTERNS OF PHOTOTROPHIC BACTERIOPLANKTON DEVELOPMENT IN SMALL STRATIFYING LAKES

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Temperature stratification is a common phenomenon for significant part of small productive lakes. Fast oxygen consumption in these lakes leads to development of sharp gradients of redox potential, organic carbon and phosphorus, resulting in distinct stratification of plankton community.

In studied lakes chlorophyll «a» maximum was located in the upper part of metalimnion during all stratification period. Initially it was caused by development of phototrophic flagellates and mixotrophic ciliates, later succeeded by cyanobacteria. Below this layer mass development of anoxygenic photosynthetic bacteria was detected. The maximum of purple sulfur bacteria (Chromatiaceae) was formed in lower part of metalimnion only if the chemocline was located in relatively illuminated zone (less than 3 Secci depths). It consisted mainly of colonial species that could form more than 50% of total bacterial biomass. Green sulfur bacteria (Chlorobiaceae) development in hypolimnion was less influenced by light intensity.

Analysis of data shows that the width of areas of mass development of anaerobic phototrophic bacteria is determined by a sharpness of abiotic gradients in the chemocline layer, while their abundance and species composition depends on illumination intensity in the anaerobic zone and concentrations of nutrients.

KAMCHATKA RIVERS ESTUARIES AND THEIR HYDROLOGICAL ZONING

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The many years research data from the Bolshaya river estuary (West Kamchatka) and Bolshoy Viluy lake are the base of the report.

Both objects are the typical tidal estuaries. Their hydrological regime is determined by dynamical interaction and mixing of river and sea water bodies, river and sea sediment deposition. Mouth processes are expressed in drainage, tidal-drainage and unsteady wind streams occurrence. Zones of river, modified and sea water bodies with periodic demineralization were identified through their hydrochemical and hydrophysical characteristics. Also zone of different water bodies exists (depending on the tide phase).

The studied areas are differs by size and prediction of future development. Bolshaya river estuary (length 30 km, area 64 km^2, low water discharge – 700 m^3/s) is separated from the sea by sand shoal head. Fresh water and intense streams prevail. Bolshoy Viluy lake is located in the seaboard hollow. The salt waters and unstable streams prevail.

The exact differences of estuaries are determined by special origin, morphology and rate of modern river factors impact.

A UNIQUE MECHANISM OF WATER EXCHANGE FORMING ECOSYSTEM OF THE WESTERN SHALLOW BAYS OF THE POSSYET BAY (SEA OF JAPAN)

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It is known that, by the level of primary production and seston contents, shallow bays of the Possyet Bay are colossal synthesizers of the organic matter in the Bay. In summer time in Expedicia and Novgorodskaya Bays zooplankton biomass and the level of bacterial production is 2-3 times higher than in the open part of the Possyet Bay (Vyshkvartsev, Kucheravenko, 1977; Vyshkvartsev, 1979).

We have made an attempt to explain high productivity of ecosystems of the western shallow bays of the Possyet Bay based on observations over currents and tidal rise.

It was discovered that during tide water level in Expedicia Bay is higher than in Novgorodskaya Bay due to orographic peculiar properties of the Bay and coastal river run-off. In the result of that a gradient current appears, and a part of waters from Expedicia Bay rushes to Novgorodskaya Bay (narrow and shallow channels limit water exchange with the open part of the Posyet Bay). It was registered that tidal oscillation in Novgorodskaya Bay was uneven, and seiche oscillation, being about 1-1.5 hours, can be clearly seen. Wind or drift currents only intensify the effect. It is shown that main income of biogenic and organic matter to Novgorodskaya Bay takes place due to water transfer from Expedicia Bay, where aqueous vegetation is richer and river run-off is significant. This mechanism of water change maintains the high level of productivity in Novgorodskaya Bay.

THE IMPACT OF *IMPACT FACTOR* IN ECOLOGICAL RESEARCH PUBLICATIONS: AN APPRAISAL

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The International Conference " Aquatic Ecology at the dawn of XXI Century" at St. Petersburg, Russia, to commemorate Prof G.G. Winberg's 100th Anniversary (3-7 October, 2005), is a fitting moment for a scientific appraisal and to have a critical glimpse at direction in which ecology is progressing, especially in Russia, but also in the world at large. I have chosen to dwell briefly upon how to judge the quality of scientific papers published in international, scientific journals. We agree that the ability to identify and evaluate scientific journals that publish high-quality research papers should apprise ecologists of the most relevant developments in ecology and related disciplines. Several parameters are considered as important for judging the journals, the papers published herein and contributing author's aptitude. The Institute of Scientific Information (ISI), a non-scientific organisation, based in Philadelphia, USA, publishes Science Citation Index (SCI) and Current Contents as well as Journal Citation Reports where "*Impact Factors"* are reported. More than 6000 journals in medical, social and ecological disciplines are ranked annually according to number of citations they recorded in the previous years. The Impact Factor for a given year, e.g. for a ecology journal in 2005, will be derived by dividing the number of citations made in 2005 to papers published in previous two years, 2003 and 2004, in this journal. The factor varies for different journals by more than three orders of magnitude, varying between 0.05 and >50. Important quality criteria that determine this factor are: peer-review procedures, citation rate, impact rate and number of agencies indexing a journal. Even though, we as scientists have often reservations for using the Impact Factor to judge or assess the quality of papers we publish in a journal, this factor has gained an ever-increasing importance to not only evaluate a journal's performance in attracting quality papers but also to determine the scientific skills of the researchers. In fact, publishing in a high-impact-factor journal has become an obsession with many, while several others are passionately opposed to it- considering it as contentious, and a 'manoeuvre' to muster scientific funding for research positions. This paper critically looks at Impact Factor as a benchmark to evaluate the quality of individual or collective research at scientific institutes and research centres.

PHYTOPLANKTON PRIMARY PRODUCTION OF THE KARST LAKES IN VLADIMIR OBLAST (RUSSIA)

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During 2003-2004 phytoplankton primary production and chlorophyll *a* concentrations (Chl *a*) were investigated in the seven softwater karst lakes of the Central Russia (Vladimir Oblast). Seasonal dynamics and vertical distribution of Chl *a* and photosynthesis, specific photosynthesis, primary production and respiration ratios were under consideration. Relationships between Chl *a*, maximal photosynthesis (A_{max}) and abiotic factors were analized. A positive significant dependence was obtained between Chl *a* and total nitrogen ($R^2 = 0.55$), Chl *a* and biochemical oxygen demand (BOD_5, $R^2 = 0.40$), A_{max} and total nitrogen ($R^2 = 0.65$), A_{max} and BOD_5 ($R^2 = 0.66$). High bacteriochlorophyll *d* concentrations were revealed in hypolimnetic layers of several lakes. On the basis of Chl *a* content and $A_{max,}$ lakes Kschara, Sankhar, Svetlen'koye, Bolshye and Malye Garavy can be classified as mesotrophic. Lakes Yuokhor and Poridovo are eutrophic.

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PLANKTON DYNAMICS AND DETERMINISTIC CHAOS

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The dynamics of plankton in long-term time series typically displays fluctuations that appear to be erratic. The time series of the zooplankton of a shallow lagoon of the southern Baltic is shown as an example. Especially for the rotifers, the shapes of the curves of seasonal biomass fluctuations differ from year to year. The influence of external climatic factors may be considered the cause. An alternative explanation may be that the inter-annual variation origins by chaotic mechanisms from the non-linear biotic interactions within the plankton. It is well known from modelling literature, that that the simulated dynamics of multi-species models conforms under certain circumstances to the principles of deterministic chaos.

An experimental approach was used to investigate the question whether chaos may occur in real planktonic systems. It consisted of parallels of mesocoms filled with fresh biotope water. These were observed over several months with respect to their similarity in species composition and dominance. The similarity between the mesocosms decreased significantly during the first weeks. A positive Ljapunov exponent was derived from this decline of similarity, which indicates the occurrence of chaotic bifurcations during the developmental process of adaptation of the biotope community to the artificial conditions of the mesocosm. The results show, that chaotic mechanisms may be a cause of variability of planktonic field data additionally to external climatic driving forces.

RESPIRATION RATE OF *BEROE OVATA (*CTENOPHORA) AS A FUNCTION OF BODY WEIGHT, TEMPERATURE AND MOTOR ACTIVITY

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The effect of body weight on respiration rate of the predator ctenophore *Beroe ovata* (introduced into the Black Sea in1999) within the size range from 0.4 mm (newly hatched larvae) to 60 mm, collected in Sevastopol Bay in September - November 2000 and in Sinop Harbour in August - September 2001 was studied. At 20^0C the relationship between weight-specific respiration rate (Q, $\mu g\ O_2\ mg^{-1}\ h^{-1}$) and body dry weight (W, mg) was described as $Q=1.1\ W^{0.64}$ and $Q=0.71\ W^{0.97}$ for the ctenophores of 0.0004 - 2.0 mg and 2.0 to 1200 mg, respectively. In larvae and juvenile *B. ovata* weight-specific respiration rate decreased approximately 25-fold (from 15-18 to 0.6-0.7 $\mu g\ O_2\ mg^{-1}\ h^{-1}$) but did not change in adult animals with increase in dry body weight. Different regression values for juvenile and adult ctenophores may be due to age dynamics of weight-specific carbon content. The mean coefficient Q_{10} was 2.32±0.76 ranging from 1.6 to 2.9 in *B. ovata* of 10-50 mm. Basal metabolism of the ctenophores was 4.6 times lower than total metabolism. The calculated daily ration of adults amounted to 10-23% whilst reached 480% in newly hatched larvae suggesting high ecological valency of young size-classes of *Beroe* population.

LIFE CYCLE OF G*AMMARUS OCEANICUS* (AMPHIPODA: GAMMARIDAE) IN KOLA BAY, BARENTS SEA

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Gammarus oceanicus (Segerstrele 1947) is a wide spread and common species of amphipods inhabiting littoral and sublittoral in boreal and sub-arctic zones of Atlantic Ocean. It was studied as a convenient object for population-dynamic researches. After analyses of size-frequency diagrams we found that in population of *G. oceanicus* in Kola Bay within 3 groups of animals: males, females and young staff could be separated within one year.

Average size was 12,9 мм ± 0,35 in female, and 15,6 мм ± 0,51 in male. During period of breeding (December-August) three generations of young animals in Mart, June, and July had been appeared. Break in breeding was in October-November. Females with eggs were again found in December and stood in the same condition until spring. Females laid up to 170 eggs. A direct relation between female size and egg number in clutch were obtained. Average diameter of egg at A-stage was stable (0,66 мм ± 0,008) when dry egg weight showed a tendency to decreasing within period of breeding. Durations of life were approximately 19 months for females and 26 month for males.

THE EFFECTS OF PETROLEUM CONTAMINATED SEDIMENTS ON BENTHIC ORGANISMS AND BENTIC COMMUNITY

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The toxicities of petroleum contaminated bottom sediments were assessed by their affects upon crustaceans (*Hyalella azteca, Gmelinoides fasciatus*), midge larvae (*Chironomus plumosus, Ch. riparius, Ch. dorsalis*), molluscs (*Planorbarius purpura, Anisus albus*), olygochaetes (*Limnodrilus udekemianus, L. hoffmeisteri, Tubifex tubifex, Aulodrilus limnobius*) and upon structure of bottom community under the conditions of natural modelling.

Among crustaceans most sensitive and less resistant were *H. azteca* (threshold effect level (TEL) – 0.1, LC50 – 0.23 g/kg of dry weight); among chironomids *Ch. riparius* (TEL – 0.08, LC_{50} – 13.5 g/kg dry wt.) was the most sensitive and less resistant; among molluscs more sensitive was *P. purpura* (TEL – 0.05 g/kg); *P. purpura* and *A. albus* were equally resistant (LC_{50} – 7.84 g/kg). All studied olygochaete species were low sensitive and highly resistant (TEL – 0.2-5.0 g/kg, LC_{50} 18-25 g/kg).

As the most sensitive species in community were mayflies (*Ephemera vulgate, Heptagenia fuscogrisea*), leeches (*Erpobdella octoculata, Hemiclepsis marginata*) and bivalve molluscs (*Euglesa sp., Musculium terverianum*), have not been foundeven in minimally polluted microcosms – 0.028 g/kg. The most resistant species, the chironomids and olygochaete occupied microcosms with a concentration of 7.95 g/kg.

ENERGY BALANCE OF THE BOTTOM COMMUNITIES OF THE KAMA RESERVOIR UPPER REGION

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Kama reservoir, created in 1954, is the most nothern one on the Kama river. Its upper region is characterized by the greatest flow, small depths and mainly by sandy ground.

The production of invertebrate population was calculated according to the values of specific production, given by V.E. Zaika.

More than 80% zoobenthos biomass in the littoral and deep-water zones is provided by the development of large mollusks *Viviparus viviparus* and *Dreissena polymorpha*. *Polypedilum nubeculosum* and *Proclacladius ferrugineus* predominate over chironomid larvae, while *Uncinais uncinata* and *Tubifex newaensis* are prevalent over oligochaeta.

In 2002 the amount of transformed energy in the shallow-water zone accounted for 28.91 kcal/m^2, in the deep-water zone 51.14 kcal/m^2. The biggest part of the contribution in this process was made by *V. viviparus* - 49% and 72% of all the assimilated energy. Within a season bottom invertebrate produce 10.65 kcal/m^2 in the littoral zone and 15.76 kcal/m^2 in the deep-water zone. 21.25 и 35.57 kcal/m^2 is left as a part of nonassimilated energy. P/B coefficient is not high comprising 1.29 and 1.67.

In 2003 the amount of assimilated organic matter reduced and made up 7.05 and 39.61 kcal/m^2 in the shallow-water and deep-water zones correspondingly. More than 50% of the energy being transformed is being made by *V. viviparus* and so was in the year 2002. All in all within a season 13.44 and 66.16 kcal/m^2 of the organic matter is withdrawn from ecosystem, about 45% of which is given back to the reservoir as nonassimilated part. P/B coefficient comprised 1.09 and 1.86.

STRUCTURAL AND FUNCTIONAL CHARACTERISTICS OF ZOOPLANKTON IN THE SELENGA RIVER DELTA

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Lake Baikal contains 80 % of fresh waters of Russia. The river Selenga brings about 50 % of a water drain to the lake, and its delta is unique fresh-water delta of the world. Over 2001-2003, the complex hydrobiological, hydrochemical and hydrological researches can been carried out during ice-covered and open water periods in channels of the delta. A hydrological description of the delta was given by V.N.Sinjukovich et al. (2004), and water chemistry by L.M. Sorokovikova et al. (2002). The studies of zooplankton performed over 2001–2003 in different delta channels have shown that a specific composition of the zooplankton was rather diverse by 111 species, namely: Rotatoria – 70, Cladocera – 25, Copepoda – 16. 75% of them have been earlier identified in lake Baikal. Zooplankton communities and their dynamics in delta waters (channels, lakes) differ from those in the river Selenga. If in Selenga species number did not exceed 60 (Sheveleva, 2004), zooplankton abundanse 2 thousand ind./$м^3$, and biomass 0,03 g/m^3, in less flowing sleeves in the central part of the delta (the channels Srednyaya and Kolpinnaya) this number reached up to 950 thousand ind./ $м^3$, and biomass up to 1,8 g/m^3 , at dominance *Rotatoria - Synchaeta grandis* during the ice-covered period, and during open water - up to 50 thousand ind./$м^3$ and 3,0 g/m^3 at dominance of *Cladocera.* In more flowing sleeves located in the left part of the delta (the channels Levoberezhnaya and Kharauz), such a number reached up to 7 thousand ind./ $м^3$, and biomass up to 0,06 g/m^3, but in channels of the right part of delta (the channels Lobanovskaya, Sebernaya) - up to 34 thousand ind./ $м^3$ and 0,6 g/m^3. Zooplankton plays a significant role in auto purification of the delta waters in its central part where filtration organisms contribute about 50-70% to the total biomass. Their food ration over June - August 2002 was equal to 51 g/m^3.

STRUCTURAL CHANGES IN THE MICROPLANKTON OF MEZOTROPHIC RESERVOIR AT ANTHROPOGENOUS LOADING

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Stationary research on accumulation of integrated parameters of auto- and heterotrophic components of microplankton was carried out in upper parts of Kanev's reservoir. Two stations (1- conditionally pure and 2 - polluted by city drains of Kiev) were analyzed for verification of HP index and functional role of dimensional structure of microplankton community. Structural parameters of bacterial plankton (number, biomass) were invariable above at station 2, whereas reproductive activity of bacteria and rate of energy stream through bacterial plankton were observed at station 1. The same tendency was noted also in two investigated groups of microzooplanktone (heterotrophic flagellates and infusorians). The quantity of bacteria and heterotrophic protists at station 2 essentially varied compared to station 1. The ratio of investigated components in a total microplankton biomass always was for benefit of the protozoa, in total number was on the contrary. The share of bacteria on stations 1, as a rule, was higher in comparison with station 2. The area of a biological surface of the bacterial component repeatedly exceeded those of microzooplanktone, and integrated values of the given parameter, being function of their number, repeated its dynamics in a space and in a time.

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CORRELATIONS BETWEEN ABIOTIC FACTORS AND BIOMASS OF ZOOPLANKTON IN LAKES

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The purpose of the study was to determine possible influence of abiotic conditions on the development of zooplankton in lakes of the temperate zone. The study was based on published data on lakes of Belarus and Leningradskaya Oblast, lakes on the coasts of the White and Barents seas, in Bolshezemelskaya tundra, Khakasia, and Transbaikalia. Consideration was given to the relationship between the development of zooplankton and the following factors: lake morphology, water transparency, pH and total mineral content, temperature regime and colour of water. Comparison of the values of separate factors with biomasses of Rotatoria, Cladocera, Copepoda and entire zooplankton shows that there are tendencies of correlation between biomass of rotifers and lake area and colour of water, between biomass of Cladocera and area, maximum depth, transparency, and temperature regime of the water-body. Biomass of Copepoda is influenced also by pH value. Total biomass of zooplankton is affected primarily by water transparency and temperature regime. To define the combined impact of abiotic conditions on the development of zooplankton multiregression analysis was applied. The equations describe rather precisely the value of biomass in the lakes ($P<0.05$). The calculations confirm the combined influence of the environmental factors on the development of zooplankton.

ANNUAL AND SEASONAL CHANGES OF PRIMARY PRODUCTION, CHLOROPHYLL «A» CONCENTRATION AND DAILY ASSIMILATION NUMBER OF BAIKALIAN PELAGIC PLANKTON

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Primary production, chl *a* concentration and daily assimilation number of Baikalian pelagic plankton has been examined during 1979-2001 in the water column 0-50 m. Samples have been taken once in 7-10 days from the depths of 0, 5, 10, 25, 50 m, filtered through nucleopore filter (pore diameter 1 mkm). PP has been determined by radiocarbon method, chl *a* concentration – by standard one. Values of indices were logarithmed because their distribution is abnormal and considerable asymmetrical.

Annual average were the following: PP in the under ice period – 1,87±1,11, median 1,26, trust interval (probability 95%) – 0,0-9,58; in the period of open water – 5,83±1,15; 5,62; 0,0-31,0 mg C m^{-3} day^{-1} respectively. Chl *a* concentration in the under ice period: 0,82±0,10, median 0,70, trust interval – 0,25-2,65; in the period of open water – 0,95±0,10; 0,94; 0,15-4,81 mg m^{-3} respectively. DAN (mg C mg chl a^{-1} day^{-1}): 1,13±0,11; 1,12; 0,21-5,61 and 8,68±1,16; 6,43; 1,2-90,2 respectively.

Average primary production under m^{-2} in the layer 0-50m in the under ice period were 7,67±0,85 gC m^{-2}; in the period of open water – 60,73±0,91 gC m^{-2}.

Maximal values of trusted intervals of these indices may be used as a criterion of autotrophic chain state in Lake Baikal monitoring system.

BENTHOS OF LAKE GLUBOKOE (MOSCOW REGION) IN SOME YEARS

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Lake Glubokoe is one of the unpolluted lakes of the Moscow region. It is deep lake (about 32 m) with a low level trophy. In the 60's some changes took place in the lake situation due to the fact that meliorative ditches were cut through the swamps surrounding the lake and most of the coloured waters were drained into the river (below the lake). A replacement of dominant species and groups of invertebrates took place. In 1948-1950 Lake Glubokoe was typical *Sergentia*-lake. Then the community of *Sergentia* was replaced of *Chironomus* and total biomass of benthos in the open part of the lake almost doubled (our data in May, 1980). Then biomass showed decrease as the results low numbers and biomass oligochaetes and *Chaoborus* (our data in May, 1998). In September, 2004, total biomass of benthos was 1.6 g/mI as a result of decrease abundance and biomass larvae *Chironomus, Chaoborus* and oligochaetes. The bottom of lake on depth from 14.7 up to 31.5 m was practically empty, except for a small abundance larvae *Chaoborus.* The rich fauna was only in the littoral of this lake.

MODERN STATUS AND BIODIVERSITY OF WETLAND ECOSYSTEMS IN ARMENIA

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Total 24 types of wetlands (according Ramsar Convention's Classification System**)** exist in Armenia. Of them most typical are open water wetlands: rivers, lakes, ponds, reservoirs that occupy 5.51% of the territory of the country and widely distributed on all regions and altitudes.

Armenian wetland flora consists of 245 species of *Algae,* around 200 species of *Fungi,* 135 species of Mosses, and 622 species of Vascular plants. Of them 42 species are listed in the Red Data Book of Armenia.

Armenian wetland fauna consists of 36 species of Fishes, 8 species of Amphibians, 4 species of Reptiles, 135 species of Birds, and 7 species of Mammals. Of them 24 species are listed in the Red Data Book of Armenia. In spite of evidence that Invertebrates, especially aquatic, play important role in functioning of wetlands, their total number is far to be known and estimates between 1,000 and 2,000 species.

All major wetland threats in Armenia are human induced. Drainage canals or pipes had crossed all large wetlands. Building dams and reservoirs had regulated the flow of many rivers. Estimated area of wetland loss is approximately 40,000 ha.

THE CLASSIFICATION OF FRESHWATER PLANKTONIC CRUSTACEANS IN THEIR TOLERANCE TO ION COMPOSITION DISTURBANCE

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The data on the zooplancton community condition in the Kenty River system (Karelia) obtained during 20 years are generalized. The potassium concentrations increased in 100 times, the sodium, calcium, magnesium, sulfate and hydrocarbonate concentrations increased in 10 times in the lakes, polluted by high mineralized ore-dressing mill waste. At the first stages of pollution (1982-1987) *Holopedium gibberum* Zaddach*, Leptodora kindtii* Focke*, Polyphemus pediculus* Linne*, Bythotrephes longimanus* Leydig*, Eurytemora lacustris* Poppe disappeared from the upper lakes of system (very low tolerance of the species). Than (1944-1996) *Eudiaptomus gracilis* Sars*, Heterocope appendiculata* Sars disappeared (low tolerance). At the high level of pollution of the lakes *Thermocyclops oithonoides* Sars*, Mesocyclops leuckarti* Claus*, Daphnia cristata* Sars*, Bosmina obtusiristris* Sars*, Kellicottia longispina* Kellicott were observed, but their abundance decreased in comparison with the beginning of the period observation (middle tolerance). During the increase of pollution sharp abundance growth was observed for *Daphnia longispina* O.F. Müller*, Bosmina longirostris* O.F. Müller*, Keratella quadrata* Müller*, Asplanchna girodi* Guerne*, Bipalpus hudsoni* Imhof (high tolerance). The hypothesis which explained the differences in the zooplancton tolerance from the historical point of view (the history of fresh water inhabitants) is proposed.

SIZE SPECTRA AND STABILITY OF AQUATIC ECOSYSTEMS

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The stability analysis of the biotic part of aquatic ecosystems is among the most important and complicated fields of modern ecology. Application of statistical relations (allometric equations and size distributions) has opened an operational way to the comparative analysis of the ecosystem structure. Powerful methods of data acquisition, using modern automated tools, can support operational approaches to the biota description, based on the Living Matter concept of Vernadsky, *Tourbillon Vital* of Cuvier and Operational Taxonomic Unit (Sneath & Sokal). Then vast data sets evidence existence of "typical" structural patterns, rather common and firm to be used for modeling and predictive ecology, but generally masked by the spatial heterogeneity, local fluctuations and pronounced annual dynamics. While much work is done on "typical patterns" of the biomass size distribution or *size spectrum* (BSS), much less attention is given till now to typical patterns of the taxonomic size spectrum (TSS). Here we compare the variability of the two types of size spectra (i.e., BSS and TSS). A new type, or *combined size spectrum*, is considered to integrate them.

ZOOPLANKTON AND COPEPODA AS ITS MAIN COMPONENT IN POLLUTED AND UNPOLLUTED WATERS OF AMURSKY BAY OF SEA OF JAPAN.

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Quantitative and qualitative characteristics of zooplankton and its main component –Copepoda – were studied in May - November, 1991 in various biotopes of Amursky Bay.

Density of zooplankton, holoplankton and meroplankton was much higher in coastal water than in offshore water, except north–northeastern Amursky Bay. Analysis of the quantitative data suggests that Copepoda can be an indicator of pollution of waters. Similar to the above groups, density of copepods was lower in the north–northeastern part of the Bay. Parameters of population structures of Copepoda varied also. Thus, in *Pseudocalanus newmani*, *Acartia hudsonica* and *Paracalanus parvus* at peak density period the share of copepodid stages I-III was low or they were not all found in the north–northeastern part of the Bay. Qualitative data have shown that the number of groups of zooplankton and the number of Copepoda species decrease in this area. Biomasses of zooplankton and of Copepoda species were also decreased.

Results suggest that coastal waters of the north–northeastern part of Amursky Bay are an area of intensive pollution of the sea environment.

A COMPARATIVE ANALYSIS OF ENERGY FLOWS IN AN ECOSYSTEM OF A SMALL EUTROPHIC LAKE DURING THREE VEGETATION SEASONS (BALANCE MODEL)

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A simulation balance model of energy flows in the ecosystem of the Lake Bolshoi Okunenok (Leningradskaya Oblast) during vegetation seasons of 1986 through 1988 is developed. The model is representing a system of equations describing energy balance for each *i*-th component per time interval Δt:

$$P_i - Food_i - Mort_i - Out_i = \Delta B_i, \quad (1)$$

where P_i is the energy increase per Δt; $Food_i$ is the energy given to all consumers of this component; $Mort_i$ is the energy of individuals that died by a natural reason; Out_i is the energy outflow from the system; ΔB_i is the energy contained in biomass accumulated per time Δt.

Thirty-three living and three non-living components were distinguished in the ecosystem, and a system of the energy relationships between them was determined. General characteristics of the water-body, biomass and abundance of each living component of the ecosystem for each date of observations were known.

The calculation of elements of the balance equations (1) for separate time interval was based on the elements of daily balance equations, which described utilization of energy consumed per day for growth, metabolic processes and excretion for every date by methods of production hydrobiology.

The sum of interval values of balance constituents for each component gave corresponding seasonal values. Joining ecosystem components by trophic group and using of the consumption matrix calculated in the model permitted estimating the amount of energy of each group that was consumed by the other groups, the portion of a given group in the ration of the other groups, and a seasonal as well as an interannual variation of this portion.

VIRAL CONTROL OF MATERIAL FLOWS, THE ENERGY BUDGET AND THE EFFICIENCY OF THE PLANKTONIC MICROBIAL LOOP IN THE COASTAL WATERS OF CARDIGAN BAY (WALES, UK)

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It has become recognized in recent years that viruses are the most abundant and dynamic members of aquatic microbial communities with viral lysis playing a vital role in the cycling of nutrients and organic matter. In particular, for the marine planktonic food web it is thought to control the energy/material budget and the efficiency of the microbial loop (ML). From the current investigation it is suggested that control is invested in a "viral loop" integrated with the ML. Thus it acts as feedback in which viruses multiply in their hosts and cause their lysis with the formation of POM and DOM for uptake by the picoplankton. We have examined this idea for the coastal Cardigan Bay by the unique use of microcalorimetry directly to measure energy flows and fluxes coupled to material flows.

Plankton pico- and femtofractions were separated and concentrated by filtration. The energy flow of picoplankton on filter strips was measured in the dark by a novel, batch calorimetric method. Energy fluxes were obtained after assessing the abundance and viability of the microorganisms by epifluorescence microscopy. The abundance of viruses and bacteria was estimated on Anodisc membranes with SYBR Gold. The energy flow of picoplankonic photoautotrophs was measured photocalorimetrically to assess the role of these primary producers. Bacterial production was estimated radioisotopically with ^{3}H-leucine and by Landry's dilution method, the latter also for the grazing rate by bacterivorous protists. Viral infection rate was estimated by TEM.

The results showed that the interaction of the bacterioplankton with the virioplankton caused a greater metabolic rate that was due to increased respiration in the bacterial production of viruses. Because of subsequent lysis, energy was lost in the viral loop while the lysed bacterial cells supplied the OM pool in the water column to produce more bacteria in the ML.

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A PHOTOCALORESPIROMETRIC STUDY OF METABOLIC STRESS IN THE MICROALGA *DUNALIELLA MARITIMA* WITH ITS ECOPHYSIOLOGICAL INTERPRETATION

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Photosynthesis is an equal and opposite reaction to respiration in biological systems. Whilst the latter is exothermic, thermodynamically the former must be endothermic to the same extent, allowing for side reactions. For cells to accumulate carbon, obviously net photosynthesis in primary producers must be greater than respiration. The situation is complicated, however, because mitorespiration and, under certain physiological conditions, chlororespiration and the oxidative photosynthetic carbon cycle (C_2 cycle) by the peroxisome, are concurrent with photosynthesis.

Dunaliella maritima has evolved a strategy for life in hypersaline conditions but this has energetic consequences. The overall aim of this study is to measure the metabolic burden caused by osmotic stress in this microalga, contrasting it with the freshwater *Chlorella vulgaris* as a control. Direct calorimetry allows measurement of heat flux changes while indirect calorimetry using a respirometer gives the changes in oxygen flux. We measured heat fluxes and oxygen fluxes of the two microalgal species in the dark and light; and used metabolic poisons to indicate the relative contributions of the various electron transport chains (ETC) to the overall process.

The results showed that the cost of combating osmotic stress is considerable in terms of both metabolic rate and growth rate of the hypersaline *D. maritima* compared with the freshwater *C. vulgaris*, presumably because of the production of glycerol.

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THE ROLE OF SYMBIOTIC INFUSORIA IN TOTAL AUTOTROPHIC BIOMASS

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Protozooplankton of the lake was studied immediately after ice melting. Mean biomass of infusoria in the layer 0-5 m (700 mg m^{-3}) was 90% of total zooplankton biomass. The basis of biomass of ciliates were species containing zoochlorella. In the largest infusoria, *Amphileptus* (body length 600 μm) symbionts comprised approximately 75% of body mass, in other myxotrophic infusoria, approximately 10%.

H.J. Spero and S.L. Parker (1985) have shown that intensity of photosynthesis of symbionts is considerably higher than in free-living algae. In the period of mass development of infusoria symbiotic algae can contribute greatly to primary production in a water-body. Biomass of phytoplankton was assessed by chlorophyll a concentration, assuming that 1 μg l^{-1} chl corresponds to 500 μg l^{-1} of raw biomass of phytoplankton.

During the spring period the portion of symbiotic algae in the total phytoplankton content varied from 10 to 39%, comprising on the average 25%; in September it declined to 3%.

There is little evidence on seasonal distribution and total value of symbiotic infusoria in fresh waters, but algosymbionts, with their mass development in plankton, can form a large portion of the total autotrophic biomass of a water-body.

EFFECTS OF SMALL INDUSTRIAL HEATING ON SEASONAL ADAPTATIONS IN CLADOCERA

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In the Kama River Reservoir we studied effects of water industrial heating (WIH) caused by electric power station on seasonal adaptations in *Daphnia longispina, Bosmina longirostris* and *Diapahnosoma brachyurum.* Several statistic tests were applied in parallel to estimate effects of WIH on life cycle in the Cladocera. We found that even small (1.4 –1.8 °C) differences in average summer-fall temperature between the station with WIH and the control station were resulted in timing of sexual breeding, sex ratio, percentage of ephippia production, population dynamics. Dispersal analyses did not show any relation between WIH and population density in Cladocera. As result population density, biomass and productivity can not be used as indicators of small WIH. In contrast we found significant correlations between WIH and sexual structure in Cladocera and recommend several new indexes based on gamogenesis effectiveness to estimate negative effects of WIH. We conclude that even minute but constantly affecting factor WIH leads to negative changes in seasonal adaptations in the aquatic crustacean.

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SPACE-TEMPORAL ORGANIZATION OF THE OB RIVER BASIN AQUATIC ECOSYSTEMS

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All types of ecosystems of lotic and lentic water bodies are found in the basin of Ob River - one of the largest rivers in the world. They differ in origin, time of existence, size, mineralization and intensity of water exchange. For their classification it is usев hierarchical distribution of composition, structure and functional characteristics of biological and biocentric systems on spatial and temporal scales including organization of substance, energy and information streams.

The typological characteristics of ecosystems in various types of rivers (Ob River with inflows Alei, Barnaulka, Ynya, Tom, Chulym), large lakes (Teletskoye, Chany, Kulundinskoye), lakes in Ob-Irtysh interfluvial area is given.

Primary production in Teletskoye Lake ecosystem is mainly due to the littoral algal cenoses. It is possible because of the unique combination of abiotic factors (long- and short-term level fluctuations, high transparency of water, lack of solid ice cover) and enhanced adaptation potential of attached algae as the elements of the ecotones to the variable environmental changes.

Annual dynamics of phytoplankton succession rate indices reflects the key events in phytoplankton life in the cooling-reservoir of Belovo thermal power plant as a result of dominant complexes change and main phases of hydrological cycle that is typical for limnetic systems of moderate latitudes.

PHYTOPLANKTON AND MACROPHYTE PRODUCTION RATIO ООТНОШЕНИЕ IN LAKES AND WATER RESERVOIRS, DEPENDING ON RELATIVE TRANSPARENCY (TRANSPARENCY: AVERAGE DEPTH)

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Examples from 107 lakes and water reservoirs are used to discuss the production of phytoplankton, macrophytes and their ratio in autochthonous primary production, depending on natural zone, average depth, transparency measured with Secchi disc and relative transparency. As relative transparency rises, the share of phytoplankton in total autochthonous primary production decreases and that of macrophytes increases. Knowing the primary phytoplankton production value, probable primary macrophyte production can be calculated with regard for relative transparency, and, vice versa, knowing the primary macrophyte production, one can estimate primary phytoplankton production, using the relative transparency index.

TROPHIC STUDIES OF AQUATIC ECOSYSTEMS USING STABLE ISOTOPE RATIO ANALYSIS

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Recently, isotope ratios of carbon, nitrogen, and sulfur (determined in organisms by mass-spectrometry as $\delta^{13}C$, $\delta^{15}N$, and $\delta^{34}S$, respectively) have been well established as promising naturally occurring isotopic "labels" in trophic studies. Consumers reflect the $\delta^{13}C$ and $\delta^{34}S$ signatures of food sources with minor fractionation, therefore, the relative importance of distinct sources to consumer species can be determined. For nitrogen, predictable biomagnification of ^{15}N occurs with trophic level, and the relative trophic positions thus can be modeled using $\delta^{15}N$ values of consumer species.

We present several examples of the efficiency of the isotopic approach in aquatic food web studies. (1) The stable carbon and sulfur isotope analyses were used to assess the contribution of seagrass, epiphytes and phytoplankton to the diet of invertebrates in the *Zostera marina* community (the Sea of Japan). (2) Relative importance of benthic macroalgae versus phytoplankton to the near-shore food web of the Lake Baikal was shown using the $\delta^{13}C$ values of food web components. (3) Contribution of biogenic methane to the macrofauna species through microbial food chain was shown in the lacustrine environment. (4) The combined stable C and N isotope analysis was used to establish a quantitative assessment of the trophic status of dominant species of the Okhotsk Sea pelagic food web.

COMPOSITION AND DENSITY OF PLANKTONIC ALGAE OF LAKE BAIKAL

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Phytoplankton from all basins of the lake in August – September 1981-2004 have been analyzed. The research and photos has been made with use of light microscope DAS by Leica.

It has been registered 161 taxa from 7 divisions. Bacillariophyta (57 taxa) is characterized by the maximal diversity due to the presence of benthic species in water column. Their number is not considerable. They are more numerous near shores, especially gentle eastern one. High diversity is a characteristics of Chlorophyta (42). Cyanophyta (27) and Chrysophyta (21) are similar in the amount of species. Cryptophyta (8) and Dinophyta (5) are characterized by low diversity, and only one species of Euglenophyta has been found.

Late-summer phytoplankton is rich in quantity. Small-celled algae constitute the bases of number everywhere. *Rhodomonas pusilla*, *Chrysidalis* sp. (Cryptophyta and Chrysophyta) and especially variable group Flagellata are constant dominants of the community. *Dinobryon sociale* and *Monoraphidium pseudomirabile* are typical representatives of this period.

From the Bacillariophyta one-celled species of genus *Stephanodiscus* and species *Aulacoseira granulata* and *A distans* var. *alpigena*(?) are the most numerous. In the hot summer years Cyanophyta (*Anabaena lemmermannii*, *Anabaena flos-aquae*) dominates. Pico-planktonic blue-green algae reach mass development constantly everywhere.

Three genera and 18 species are published for the first time for Baikal, four species of them are probably new in science.

BIOLOGY AND ECOLOGY OF CADDISFLY *ARCTOPSYCHE PALPATA* MART. (TRICHOPTERA: ARCTOPSYCHIDAE) IN THE KEDROVAYA RIVER (SOUTHERN PRIMORYE, THE RUSSIAN FAR EAST)

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Our investigations were devoted to some biological and ecological aspects of the net-spinning caddisfly *Arctopsyche palpata* Mart., an important zoobenthos component of many mountain and foothill streams. Quantitative samples of zoobenthos were made in the Kedrovaya River during July 1979 – July 1980 from the middle section of the river stream (metarhithral), along 6 km and during April 1993 – April 1994 within a "pool-riffle" structural unit (60 m). Biomass and density data, life history, larval retreat construction and their food composition are given. Correlation equations between body weight and length, and between body weight and the larvae head capsule width were obtained. Larval growth in natural population and under experimental conditions was studied. Parameters in the equation relating absolute growth rate with body weight were calculated. Changes of calorific values, dry and wet body weight ratio and relative ash content were observed in the course of development. The production and energy expenditure of larval population during two vegetation seasons were estimated. The annual P/B-coefficients and mean values of coefficients of food assimilation on growth (K_2) during life history were calculated. Correlations between flow of energy and biomass in larval population of *A. palpata* and between energy expenditure and production were obtained.

PERIPHYTON STRUCTURAL DYNAMICS AND PRIMARY PRODUCTION IN A SMALL RIVER

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The dynamics of attached algal communities was monitored in River Lizhma (southern Karelia). Periphyton biomass was determined from chlorophyll content, and its production – by the oxygen method. Samples were collected from the natural and experimental substrates, from river stretches differing in the hydrological regime.

The seasonal succession of attached algal communities has displayed two models: a relatively stable low biomass period and a seasonal cycle. Biomass is the maximum in spring, prior to the development of foliage, and late in summer. In autumn, relative chlorophyll content in the stored organic material decreases, although the total amount of the algal component generally grows. Deviations from the classic seasonal dynamics are observed in sites shaded by waterside vegetation, and when ice stays far into spring. Biomass is the lowest over gravelly substrates during low-water periods, and the highest – over bouldery substrates. A rise in the flow rate to 0.4-0.5 m/sec has a positive effect, because relatively high flow rates are optimal for the development of most filamentous algae. The highest colonization rate and density of periphyton groupings over experimental substrates were most often recorded at a flow rate of 0.2 to 0.4 m/sec. It is at the first stages of the succession that a clear correlation exists between the growth rate and ecological factors, which weakens once a relatively dense algal mat is formed.

MICROBIAL LOOP AS A COMPONENT OF PLANKTONIC COMMUNITIES IN LAKES, RIVERS AND RESERVOIR

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Abundance and activity of the main components of the planktonic microbial community: phototrophic picoplankton, bacteria, heterotrophic flagellates and ciliates were studied in 12 lakes, 11 rivers and Rybinsk reservoir. In lakes the microbial biomass (B_m) varied from 36 to 1262 mg C m^{-3} that amounted to 12-51% of the total plankton biomass (B_s). The maximal values were recorded in eutrophic freshwater lakes and in mesotrophic brackish lake. In Mongolian rivers B_m was 182-590 mg C m^{-3} or 52-84% of B_s. In these rivers the protozoan biomass exceeded significantly the zooplankton biomass. In small temperate rivers of Russia B_m was 63-476 mg C m^{-3} and 23-39% of B_s. B_m increased greatly in river sections subjected to a significant anthropogenic impact. In beaver ponds of the rivers fraction of B_m in B_s decreased greatly. In large mesotrophic Rybinsk reservoir the absolute values of B_m were 1.5-2.0 times higher in littoral zone than in pelagic zone but the relative contribution of B_m into B_s was 33-38% in both zones. In temperate aquatic ecosystems of Russia during the ice-free period the portion of protozoans in B_m and the fraction of B_m in B_s varied greatly.

SUCCESSSION AND DIVERSITY OF PHYTOPLANKTON IN THE RESERVOIRS

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Basing upon the analysis of long-term trends of phytoplankton dynamics in the variety of reservoirs in the European part of Russia, Siberia, Ukraine, Poland etc. it is revealed that there are similar changes in the taxonomic composition of reservoirs phytoplankton. These relate to: increase of domination of limnophilic diatoms, mixotrophic flagellates, nonheterocystic blue-greens adapted to the high contents of organic substances, and also increase in diversity and abundance of greens. In the Volga and Dnieper reservoirs connected with sea basins by common discharge, in the phytoplankton communities it is observed the occurrence and increase in abundances of euryhaline invading diatoms. The long-term phytoplankton biomass variability correlates to cycles of hydro-climatic processes. Against the background of such long-term dynamics the community changes considerably outstrip the biomass growth due to change of the "large – small" cell forms balance. The increase in specific diversity and decrease in the cenotic phytoplankton diversity is noted. All these changes may result in quite serious consequences: the change of nitrogen and carbon currents in the reservoir ecosystems.

DIET OF SEA OTTER AND ITS INFLUENCE ON BENTHOS OF SHALLOW WATERS OF THE COMMANDER ISLANDS, THE KURIL ISLANDS AND THE KAMCHATKA PENINSULA

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The sea otter is a polyphage, its diet includes more than 80 mainly benthos animals inhabitating different types of grounds. Diet structure of sea otter differs depending on region, coast, a site of littoral and sublitoral zones. The increase and stabilization of the number of sea otter in the Russia makes an essential impact upon benthos communities of shallow zone, that, in turn, is reflected in the diet structure of sea otter. According to the data of scat analysis, the part of crustaceans (the leading position belongs to *Dermaturus mandtii*), gastropods, chitons and fish in the diet of sea otter in the Commander islands has increased for the long-term period (1931-2004), but the occurrence of bivalves including *Mytilidae* family has reduced, *Mytilus trossulus* and crab *Paralithodes brevipes* have practically disappeared from the diet. The abyss between the diets of sea otter in the Bering and Medny islands occur. On the eastern coast of North Kuriles (Shumshu, Paramushir) and South Kamchatka the basis of diet of sea otter is comprised of epifauna mollusks, round urchins and crabs of *Atelecyclidae* family. However, the latest investigation has revealed reduction of mollusks of *Mytilidae* family and increase of *Mactromeris polynyma* and *Megangulus luteus* in the diet of sea otter. On the Okhotsk coast of North and South Kuriles sea otters obtain mainly round urchins, crabs and chitons of g. *Tonicella*. Sea urchins g. *Strongylocentrotus* are dominating objects in the diet of sea otter, in the territories with high number of sea otter they distinguish by small sizes (about 30 mm) during the long period.

S.G. Korostelev

PRIMARY PRODUCTION OF PHYTOPLANKTON IN ARAKHLEY LAKE (TRANSBAIKAL REGION)

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Arakhley Lake is the largest among Ivano-Arachley lakes of Transbaikalia. Its area is 58,2 square km; maximal depth is 17 meters (The Atlas of Transbaikalia, 1970). The reservoir has commercial fishery and recreational importance.

The observation for primary production and breath plankton by means of "light and dark bottles" method were carried out during a vegetative season 2004 and in the winter 2005. Active vegetation phytoplankton has begun in June and has made 0.21mg O^2/л per day and 1.42g O^2/м^2 per day in the central part of lake. Primary production has achieved upper bound in August - 0.47 mg O^2/л per day and 3.43 g O^2/м^2 per day. From September till January the rate of organic substance production has decreased and has made about 2.1 g O^2/м^2 per day. At the end of January and in the beginning of February thickness of an ice has made 1.6 m and the snow cover has extended on all mirror of the lake. In this period the rate of photosynthesis was not caught by the "light and dark bottles" method. During the autumn-winter period the rate of organic substance destruction in plankton exceeded phytoplankton production in 2-3 times.

Analyzing a seasonal trend of organic substance production it is possible to tell that Arakhley Lake as before is included into group of a mezotrophic type reservoirs.

REPRODUCTIVE SUCCESS AND EGG PRODUCTION OF DEEP-WATER COPEPODS IN THE ARCTIC OCEAN

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The study was aimed to better understand the reproductive strategies and life cycles of the deep-water calanoid copepods in the Arctic Ocean. We carried out egg production experiments with females of 14 species from the *Aetideidae, Spinocalanidae, Scolecithricidae, Heterorhabdidae, Euchaetidae, Bathipontiidae* and *Augaptilidae* families collected in the Nansen Basin and Fram Strait from the depth layers 0-900 and 0-1500 m. In addition, we analyzed developmental stage composition of the most abundant deep-water copepods in all-year round collections of the Russian drifting stations "North Pole" (1950-1978) and the summer collections of six expeditions with the ice-breaker «*Polarstern*» (1993-1998). We observed reproduction of 10 meso- and bathypelagic copepods under experimental conditions. Females of seven species (broadcast spawners) released eggs freely into the water. The three species, *Aetideopsis minor, A. rostrata* and *Augaptilus glacialis* produced egg sacs (egg-brooding spawners). Females of the other four egg-brooders (*Pareuchaeta glacialis, P. polaris, P. barbata, Chiridius obtusifrons*) were often found in the samples with egg sacs. Both the results of the egg production experiments and data on the development stage composition indicate that majority of the deep-water calanoids reproduce successfully in the Arctic Ocean.

STRUCTURALLY FUNCTIONAL ANALYSIS OF BACTERIOPLANKTON OF VARIOUS LAKES

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Bacteria play a central role in aquatic food webs. Spatial and temporal distribution, morphological and size structure, fraction of active cells, production and grazing rates of bacterioplankton were studied in 18 lakes, located in various geographical zones and differed in genesis, morphometric and hydrochemical characteristics, trophic status and level of antropogenic impact. Bacterial biomass varied from 29 to 977 mg C m^{-3} that amounted to 10-38% of the total plankton biomass. Considerable fraction of bacterioplankton in eutrophic lakes is aggregated (up to 37% of the total bacterial biomass (B_b)) and is represented by filamentous forms (up to 43% of B_b). The presence of a large number of aggregated bacterioplankton broadens the spectrum of consumers and accelerates the self-purification of natural waters. The patterns of vertical distribution of bacterioplankton depend on type of the lake. In stratified lakes the vertical stratification of bacteria is expressed pronouncedly and maximal bacterial biomass is usually recorded in anoxic waters. In summer all daily bacterial production can be consumed by protozoans. Both spatial distribution and seasonal dynamics of bacterial production were influenced by primary production.

PLANKTONIC FAUNA IN THE RIVERS OYAT AND PASHA (LADOGA LAKE BASIN)

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Zooplankton was studied in the Rivers Oyat and Pasha and their tributaries in 1986-1988. The planktonic fauna of watercourses consisted of 38 species (Rotifera 34%; Cladocera 50%; and Copepoda 16%).

The zooplankton of the River Oyat and its tributaries (V. Kurba and Tyanuksa) does not exhibit a high species diversity; rotifers (Brachionidae, Euchlanidae, Synchaetidae) and cladocerans (Chydoridae) were equally dominant (44% each). The quantitative indices of zooplankton in from the River Oyat are extremely low (maximum abundance did not exceed 2.0 thous. ind./m^3 , its biomass being 0.005 g/m^3). The effect of the tributaries V. Kurba and Tyanuksa on the planktonic fauna of the River Oyat is insignificant.

The planktonic fauna of the River Pasha and its tributaries Kapsha and Yavosma because these water bodies are inhabited by a larger number of the lake crustacean species. Cladocera (47%) and Rotifera (34%) species are most abundant. The quantitative characteristics of zooplankton in the River Pasha are much higher than those in the River Oyat (maximum abundance is 48.1 thous.ind./m^3 and biomass is 1.8 g/m^3). An additional source of planktonic organisms for the River Pasha is provided by the River Kapsha.

The bulk (up to 97%) of river zooplankton biomass is formed by Cladocera, an important type of food for juvenile fish.

The composition and quantitative development level of the dominant zooplankton complex are generally typical of minor rivers in North European Russia that have a runoff slightly regulated by lakes.

STRUCTURAL AND FUNCTIONAL CHANGES IN MACROZOOBENTHOS COMMUNITIES IN WATERCOURSES OF KARELIA UNDER VARIOUS HUMAN IMPACTS

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Structural and functional parameters of the benthic invertebrate communities exposed to three types of anthropogenic pressure (easily oxidizable organic substances, runoff from drained areas, mineral pollution) have been compared. In all cases, the communities recovered upon the disturbance by amplifying the structural complexity – raising the biodiversity, increasing the proportion of stenotopic organisms.

Organic pollution and drainage impacts resulted in increased ratios of production to total metabolic losses (P_c/R_c), shifting the river zoobenthos community to early stages of the succession. Further on, as the impact lessened, they developed towards later stages, as it happens when aquatic organisms colonize new habitats or when the pressure of vertebrate predators diminishes (Golubkov, 2000). In the case of mineral pollution however (a rise in water mineralization from 20-30 to 300 mg/l, no highly toxic heavy metals present), recovery of the communities upon attenuation of the pressure proceeded with a rise in the P_c/R_c ratio, indicating a change toward earlier succession stages. Thus, in contrast to other contaminating impacts, growing mineralization of the ultra-fresh river water typical of the region may trigger "ageing" of macrozoobenthos communities.

MEIOBENTHOS OF FRESHWATER ECOSYSTEMS AND AQUATIC ECOLOGY

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From the evolutionary considerations the meiobenthos was the first community of metazoans in the forming ecosystems in the Middle Precambrian. The essential mechanisms of functioning of water communities, apparently, have been formed already at a level of meiobenthos. Meiobenthos as the object of studying in aquatic ecology possesses a lot of advantages to investigate the mechanisms of formation and functioning of communities of water organisms. The importance of meiobenthos in freshwater ecosystems is connected not only with its large share in the overall flow of matter and energy through benthic communities, but also with the specific role of meiofauna. Meiobenthos transfer a part of the energy of bacterial populations as well as of detritus to the macrobenthos and fish. As opposed to marine and estuary ecosystems, where serious researches on meiobenthic ecology have been done, in the field of freshwater hydrobiology, similar works are not being conducted. Benthic research in freshwater environments has, until recently, been dominated by investigations of the macrobenthos. To some extent, this has lead to the misconception that meiobenthos is not important community in freshwater ecosystems. The report contains the information that removes this misunderstanding and focuses attention on the role of meiobenthos in freshwaters as well as importance of its investigations for progress of aquatic ecology.

CHANGES IN PLANKTONIC COMMUNITIES CAUSED BY INTRODUCTION OF FISH AND ZEBRA MUSSELS INTO MESOCOSMS

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The abundance, biomass and activity of bacteria and phytoplankton were reliably low in mesocosms with zebra mussels living on the sediments. The number of Cladocera decreased, simultaneously the portion of juvenile Copepoda and Rotatoria and the index of species diversity increased. When molluscs were located above the bottom sediments the phytoplankton developed weakly, low values of chlorophyl *a* and of primary production were recorded. The bacteria biomass increased, their activity decreased. High density of Cladocera were marked.

In mesocosms with perch abundance of Rotifera increased. The content of Cladocera decreased sufficiently that resulted in increase of chlorophyll concentration and of the rate of photosynthesis. Quantitative characteristics of bacteria varied depending on the development of phytoplankton and some zooplankton species.

In mesocosms with perch larvae and zebra mussels together the biomass and species diversity of zooplankton declined. The phytoplankton indices decreased 5-10 folds as compared to such indices in ecosystems with only perch. The biomass and activity of bacteria were less variable.

The analysis of B_z/B_{ph} allowed to reveal a number of different situations in the communities. Perch and molluscs influenced directly on the zoo- and phytoplankton. The abundance and activity of bacteria were dependent on zooplankton grazing and via phytoplankton.

DIVERSITY AND VARIABILITY OF ROTIFERS

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The morphological, morpho - functional and ecological diversity of rotifers is determinated by consecutive development of key structure – corona and mastax - against the background of high combinative variation of all characters. The morphological trends is realized in different ways in different taxa.

Reproduction in rotifer is diverse and includes obligatory sexuality in Seisonida, obligatory parthenogenesis in Bdelloida and heterogony in rest of the taxon (Monogononta). In the latter group males posses strongly atrophied organs, except for the sexual and nervous systems. In those species exhibiting heterogony, females of three types are found (mictic, amictic and amphoteric) along with their eggs (male and female eggs, fertilized eggs [latent or resting] and pseudosexual [doubtful]). The obligatory parthenogenesis of Bdelloida is an interesting phenomenon as it seems to be an extreme case of the loss of the male within the phylum.

Individual development of rotifers includes three types of ontogenesis: (1) ovipositional type is most widely spread in rotifers, (2) viviparity is observed in only small groups of species, (3) larval ontogenesis involves a group of sessile rotifers.

The modification phenotype is the result of interaction of the genotype and external factors without altering the genotype (i.e., a non-genetic change). This phenomenon, which is termed phenotypic plasticity, is particularly acute in some loricate species. Cyclic seasonal changes of phenotype within populations long known as cyclomorphosis. Phenotypic cycles also can be brought about by seasonal replacement of genetically different clones. Dietary polymorphism is capable of protecting against certain tactile predators.

Genotypical variability is determinated by arising of new genotypes, which normally leads to changes of phenotype. It has been found that *Brachionus plicatilis* is complex of more than three sibling species, and also existence of polyploidy, triploidy and teratomorphes of several species.

The greatest species diversity is achieved in groups where adaptogenesis occurs with functional continuity and with consecutive morphological transformations.

EFFICIENCY OF THE ENERGY TRANSFORMATION IN FISH GROWOUT PONDS AT THE DIRECTED INFLUENS ON AN ECOSYSTEM

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The production processes at one-summer-old fish rearing in polyculture and by the directed influence on the natural food supply have been studied at experimental ponds of the EPO "Yakot". The stocking densities of carp, bighead and grasscarp hybrids were 30 000 fish per hectar, at the total density of 90 000 fish/ha. Before flooding the ponds bottoms were limed, made light, and an organic fertilizer was spread; mineral fertilizers were applied into the water. The introduction of *Daphnia magna* was carried out 10 days before fish stocking. In the third ten-day period of July and in August, duckweed and small green vegetation sheafs were introduced into the ponds.

The gross primary plankton production varied at an average during a season between 1.9 and 2.5 gO_2/m^2 per day, the destruction of the organic matter between 1.2 and 1.8 gO_2/m^2 per day. The production of zooplankton in ponds made up 2670 to 3520 kg/ha, those of zoobenthos 70-310 kg/ha. The total fish yield varied between 1440 and 1790 kg/ha at the food expenditure of 1.2-1.5 units. The natural fish productivity made up 68-84% of the total one.

The percentage of zooplankton production to primary production was 22.2-31.5%. The percentage of zoobenthos production to primary production amounted to much lower values (0.6-3.8%) what testifies to a more energy flow through zooplankton community. The percentage of fish production to those of phytoplankton averaged 18%. The introduction of herbivorous fish in polyculture increased the efficiency of using production of the first trophic chain element by average 6.9%.

THE MYCOPLANKTON OF FRESHWATER STREAMS AND BASINS

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A direct method of calculation of fungi in water (which we have been using since 1972) demonstrated their real quantity in plankton. It permitted us to speak about a component of plankton associations previously unknown to science, a mycoplankton. As plankton fungi we treat actively swimming in water zoosporic stages of saprotroph and parasitic fungi inhabiting benthic and periphyton habitats, and also whole thalli, hyphae of fungal mycelia, fungal aplanospores - they all being either not attached to any substrate or attached to some detritus particles suspended in water or to plankton organisms and swim passively in the water column. The main components of mycoplankton are zoospores of lower fungi. They lack any firm wall (in contrast to persistent chitin walls of spores of higher fungi). Thus, they represent a good palatable food for animals-filtrators. The number of propagules was determined in fish-ponds in Ukraine and Uzbekistan, in streams and water basins of different kind in Karelia and Moscow Region. It was revealed that the number of propagules determined by means of the direct method is some orders higher than the number which was estimated previously using the method of dilution or inoculation of laboratory media. In hypertrophic fish-ponds zoospores of chytrids and saprolegnids dominated, their quantity fluctuating from 0.001 to 1.2 millions in 1 ml (average 0.2 millions in 1 ml, biomass – 7 mg/l). In streams conidia of hyphomycetes (higher fungi) dominated. Distribution of fungal propagules in water is irregular and depends on many abiotic and biotic factors.

OCEAN UPPER ACTIVE LAYER FORMATION UNDER CONDITIONS OF THE BIOTIC FACTORS

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Nowadays thermal balance of atmosphere and upper ocean layer, convection and wind -induced mixing of surface water masses are well recognized as the conditions responsible for ocean upper active layer formation and seasonal mesolimnion derivation.

Process modeling and data formalization concerning these oceanologic studies accordingly only these factors lead to some contradictions.

Planktonic organisms are considered to be an environmental condition of seawater transformation and mesolimnion formation.

During phytoplankton summer vegetation amount of seawater dissolved biogenic matter decreases to 50-80 %. Seawater density of photosynthetic zone (upper active water layer) decreases due to dissolved matter transformation into fluidized aggregation and its further transmission through throphic nets. The process limits lower border of phytoplankton distribution. Phytoplankton community partly uses sun energy for primary production and partly for fluorescence and emission of thermo energy. Exuberant thermo energy emission in the process of phytoplankton photosynthesis results to upper water layer heating.

Planctonic organisms evidently are considered as a significant factor of ocean upper active layer formation mesolimnion derivation.

PRODUCTION OF ZOOPLANKTON COMMUNITY OF SECONDARY-OLIGOTHTOPHIC LAKE

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CHANGING VIEWS IN LIMNOLOGY: FROM ECOPHYSIOLOGY TO EVOLUTIONARY PHYSIOLOGYCAL ECOLOGY

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The past 40 years have seen the merger of two important lines of ecological concepts: bioenergetics and evolutionary ecology. The IBP Handbook by Edmondson and Winberg (1971) marked the time when new methods were available to quantitatively study energy budgets of aquatic organisms and integrate the results into schemes of energy flow and productivity of ecosystems. The question to answer was *how* organisms functioned in response to the environment, and *how* their properties determined the function. On the other hand, evolutionary ecologists asked the question *why* organisms functioned in a certain way and achieved their properties. It took much longer until this branch developed quantitative methods to test their ideas, and only now, with the rise of molecular genetic methods, are the tools available for truly mechanistic studies.

For long, the two schools did not communicate, but when evolutionary ecologists developed quantitative models, it became evident that resource consumption and utilization are important components of fitness. Physiological trade-offs often determine the direction of evolutionary processes. Adaptations in morphology, life history and behavior are the result of the balance between costs and benefits that are often paid in terms of energetics and resource utilization.

Evolutionary physiological ecology has filled the gap between the diverging lines. The approach can be demonstrated particularly well with examples from aquatic ecology, such as the size-efficiency hypothesis, diel vertical migration, and inducible defenses.

UNDER-ICE HABITAT OF PLANKTONIC ROTIFERS IN LAKE BAIKAL AND THE PROBLEM OF THEIR ENDEMISM

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An endemic assemblage of planktonic rotifers proliferates under ice although their endemism is rare in this faunistic group (Kutikova, 1986; Rotifera…, 1993). The study of ecological properties of these species will enable us to elucidate the reasons for endemic rotifer existence in plankton of Lake Baikal.

Ice is unlikely to be an obstacle for the propagation of endemic rotifers elsewhere beyond Baikal that has been proved by recent data on the occurrence of endemic Baikal rotifers in mountainous lakes in the north-eastern part of Zabaikalye (Arov et al., 2004). However, we will have to know the routes of rotifer distribution and compare them with the paleo-events in the Baikal Rift Zone.

We studied the confinement of endemic and non-endemic rotifers to various microbiotopes. The life cycle of endemic Baikal rotifers appears to involve a peculiar microbiotope – mucous algae fouling of ice. In March 2001, we observed endemic species of *Notholca* and *Synchaeta*, as well as abundant morphotypes, especially of *Notholca* species in the narrow under-ice layer. The data obtained in April 2003 indicate that endemic species of *Synchaeta* are confined to the 1-2 m layer under ice; *Notholca* species – to lower layers, and non-endemic species of *Keratela, Filinia, Kellicottia* dwell in the 5-25 m interval offset towards the open lake.

ZOOPLANKTON STRUCTURE AND ABUNDANCE IN SHALLOW HYPERTROPHIC LAKE NERO (YAROSLAVL REG. RUSSIA)

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Zooplankton of hypertrophic Lake Nero (area 58 km^2, mean depth 1.6 m) was investigated during 2000-2004 and 70 zooplankton species of Cladocera, Copepoda, Rotatoria were found. Rotifers that made over 60% of total species number formed 40-70% of zooplankton density and 25-60% of biomass. *Brachionus diversicornis* Daday, *B. angularis* Gosse, *Keratella cochlearis* Gosse, *K. quadrata* Müll., *Conochilus unicornis* Rouss., *Asplanchna girodi* Guerne, *A. henrietta* Lang., *A. priodonta* Gosse, *Trichocerca pusilla* (Laut.), *T. similis* (Wierz.) were the dominant forms and *Brachionus calyciflorus* Pallas, *Synchaeta pectinata* Ehrenb., *S. tremula* Müll. were abundant during spring only. New zooplankton species invaded to lake during 1990-2004 are underlined. *Mesocyclops leuckarti* Claus, *Bosmina longirostris* (Müll.), *Chydorus sphaericus* (Müll.) are the dominant crustaceans. Mean by May-October zooplankton density and biomass (50-393 thous. ind./m^3 and 0.3-1.1 g/m^3) associated with oligotrophy. The same species were abundant earlier in 1987-1989, while zooplankton density reached 410-1169 thous. ind./m^3 and biomass 2.2-5 g/m^3. Nowadays, rotifers are more abundant than crustaceans. Number of zooplankton species associated with eutrophy (17 species) is higher than the ones associated with olygotrophy (5 species) that shows a high trophic status of lake ecosystem. Such disproportion between parameters of zooplankton structure and abundance associates with hypertrophy, as a rule.

MATHEMATICAL MODELING OF BIOGENIC SUBSTANCE TRANSFORMATIONS AND CREATION OF BIOPRODUCTION IN ECOSYSTEM OF ANIVA BAY

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The Aniva Bay is most studied and intensively exploited area of Sakhalin Island. The development of oil and gas deposits in a coastal zone of the Sakhalin Island, the construction of terminals and moorages for supertanker bunkering will generate a hazard for marine environment pollution. This study was done to characterize the natural regime of biogenic substance transformations in Areas 1–5 of the Aniva Bay. Hydroecological model was used as a tool for this study. Model was running on long-term monthly mean characteristics of marine environment (temperature, light intensity, transparency of water, biogenic load). Water transfer between areas was estimated on the base of water regime and sea level data.

Analysis of calculated substance concentration dynamics shows that the model reproduces the entire spectrum of the regular annual variations in the concentrations of organic and mineral nutrients, in particular, N and P compounds. The decline in nutrient consumption by hydrobionts in winter results that DON, NO_3, DOP, and DIP accumulate in higher concentrations in the surface layer. In spring, when the activity of hydrobionts increases, the concentrations of organic and mineral components is found to decrease, and in summer the reserves of organic matter increase because of more active production processes. An increase in the concentrations of organic and mineral substances takes place in the late autumn – early winter period. In this period, additional input of nutrients occurs with waters of Eastern-Sakhalin Current. The conformity of nutrient concentrations, calculated by model and observed in 2001-2002, was demonstrated.

It was found that winter maximum of diatomic algae exists in annual dynamics of plankton and it is highest in waters of the Salmon Inlet (Area 1). In spring (April) the maximum of diatom biomass is created earlier in Areas 3 and 4, one week later – in Areas 2 and 5, and in Area 1 it occurs in May. In summer, the diatom biomass is increased in Area 2 and to October it is decreased here. Development of phytoplankton of group 2 and 3 depends on the nutrient recycling in summer period as well as on the input of substances with waters of Eastern-Sakhalin Current during second part of year. In Areas 1, 3 and 5, the development of these plankton organisms occurs more actively than in Areas 2 and 4. Environmental conditions of zooplankton development are optimal in the Salmon Inlet. Here, biomasses of herbivorous and predatory zooplankton are highest. In Areas 3 and 5 the activity of zooplankton is increased as a result of upwelling processes. Model calculated values of bioproductivity are used in the analysis of seasonal development of plankton and bacteria biomasses in Areas 1 – 5 in relation with changing of nutrients and environment factors.

PRIMARY PRODUCTION IN THE SALMON SPAWNING-NURSERY LAKE KURILSKOYE (SOUTH KAMCHATKA)

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A complex of abiotic factors (a high (>10) ratio between mineral nitrogen (nitrates prevailing) and mineral phosphorous, annual averaged water temperature in the layer 0–200 m 2.0–4.0°C, a discrete phosphorous input with the carcasses of dead salmon post-spawners, a stable organic substance pool (137–266 mgC/m^3)) form a sustainable community of primary plankton producers of Kurilskoye lake represented by the diatoms.

Maximum primary production (PP) is characteristic for June-July, sometime the maximum can be observed in September. High level of PP also can be observed in winter, when no ice covering. The most productive zone is near-shore zone of the lake (bays) with maximum depths from 90 m to 180 m. Central aquatic zone with maximum depth 306 m is less productive, although the dynamics of PP in all the lake zones is of similar character.

When *Aulacoseira subarctica* (O. Müll.) Haworth dominants, the increase of phytoplankton biomass is accompany the PP decreasing, what has been displayed in a reversed correlation between these two parameters ($r = 0{,}78$; when $p<0{,}05$; $n = 5$). In 1980–1982 and 1985–1986 annual PP has got 3430-7917 mg/m^3, what is 3–8 times as much than annual zooplankton production.

USE OF AN EXPERIMENTAL MICROCOSM FOR STUDYING SPACEFLIGHT EFFECTS ON THE ECOSYSTEM LEVEL OF A BIOLOGICAL ORGANIZATION

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Building of closed eco-systems for human life support aboard space vehicles requires knowledge of the effects of spaceflight factors (SFF) on the ecosystem level of a biological organization. To this end, an aquatic algae-bacteria-fish microcosm was studied in experiments flown aboard biosatellites Kosmos-1887 and 2044.

The microcosm was formed inside an airtight aquarium with a volume of 2.5 L, illumination intensity of 12 W/m^2 PAR, light period of 16 hr/d and water temperature of 22±2 °C. Experiment duration was 18 days.

The biological components were selected out of well-investigated, including in microgravity, organisms, i.e. *Chlorella* LARG-1 and life-bearing guppy fish. Saprophage organisms were represented by algal microflora. Physiological-ecological analysis of these objects provided a base for determination of the most favorable hydrochemical environment, and permissible mass of the biological components that would ensure the balance of autotrophic and heterotrophic processes over a preset time period.

Analysis of the environmental parameters and investigations of individual components and the microcosm as a whole failed to reveal any significant SFF effects on the multispecies system. The experimental micro-ecosystem had distinguished boundaries, was easy to reproduce and convenient for quantitative investigation of eco-relations which makes it a good objects for supraorganismic studies of biological organizations during space flight.

ZOOPLANKTON OF HYPERHALINE LAKES IN THE CRIMEA

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In 2004, zooplankton community of Crimean hiperhaline lakes was studied. Eight lakes from the Kerch Peninsula, north-western and south-western parts of the Crimea were investigated. Salt lakes had different origin. Kojachskoe, Tobechikskoye, Feodosiyskoe, Chersonesskoye and Bakalskoye lakes are former lagoons (marine origin). In August 2004, much of seawater was flowed in Bakalskoe Lake during a storm (over washout of spit separating the lake from the sea). Kirkojachskoe, Chimahanskoe and Marphovskoye lakes are hyperhaline lakes of continental origin.

In total, seven zooplankton species were found: Rotifera (*Hexarthra oxyurus*, *Brachionus nilsoni* and three subspecies of *Brachionus plicatilis*), Anostraca (*Artemia salina*), Cladocera (*Moina mongolica)* and Copepoda (Calanoida: *Diaptomus salinus*, *Acartia tonsa*). *Acartia tonsa* – marine species (recent invader in the Black Sea) was abundant in Bakalskoye Lake.

The resting eggs of *Artemia salina* were found in all studied lakes. Nauplia and adult specimens inhabited by lakes with more then 60 ‰ salinity.

Abundance and biomass of zooplankton ranged widely.

Dependences between species composition, abundance of zooplankton and environmental factors were discussed.

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INFLUENCE OF ABIOTIC AND BIOTIC FACTORS ON THE ZOOPLANKTON COMMUNITY OF EASTERN PART OF THE BALTIC SEA

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In August 2004, an abundance of zooplankton community in the Baltic Sea averaged 23.7 ind.·10^3/m^3 and varied in large scale. Minimal density (5.4 ind.·10^3/m^3) was detected in shallow zone of the eastern Gulf of Finland. The highest abundance of zooplankton was in western part of the Gulf of Finland. Rotifers *Keratella quadrata* and *Synchaeta monopus* (123.7 and 28.2 ind.·10^3/m^3, respectively) dominated in this region.

Freshwater and oligohalines copepods were prevailed in zooplankton community in shallow region of the eastern Gulf of Finland. High density of rotifers characterized the western part as well as the deep-water zone of eastern part of the Gulf of Finland. The Eastern-Gotland and Gdansk basins differed from others one by high abundance of euryhaline and marine copepods. Cladocerans dominated in the Bornholm basin.

Species composition and abundance of zooplankton community were mainly determined by salinity in the eastern part of the Baltic Sea. We did not found significant correlations between abiotic and biotic factors (water temperature, pH, oxygen concentration, values of primary production and concentration of chlorophyll "a") and species composition and abundance of zooplankton.

This study was partly supported by the Russian Foundation for Basic Research № 05-04-49703, grant HIII-1634.2003.4 and the programs of RAS "Biological Resources" and "Biodiversity".

OPTIMIZATION OF EMBRIONAL DEVELOPMENTS FRESH-WATER HYDROBIONTS AT ASTATICISM OF FACTORS OF ENVIRONMENT

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Now numerous data about positive influence of fluctuations of temperature, salinity, pH, light exposure on growth, a physiological condition, and power of fishes and are obtained others hydrobionts (Stroganov, 1962;Galkovskaya, Suschenya, 1978; Konstantinov, 1988, 1993; Konstantinov, etc., 1987, 1998, 2004;, etc.). However for a final conclusion about popular in biology astatic conditions on hydrobionts it is necessary to expand laws of optimum influence regular amount of species the groups researched in this respect hydrobionts, and to show influence of fluctuations of ecological factors on early stages of their life cycle.

From invertebrate hydrobionts we researched influence of fluctuations pH, salinity and temperature on embrional development *Lymnaea stagnalis* L. It is received, that periodic changes of parameters of environment cultivation led to acceleration of development of germs on 10-30 %. The increase in their survival rate at 25-30 % testifies To optimization of conditions incubing embryos in variable modes in comparison with constant optimum conditions, and also increase in dimensional parameters of germs during their moment output from an egg also.

Periodic changes of temperature, pH and rendered salinity optimizing influence on embrional-larval development *Esox lucius* L. At daily fluctuations of the investigated factors acceleration embrional-larval developments of a pike up to 20-30 %, increase in speed of linear growth prelarvaes (up to 10-15 %) was observed. The survival rate of embryos increased in optimum variable modes considerably up to 10-15 % and prelarvaes, especially during the critical periods.

Fluctuations pH, temperatures, salinity and light exposure in optimum ranges statistically authentically accelerated linear and weight growth of tadpoles of three kinds Anura amphibious (grassy, lake and clawed a frog). Thus in astatic conditions speed larval developments and a metamorphosis increased, and young frog after end a metamorphosis had larger sizes.

Data obtained by us specify on acknowledges character of an optimality astatic conditions for ability to live of hydrobionts. From the birth up to destruction any alive organism functions in constantly changing conditions of an inhabitancy, and this dynamical environment is for it norm of existence.

SEASONAL DYNAMICS OF HYDROCHEMICAL AND PHYTOPLANKTON CHARACTERISTICS IN A SHALLOW HYPERSALINE LIKE AT CAPE KHERSONES (THE SOUTH-WEST CRIMEA) IN 2004/2005.

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Seasonal dynamics of chlorophyll a, phytoplankton, nutrients, oxygen, salinity, pH and temperature were analyzed in a small (0.02 km^2), hypersaline lake of marine origin at Cape Khersones near Sevastopol. It is separated from the Black Sea by the narrow, stony isthmus of about 15 m width through which is a permanent infiltration of sea water. The lake depth does not exceed 85 cm in winter and 60 cm in summer. The surface water samples were collected 2 times every month. The lake ecosystem is characterized by the early season formation of the floating mats of *Cladophora siwaschensis*, moderate seasonal dynamics of surface chlorophyll *a* (annual mean, AM= 2.3±1.34 mg m^{-3}), phosphate (AM= 0.74 ±0.32μM), nitrate (AM = 1.76 ±0.91 μM), oxygen saturation (AM = 102.3 ±26.3%), pH (AM=8.74 ±0.31), and considerable annual changes of temperature and salinity (from -0.15 to 28.5^{0}C and from 37.76 to 70.76‰, correspondingly). Annual mean primary production of the lake phytoplankton (~ 260 mgC m^2yr^{-1}) is higher than production of the Sevastopol Bay and north-western shelf, the same order of values as in the shelf of the Black Sea Bulgarian sector, but less than in-Danube shelf.

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CONTRIBUTION OF THE VARIOUS GROUPS OF MICROHETEROTROPHS TO THE TOTAL BIOMASS

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The abundance and biomass of the whole size spectrum of the heterotrophic forms in the microplankton community has been studied in Sevastopol Bay. In course of 2004 the microheterotrophs' biomass varied between 152 and 2414 mg/m^3.

The biomass maxima were associated with the high abundances of micro- (65 to 70%) and nanoplanktonic (20 to 70%) organisms. The abundance of the heterotrophic bacteria remained quite high in course of year but, owing to their small size, their contribution to total microplankton biomass was not high (10-20%). At low total microplankton biomasses (150-300 mg/m^3), this portion increased up to 80%.

It follows from the negative correlation between the bacterioplankton and the bactivorous protists (flagellates and ciliates) that grazing impact was a major factor controlling the bacterial dynamics during 2004.

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INVERTEBRATES AND FISH DIVERSITY IN WATER RESERVOIRS OF THE KARA SEA BASIN

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Invertebrates and fish communities in numerous internal water reservoirs of the Baidaratskaya Bay in the Kara Sea are practically not studied until now.

The results of zoobenthos and fish population studies in internal reservoirs of different types and in the Baidaratskaya Bay tidal zone are represented. The bottom fauna in the basin reservoirs is characterized by relatively high value of specific diversity. In its composition about 200 species and forms of invertebrates were registered. Cladocerans, copepods, oligochaetes, chironomids and mollusks are the most widely represented. The basis of the fauna consists of species with large ranges: holarctic; palearctic species, widespread European ones; species of the Siberian fauna occur. Lakes are distinguished by especially rich specific diversity and quantitative indices of zoobenthos development. The maximum of specific diversity of fish population was registered in Gnet'ty and Komaty lakes. The highest diversity of fish families was discovered in the Gnet'ty lake — 6; in Komaty and Bolshoi Ngosavei lakes 5 families in each were noticed. The fish fauna in studied reservoirs is represented by next ichthyofaunistic complexes: freshwater Siberian, freshwater arctic, submountain boreal and generative-marine ones.

Obtained materials allow to broaden fundamentally our notion on water communities structure in the Kara Sea basin.

AMPHIPODS DISTRIBUTION IN THE SOME FJORDS OF THE WEST SPITZBERGEN

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The investigations of the amphipods (Amphipoda, Gammaridea) inhabited in the West Spitzbergen waters are based on more than 240 samples from Isfjord, Grenfjord, Bellsund and Hornsund at 68 stations collected during cruises of the Murmansk Marine Biological Institute in 1995-2003. Benthic samples were made by Van Ven and Petersen grabes with covering area 0.1 m^2 and 0.025 m^2.

The peculiarities of amphipods distribution in the study area are connected with presence of different water masses. Arctic and high boreal arctic species occur in the inner parts of the bays with arctic waters. Widespread and Atlantic boreal-arctic amphipods colonize the mouth areas of fjords, were warm Atlantic waters occurs.

In the study area were found 64 amphipods species from 22 families. Number of species per station and index of taxonomic diversity (I=T/S, I – taxonomic diversity, T – amount of families, S – numbers of species) were highest in the mouth of the fjords. Decreasing of these values was registered in the inner parts of the bays. Maximal amphipods biomasses in the investigated area are located on the bank, in the mouth of narrow bays and in the tidal zone.

Some factors and cases affected on amphipods communities in this area are discussed.

HYDROCHEMICAL PECULIARITIES OF FISH PRODUCTIVE LAKES OF KAMCHATKA AND SAKHALIN

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The peculiarities of hydrochemical conditions in lakes of Kamchatka (Kurilskoye L., Azabachye L.) and Sakhalin (Tunaicha L.) which are the very important spawning and growing basins for salmons, are considered.

The high content of silicates (60-80 μM) and nitrates (25-30 μM) in the whole water column and the very low concentration of phosphates (0.1-0.2 μM) are the characteristic features of the Kurilskoye Lake. Waters of the Azabachye Lake have very low concentration of phosphates (up to 0.2 μM) and nitrates (less than 1 μM) and high concentration of silicates (100-150 μM). The surface waters of the Tunaicha Lake are also characterized by low content of inorganic nitrogen and phosphorus (~ 1 μM and ~ 0.4 μM, respectively). The characteristic feature of the Tunaicha Lake is the presence of the deepwater basin, where sea waters penetrate from the Mordvinov Bay and where the organic matter is accumulated and mineralized, accompanying by an essential increase in concentrations of nutrients.

The low concentrations of inorganic phosphorus and nitrogen in the investigated lakes indicate on the transition of ecosystem to existence mainly due to recycling of nutrients and their inflow into the euphotic layer with the coastal runoff.

DREISSENA POLIMORPHA AND *DREISSENA BUGENSIS (*BIVALVIA, REISSENIDAE) IN MOSCOW-RIVER

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Dreissena polymorpha (Pall.) was the only Dreissenid species found in Volga River until the 1992 (Starobogatov, Andreeva, 1994). *Dreissena bugensis* (Andr.) was firstly reported in the Volga in 1992 (Antonov, 1993).

In 1937 Moscow Canal was built making connection between Volga and Moscow-River. It made possible the penetration of Dreissenids occurred in periphyton of boats traveling from Volga into Moscow-River.

For the first time *D. polymorpha* (Pall.) was found in Moscow-River within the city of Moscow in 1987 in Strogino plain-food (maximum biomass 20 kg/m^2; Paliy et al., 1992). In 1993 *D. polymorpha* was ranged in all kinds of hard substrates in the lot of Moscow-River between Rubliovo and Fili (Lvova et al., 1996).

D. bugensis was found for the first time in Strogino plain-food of Moscow-River in October 2003. It was disclosed in all mixed aggregations, it comprising only 12 % of both species Dreissenids. Maximum shell length was 24 mm, the age was no more then 2+. Therefore, these molluscs appeared firstly in Moscow-River during 2001.

In October 2004 *D. bugensis* was the dominant species on the same river area in all mixed aggregations, comprising 71% of the total number. The maximum shell length was 32 mm.

ENERGETIC BALANCES OF EARLY DEVELOPMENTAL STAGES OF FISH SPECIES FROM THE VISTULA LAGOON

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Production (P), respiration (R), egestion (faces – F) and excretion (urinary waste – U) were measured in early developmental stages of five fish species (stickleback *Gasterosteus aculeatus*, Baltic herring *Clupea harengus membras*, smelt *Osmerus eperlanus*, perch *Perca fluviatilis* and zander *Stizostedion luciperca*) and mysid shrimp (*Neomysis integer*) living and competing for food in Vistula Lagoon. The daily energy requirement (or daily food ration, or consumption C) was calculated as a sum of measured elements: C=P+R+F+U.

The highest production rate (0.171 calories per one milligram of animal's body wet weight per day) was observed in stickleback, and the lowest (0.00009 cal) in adult mysid shrimp. Also the highest respiration rate and consumption rate were observed in stickleback (o.138 cal and 0.318 cal, respectively), and lowest in zander (0.055 cal and 0.095, respectively).

Production rate (growth rate) in stickleback is very high, but its cost of maintenance (respiration rate) is also very high. Early developmental stages of herring represent another type of life strategy: its production is rather high, and the cost of maintenance very low.

CHANGE OF ECOLOGICAL CONDITIONS IN AREAS OF PROSPECTING DRILLING IN GULF OF OB

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During 2000-2004 researches in the Ob which purpose was the assessment of risk of pollution of water medium at prospecting drilling chinks on gas were carried out. The complex approach including chemical, biological and toxicological methods of analysis of quality of medium was used. The object of researches chooses fields of drilling in limens of 5000 m from a drill holes. As background values used parameters of a state of water medium of the areas, not exposed to anthropogenic influence.

The carried out researches have shown, that drilling chinks produce series of the negative consequences bringing in deterioration of toxicological conditions in area of a drill holes. Among hydrochemical parameters the augmentation the quantity of suspended matters (in 2-4 times more than background values) and mineral oil (2-3 maximum concentration limits) is marked. Results of biotesting testified, that water and bottom-dwelling deposits had toxic effect. All these negative changes took place in the season of drilling in radius of 500 meters from a drill holes. And in the greater degree benthonic layers of water and bottom-dwelling deposits are polluted.

Among hydrobiological parameters what or infringements it was marked not.

After the arrest of chisel works the tendency to enriching ecological conditions is established. However, this process in the time attitude is long, and in spite of the fact that the quantity of chemical pollutants and has decreased to background sizes, the toxic effect is kept by places.

SOME ASPECTS OF DYNAMICS OF MICROPERIPHYTON STRUCTURE

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The dynamics of periphyton structure is determined by complex of interacting external (abiotic and biotic factors) and internal (interaction between community elements) factors. This dynamics is multidirectional and includes vertical, horizontal and biotop-related changes, natural succession, seasonal and long-tem fluctuations, etc.

We studied changes in quantitative ratios between algae, bacteria, invertebrates and detritus during the process of formation and development of microperiphyton. With use of Confocal Microscopy, changes in the architecture of periphyton films were also investigated. The studies were conducted in different-type lake and riverine ecosystems of Belarus during 1981-2004. It was found for ecosystems of different type that biotic components dominate at the yearly stage of periphyton formation, while detritus become abundant during periphyton ageing. In old periphyton, detritus makes up to 70% of the total weight. As a rule, the most abundant biotic component is algae (on average, 5-20% of total weight). The increase of detritus content leads to significant transformation of the overall architecture of periphyton. Detritus serves as additional substrate for bacteria, single-celled algae and some protozoans. The particles of detritus and vital excreta of bacteria and algae form the integral structure of peryphiton film.

The present report also contains results of studies of seasonal changes in species structure and algal density in climax communities of periphyton on perennial *Chara* spp.

PRODUCTIVITY OF BAIKALIAN WATER'S MICROBIOCENOSES IN SUMMER 2003

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The material was assembled in July - August during maximum productivity of Baikal ecosystem. The urgency of researches is defined by necessity of drawing up of the balance equations connecting processes of production and bacterial destruction. In this connection the limits of productional possibility of microbial communities in pelagic Baikal were investigated. Bacterial production calculated on dark assimilation of $^{14}CO_2$.

The limits of bacterial production in Southern Baikal were 20,0 – 23,16 mkgC/l day. Maximum production is registered in the Middle Baikal (29,8 mkgC/l day). In North Baikal it varied from 2,79 up to 16,9 mkgC/l day. At comparison of average bacterial production it has appeared the microbial communities of Middle Baikal are more active (22,28 mkgC/l day), than of North and Southern (10,3 and 18,28 mkgC/l day accordingly). The average for all basins bacterial destruction, calculated with use assimilation coefficient of 0,4, was 423,8 mkgC/l day, that exceeds primary production in 4 times.

Until now question on considerable excess of bacterial production in Baikal waters above a primary production is not clear. Besides complexities and vagueness of estimation of primary and bacterial production, the discrepancy of total productivity of phytoplankton and oligotrophic microbial communities in can also be connected with underestimation of organic matter, emanation of which from deep faults in bed of Baikal can be rather essential.

ECOLOGICAL FEATURES OF THE INDIGENOUS FISHES OF THE LAKE BALKHASH BASIN

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The native fauna of fish inhabited in the lake Balkhash basin was formed in conditions of a long-lived geographic isolation. At the 20th century more than 20 non-indigenous species were installed here. In connection with increase of a population an anthropogenic load by basins of this basin considerably has increased. Thus, the considerable change of biotic and abiotic conditions of existence of fishes has taken place. It has allowed us to estimate capabilities of the indigenous fishes in existence in new biocenoses.

Balkhash perch (*Perca schrenki*) and bearded stone loaches (*Nemacheilus*) are capable to coexist with the many nonpredatory non-indigenous species, to settle down in new habitats and to endure considerable pollution of water. Scaleless osman (*Diptychus dybowskii*) is capable to endure considerable pollution of water, and to coexist with some non-indigenous species. Balkhash marinka (*Schizothorax argentatus*), scaled osman (*Diptychus maculatus*) and minnows (*Phoxinus*) are adapted to broken conditions of existence worse than other native species of fish. Balkhash perch, monnows and spotted stone loach (*Nemacheilus strauchi*) have shown high enough immunity to a stress in experiment. However them elasticities are considerably less developed to those of a non-indigenous species - stone moroco (*Pseudorasbora parva*).

The natural habitats of all indigenous fishes are decreased. They dominate only in the some water bodies with a minimum anthropogenic load.

RECENT STATE OF FISH POPULATION IN LAKE BAIKAL

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Fish in Lake Baikal inhabit all water layers. High correlation is observed between dynamics of fish catching and changes of hydroclimatic factors. Fish inhabiting estuaries consume rolling juveniles of generative riverine fish of the open Baikal. The latter in turn influence fish of an endemic complex. Predation increases especially in Cottocomephorus, while cannibalism intensifies in Comephoridae. Hence, the interaction of fish from different ecological and fauna complexes is more directed. Fishery, artificial breeding, pollution and artificial regulation of water level in Lake Baikal break existing relations. Control methods are often insufficient for detection of these changes. The most active method of observation for dynamics of omul abundance is a trawl-acoustic method, whereas for that of Cottocomephorus - vertical installation of nets of special construction providing simultaneous layered catching. A new device was used for catching Comephoridae within the whole water column. It allowed to concurrently catching fish at different depths at any interval (usually 2 m) from surface to bottom. New methods of catching give a possibility to correct interrupted observations for dynamics of productivity of fish generations and to start studies on fish distribution within the entire water column of Lake Baikal.

ZOOBENTHOS OF LAKE ORON (NORTHERN ZABAIKALYE)

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Lake Oron, one of the largest lakes of glacial-tectonic origin in Baikal Rift Zone, is located in the basin of Vitim-Lena Rivers. It is 23 km long, its widest part is 6,5 km, and maximal depth – over 180 m.

The researchers' concern is basically related to the fauna genesis of the water bodies in Baikal Rift Zone and Baikal elements in it (Kozhov, Tomilov, 1949; Tomilov, 1954; Rusanov, 2001; Rozhkova et al., 2004).

According to the authors' data (2000-2003), over 130 animal species, including above 50 new for the lake species and 1 new for science, have been registered in the lake. 80% of the species is composed of insects, among which *Chironomidae* and *Trichoptera* are most diverse. The abundance of zoobenthos species is due to the hydrological peculiarities of the lake.

As a rule, the zoobenthos is quantitively dominated by *Oligochaeta*, *Chironomidae* larvae and rarely *Sialidae*. The most productive part of the lake is situated in bayou Gnilaya, where the average zoobenthos biomass reaches 5,2 g/m^2, and the amount exceeds 5 thou. specimens/m^2. Open parts of the lake are characterized by low numbers and biomass (1,7 g/m^2 and 800 specimens/m^2). In Lake Oron, the average zoobenthos biomass grows with depth and the amount drops.

Our investigations showed that zoobenthos structure and quantitative characteristics experienced no significant changes for the past 55 years.

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BIODIVERSITY PATTERNS OF THE MICRO-AND MEIOFAUNA: SCALING EFFECT

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Biodiversity as an integral component of the species community structure was studied in the heterotrophic flagellate, testate amoebae, ciliate and freshwater metazooplankton (rotifers and crustaceans) communities in different spatial scales. Local-regional richness relationship (LR), alpha-beta-regional relationship (ABR), species-area relationship (SAR) and species-sampling effort relationship (SSE) were used in order to characterize biodiversity patterns in different scales. There are distinct changes of both LR and ABR in the communities of small size organisms across spatial scales, whereas it tends to form constant patterns in the communities of large size organisms. Protozoan communities are beta-dominant in small spatial scales and alfa-dominant in large ones. Metazoan communities represents as beta-dominant in all scales studied. Species richness of protozoan communities is affected predominately by regional processes, whereas metazoan communities – by local processes. In protozoan communities there is distinct SAR and SSE within small scales that is decreased in large scales. In metazoan communities both SAR and SSE levels are the same in different scales. These features may be explained in terms of the characteristic scale of perception of the environment for organisms of different size. Protozoans percept environment as more heterogeneous in small spatial scales and more homogeneous in large ones.

ASSESSMENT OF THE CURRENT STATUS OF LAKE PSKOVSKOYE-CHUDSKOYE (PEIPSI) ECOSYSTEM FOR MACROZOOBENTHOS INDICES

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Macrozoobenthos of a big shallow Lake Pskovskoye-Chudskoye (3555 кmI; mean depth is 7.1 m) features high species diversity, high abundance values and biomass of hydrobionts.

In the open part of the lake on the muddy bottom occupying the major parts of L. Pskovskoye and Chudskoye mean seasonal numbers of bottom animals comprise 3279 and 2855 ind.m^{-2} respectively, biomass – 18.05 and 16.23 g m^{-2} (2001- 2004). *Potamothrix hammoniensis* (Mich.) prevails in numbers, *Chironomus plumosus* (L.) – in biomass. Since 1980-ies in L. Pskovskoye the role of Valvatidae (Gastropoda) in creation of biomass of profundal increased.

Silty sands nearly all over the perimeter of Lake Pskovskoye and on the large part of L. Chudskoye are currently occupied by the community predominated by *Dreissena polymorpha* (Pallas). Expansion of *D. polymorpha* is continued to the central part of L. Pskovskoye where it finds appropriate substrate on the abandoned nets.

Lamprodrilus isoporus Mich. (Oligochaeta) preserves big numbers on clean sands, *Monodiamesa bathyphila* (Kieffier) and *Pallasiola quadrispinosa* (Sars) are still can be found.

Preservation of species composition including species typical of oligotrophic and mezotrophic waters and quantitative characteristics of macrozoobenthos development evidence rather a high stability of the lake ecosystem.

CURRENT TRENDS IN MODELLING OF LAKE AND RESERVOIR ECOSYSTEM

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The method of biological balance was dominated in ecological modeling from the 70th of last century. Balance of energy (Vinberg, Anisimov, 1966) was developed to balance of phosphorus, nitrogen and even silica. Dissolved oxygen was usual element of freshwater ecosystem models. More then 30 years of exploitation of balance models determinates the main field of its applications. It was the processes of eutrophication. But for many practical and theoretical problems the balance approach are inefficient.

Using the methods of individual-based modelling, object-oriented technology and evolutionary programming (genetical algorithm) is efficient in solving these problems. In first step these methods was applied to objects, which was successfully modeled by traditional technology. (These objects were the population of perch in lake Herja-jarvi, the fish community in the lake Dalnee, the fish community in a small river, the population of Eudiaptomus gracilis, ecological systems of lake Ladoga and dam reservoir Solina), Models, which created by using new technology, can demonstrate all results of traditionally (balance) models. But many effects, which cannot be achieved by balance models, were obtained. For instance, prediction the list of fish species in new constructed reservoir, the effect of changes in genetic construction of fish population under high fishing pressure, the adaptation of zooplankton population to changes of food base and predators pressure (diurnal vertical migration).

THE HYDROBIOLOGICAL APPROACH TO THE ESTIMATION OF MAXIMUM PERMISSIBLE HARMFUL INFLUENCE **(MPHI)** ON WATER STREAMS (THE RIVER TURA CASE STUDY)

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The establishment of the **MPHI** standards assumes revealing of negative influences water body. This will allow for the determination of allowable influence limits which do not result in the changes in qualitative and quantitative features of biota. At the same time, no any reliable approach to standard establishment of **MPHI** has been developed yet. That is why we developed our own approach to **MPHI** defining.

As a criterion of a influence upon ecosystem of the water-current we used a slightly modified index of deviation from a background condition (D), calculated from qualitative and quantitative indices of macrozoobenthos. The following equation was used:

$$D = \frac{\sum_{i=1}^{K} \frac{Ni - ni}{Ni\,\max}}{K} \cdot 100,$$

where Ni – numbers of organisms of i – species at the background crossection; n_i – numbers of organisms of i – species on the crossection that is under study; Ni_{max} – maximum numbers of organisms of i – species at one out of two compared crossections; K – number of species on background crossection.

The values of indices provide objective representation of the processes occurring in ecosystem of the river which subjected to anthropogenic impacts.

For the background sites where the ecosystems have not undergone catastrophic transformations, the lists and concentrations of the most typical pollutant in water and sediments have been established. The multitude of these parameters defined the **MPHI** norms.

THE COMPARATIVE ANALYSIS OF PHYTOPLANKTON STRUCTURE ON THE PARTS OF KANEV'S RESERVOIR WITH DIFFERENT LEVEL OF ANTHROPOGENIC POLLUTION

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The research of spatial-temporal structure of phytoplankton for subsequent verification of HP index are carried out on two parts of Kanev's reservoir with different level of water pollution (station 1, river-bed, conditionally pure area and station 2, polluted by Kiev's city drains). Phytoplankton of mentioned parts was characterized as the diatom-green with increase of a role of blue-green algae during the summerly-autumnal period. The peak of phytoplankton (station 1) was observed at beginning of summer (numbers – 4.5-6.2 mil.cell/dm^3, biomass – 2.33-1.3 mg/dm^3, area of the cell surface – 14.45-9.9 sm^2/dm^3) due to intensive development of diatom algae, especially *Stephanodiscus hantzschii*, and also during middle of summer for account *Microcystis aeruginosa.*

Phytoplankton of the station 2 was characterized by the maximal parameters (number – 7.1 mil.cell/dm^3, biomass – 1.31 mg/dm^3, area of the cell surface – 12.94 sm^2/dm^3) not only at the beginning of summer. The enough high parameters (number – 5.5-4.8 mil. cell/dm^3, biomass – 2.53-2.88 mg/dm^3, area of the cell surface – 32.76-38.16 sm^2/dm^3) were observed also at the end of summer and during beginning-middle of autumn due to intensive development of blue-green hormogonial algae. Thus, the investigated parts, despite their close arrangement, have various spatial-temporal structure of phytoplankton.

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QUANTITATIVE DEVELOPMENT AND PHYTOPLANKTON FUNCTIONING IN NAROCH SYSTEM LAKES IN DIFFERENT PERIODS OF EVOLUTION OF THEIR TROPHIC STATE

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The lakes of Belarus Naroch, Myastro, Batorino have passed different pediods of evolution of their trophic state in connection with changed ecological conditions on their watershed: I) the period with insignificant antropogenic load (up to 1976), II) the period of antropogenic eutrophication (1977–1991) and III) the period of deeutrophication (1992–2004). Up to beginning of the III period, the Naroch L. was considered as mesotrophic, Myastro L. as middle-eutrophic and Batorino L. as hypereutrophic. At present, Naroch L. conserves its mesotrophic status, Myastro L. has transformed into category of weakly eutrophic and Batorino L. has become an eutrophic waterbody.

The eutrophication and deeutrophication processes affected the quantitative phytoplankton development, its community structure and production possibilities.

The comparison of phytoplankton biomass and chlorophyll content (without phaeopigments) for the whole investigated period (1968–2004) revealed positive correlation for all three lakes: for Naroch L. r=0,42; for Myastro L. r= 0,89 and for Batorino L. r=0,70.

At present the values of quantitative development of phytoplankton testify about the more low trophic state of Naroch system lakes, than before the beginning of their eutrophication.

DIVERSITY AND PRODUCTION OF CYANOBACTERIAL COMMUNITIES IN SALINE LAKES

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Five saline lakes in Kerch peninsula, the Bakalskoe lake and many small shallow waters near the Bakalskoe lake in Crimea were studied.

A 38 species of cyanobacteria were identified: filamentous (*Lyngbya* – 9 species, *Oscillatoria* – 12, *Phormidium* – 11, *Spirulina* -3, *Microcoleus* -1, *Anabaena* -1) and unicellular (*Microcystis* – 1, *Synechocystis* – 2). The abundance of species differs in a wide range: from 32% (*Lyngbya confervoides*) to a single occurrence (different species).

Differences in species composition of cyanobacteria depend on the depth of water, but not on the salinity: filamentous cyanobacteria develop in shallow water, and unicellular cyanobacteria and green algae – at larger depths.

Highest chl a concentration (1500 mg/m^2) was found in cyanobacterial mat in small shallow water with salinity 5,5%. The mat mainly consists of *Microcoleus chthonoplastes* and *Lyngbya aestuarii* and purple bacteria *Ectothiorhodospira.* The chlorophyll content in different places is presented below: a bottom stone biofilm with development of *Oscillatoria lacustris* and *Phormidium luridum*, green algae *Cladophora* – 800-950 mg/m^2; a sand biofilm formed by *Microcoleus chthonoplastes* – 265 mg/m^2; a mud biofilm with development of *Spirulina, Phormidium* and mucilage unicellular green algae *Botryococcus Braunii* – 130-200 mg/m^2; a floating mat with development of green algae – 80- 100mg/m^2; a *Diatomea*, developing on sand, – 30-50 mg/m^2.

PHYTOPLANKTON SPATIAL DISTRIBUTION AND PRIMARY PRODUCTION IN THE VOLGA RIVER RESERVOIRS

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Phytoplankton spatial distribution in the Volga river reservoirs is characterized by substantial horizontal heterogeneity resulting from reservoir morphometry, their hydrological regime, input of the tributaries, presence of different water masses. The small-scale phytoplankton distribution in reservoirs is the most homogeneous, while mid-scale distribution is characterized by a moderate degree of variability and the large-scale heterogeneity is of the greatest degree of variability. Complex hydrological structure of reservoirs causes formation of sites differed in their biological production as well as trophic state. Daily photosynthesis intensity in cascade makes from 2.10±0.17 up to 2.91±0.34 mg O_2/l, and daily primary production in the water column that follows the depth of euphotic layer varies from 2.16±0.15 to 3.24±0.26 g O_2/m^2 becomes higher in the Low Volga reservoirs. Euphotic zone occupies 36-70% of total reservoir storage, therefore the degree of phytoplankton light starvation is estimated as 64-30%. Ratio of primary production and respiration values in the water column as a rule is <1 that testifies to heterotrophic functioning of reservoir ecosystems. At the same time autotrophic processes prevail over heterotrophic processes at the littoral shallows that make essential input to total biological production in reservoirs and enrichment of ecosystem by autochthonous organic matter.

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RESTORATION OF LAKES THROUGH THE PRISM OF THE THEORY FUNCTIONING OF WATER ECOSYSTEMS

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Foreign and Russian practice of lake restoration used now is based on hydraulic engineering actions without taking into account features of functioning of water ecosystems. The concept of water restoration now is in a stage of development, here again it is necessary to define precisely theoretical bases and the positions put in practice of restoration. In particular, it is the general ecological laws and positions of the theory of water ecosystems functioning, such as:

the law of evolution - ecological irreversibility (it is not necessary to set as the purpose achievement of an initial condition of water ecosystems);

knowledge of features of a balance of energy and circulation of substances;

understanding of a role of lake sediments as the basic reservoirs of substances in a sedimentary cycle of circulation of substances (it is impossible to plan the large withdrawal of sediments, that conducts to a dystrophy of lakes);

positions about processes of autopurification of water reservoirs from the point of view of circulation of substances (Vinberg, 1973);

position about of interrelation of small lakes with catchment area (Drabkova, Sorokin, 1979), that by a principle of «genetic memory» (Mingazova, 1999) promotes restoration;

positions of the theory of stability water ecosystems, etc.

The knowledge of the theory will allow to prevent many negative consequences of restoration actions (a dystrophy, pauperization by kinds, etc.).

THE ENERGY FLOWS THROUGH THE ZOOPANKTON IN THE OPENED AND CLOSED ESTUARIES

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Curonian and Vistula Lagoons form part of Baltic Sea basin, although they present different ecological conditions. According to a water relation Curonian Lagoon is closed estuary and Vistula is opened one.

The faunistic composition and zooplankton abundance, biomass and productivity in Vistula and Curonian Lagoons has been analyzed and is described using long-term observations obtained during 1980-2002. The type and length of trophic chains and the connectance of the zooplankton was assessed according to Briand.

About 90% of zooplankton biomass in Curonian Lagoon has made by herbivorous species and in Vistula Lagoon omnivorous one.

The energy flows are forwarded in two basic directions - through Cladocera and Copepoda in Curonian and one direction - through Copepoda in Vistula Lagoon.

The zooplankton trophic chain in Curonian Lagoon is characterised with complexity and relative constancy and in Vistula it is rather simple and variably. Parameters of lagoons zooplankton food chain were differed. The connectance of zooplankton variation from 0.5 tills 1.0 in Curonian and from 1 till 3 in Vistula Lagoon.

Concluded that zooplankton of opened estuary was more vulnerable, than zooplankton of closed estuary. This community reflects external impact with omnivores at chain top and energy transport through omnivorous species.

TAXONOMIC BIODIVERSITY, STRUCTURE AND QUANTITATIVE CHARACTERISTICS OF ALGAL COMMUNITIES OF RAZDOLNAYA RIVER (PRIMORYE, RUSSIA)

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Algalflora of Razdolnaya River is represented by 375 species (436 species, varieties and forms) of algae belonging to nine divisions: Cyanophyta - 36 (37), Euglenophyta - 10 (10), Dinophyta - 4 (4), Chrysophyta - 2 (2), Bacillariophyta - 259 (312), Xanthophyta - 1 (1), Rhodophyta - 1 (1), Chlorophyta - 60 (67) and Charophyta - 2 (2).

Flora of algae of Razdolnaya River is quite diverse and abundant, with a number of mass species. Dominants and subdominants of periphyton communities are 4 species from Cyanophyta division - *Phormidium autumnale*, *Homoeothrix varians*, *Anabaena affinis*, *Aphanizomenon flos-aquae*, one species from Chlorophyta division – *Oedogonium* sp. ster. and 29 species from Bacillariophyta. Among Bacillariophyta species *Encyonema silesiacum* is the only dominant species at several stations, or it dominates along with *Achnanthidium minutissimum*, *Fragilaria vaucheriae, Cymbella affinis*, *Navicula cryptocephala*, *Nitzschia dissipata* and some others. Diatom *Aulacoseira italica* var. *tenuissima* dominates in phytoplankton communities in the low part of Razdolnaya River.

Coefficient Sцrensen was used for comparison of algal communities of all hydrobiological stations of the river. Dendrogram shows high degree of taxonomic composition similarity especially at the middle part of the river.

Average meaning of biomass and density of periphyton and phytoplankton of algal communities were distinguished along the river channel from the Russian-Chinese border to the mouth of Razdolnaya river.

Benthic, oligohalobic, alkaliphilous forms, в-mesosaprobionts and п-saprobionts organisms are prevailing in algal flora of Razdolnaya River.

FLUCTUATIONS AND ROLE OF PHYTOPLANCTON IN STRUCTURE AND FUNCTIONING OF LAKE KRIVOYE IN TWO PERIODS

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Ecosystem of Krivoye lake was investigated in 1968-1972 year in frame of International Biological Program.

The research carried out in 2002-2004 showed that the proportion of some certain endogenous populations of plankton algae had decreased (*Bacillariophyta*), while others had increased in number (*Chroococcales, Cyanophyta*).The *Cryptophyta* algae turned out to be a new group for the phytoplankton of this lake. The total biomass increased from 0.14-0.20 up to 0.33-0.50 mg/l, according to which Krivoye may be still characterized as oligotrofic reservoir. At the same time, the phytoplancton characteristics of this reservoir (like P/B coefficient, chlorophyll proportion in biomass) remained on the same level.

Progressions occurred in phytoplankton structure had increased its nutritional importance. Abundance of algae which are available for consumption by zooplankton filterers according to their size had increased (*Cyanophyta, Cryptophyta,Dinophyta*). Phytoplankton accessible for filterers at present comprises more than 50% of total phytoplankton biomass. That fully corresponds to the data obtained earlier (Nikulina, 2003). Along with structural fluctuations and enlargement of phytoplankton biomass, we had also observed almost two-fold increase in biomass of algae consumers, i.e. *Cladocera*-filterers.

The data obtained show that plankton assemblage of Krivoye lake functions according to the same scheme as in 1968-1969, but with higher level of productivity.

THE CONTENTS OF THE CHLOROPHYLL «A» AND BIOGENIC ELEMENTS IN SMALL LAKES OF THE BOTTOM VOLGA

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Long-term researches of lake systems of different areas of basin of the Bottom Volga have shown, that in region small lakes eutrophic and hypertrophic type have a wide circulation.

Under the contents of total phosphorus in classification Vollenweider, Kerekes (1980) majority from surveyed - hypertrophic. In territory Samarskay Luka from 16 - 11 (eutrophic 4, mesotrophic 1); from 12 in Volga-Ahtubinsk flood-lands - 8 (eutrophic 1, mesotrophic 3); from 9 lakes Vasiljevskih at Togliatti 7 hypertrophic and 2 eutrophic. Its concentration in a superficial layer hypertrophic lakes reaches 0,6 (Togliatti) - 1,2 mg P/l (Samarskay Luka) and 1,0 (Volga-Ahtubinsk flood-lands); eutrophic - accordingly, 0,078; 0,074 and 0,037 mg P/l. The maximum of the contents of mineral nitrogen - 11,33 (Samarskay Luka) and 0,86 mg N/l (city lakes).

Such concentration of biogenes determine high production of phytoplankton. Under the contents of chlorophyll in G.G.Vinberga's classifications (1960) majority of lakes is included into group eutrophic: in territory Samarskay Luka - 8 (6 hypertrophic and 2 mesotrophic), in Volga-Ahtubinsk flood-lands - 8 (2 hypertrophic and 2 mesotrophic), at Togliatti - 9. Its average contents in eutrophic lakes reaches 83,1 mg / m^3 (Samarskay Luka), 71,8 (Volga-Ahtubinsk flood-lands) and 90,6 (Togliatti), in hypertrophic - 193,6 (Samarskay Luka) and 204,9 mg / m^3 (Volga-Ahtubinsk flood-lands).

ACTINOMYCETES AND CIANOBACTERIA AS A PART OF AQUATIC COMMUNITIES OF ALTERNATLY DRYING LAKES IN THE CRIMEA

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The actinomycetes are a group of gram-positive mycelial organisms. They are able to interact with other microorganisms, plants and animals and form associations with them in nature and under experimental conditions. Associations of actinomycetes with green algae are well known and named actinolichens.

Investigations of "behavior" of actinomycetes in associations with algae are the new aspect of ecology of actinomycetes.

Blue-green algae are abundant in lakes and streams and do, no doubt, fix considerable nitrogen when living in such environments under favorable conditions. There is no reason to exclude possibility of existence of actinomycetes in such communities.

A large number of experiments have been made earlier at our laboratory to demonstrate a specifity of relationship of blue-green alga *Oscillatoria terebriformis* (Ag.) Elenk. emend. from algal-bacterial mat of hot spring of Kamchatka and *Streptomyces odorifer* from accumulated culture algae.

The goals of this investigation were: isolations and genera identification of cultures of actinomycetes from samples of soil from different localities in the Crimea. Samples of soil were taken under blue-green algae films in shores of lakes and from bottom of temporarily alternatly drying lagoons. pH of lake water was 8.7. For this reason we isolated microorganisms on Gause-agar mineral medium with pH 8.

Results of investigation: we isolated 18 strains of actinomycetes. All of them belong to the genera *Streptomyces* and to sections and series (% of total sum of isolated strains): *Cinereus Achromogenes* (33), *Cinereus Chromogenes* (17), *Helvolo-flavus Helvolus* (33), *Roseus Fuscus* (11), *Roseus Roseoviolaceus* (6).

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AQUATIC INVADERS IN THE NEVA ESTUARY ECOSYSTEM (BALTIC SEA): FUNCTIONAL GROUPS, IMPACTS AND EFFECTS

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Historical retrospective, field and experimental studies in pelagic zooplankton, benthic and littoral communities were carried out in 1996-2004 in Neva Estuary. The study was aimed at estimation of xenodiversity, prerequisites and consequences of the invasions, and at revealing role of invasive species in structure and functions of aquatic communities. Previous results and monitoring data have confirmed the hypothesis that success of invasion is determined not only by properties of the invader itself but also by preceding changes in local communities and environmental conditions to a benefit of a newcomer. Of 20 non-indigenous invertebrates and 1 fish species recorded in our research the eight are considered as successful invaders and have various impacts on the communities and water quality. They belong to three functional groups. The first group covers sessile seston-feeders represented by Ponto-Caspian zebra mussel (*Dreissena polymorpha*) in freshwater to oligohaline zones, and American barnacle *Balanus improvisus* in mezohaline zone. They are acting as habitat engineers in shallow waters and provide benthic–pelagic coupling. Onmivorous vagile organisms, the second group, comprise planktonic Ponto-Caspian cladocerans *Cercopagis pengoi*, two amphipods – Siberian *Gmelinoides fasciatus* and Ponto-Caspian *Pontogammarus robustoides*, and the fish amur sleeper *Percottus glehnii.* High functional diversity allows these organisms to share resources between sizes, ages and stages, and control the lower trophic levels. In the deepwater zones, organisms of the third group – infaunal detritivores – play a role of bioturbators represented by two North Atlantic annelids: *Tubificoides pseudogaster* (Oligohaeta) and *Marenzelleria viridis* (Polychaeta). These worms may be responsible for diversity loss in the soft bottom communities. The effects of invaders in estuaries are generally expressed at local level and are more difficult for evaluation than in lakes.

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NAROCHANSKIJE LAKES FROM THE WINGERG'S TIME UP TO NOW

A.P. Ostapenja

MECHANISMS OF THERMAL ADAPTATIONS IN POIKILOTHERMAL AQUATIC ANIMALS

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The number, distribution and biodiversity of species limited considerably by both habitat temperatures and thermal adaptations. The adaptations to low temperatures associated with biological antifreezes, dehydration, aminoacid substitutions resulted in increasing of the protein flexibility, the homeostasis of membrane lipid viscosity, temperature compensation of the respiration rate. Adaptations to high temperatures associated with induction of heat shock proteins, aminoacid substitutions, polyamine synthesis.

Basic mechanism of metabolic thermal adaptations associated with genotypic changes of enzyme structure and functions. These changes on embryos of various fish species were analyzed. The minimum of K_m values for lactate dehydrogenase (LDH) from fish embryos correlated with the optimal temperatures of development in natural environment. For the embryos developing at cold habitat (rainbow trout, Atlantic salmon, autumn cisco, Siberian cisco) the K_m values shows a minimum at 5-8^{0}C, whereas for the for species preferring warm habitats (carp, gold fish, zebrafish) this minimum is at 25-28^{0}C. LDH from embryos developing at low temperatures shows lower E_a and thermal stability, than those embryos of other species. On the other hand acclimation of fish *Misgurnus fossilis* to low and high temperatures gives rise to phenotypic changes in properties of LDH from muscles: the position of K_m minimum, thermal and urea-induced inactivation.

BIOLOGICAL DIVERSITY AND ECOLOGICAL STATE OF KARSTIK LAKES IN THE MIDDLE VOLGA REGION

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The ecological investigations carried out from 1984 to 2004 years in the 70-karstik lakes in the Middle Volga Region. The species richness was determined.

712 species and forms of phytoplankton from 8 departments with prevalence of green (41 %, 28 families) and diatoms (23 %, 18 families) algae were determined. The number of species and forms changed from 4 to 214. The cosmopolites, true – planktonic, indifferent to salinity (37,4 %) and acidity (62 %) species prevailed. 164 species of zooplankton revealed (*Rotatoria* - 39 %, 15 families; *Cladocera* - 40 %, 10 families; *Copepoda* - 21 %, 4 families). In the littoral and profoundal zones 393 species and forms of zoobentos revealed (3 - *Turbellaria*, 1-*Nematoda*, 37 - *Oligochaeta*, 12 - *Hirudinea*, 3 - *Crustacea*, 8 - *Arachnida*, 262 - *Insecta*, 46 - *Gastropoda*, 19 - *Bivalvia*). 18 species of fish from 5 families identified in these lakes, the number of species changed from 1 up to 10.

There are a lot of mezotrophic karstik lakes owing to their significant depths. The oligotrophic lakes exist not so mach, eutrophic and hipertrophic lakes exist also. The ecological lakes state depends from complex of parameters and character of anthropogenic influence.

SEASONAL DYNAMICS OF HYDROID INTERTIDAL FAUNA FROM EAST MURMAN

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Intertidal fauna of hydroids (*Cnidaria*, *Medusozoa*, *Hydroidea*) was studied in 1996 - 2003 in the biostation of Murmansk Marine Biological Institute in Dalnie Zelentsy (Barents Sea, Kola peninsula coast, East Murman). The area under investigation is ice free in winter and the maximum difference of water level between high and low tides is up to 4,6 m.

Sixty nine species, half of hydroids list species from the Barents Sea were found in the study region, twenty two of them occur in the intertidal zone with evident zonal distribution. Seasonal dynamics of species composition depend on seasonal environmental changes, mainly on water temperature. Species composition of hydroids in winter is reduced to 9 species. «Dislocation» trend of hydroids into lower littoral and sub-littoral is observed. Some species keep to non-freezing tidal pools, but *Dynamena pumila* and *Symplectoscyphus tricuspidatus* manage to survive when frozen in ice for a short time. Colonies of most species overwinter in the form of unidentifiable hydrorhiza and they restore completely in summer. Rise of water temperature is a trigger event which gives start to growth and restoration of the colonies.

The peculiarities of hydroid life-cycles and their adaptation to living condition in the tide zone are discussed.

TROPHIC CLASSIFICATION AND WATER QUALITY ESTIMATING

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To become a tool of optimal management by water resources, lake water quality (WQ) should be expressed in quantitatively measurable units. The procedure of quantification should include establishment of the following relationships: 1. Between ecological value of WQ Index (e. g., chlorophyll concentration) and some numerical number ("Rating", 0<R<100); 2. Between ecological value and Management Measure (MM, e. g., nutrient load); 3. Direct relationship between WQ (as "Rating") and MM. Different aspects of the quantification procedure are considered for the trophic classification system and water quality system established for Lake Kinneret (Israel) using DELPHI method.

MICROHETEROTROPHIC PLANKTON IN THE KRYVOE LAKE

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The structure of bacterial and uncoloured nanoflagellates communities were studied in the nothern lake Kryvoe during three seasons of vegetation. A total bacterial number was minimum at the beginning of the season – near 0,2 ml cells/ml and maximum was in the middle of summer – about 1 ml cells/ml in some layers. The biovolume of bacterial cell was various in the different seasons. Therefore the biomass of microflora was fluctuated from 12 to 155 mg/m^3.

Comparing the bacterioplankton structure within 1968-1969 (Zharova, Kuzmiczkaja, 1975) have shown only qualitative changes.

The development of nanoflagellates was also different in the investigated seasons. Their number was 400-900 in 2002 and 2300-7000 thouthand/ml in 2003-04. The biomass corresponds to 12-380 mg/m^3 for three seasons. Such high concetration of flagellates causes the strained relation into microheterotrophic community and decreases the bacterial population. Correlation between bacterial and nanoflagellates biomasses is differ of such parameter in the more southen basin (Kopylov, Krylova,1993).

THE BALANCE OF ORGANIC MATTER IN THE KRIVOYE LAKE

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The oligotrophic northern Krivoye Lake was investigated in 2002—2004. Primary production (A) was determined by the radiocarbon method and destruction of organic matter (D) by oxygen uptake by the plankton community. The photosynthesis rate varied from 83 to 330 mg C m^{-2} day^{-1}, with a maximum in the first half of June, and a minimum in the first half of August.

The greatest amount of organic matter (OM) was decomposed in the beginning of the season, 600 mg C m^{-2} day^{-1} and almost three times less in other periods.

In the layer of active photosynthesis (0—5 m) the production exceeded the destruction in the beginning of the season, in the second half of July and in the end of the summer. In other periods A/D ratio in this layer was about 0.5. The balance of OM under average 1 m^2 was negative: A/D ratio was changing within the limits of 0.3—0.7. Autochthonous organic synthesis in the Krivoye Lake has increased two-fold in last 30 years, destruction of OM by plankton, 2.3-fold. The balance of organic matter in the Krivoye Lake has remained practically negative. Primary production has currently increased, but heterotrophic organisms are able to utilize it. Therefore, this ecosystem keeps stable.

PARTICULARITIES OF FEEDING JUVENILE AND ADULT RED KING CRABS (*PARALITHODES CAMTSCHATICUS*) IN THE COMMUNITY OF LAMINARIA ALGAE

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Feeding interaction of juveniles and adults king crabs with the community of laminaria algae were investigated. The material was collected in August 2003-2004 by divers from depth 2-30 m in Dalnezelenetskaya bay (Barents sea, Kola peninsula). Width of carapax (CW) of juvenile crabs was 10-70 mm, of adults - 120-182 mm CW.

High resemblance of the food spectrum of juvenile and adult crabs was determined. In crabs stomachs simultaneously were found 1-12 benthos invertebrates species (at average 6-8), which are typical for the laminaria algae community.

The most important food of the adult crabs is bivalves (frequency of occurrence 82%), gastropods (68%), echinoids (55%), asteroids (50%), ophiuroids (42%), polychaetes (34%) and crustaceans (44%). The base of the diet of the juvenile crabs consists of bivalves (74%), gastropods (50%), ophiuroids (45%) and crustaceans (40%). Echinoids and asteroids were not a prey of the juvenile crabs. Feeding analysis has shown that crabs prefer some benthos invertebrates species, which has high abundance (mollusks *Mytilus edulis*, *Margarites helicinus*, ophiuroid *Ophiopholis aculeata*) or high biomass (echinoid *Strongylocentrotus droebachiensis*, asteroid *Asterias rubens*). Reconstruction of the biomass of the some crab's preys has shown that crabs can cause significant damage to benthos community.

PRODUCTION DYNAMICS OF *EPISCHURA BAICALENSIS* SARS (CALANOIDA, COPEPODA) AS THE FACTOR REGULATING PHOSPHORUS CYCLE IN LAKE BAIKAL

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Endemic species epischura products about 80% of zooplankton production in the pelagial of Baikal. Its annual production and the phosphorus flows to the deep layers with dead organisms during 1946-2004 have been estimated.

Samples have been taken once in 7-10 days in the 0-250 m layer with Judey's net.

Production has been calculated by average for 10 years P/B coefficient. For the calculation of phosphorus carrying out from photosynthesis zone the next ratios are used: phosphorus content in the raw weigth is 0,0025 mg mg^{-1}. The speed of dead epischura submerge is 105 m day^{-1}.

Dead epischura carries out phosphorus from the photosynthesis zone: in the years of maximal production – up to 0,7, in the years of depression – up to 0,15 g $m^{-2}year^{-1}$.

Annually from the deep layers about 0,223 g of phosphorus is carried out to the upper layer, from the external sources being not more than 0,042 g m^{-2}. In the years with the high production and high biomass of dead epischura, in the photosynthesis zone during 1,5-2 months due to the carrying out phosphorus by epischura the concentration of mineral phosphorus decreases from 7,5-8,0 to 2,5-2,0 mg m^{-3}.

Variability of epischura production is the main regulator of phosphorus content in the photosynthesis zone in lake Baikal.

ANNUAL FLUCTUATIONS OF ZOOPLANKTON OF THE SOUTH BAIKAL

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The analysis of annual fluctuation of zooplankton of the South Baikal pelagic part for a layer of 0-50 m during the period 1981-2003 is done. Average annual values of number and biomass of the dominant species endemic *Epischura baicalensis* Sars (Copepoda, Calanoida) and *Cyclops kolensis* Lill. (Copepoda, Cyclopoida) are resulted. Dynamics of Rotifera and Cladocera number for the same period is considered. The following conclusions are done: number of *E. baicalensis*, Cladocera and Rotifera remains enough stable unlike number of *C. kolensis* which has tendency to increase. Character of annual variability of dominating and mass species of zooplankton - *E. baicalensis* and *C.kolensis* is distinguished. Total number of zooplankton in South Baikal fluctuate around many years average values and essentially does not vary. Positive dependence of number of zooplankton from temperature of water in a layer of 0-50 m for 1981-2003 is established.

INTRAPOPULATIONAL VARIABILITY OF CLADOCERANS (*DAPHNIIFORMES*) IN LAKE BAIKAL

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In Baikal, cladocerans play an important role in the zooplankton of bays and coastal shallows. Populations of *D. galeata* and *D. hyalina* are characterized by high variability of different features, including sizes and age structure, morphological properties (local variability related to the influence of abiotic factors, and response to predation), life history and other adaptive strategies. Daphnia are subjected to predation in bays, where we observe strong defensive structures, decrease of body length, growth of fertility and sizes of the brood. Such variability of adaptive traits can be attained only in terms of sufficient food supply. The populations inhabiting the bay gate have a much longer tail spine, which might be a direct response to the action of turbulent water flows. Daphnia collected in the open parts of Middle Baikal have such adaptive variations typical for cold environments with food deficiency as growth of the body sizes and fertility. We observed no signs of defensive structures or fertility growth in the presence of predators.

Similar changes were registered in *Bosmina longirostris* population, more adapted to low temperatures: development of defensive structures and different body size variations in the bays. However, fertility variations were seen in this species more often than in daphnia.

THE IMPACT OF PHOTOPERIOD ON THE GROWTH OF STRESSED RAINBOW TROUT (*SALMO GAIRDNERI* RICHARDSON) FRY.

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Considering possible reasons of rainbow trout fry infection by infusorians *Tetrahymena pyriformis*, we suspected that infusorians could penetrate only fry weakened by stress. The most obvious stressing factor was the temperature: the mean daily temperature at Spring fluctuated from 20 to 22°C, although the optimal temperature was 17-18°C. We suggested that photoperiod could be an additional stressing factor.

To test the influence of photoperiod on the growth of fry we undertook an experiment. Aquariums were exposed to the same conditions except for photoperiod (3, 6 and 9 hours). Temperature in all aquariums ranged from 23 to 24°C.

Experiments revealed that the fry's growth and the variation coefficient (Cv) of fry's weight depended inversely on the length of the light period. Aggressiveness of fry varied directly with the length of the light period. Aggressiveness and weight of fry showed a significant inverse relationship. A direct relationship between Cv and fry biomass was statistically proved. So, we can conclude that photoperiod has an indirect influence on the fry's growth. Length of the light period affects the quantity of aggressive interactions, which directly inhibits the fry's growth.

BODY MASS DYNAMICS: CONCEPT, METHODOLOGY, AND SOME RESULTS

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The concept of body mass dynamics lies at the intersection of life history theory and production hydrobiology, but its potential has remained largely untapped due to a lack of analytical methodology. We propose a method, called contribution analysis, which enables us to decompose changes in body mass into contributions, each of which being associated with changes in a single trait. The traits involved are individual egg mass, clutch size (number of eggs per brood) and standard somatic mass (somatic mass adjusted to body length). The method is applied to study body mass dynamics in *Daphnia galeata*. We found that when recovering from a poor-resource environment just above the threshold food concentration, *Daphnia* primarily increase their standard somatic mass, that is, restore body condition. When the trophic environment improves further but remains below the incipient limiting level, resources are invested equally to enhance body condition and reproduction in terms of clutch size, but relatively little goes to individual egg mass. Finally, when food is no longer a limiting factor, almost all resources are committed to increase clutch size. We interpret the observed shift in resource allocation priorities as a mechanism enabling an adult female to survive under poor trophic conditions and to produce more offspring under favourable conditions.

EFFECTS OF SUPERFICIAL-ACTIVE SUBSTANCES ON SUBMICROSCOPIC ORGANIZATION OF UNICELLULAR PLANCTONIC ALGAE

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The revealing destructive changes of submicroscopic organization of alga cells, especially in the samples from polluted parts, rather frequently appear as a result of anthropogenic pollution of the reservoirs. Superficial-active substances (SAS) due to their wide spectrum and intensive use in the life and industry represent a special danger. The last essentially influence on functional indices (Parshikova et al., 1994) and also on ultrastructure of alga cells (Popova et al., 2004).

For estimation influence of stressful factors on water systems, the model experiments with unicellular planktonic algae are used. The relationship of ultrastructural reorganization and functional state of the *Chlamydomonas reinhardtii* Dangr. cells were investigated under influence of anion- and cation-active substances (laurilsulfate and catamine, Sigma) during various times. The different concentrations (0,1-10,0 mkg/l of SAS) were tested. Considerable vacuolation, gradual dechromatization of nuclei, reorganizations of mitochondria structure and also destructive changes of cellular membranes, including the thylakoids, were revealed. Definite dose-dependent reorganizations of organelle ultrastructure and some functional parameters (photosynthetic activity, the chlorophyll contents) are established, and a degree of their display coordinates with duration of cell contact with SAS.

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PRODUCTION OF CHIRONOMID IN LOWER MONTANE RIVER CONDITION

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The stationary studies since March 2004 to April 2005 are carried on the large river of Middle Ural (Tchusovaya River). The received data allowed to determine efficacious temperature sum which necessary for development of one generation and to value production of dominating species. For account of chironomid production we use the summation of daily growth method (Konstantinov, 1967; Konstantinov, Netchvalenko, 1968).

Average chironomid abundance and biomass of study period reached 2583 ind./m^2 and 1.74 g/m^2 expediently. In this time the development of *Microtendipes* gr. *pedellus* and *Thienemannimyia* gr. *lentiginosa* has been provided 47.8% of number and 62.1% of biomass. Efficacious temperature sum composed 620 degree x day for *M.* gr. *pedellus* and 625 degree x day for *Th.* gr. *lentiginosa* that are only little more than data of others authors (Sokolova, 1980; Balushkina, 1987). Critical temperature ($t°_0$) for *M.* gr. *pedellus* was equal 9°C (Sokolova, 1980) and $t°_0$ for *Th.* gr. *lentiginosa* – 5°C (Balushkina, 1987).

The annual production of *M.* gr. *pedellus* was equal 7.65 g/m^2, ratio P/B (production/biomass) was 9.56. The annual production of *Th.* gr. *lentiginosa* was equal 3.74 g/m^2, ratio P/B composed 7.79. Specific production accounted by formula of E.V. Balushkina (1987) $C_w=0.069 \cdot W^{-0.367}$ where W is average individual mass in population. Value of C_w of *M.* gr. *pedellus* for vegetation period composed 0.072, C_w of *Th.* gr. *lentiginosa* was 0.082.

SPECIFIC RELATIONSHIPS BETWEEN BACTERIA AND ZOOPLANKTON DURING WINTER AND SPRING PERIODS

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The significant role of bacteria in the energy and matter flow in reservoirs and the need for all-round study of such links in the trophic chain as bacterio- and zooplankton is beyond any doubt. The functioning of plankton communities during low temperature seasons is the least studied topic. The data obtained in the upper part of Kanev reservoir during November 2001 – May 2002 period support the existence of relationship between the level of mezoplankton development and habitat temperature. Temperature decrease leads to fading of its vegetation in November; when the water warms to 5-6^{0}C in March, the abundance of invertebrate plankton is significantly increased. The bacterial plankton content has not changed much and has been quite high during the period of study, though its reproductive activity has dramatically decreased when the temperature at the end of the fall and during spring flood-time periods. There was a tight positive correlation between zoo- and bacterial plankton content, which was determined by similarity of their biological cycles, rather than trophic relationships. This can be proven by the low values of bacterial plankton consumption, whereas its supply was many times higher than invertebrate's food requirements. The positive correlation between bacterial plankton and organic matter content, i.e. the existence of upward regulation, as well as its low consumption, i.e. the decrease of downward regulation, provide the evidence for the shift of bacterial plankton role towards recycling of biogenic elements during winter period.

PRIMARY PRODUCTION OF PHYTOPLANKTON AT MOUTH OF THE CHUPA BAY

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Now the attention of many experts is attracted to studying of structurally and functional characteristics of communities in a complex with abiotic conditions of environment. The purpose of this research was studying influence of hydrological conditions on primary production of phytoplankton at mouth of the Chupa Bay.

The material was collected at station D-1 at mouth of the Chupa Bay in 2002-2004. Primary production was determined during the summer and autumn in a surface layer by oxygen method. In 2004 simultaneously with oxygen, the C^{14} method of primary production assessment was used. Simultaneously with estimation of primary production, measurements of temperature and salinity of water were made, and also meteorological conditions were recorded.

The researches have shown, that the form of the response function of primary production on abiotic conditions of environment is defined basically by light and temperature of water. On the basis of the received data the three-dimensional model of dependence of primary production on these two factors was constructed.

Results of parallel measurements of the primary production made by oxygen and radiocarbon methods in 2004, differed 2-fold (61.8 and 29.1 mgC/m^3 per day accordingly), probably due to loss of C^{14} in dissolved assimilators and destruction of a part of vegetative cells at a filtration. To avoid losses of radioactive carbon it is recommended to enter correction coefficient 1.43, but as a whole these losses can cause underestimates of primary production determined with the help of a radiocarbon method by 30-50 %.

Thus, it is possible to conclude, that oxygen and radiocarbon methods of definition of primary production give similar results and can be used with success in researches of production of phytoplankton in the White Sea.

DIPTERA IN THE SHALLOW WATER ZONE OF LAKES IN NORTHWESTERN RUSSIA: STRUCTURE OF COMMUNITIES, ABUNDANCE, LIFE CYCLES AND LATITUDINAL TENDENCIES

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Dipteran communities were studied in 1996-2001 in three groups of small freshwater lakes situated at latitudes from the Polar Circle to 55є North. Within each lake, littoral and water margin zones were investigated. The study first combined quantitative assessment (numbers and biomasses) of immatures of all families, and reliable identification of these based on mass rearing to adults using three methods.

Faunal composition in 10 lakes was 245 species in 30 families (excepting Chironomidae). Species' habitat and depth distribution, seasonal dynamics and voltinism were studied.

The percentage of non-chironomid dipterans in total biomass of littoral macroinvertebrates was 0.5-6% (0.05-4 g/m^2), depending on habitat and latitude. Vegetation and bottom sediments are main complex factors that determine composition and abundance of Diptera in littoral zone. In littoral communities, Diptera are represented mainly by insectivorous predators, detritivores and phytophages of emergent macrophytes. Trophic links between lake dipterans and their parasitoids were described and analyzed.

Seasonal emergence patterns were ascertained for 68 species of 16 families. In northern lakes, most of common species are uni- or semivoltine, whereas to the south, many species tend to be bi- or polyvoltine. Latitudinal tendencies in community structure, abundance, taxonomic composition and life histories of lake Diptera are first revealed.

LONG-TERM CHANGES IN PHYTOPLANKTON PRIMARY PRODUCTION IN THE RYBINSK RESERVOIR CAUSED BY EFFECT OF CLIMATIC FACTORS

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The primary production in water-bodies was one of the most important issue in G.G. Winberg's studies. In elaboration of this field of studies the factors of photosynthesizing activity of phytoplankton have been carried out at the Institute for Biology of Inland Waters RAS for many years. This work examines long-term changes in phytoplankton primary production and hydrometeorological conditions in the Rybinsk reservoir - a large shallow water-body of the lake type - during the half-centure period (1958, 1969-1995, 2004). Primary production was estimated by means of a mathematical semi-empirical model of underwater photosynthesis according to the data on chlorophyll «a» content in the reservoir, incident solar radiation (total spectrum), temperature, and transparency of water for every day of the ice-free period. The periodicity close to the 11-year cycles of solar activity (the Wolf "s numbers) was documented in the variability of primary production annual values. Quasi-cyclic variations with the period of 7-10-years were also established in the dynamics of chlorophyll content, solar radiation, water temperature, and transparency, water year. The conjugacy of these variations was found that can evidence the general mechanism of their origin connected with solar flare activity.

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SEDIMENT ENRICHMENT WITH PHYTAL MATERIAL *VERSUS* SPATIAL AND TEMPORAL DYNAMICS OF MEIOBENTHIC COMMUNITIES IN A EUTROPHIC BALTIC COASTAL LAGOON

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Phytoplankton blooms are commonplace in shallow coastal water bodies (lakes and lagoons) of the Baltic Sea. As the remains of the bloom sink to the bottom, the sediment receives a supply of organic material of phytal origin. According to one scenario, this supply may periodically alter sediment properties by a pulse-like influx of organic matter and elicit a direct (immediate or time-lagged) response from benthic biota as a result of increased food supply. Another scenario holds the sinking phytal matter to be a quasi-permanent source of organic material supply to the sediment and to provide a predictable backdrop for benthic communities dynamics to be shaped by other factors. To find out which scenario seems more plausible with respect to benthic biota of the Szczecin Lagoon, a strongly eutrophic part of the River Odra estuarine system interacting with the southern Baltic, changes in the abundance of meiobenthos as well as variations in the sediment properties (plant pigment, silt-clay fraction, and organic matter content) were followed from May to October 2002 at 4 relatively deep, muddy bottom sites in the Lagoon. Variations in the sediment properties and meiobenthos were viewed in relation to the advancement of the phytoplankton bloom, as revealed by changes in the water column chlorophyll *a* content. Although the bloom conditions extended almost throughout the period of observations (until September), the heaviest bloom prevailed over May-July. We observed pronounced site-specific effects in phytal material sedimentation, most probably related to the Lagoon's hydrodynamics. The dynamics of meiobenthos abundance was highly site-specific as well, without showing a readily discernible response to changes in sedimentation of phytodetritus.

THE OPTIMIZATION OF SETTLEMENT AND RECRUITMENT OF INVERTEBRATES BY BENTHIC COMMUNITIES

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Benthic communities inhabiting the near-bottom layer influence significantly on its physical (and chemical) structure. Our studies showed that thickets of the brown alga *Laminaria saccharina* decreased natural turbulent pulsations in the near-bottom layer. The effect of *L. saccharina* stimulated the settlement and recruitment of the polychaetes *Spirorbis spirorbis, Circeis spirillum* and the bryozoan *Electra pilosa* on experimental artificial substrates. The blue mussel banks, on the contrary, enhanced natural turbulent pulsations in the near-bottom layer. The enhancement of the turbulence stimulated the settlement and recruitment of mussels *Mytilus edulis* and *Hiatella arctica*. Experiments made with the use of hydrodynamic grids confirmed the above-mentioned findings. The analysis of data obtained permits to consider that benthic communities influence selectively on settlement and recruitment of different benthic species and thus optimize conditions for the colonization by them of hard substrates.

BIOMONITORING OF THE AQUATIC ENVIRONMENT AND A PROPOSAL FOR "ECOLOGICAL MONITORING"

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This paper aims to compare the advantages and drawbacks of the most commonly used biomonitoring methods: indicator organisms, biotic indices, biodiversity and similarity indices, saprobic level and accumulator organisms. Since biomonitoring involves only the biota without taking into account the influence of the physical environment, its usefulness is limited to being a "warning signal" of ecosystem changes, without identifying their causes. Identification of the causes and evaluation of their relative importance are the basis for deciding the best way of managing an environment to attain the desired goals of conservation of the environment and the correct use of the water body. The functioning, decline and recovery of an ecosystem is the result of interactions among the physical, chemical and biological compartments; it follows that, to be useful, monitoring cannot be limited to one compartment such as biomonitoring. There is therefore a need for "ecological monitoring" which can produce information leading to a knowledge of the actual situation of the environment and which can predict its future evolution. On this basis a management programme for the real environment can be developed. Ecological monitoring takes account of some selected biological, as well as physical and chemical, variables; the watershed can also be taken into consideration, in so far as it is the main source of nutrient substances and toxic pollutants to the water body. Ecological monitoring is not limited by a rigid protocol, and the parameters and processes to be estimated depend on the characteristics of the ecosystem taken into account, and on the goals set for its management. Ecological monitoring is not an academic research, but a useful tool for evaluating the importance of certain relationships leading to correct management.

EFFECTS OF PERIPHYTON DENSITY AND LIGHT REGIME ON PERIPHYTON NUTRIENT CONTENT AND BACTERIAL DYNAMICS

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In laboratory experiments we have manipulated periphyton density by maintaining different levels of current velocity in order to test whether periphyton-associated bacteria respond to changes in supply of nutrients from the ambient water. In addition, algae-bacteria coupling was tested under high and low irradiance.

Despite a strong negative effect of shading on periphyton abundance, total bacterial numbers and production were not significantly different between various light levels. However, carbon-specific bacterial production was significantly higher for low than for high light levels. In addition, shaded periphyton was characterized by a significant higher content of phosphorus (P), resulting in decreased C : P ratio.

At high light, periphyton C : P ratio significantly declined with decreasing periphyton density, indicating an improved supply of P from the ambient water. As a result of this, carbon-specific bacterial production tended to increase with decreasing periphyton density.

At low light, C : P ratio was not related to periphyton density, suggesting that P incorporation by the shaded algae presumably superimposed the effect of periphyton density on the delivery of nutrients from the ambient water. For shaded periphyton we found an extremely weak linkage between algae and bacteria. Thus, our experiments reveal that bacteria have a better availability of nutrients and carbon in the thinner layer of shaded periphyton.

Changes in the linkage between periphytic algae and bacteria, thus, affect internal nutrient and carbon cycling within the periphyton community but also the cycling of nutrients in the ambient water.

THE LONG-TERM SEASONAL DYNAMICS AND SPATIAL DISTRIBUTION OF THE PHYTO- AND BACTERIOPLANKTON COMMUNITIES IN THE AQUATIC AREA OF SEVASTOPOL BAY

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The seasonal dynamics and spatial distribution of the phyto- and bacterioplankton communities from the sites of Sevastopol Bay have been analyzed on the basis of the literature and our own data. When the data have been averaged for the decades (1938-2004), the dependence (r^2=0.68) between the phosphates concentration and the phytoplankton abundance has been revealed. Maximum values of both indices were recorded in the late 70-ies, and the minimum ones – in the late 90-ies of the last century. A reverse correlation (r^2= - 0.79) between the long-term dynamics of the abundance of the phyto- and bacterioplankton communities has been found. From the end of the 70-ies, the increase of the total abundance of bacteria (TAB) from 1 to 2-3 mln.cells/mlillions has been recorded; the value has been stable from 1982 until the present. It may have been partially caused by the water temperature increase, particularly in summer; however, the correlation between the temperature and the TAB was quite low for the whole period (r^2= 0.5).

When the spatial distribution being studied, there was a considerable variability of the quantitative indices of the phyto- and bacterioplankton. Maximum values (as well as the ranges of the fluctuations) have been found in the top parts of the Bay.

The authors relate all the changes occurred in the Bay to both the intensive anthropogenic activity and the long-term fluctuations of the climate.

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EXSUVIUM PRODUCTION AT LARVAE FITOFILIG WATER INSECTS

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Studied exsuvium production at 5 species fitofilig larvae water insects belonging to two groups: *Odonata*, suborder *Anisoptera-Aeshna juncea L., Libellula quadrimaculata (L)., Sympetrum vulgatum L.*, suborder *Zygoptera-Coenagrion hastullatum Charp.; group Ephemeroptera-Cloeon simile Eat.* For the description of dependence of weight of moults from weight личинок used linear function, the share of torn away substance - *(Рэх.)* is appreciated, as the attitude{relation} of crude weight экзувия to crude weight before moult individuals. $P_{эх.} = W_{экз.}/W_{лич.}$ (Xmeleva, Golybev,1984).

At studied kinds, the share exoskeleton in a lump of an individual increases in process larvae a stage онтогенеза. At larvae dragonflies the average value of a share exoskeleton changes within the limits of 13-19 % of weight of an individual, at larvae Ephemeroptera the given parameter makes about 37 %. The equations of regress by definition of weight exsuvium substances are designed depending on population weights of a kind. Reliability of the equations is determined. The received equations can be used for calculations exsuvium production of populations of studied kinds in fitofilig биоценозах litoral zones of fresh-water reservoirs.

THE CAUSES OF CHANGES IN THE CASPIAN SEA ECOSYSTEM AND ITS PRESENT STATE

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The long-term monitoring of abiotic factors of the Caspian Sea ecosystem allowed to distinguish the same changes in its hydrochemical structure which occurred as a result of regulation of all large rivers flowing into the Caspian Sea. The ecosystem changes were similar to those occurred in the Black Sea.

At present, the Caspian ecosystem comes to a new equilibrium state, with the higher concentrations of allochthonic and autochthonic organic matter and higher activity of bacteria, protozoa and saproplankton.

The freshening of the surface layer resulted in a weakening of winter convection effects and a decrease in nutrient flow into the photic layer that lowered the value of a new primary production and flow of matter and energy to the higher trophic layers. The result of these processes is associated with a sharp deterioration of habitat conditions for pelagic fish species. At the same time, there were transfer and accumulation of nutrients in deep waters, where the concentrations of phosphates and nitrates reached the level of the 1930s, and for silicium they exceeded this level. The oxygen concentration dropped to a very low level.

PECULIARITIES OF SENSOR ORGANS OF BAIKAL ENDEMICS – GOLOMYANKAS (COMEPHORIDAE)

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Complex integration of all the analyzer systems causes behavior reactions in fish. The aim of this work is to reveal the role of otolith analyzer ear in the general sensor system of Baikal big and small golomyankas. Golomynkas are pelagic deepwater fish, which have not been seen in schools and they perform vertical feeding migrations. Golomyankas make up a considerable portion of seal and pelagic fish diet.

Data on golomyankas biology correlate with brain macrostructure of mature species. The following organs are well developed: lobi opticus of mesencephalon and medulla oblongata. Cerebellum with well-developed valvulae cerebelli is clearly differentiated. Telencephalon is developed, but not so well as other sections of the brain.

Ear is likely to dominate among other sensor analyzers of golomyankas but vision and olfaction analazers have an additional load. A detailed electron microscopy study on otolith analyzer ear accepting distant sound field was carried out for comparison with the seismosensory system. The ultrastructure of sensory maculi is described in detail: its area, morphological polarization and location density of hair cells.

FOOD WEB STRUCTURE IN A SMALL MACROPHYTE-DOMINATED LAKE AS DEDUCED FROM STABLE CARBON AND NITROGEN ISOTOPES

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Ratios of natural stable isotopes of carbon and nitrogen ($^{13}C/^{12}C$ and $^{15}N/^{14}N$) are potentially useful tools for elucidating food web structure. The approach assumes a stepwise enrichment in the heavier isotope (in the delta notation 0-1 ‰ in carbon and 3-4 ‰ in nitrogen) from one trophic level to the next. We used stable isotopes to disclose important food web linkages in the small and shallow lake Littoistenjärvi (SW Finland), profoundly influenced by cyclic fluctuations of the submerged macrophytes *Elodea canadensis* and *Ceratophyllum demersum*. Isotope signatures were determined in 2002-2004 for the major zooplankton, zoobenthos and fish species, periphyton, macrophytes, particulate organic matter (POM), certain phytoplankton taxa, sediment, and unionid mussels. Food web structure indicated by stable isotopes was far from regular. Late summer cyanobacterial blooms affected both carbon and nitrogen signatures of POM and *Daphnia*. Among benthic animals, *Chironomus* larvae and oligochaetes showed very low carbon signatures, suggesting methanotrophic bacteria as a partial carbon source, while *Asellus* had high signature for carbon and low for nitrogen. Carbon signatures were also low in zooplankton, except in *Daphnia*. In perch, the switch to piscivory at larger size was clearly visible in the nitrogen signature. The enrichment of the heavier isotope from zoobenthos and zooplankton to benthivorous and planktivorous fish (roach, bream and small perch) was much higher (4-6 ‰ in N, 5-10 ‰ in C) than expected, while the enrichment between prey fish and piscivorous fish (0.5 ‰ in C and 1.8 ‰ in N) largely corresponded to expectations. The aberrant zooplanktivore signatures could be explained if *Chaoborus* was an important prey species. The isotope signatures of macrophytes differed clearly between ecological groups. The submerged macrophytes and periphyton were highly enriched with ^{13}C compared to all other food web components, showing that their production was not directly used by consumers.

CHARACTERISTICS OF THE VERTICAL DISTRIBUTION OF SPONGES ON THE STONY LITTORAL OF SOUTHERN BAIKAL

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Sponge distribution investigated in 2001-2004 at Berezovy polygon: 226 diver samples (depths: 1.5-2.0m; 3.0-4.5m; 5.0-8.0m; 10.0-16.0m) were analyzed. Occurrence frequency of 7 species of Lubomirskiidae: *Lubomirskia incrustans, Baikalospongia intermedia, B. martinsoni, B. bacillifera, B. recta, B. fungiformis, Swartschewskia papyracea* and representatives of Spongillidae was calculated. Only 3 species of Lubomirskiidae were encountered at depth less than 3.0m: *L. incrustans, B. intermedia, B. martinsoni* and Spongillidae, dominated by *L. incrustans* (60.0%); subdominated by *B. intermedia* (32.0%). Starting from 3m *S. papyracea* (7.0%) join in, *L. incrustans* (46.0 %) still dominating. Spongillids registered more often here and in company of *B. intermedia* become subdominants (19.5% and 20.4% respestively). Highest species diversity is observed at depths 5-8m, *B. bacillifera* (32.0%) being most common here followed by *L. incrustans* (24.0%). Below 10m one can see *B. bacillifera* (30.2%) and *B. recta* (19.0%) most often; spongillids are absent. Occurrence frequency calculations in all samples revealed that *L. incrustans* (36.0%) and *B. intermedia* (44.0%) are most common; the share of *L. incrustans* gradually decreases with depth. Absolute absence of *L. abietina* and *L. fusifera* at this rocky littoral typical for South Baikal is enigmatic. Such detailed investigation of vertical distribution of littoral sponges in Southern Baikal has been carried out for first time.

THE PHENOTIPIC AND ALLOZYME VARIABILITY OF *DREISSENA POLYMORPHA* POPULATION IN NORTH – EAST AREA

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The peculiarities of phenotypic structure and allozyme variability of *Dreissena polymorpha Pallas* populations in Volgobaltic and Severodvinsc water system were studied. That systems are used as water - transport way. Anthropogenic impact on that system is considerable. Besides this *Dreissena* populations living at north – east margin area. In order to reveal adaptational characteristics of mussel on genetic and phenetic levels the shell colorations was used. The peculiarities of *Dreissena polymorpha* phenotypes in aspects of the shell pattern, melanisation and shell shape are discussed. Five populations of mussel from Volgobaltiic and Severodvinsc water system were investigated. Several population groups with different phenotypic structure were found.

Intrapopulation variability of the meristic characters of *Dreissena* correlated with discreteness of color morph. Morphological adaptations of the mussel reflect specific conditions habitat in different bottom biotopes. Allozyme variability of mussel *Dreissena polymorpha* was investigated by the method of gel electrophoresis. Nine highly polymorphic protein loci were analyzed: phosphoglucoseisomerase (Pgi), Leucine aminopeptidase (Lap), 6-Phosphogluconic dehydrogenase (6 Pgd), aconitase (Aco), esterase F (Fe), two loci isocitrate degydrogenase (Idh), malate degydrogenase (Mdh). At some of the loci, significant differences in genotypic, and allel frequencies were found in the comparison of different samples.

MEIOBENTHOS OF THE METHANE GAS SEEPS IN THE UPPER ANOXIC ZONE (UNDERWATER DNIEPER CANYON, BLACK SEA)

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In 1989, researchers of IBSS discovered the fields with the active free-methane seepages from the Black Sea bottom sediments. The majority of these gas seeps are located in the Dnieper submarine canyon (NW Black Sea) at the edge of continental shelf as well as at the upper seabed slope, in water depths ranging from 60 to 725m. It is most noteworthy, that methane seeps are situated along all three characteristic levels of the hydrochemical stratification: in the oxygen zone, in transitional oxic/anoxic interface and in the deep-water hydrogen sulphide zone.

Multidisciplinary international studies, have been allowed to determine, that the fields of methane seeps in the H_2S zone it is sites of extremely high biological productivity, formed by anaerobic methane-oxidizing bacteria. In view of these data, during the expedition of RV Poseidon (Germany) in October 2004, in the gas-enriched Dnieper canyon were studied the taxonomic structure and quantitative abundance of meiobenthos - possible consumer of organic matter.

The results obtained from the studies of meiobenthos, which inhabit the seabed sediments of the upper anoxic zone (181-295 m depths) under conditions of methane coming from the bottom are discussed. Meiobenthos includes representatives of eight great taxons, *Ciliata*, *Foraminifera*, *Nematoda*, juvenile *Polychaeta*, *Bivalvia*, *Gastropoda*, nauplia of *Copepoda*, *Amphipoda* and juvenile *Cladocera*. *Nematoda* and *Foraminifera* dominate. Density of meiofauna habitats at the studied depths changes within the range 182 - 5458 ind./0.1 m^2. Maximum abundance of meiobenthos was registered at the depths 213 m (4696 ind./0.1 m^2) and 249m (5458 ind./0.1 m^2). Species stratification was revealed in the upper 0-5 cm columns of bottom sediments.

CLIMATE VARIATIONS AND LONG-TERM CHANGES IN ECOSYSTEMS OF THE COASTAL SEA ZONE: LIMITS OF UNDERSTANDING AND PREDICTING

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Presence of the long-term changeability ecosystems connected with climate fluctuations is not denied. At the same time long-term changes in the ecosystems are explained, mainly, by the influence of the different anthropogenic causes.

Changes in the ecosystems of the Black Sea coastal zone are discussed. Quasi-periodical changes of the mollusks in the Kruglaya bay, which occur during the past 15 years, are stipulated, mainly, by the precipitations regime.

Outflow of the terrigenic substance into the coastal waters at the expense of the shore erosion undergoes quasi-periodical fluctuations (data for 30 years), stipulated by the changes in precipitations and winds regimes.

Ecosystems of hypersaline lagoons undergo considerable reconstructions as a result of climate fluctuation.

Possibility of understanding and predicting the ecosystem response to the climate variations is discussed.

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LEVEL OF KNOWLEDGE OF AQUEOUS INVERTEBRATES OF KAZAKHSTAN AS AT BEGINNING OF THE XXI CENTURY

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The fauna of large water bodies of Kazakhstan, such as Kaspian Sea, Aral Sea, Balkhash Lake had been intensively studied in the XX century. As a result of analysis of major publications 266 taxons of animals of 6 types were revealed in the composition of the Caspian plankton, and 635 taxons of 11 types in benthofauna.

Modern hydrofauna of the Aral Sea is depleted. *Artemia sp*. dominates in the hyperhalinous Greater Aral where 2 species of benthons are available. Salinity increase of the Lesser Aral Sea invoked depletion of zooplankton to 16 taxons and 6-9 zoobenthos species. 234 taxons of 4 types in plankton fauna and half of that of bottom species of 3 types are found in the Balkhash Lake. Hydrofauna of Kazakhstan water reservoirs had been described.

Integrating reports per individual groups of aqueous invertebrates are few in number. Those are catalogues of freshwater *Crustacea: Amphipoda, Cladocera, Decapoda - Astacida.* Recently fauna of aqueous beetles such as *Coleoptera, Hydradephaga* had been investigated seriously. Regional lists had been formed, as follows: *Rotifera* of Central, Eastern and South Kazakhstan, *Mollusca* of the Syrdaria river middle and under currents, *Plecoptera* larvae of the Upper Irtysh river basin. Aquatic invertebrates are studied poorly.

ECOLOGICAL ASPECTS OF FE(III) REDUCTION OF MICROORGANIZMS FROM BOTTOM SEDIMENTS

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The influence of abiotic factors on Fe(III) reducing activity of a number of ecologo-trophic groups of microorganisms from different types of silts of Samarskaya Luka lakes was studied. Dependence of the degree of Fe(III) reducing activity of 24 environment factors and there specific influence was demonstrated.

The amount of Fe(II) in different enrichments varied from 2,0 мМ to 18,5 мМ.

In the peaty silts in iron reduction dominanced ammonifying microorganisms. The influence of N_{min} on their Fe(III) reducing activity was appreciated in 93,4%.

The concentration of Fe(II), reducing by butyric-acid microorganisms, decrease in the peaty silts; in the detritus and clay silts it increased with depths (74,6%).

Negative influence rH_2 (28,4 %) and depths (65,7 %) on Fe(III) reducing activity of methylotrophs was revealed.

Methanotrophs and H_2-oxidizing microorganisms most actively reduced iron in the silts of humic lakes: influence color of water was appreciated in 41-50%. For methanotrophs another essential factor was temperature (38,6%), for H_2-oxidizing microorganisms – shallow water (26,4%).

For citrate-, lactate-, acetate-, H_2-oxidizing and methanotrophs from diatomaceous, peaty, detritus and clay silts negative correlation ($r = - 0,69$) between the production of iron and the concentration of bicarbonate in sediments was established.

MODERN STATE OF MICROBIAL COMMUNITIES OF BAIKAL IN THE AREA OF 40-YEAR'S ACTIVITY OF BAIKALSK PULP AND PAPER PLANT

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The necessity of ecology-microbiologic and sanitary - bacteriological analysis of the modern situation which has been usual in the in water column near BPPP is connected with its conversion on the closed cycle by 2006.

On the basis of perennial sanitary - microbiological inspection of littoral waters of Southern Baikal in a summer period it has been shown, that contamination of waters in area of sewage disposal of BPPP on a coli-index, saprophytic microorganisms and total amount of microorganisms in 1990-2004 remained of the same level from the 1967. The total number of microorganisms in area of sewage disposal exceeds number of microorganisms in background areas at 3 times. During the number of years the borders of changes of total number in the area of waste water of BPPP were practically constant, that testifies to monotony of anthropogenic effects and abiotic conditions for an ecosystem of Baikal. In distribution of saprophytic bacteria the stable regularity is marked during all years of researches: first, their microzonal distribution with a maximum up to 1000 CFU/ml, secondly, the number of them is 10 time more in the area of sewage disposal, than in the background areas.

Summarizing, it is possible to predict stability of an ecological situation in Baikal in water area of activity of BPPP after it conversion on the closed cycle.

ANNUAL FLUCTUATIONS IN THE NUMBER OF CELLS OF PLANKTONIC ENDEMIC BACILLARIOPHYTA IN SOUTH BAIKAL

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Annual fluctuations in the cells number of *Aulacoseira baicalensis*, *A. skwortzowii*, *Stephanodiscus meyerii* has been examined during 1951-2001. Samples have been taken once in 7-10 days from the depths of 0, 5, 10, 25, 50 m.

Annual average values and their logarithms have been calculated. *Lg* values exceeding the limits m±δ (m – mean logarithm value, δ – standard deviation) have been considered to be the peak or depression.

A. baicalensis had 10 peaks with intervals 3, 2, 2, 3, 2, 2, 7, 11, 2 years (m=3,78±1,05) and 8 depressions with intervals 24, 3, 5, 1, 3, 5, 1 year (m=6,0±3,06). The tendency of number decrease has been noticed. Average annual values for 1951-1975 is significantly exceeds the once for 1976-2001.

A. skwortzowii had 9 peaks with intervals 3, 6, 3, 7, 2, 10, 6, 2 years (m=4,87±1,0) and 8 depressions with intervals 6, 3, 2, 7, 5, 4, 5 years (m=4,57±0,65).

S. meyerii had 8 peaks with intervals 2, 3, 2, 2, 1, 3, 14 years (m=3,86±1,71) and 8 depressions with intervals 6, 6, 10, 3, 3, 2, 4 years (m=4,86±1,03).

Correlation between species is absent. R^2 for *A. baicalensis–A. skwortzowii* is 0,05; for *A. baicalensis – S. meyerii* is 0,02; *A. skwortzowii–S. meyerii* is 0,11. The absence of mutual factor of environment, determining their dynamics may be assumed.

FUNCTIONAL BASIS OF BIODIVERSITY AND BIOLOGICAL PROGRESS IN AQUATIC ANIMALS

G.E. Shulman

LONG-TERM OBSERVATIONS OF DYNAMICS OF SPECIES AND TROPHIC STRUCTURES COMMUNITIES OF ZOOPLANKTON OF CHEBOKSARSKOE RESERVOIR

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The dynamics of species and trophic communitiy structures of zooplankton in Cheboksarskoe reservoir were the results of the limnobiotic seral processes. On the basis of the multidimensional vector-like analysis space of the number species the long-term data on population of zooplankton species on water body of the Cheboksarskoe water resevoir area separate zooplankton communities are revealed, and also their spatial distribution obtained. On basis of analysis aquatic ecology behavior of dominant species the sorts of main zooplankton communities were explored. The differences of species structure the sorts of main communities were studied by determining the discriminated species. It was shown that right band river's zooplankton community was the aquatic flow's community. But left band river's and lake's part zooplankton communities were limnobiotic. The transitional zooplankton community combined the patterns of water flow and limnobiotic communities.

The velocities of changes in structures of zooplankton communities Cheboksarskoe reservoir's as the vector at the multidimensional vector-like space of the number species determined. The stabilize in the line of the velocities of structural adjustments was manifested. The maximal stability in the line of the velocities of structural adjustments was detected in the lake part zooplankton community. Accompanied similar intense reconstruction the trophic structure, particularly within first ten years of Cheboksarskoe water resevoir took place. The considerable trophic structural change obtained along left band river zooplankton community, through the quantitative system parameters were stable. On the contrary in the transitional zooplankton community trophic structure was stable while the quantitative system parameters were growing.

FISH POPULATION OF WATER BODIES IN PAANAJARVI NATIONAL PARK (KARELIA, RUSSIA)

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A great aesthetic value, a variety of undisturbed water and terrestrial ecosystems and a large number of rare animal and plant species have provided a basis for establishing Paanajarvi National Park in North Karelia (tundra zone) in 1992. The park covers an area of 103.3 thousand hectares. Ichthyological studies have shown that postglacial Arctic fishes have survived in the numerous lakes, lambas and creeks of the park that have clean, transparent water. The water bodies of the park are inhabited by the Arctic char *Salvelinus alpinus L.*, including its dwarf form. The lake trout *Salmo trutta m. lacustris L.* feeds and grows successfully not only in large lakes, but also in small water bodies that have an area of not more than 1 ha. Lake trout juveniles in the water bodies are often as abundant as 1 ind./m^2. A large form of the whitefish *Coregonus lavaretus pidschian (G.)* has been reported from mant lakes. The ichthyofauna of the park consists of about 15 species. Hopefully, a strict licensed fishing regime established in the water bodies of the park will help preserve valuable fish species in this territory.

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SEASONAL DYNAMICS PIGMENTS OF THE PHYTOPLANCTON AND RELATIONSHIPS CHLOROPHYLL "A" WITH ENVIRONMENTAL FACTORS IN THE LAKE NERO

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Pigments of the phytoplankton in Lake Nero were studied as the important indicators of ecosystem productivity in 2000-2004 years. In general, seasonal variations of Chl "a" concentration consisted of a gradual spring increase which reached maximum in summer and in autumn. Average content of Chl "a" for the vegetative period in 2002-2004 ranged from 36.7 to 55.6 μg /l. Low concentrations of Chl "a" were detected in summer 2002. In summer 2000 the quantity of Chl "a" reached up to 180 μg /l.

Highly negative correlation between water transparency and Chl "a" concentration for different years was described. The dependence of seasonal dynamics of Chl "a" on the concentrations of inorganic nitrogen, phosphate and water temperature was observed in several seasons of a year. It was established that contents of pheopigments (chlorophyll derivatives) increase during periods of the greatest abundance of zooplankton. The contents of Chl "b", Chl "c", carotenoids, pheopigments, pigment ratio (E480/E664) in lake changed in correlation with Chl "a". The use of other pigment characteristics along with Chl "a" as indicators of trophic status of the reservoir will be discussed.

REVIEW OF PLANT PIGMENTS INVESTIGATIONS IN THE UPPER VOLGA BASIN

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Study of plant pigments in Russian aquatic ecology has been started by G.G. Vinberg who proved an opportunity and necessity of application chlorophyll content as a parameter of phytoplankton productivity as well as waterbody trophic state and eutrophication processes. The guidelines received its further development in ecology of inland waters. Traditional spectrophotometric technique is one of the basic methods in researches of the Upper Volga basin. Plant pigments are considered as indicators of ecosystem structure and functioning. Data on pigments content in water and bottom sediments are of great importance. Relationship of pigment characteristics with biotic and abiotic factors is quite urgent. Study of pigment distribution in ecosystem elements and long-term observations is important too. Peculiarities of lakes and reservoirs can be revealed according to horizontal distribution and stratigraphy of pigments in bottom sediments of different age. Content of carotenoid pigments in zooplankton is appreciated. Plant pigments can be used as parameters of water masses differentation and transformation. Plant pigments remain the most accessible indicators of algocenoses primary production and ecological state of the basins. Therefore, it is necessary to develop the modern methodical approaches of pigment analyses and introduce the new methods, the most perfect and improved.

ON THE DISTRIBUTION AND ECOLOGY OF THE DECAPOD CRUSTACEANS (CRUSTACEA, DECAPODA) IN THE DROZDOVKA INLET OF THE BARENTS SEA

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The 14 species of Decapoda were collected at depth from 0 to 30 m during scuba investigation of Drozdovka Inlet in 2003-2004. *Paralithodes camtschaticus* and *Eualus gaimardi* were the most numerous species in the area investigated. Glaucothoe of the *P. camtschaticus* successfully settle on the algal thaloms in parts of inlets relatively protected from the wave action. Juveniles crab of 0+ year group inhabit on the thaloms of Desmarestia aculeata, druses of mussels, and in cavities under stones. Crabs at age 1-2 years reached high population density in the middle part of inlets on the hard ground in the kelp of Laminaria spp., and in biocenosises of Lithotamnion and Modiolus along the coast with a moderate wave activity.

In autumn *E. gaimardi* and *Spirontocaris phippsi* inhabited on thaloms D. aculeata in the parts of inlets with low wave activity at depth from 4 to 30 m. In early summer these shrimps were observed more deeply in different biocenosises. *Lebbeus polaris* was found everywhere on the hard ground in the kelp of red algae and Lithotamnion sp. The hermit-crabs *Pagurus pubescens* and *P. bernhardus* occupied different biocenosises. *P. bernhardus* lived on sandy bottom dipper the kelp of Laminaria spp. On the contrary *P. pubescens* usually found on hard grounds or on mud bottom algae kelps include. Thus, distribution, specific and size-sexual structure of decapod crustaceans in the inlet depend on a season, depth, ground and wave activity.

OXYGEN STATUS OF SKELETAL MUSCLES IN MARINE FISHES DURING AN ANNUAL CYCLE

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Capillary density, oxygen tension distribution in skeletal muscles and oxygen transport characteristics of blood were investigated in three species of the Black Sea fishes (*Liza aurata* R., *Neogobius melanostomus* P., *Platichthys flesus luscus* P.) during annual cycle.

It was shown that utilisation and oxygen diffusion in fish skeletal muscles within one year depended from capillary density, lipid and water content in tissue. The degree of tissue capillarization positively correlated with sea water temperature and affected oxygen status skeletal muscles in fact. Lipid and water level in muscles were determined of fish functional state: fattening, spawning, migration, wintering. The content of these compounds can strengthen or to decrease temperature dependence of diffusive properties of skeletal muscles as a whole.

It was revealed that anaerobic processes increased periodically in fish muscles during an annual cycle. This state was connected with prespawning period and was due to decrease of hemoglobin concentration and rise of methemoglobin level in blood. The anemia and methemoglobinemia of prespawning state were related to irregularity of functioning of hemopoietic tissue. Active erythropoiesis occurred only within 2-3 months after spawning. During residual the destructive processes predominate in red blood system influencing the number of circulating erythrocytes and the level of oxidative processes in them.

INVASION MOLLUSCS IN DANUBE DELTA

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In recent, there are 7 species of invasion molluscs in Danube Delta: *Corbicula fluminea* (Müller, 1774), *C. fluminalis* (Müller, 1774) and *Sinanodonta woodiana* (Lea, 1834) (main channel and branches of delta, woodplain lakes, desalinated zones of avandelta and lagoons; *Dreissena bugensis* Andrusov, 1897 (Romanian part of the Danube Delta (Micu, Telembici, 2004)); *Potamopyrgus jenkinsi* (Smith, 1889) (paramarine lake Razelm (Grossu, 1951), temporary waterbodies, lake-estuary Yalpuh); *Physa skinneri* (Taylor, 1954) (main channel and branches of delta, woodplain lakes, temporary waterbodies; *Physella acuta* (Draparnaud, 1805) main channel and branches of delta, woodplain lakes.

These molluscs expanded to Danube Delta by two invasion corridors. First – distribution along Danube stretch (*C. fluminea* and *C. fluminalis, S. woodiana*). Danube, connected within other European rivers in invasion corridor, transported invasion species throw all European watershed. Second invasion corridor – expansion of alien species, don't bordered by river channels. It is usually for species, what transported by birds and amphibiotic insects. *D. bugensis* and *P. jenkinsi* distributed along Black Sea coastal freshwater and brakishwater waterbodies. *Ph. skinneri* and *Ph. acuta* distributed along any types of freshwater waterbodies.

SPATIAL DISTRIBUTION OF GOLOMYANKAS (COMEPHORIDAE) IN THE CENTRAL PART OF SOUTHERN BAIKAL PELAGIAL DURING ICE-COVER SEASON

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Some data on golomyankas distribution in the deep part of Southern Baikal pelagial have been obtained. The fish was taken above the depth of 1380 m in the zone of gas hydrate occurrence.

We used traps for golomyanka that allowed to catch the fish simultaneously from the horizons of the whole water column with 2 m intervals. The trap was installed for the period from February 26 until March 6, 2005.

Golomyankas are viviparous fish. We observed casting out of *Comephorus dybowski* embryos from January until May. The catches contain 67,2% of the total number of mature females after casting out embryos; immature specimens comprise about 4,9% of the whole catch and males – 20,2%. Mature females dominate the depths of 200-600 m. The largest number of males is found at the depth of 1000 m and lower.

The distribution of *Comephorus baicalensis* is more even mainly at the depths of 400 to 1200 m. The overall catch of golomyankas includes 19,8% of them. During this time gonads of many maturing females are at the III and IV stages (after Koryakov, 1964).

The amount of golomyankas in the upper 200 m layer and in near-bottom layers is small.

PLANKTON COMMUNITY STRUCTURE IN THE SMALL LAKES ON VALAAM ISLAND

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Investigations of phyto- and zooplankton of 10 small lakes on Valaam island were conducted in June and September 1997- 2002. Transparency, temperature and main hydrochemical parameters were measured at the time of sampling.

265 species and varieties of phytoplankton were identified. Chlorophyta (29 %) were the best represented, followed by Bacillariophyta (25 %) and Euglenophyta (20 %). 66 zooplankton species were founded with - 22 Rotatoria, 18 -Cladocera, 26 - Copepoda (15 Cyclopoida и 11 Calanoida). Phytoplankton biomass in the lakes varied from 0.1 to 40.5 g m^{-3}, zooplankton –from 0.001 to 2.5 g m^{-3}.

Curtain variety from year to year of abundance and species diversity were showed for each lake. For the lake group a wide range was discovered for hydrologic and hydrochemical parameters, which leads to differences in phyto- and zooplankton structure in the lakes. Reliable correlation coefficient between phyto- and zooplankton structure, temperature, oxygen and carbonic acid content and pH were obtained.

THE DEPENDENCE BIODIVERSITY CALANIFORMES (CRUSTACEA) OF SIBERIA ON GEOGRAPHICAL FACTORS

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Distribution areas of the freshwater Calaniformes of Siberia were constructed on the basis of original materials and published date. 49 species, 16 genus, 3 families of Calaniformes are known for the territory of the Siberian subarea of Paleoarctic. The area of the elevated diversity is determined with 28 species, 9 genus, 1 family. This area is located on low plains in the field of the ancient (paleozoic) rugosity. Its north border coincides with the border of the regular seasonal frosting zone, in the west – with border of the new-born mountain area, and in the east it is limited to the area of high plains. The connection of border with the structure of earth is not so obvious in the south. Partially it has concided with the Turgai plateau in the southeast. The established area of the heightened diversity lays within the limits of 60°N and 54-57°E.

COMPLEX INVESTIGATIONS IN THE GULF OF OB

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The Gulf of Ob is a unique reservoir in Ob basin. Water of the gulf of Ob on salt composition is little mineral and very mild with not high contents of chlorides and Zinci sulfates. In summer water had the heightened amount of easy oxygenating organic substances. Under contents of oil compounds in water and bottom-dwelling deposits the gulf of Ob had a satisfactory state.

In phytoplankton, dominate diatoms, in the warm season the strengthened vegetation cyanellae is marked. Algae-vegetation is characterized by a high specific diversification. Observed drop of a specific diversification in the summer 2003, is conditioned by intensive vegetation blue-green algae.

Zooplankton of the gulf of Ob is diverse ecologically, in summer, and in autumn dominate *Rotatoria* and *Copepoda*. In summer 2003 *Cladocera* had mass development. Essential distinctions in quality and quantitative development of zooplankton of the gulf of Ob in comparison with investigations of past years it isn't revealed.

Benthos of the gulf of Ob is rich and diverse. Unique feature of gulf of Ob is presence of a relict fauna of the highest *Crustacea*, including four kinds of glacial relicts. The abundance of the most mass kind relict *Crustacea* wasn't diminished for last 35 years.

RESULTS OF THE STUDY OF THE BIOLOGICAL PRODUCTIVITY OF LAKE SYAMOZERO

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Long-term monitoring of the Lake Syamozero ecosystem has made it possible to compare its state in the cases of no eutrophication (1940s), poor eutrophication (1950-60s), very strong eutrophication (1970-80s) and during de-eutrophication (1990-2000). Calculations of production utilization on different trophic levels are based on the principle of relationship (Winberg, 1962), according to which relations between the constituents of an ecosystem can be expressed quantitatively.

The transformation of substance and energy flow in Lake Syamozero is discussed on the phytoplankton, zooplankton, zoobenthos and fish production level. Considering that some authors calculate production on a dry weight basis and others on a fresh weight basis and that different units of measurements are used, we present data in g/m^2 and in kg/ha per fresh mass.

During the 65-year study period phytoplankton production has increased from 270 to 760 g/m^2 and zooplankton production from 35 to 190 g/m^2. In this connection, plankton-eating fish production has risen from 15 kg/ha to 30-45 kg/ha. As zoobenthos production has remained unchanged (85-90 g/m^2), benthos-eating fish production has not changed markedly (11-13 kg/ha). Predatory fish production has increased slightly (4-9 kg/ha) because of the predatory smelt share.

Some time ago there were two equal flows in the lake: zooplankton-planktophages-predatory fish and benthos-fish-benthophages-predatory fish, but the former flow now clearly dominates over the latter.

MICROBIAL LOOP IN BIOMASS AND PROCESSES OF RESERVOIRS AND LAKES

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Microbial assemblages in pelagic region of lakes and reservoirs consist of bacteria, autotrophic picoplankton and heterotrophic protists (heterotrophic nanoflagellates and ciliates). Bacteria are the permanent and usually also the most conservative component of pelagic biomass. Their importance in total biomass increases with increasing depth and decreasing trophy of lake or reservoir. Their biomass might exceed that of metazoic zooplankton and even of autotrophic phytoplankton. The role of heterotrophic protozoa in bacterivory depends on the abundance and structure of metazoic micro- and mesozooplankton (especially on the occurrence of effective filtrators like daphnids). Autotrophic picoplankton usually was referred to be important in oligotrophic waters, but there are many exclusions from this rule. The above statements are documented in case studies where the biomass structure and function of different microbial assemblages is discussed: (i) importance of bacterivorous protists in meso- to eutrophic reservoirs in particular periods of seasonal cycles, (ii) scarcity of autotrophic picoplankton in ultraoligotrophic mountain lakes on one side, and their importance in total primary production of the oligotrophic lake Baikal on the other side, (iii) occurrence of autotrophic picocyanobacteria (as single cells developing to multicellular colonies) during particular periods of seasonal cycle in eutrophic reservoirs, (iv) the occurrence of filamentous pelagic bacteria in acidified low alkalinity lakes with myxotrophic flagellated bacterivores and absence of metazoic zooplankton.

BIOTIC STRUCTURE OF THE AZOV SEA ECOSYSTEM AND SPECIFICITIES OF ITS FUNCTIONING IN THE PRESENT-DAY PERIOD

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The anthropogenic history of the Azov Sea and its ecosystem in regard to hydrobionts' habitation is characterized by such specificities as:

- The runoff of the river water entering the Azov Sea changes in the range of 33-42 km^2 and provides the salinity favorable for the development of brackish- and freshwater hydrobionts.
- The temperature regime reflects possibility of coming anomalous weather conditions (typical for the climatic genesis of the last years) that affects the hydrobionts' development.
- The level of chemical pollution is still high, especially in the bottom sediments.

The ctenophore *Mnemiopsis leidyi* is the main source of biological pollution in the Azov Sea. The population of this organism regenerates each year, with the biomass of 15-16 mln. tons of wet weight.

These environmental specificities affect the ecosystem functioning in the following way:

- Biological communities of the Azov Sea ecosystem change in accordance with natural and anthropogenic factors and the total productivity of the ecosystem depends on these changes. The chemical and biological pollution of the sea is the result of human activities. The floristic diversity of the sea communities reduces sharply in in places undergoing high anthropogenic effect.
- After the intrusion of ctenophore the Azov Sea ecosystem has remained still high. In spite of the considerable anthropogenic effect the Azov Sea is a high productive water body of the mesotrophic-eutrophic type with quite balanced biotic turnover.
- Under present conditions primary heterotrophic organisms (i.e. microplankton) play the role of the main stabilizing block, which determines the low fishery efficiency of using the primary organic matter produced by the ecosystem.

ROLE G.G. WINBERG IN DEVELOPMENT OF HYDROBIOLOGY IN USSR

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The professor G.G. Winberg (1905-1987) – famous biologist XX centuries which have contribute to experimental hydrobiology in USSR, brought in large contribution to study biotic of balance of matter and energy; energetic metabolism, feeding and growth of water organisms, theory of functioning of water ecosystems.

His researches cover a wide sphere of problems in general and applied hydrobiology, ecology and ecological physiology of hydrobionts. He is the author of measurement of a photosynthesis and respiration in lakes by a method of light and dark bottles, investigated intensity of energetic metabolism of bacteria, protozoan, mollusks, fishes and other classes of water animals, contents of chlorophyll in plankton and organic matter in fresh and sea waters. G.G. Winberg has played a large role in study of efficiency of mineral fertilizing of ponds, assessment of value photosynthetic re-aeration during a self-cleaning of reservoirs.

The momentous in development of hydrobiology had his monographs «Intensity of respiration and food requirements of fishes» (1956), «A primary production of reservoirs» (1960), «Fertilizing of ponds» (together with V.P. Lyakhnovich, 1965), and numerous papers on fundamental problems of general biology, hydrobiology and ecological energetic.

G.G. Winberg was an originator of application of energy principle in study trophic relationships and productivity of water ecosystems, has determined paths of quantitative study of respiration, consumption and utilization of food by water animals, definition of their production, has created a basis of mathematical modeling of water ecosystems. It has enabled him and his employees in Minsk (BSU) and Leningrad (Zoological Institute) to give a complex quantitative estimation of a biological productivity of lakes of a different type in various geographical zones USSR.

Development of this approach, follower G.G. Winberg the academician A.F. Alimov has close to a quantitative assessment of basic elements of functioning of water ecosystems.

G.G. Winberg was the large theorist, editor and scientific critic. Under his management the Soviet part of the International biological program on productivity of continental water is successfully executed.

The ideas incorporated in numerous works G.G. Winberg and of his progeny on general ecology, hydrobiology and ecological physiology in Belarus, Russia and other republics the former USSR, still will long have production hydrobiology of research of water ecosystems in many countries of the world.

ENERGETICS OF THE COPEPOD *CALANUS EUXINUS*: THE COSTS OF LOCOMOTION, FILTRATION AND DIGESTION OF FOOD

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The relationship between respiration rate and mechanical power of cruising and escape swimming was shown for food-deprived females of *Calanus euxinus*. The effect of feeding process on locomotor activity and respiration rate was studied in tethered and free-swimming copepods using tensometry and videofilming. Metabolic and mechanical power generated by mouth appendages at continuous locomotion with the frequency of 40 Hz accounted for 0.026 and 0.0031 W, respectively. The losses of total mechanical energy for body propulsion amounted to 0.0013 W, whilst the cost of feeding current generation run up to 0.0018 W, or 58% of the total. To overcome hydrodynamic drag of the body during foraging with the speed of 3.2 cm s, the copepods required 0.0004 W, or 1.3% of total metabolism. In starved copepods with low locomotor activity feeding event stimulated the increase in frequency and total duration of locomotion which resulted in energy expenditure elevation provoking the "apparent SDA". At maximum algae concentration of about 300 μgC L^{-1} the SDA magnitude averaged 1.2 ± 0.44 nL O_2 mgC^{-1} h^{-1} independently of the level of activity. Due to SDA respiration rate increased by 23-85% and about 10% in slow-acting females and copepods with maximum motor activity, respectively.

OPTIMIZATION OF THE INTERCOMPONENT ENERGY EXCHANGE WITHIN BIOLOGICAL LIFE SUPPORT SYSTEMS INCORPORATING UNICELLULAR ALGAE

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Long-term functioning of humans outside the Earth's biosphere is conceivable only if sustained by biological life support systems (BLSS). Investigations of these systems in the USSR and then in Russia have been pursued for more than 40 years. The existing experimental BLSS is dependent on photosynthesis of unicellular algae. The model has its own practical purpose as a system for biological regeneration of air and water. However, the system can be enhanced by integration of a heterotrophic component. We investigated two-component laboratory BLSS the autotrophic component of which was cyanobacteria (*Spirulina platensis*) and the heterotrophic component was Japanese quails (*Coturnix coturnix japanica dom.*).

Experimental evidence was obtained that full stabilization of gas exchange in the closed two-component system and equilibrium between *Spirulina* K_{ass} and quail K_{resp} could be attained by modification of the algal biomass content toward a higher carbohydrate level and a lower protein level through partial nitrogen limitation of the culture. The experimental investigations showed that optimization of the energy and supplies flows raised the material balance within the two-component system to 76% of the total balance between the autotrophic and heterotrophic components under the condition of autonomous cultivation.

BIOCHEMICAL APPROACH TO ESTIMATION OF THE MICROPLANKTON PRODUCTION-DESTRUCTION SUCCESSION STAGE IN THE BRANDSFIELD STRAIT (WESTERN ANTARCTIC) SURFACE WATERS

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The production potential of pelagic community is determined mainly by microplankton autotrophic part functional abilities to replenish biomass. Biomass increase depends, in its turn, on autotrophic and heterotrophic components ratio in community. Thus the organisms' physiologic state and autotrophic biomass quota determination can be sufficient for the microplankton biomass development vector estimation.

The adenilate energy charge determination may be in use for physiological state estimation. The chlorophyll «a» and ATP concentrations ratio reflect autotrophic and heterotrophic biomass ratio in microplankton community.

Works were carried out during 7th Ukrainian Antarctic Expedition in March 2002 at 20 stations of the polygon within the boundaries of coordinates: 60°50' – 64°20' S. and 60° 30' W. The most oppressed physiological state was revealed in places at the west and north of the polygon. Relatively high degree of adenilate system charge and great quota of autotrophic biomass were marked at the most part of polygon that evidenced to the production-destruction homeostasis not typical for late stages of production succession. Such high production potential at the end of vegetative season allows to assume, that abnormally cold summer of 2002 with long-term freezing-over shifted terms of microplankton development for later period.

DYNAMICS OF SIZE SPECTRA OF AUTOTROPHIC AND HETEROTROPHIC MICROPLANKTON IN A COASTAL AREA SUBJECTED TO LONG-TERM ANTHROPOGENIC STRESS

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The dominant nourishment type defines the development trend of the whole pelagic community. The heterotrophic-photoautotrophic index (HPI) or the concentration ratio of ATP to chlorophyll-a (Chiaduani & Pagnotta, 1978) was used by authors of this work for seasonal monitoring of microplankton size categories at several sites of the Sevastopol Bay (Black Sea). In spite of pronounced seasonal variations of ATP and chlorophyll-a (by an order of magnitude and more), it has evidenced significant differences of the annual mean values of HPI between stations. Pronounced peaks of HPI reflect the interchange between winter (April) and summer (October) phytoplankton.

A characteristic peculiarity of the seasonal dynamics of the heterotrophic microplankton was a "symmetry point" in July-August. Typical annual dynamics of the microplankton HPI of the main size categories was characterized by the strongest fluctuations in micro-fraction and the weakest fluctuations in nano-fraction. The maximal values of HPI, with the microplankton peak at the beginning of summer and the picoplankton peak at the beginning of autumn, were noted at station 4 which was subjected to influence of both allochtonous organic and thermal stresses. Asynchronous fluctuations of HPI in the microplankton fraction reflected an interchange of different groups of the community.

CRITICAL POINTS OF TEMPERATURE CONDITION OF AQUATIC ENVIRONMENT AS ONE OF THE CONSTITUTING COMPONENTS AT MODELING THE POSSIBLE NUMBERS OF SMELT OF LAKE CHUDSKOYE (PEIPSI)

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Modelling of populations of aquatic organisms communities undoubtedly plays a significant role for the possibility of preliminary prediction of the conditions of a waterbody.

The data accumulated for the past five years made it possible to mathematically reflect the impact of the temperature of aquatic environment on the numbers of one-year-old individuals of Lake Chudskoye smelt.

Using the ratio of the number of the spawned breeders and one-year-old individuals of the corresponding generations as well as the data on temperature within the post-spawning and summer periods equations of dependence were calculated.

The comparison of the theoretically obtained indicators of the number of one-year-old individuals of Lake Chudskoye smelt with the actually observed values showed minor deviations. This allows practicing the obtained equations.

Undoubtedly the existing deviations evidence the fact that apart from temperature other parameters may impact the survivability of one-year-old individuals with the impact degree varying in the course of the time. Knowledge of the regularities of the impacts will further allow defining more precisely possible strength of the appearing generations of smelt in this or that year.

FORECAST OF THE STATE (EUTROPHICATION AND PLOLLUTION) OF WATER ECOSYSTEMS EXEMPLIFIED BY LONG-TERM INVESTIGATION ON LAKE BAIKAL

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The long term systematic investigations of trophic status components of the water the lake proper, its tributaries and atmospheric precipitation, together composing the main input of substance into Baikal, and also the Angara river, as output part of the balance matter allowed the lake recent state to be evaluated in terms of both chemical pollution and possible eutrophication of its water. The years of investigation were different in term anthropogenic impact and in terms of productivity of phytoplankton and hydrological regime. Some years were years of high yield of *Aulocoseira Baicalensis*, *Synedra arcus* or *Nitzschia acicularis*. 1971 and 1973 are characterized by big rain flood.

The absence of abundant phytoplankton in the period studied when the ratio of silica to phosphorus is optimum (over 100), as well as a reverse correlation between winter nitrogen content and spring of chlorophyll-a concentration in the Baikal water lead to the conclusion that the Baikal water contains toxicants. This served as the start of studying persistent organic pollutants (Mamontov, 2001).

Thus, the investigations of the dependence of chlorophyll-a on the previous concentrations of biogenic elements is an express method to evaluate the state of the water ecosystem.

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THE KINETICS OF CARBON IN PLANKTON COMMUNITY AND THE BIOTIC BALANCE OF PELAGIC ECOSYSTEMS

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Under daily exposition of bottles in the absence of grazing impact, radiocarbon method for determining primary production yields estimates close to those of net production of particulate organic matter. In the presence of phytivorous consumers the loss of phytoplankton through grazing is comparable with phytoplankton production, and organic radiocarbon excreted or respired by the consumers. As the result, estimates obtained using ^{14}C-method may considerably differ from those of net production.

In order to compare the value of net primary production (P) with production measured through ^{14}C-method (P_{C14}) under different parameters of the community, we applied suggested by G.G. Winberg computing technique at the model steady-state plankton community. Kinetics of ^{14}C was computed for a community in which phytoplankton production equals the loss through grazing and specific values of phytoplankton production and consumers respiration vary in the range characteristic of the natural communities.

Correlation between P/P_{C14} ratio and the stated parameters was positive; the ratio increased from 1.02 to 2.42 under their minimum and maximum estimates, respectively. The obtained values of P/P_{C14} adjusted to parameters of a specific community can be used as correction factors in assessing net primary production through data of standard radiocarbon method that facilitates computation of biotic balance of the community and ecosystem as a whole.

PRIMARY PRODUCTION AND DESTRUCTION OF ORGANIC MATTER IN LAKE ONEGA

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Intensity of primary production and destruction of organic matter (OM) and their ratio (biotic balance) define a degree of influence avtochtonic and allochtonic components on trophic and energy state of ecosystem. Long-term studies of these parameters were carrying out in Lake Onega. It is shown, that primary production and destruction processes are very slowly on the most part of the lake, but they increase in 2-5 times in the Kondopoga and Petrozavodsk Bays, which are being exposed to eutrophication. Photosynthesis in the surface water layer is varied within the limits from 20±3 to 330±55 $mgC \cdot m^{-3} \cdot day^{-1}$, the integrated values – 70±10 – 500±78 $mgC \cdot m^{-2} \cdot day^{-1}$ in the different parts of the lake. As a rule, destruction is recorded in all water column (from 0.01 to 0.07 $mgC \cdot l^{-1} \cdot day^{-1}$), however sometimes it has zero value. In the surface water layer its parameters vary from 20±3 to 170±77 $mgC \cdot m^{-3} \cdot day^{-1}$ on water area in summer. Integrated values of destruction depend on depth and reach to 1.5 - 5 $гC \cdot m^{-2} day^{-1}$. Biotic balance is strongly negative due to considerable influence of allochtonic OM on ecosystem. The terrigenic drainage, which biochemically steady OM prevail, has important significance for lake ecosystem, which is characterized by significant shore-line coregulavity and large catchments. The natural oligotrophic state of Lake Onega is defined by its high destruction potential.

BIODIVERSITY AND FUNCTIONAL ROLE OF ZOOPLANKTON IN LAKES, RIVERS AND ESTUARIES

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Specific characteristics of zooplankton species diversity, community structure, and trophic interactions related to the impacts of natural (environmental) and anthropogenic factors were analyzed in water bodies of different types: small and large lakes, rivers, and estuaries of NW Russia, Europe, and North America. Planktonic rotifers were shown to form the most diverse component in the pelagic communities of major types of fresh and brackish water bodies. Functional role of microzooplankton (rotifers) is of exceptional importance throughout a vegetation season in certain waters (e.g. rivers and turbid estuaries), as well as in large and small lakes during early spring and fall months. Comparable to crustaceans, planktonic rotifer assemblages in general are less affected by water flow velocity and high concentration of suspended inorganic particles (in rivers and estuaries), less vulnerable to the salinity gradients (in brackish water reaches of estuaries), and more tolerant to eutrophication and pollution from point sources in large lakes (e.g. Lake Ladoga). In the framework of study into the fundamental problem of "biological pollution", species diversity and functional specificity of zooplankton communities in the major gulfs and estuaries of the Baltic Sea were analyzed. The invasive species *Cercopagis pengoi* in the Neva Estuary was used as a model population for elaboration of the method for quantitative estimation of the impact of a predatory alien species on the native estuarine zooplankton. The method bases on the classical principles on production hydrobiology postulated by G.G. Winberg. Results of the author's experimental and field studies support the conclusion that diversity of zooplankton communities, specific role of microplankton component (rotifers), and feeding modes of the dominant invertebrate assemblages define (control) the major energy flows and, consequently, the state of the aquatic ecosystem.

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VERTICAL DISTRIBUTION AND FEEDING ACTIVITY OF NAUPLII *EPISCHURA BAICALENSIS* SARS IN LAKE BAIKAL

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Little is known about feeding rhythms of Baikal copepods and the influence of different factors on stereotypes of their behaviour. The distribution and rhythms of feeding of zooplankton can vary depending on the conditions of habitats and existence of predators.

In March 1999 and 2000, we carried out synchronous observations for species representing the entire pelagic food web in Baikal: *Epischura baicalensis*, *Cyclops kolensis*, amphipods *Macrohectopus branickii*, and juveniles of oil fish (Comephoridae).

In the daytime, the layer with maximal density of nauplii distribution of *Epischura* coincides with the maximal distribution of pico- and phytoplankton (0-15 m). Nauplii with active feeding make up 60-70% in this layer. Diurnal rhythms of the distribution of *Epischura* nauplii coincide with those of juvenile fish, which intensively feed on *Epischura* nauplii in the daytime (Dzyuba, 2004) and are in the antiphase with the distribution of another predator – *Macrohectopus*. The under-ice daylight and fish juveniles do not influence the intensity of *Epischura* nauplii feeding. At night, the decrease of feeding intensity and deepening of maximal distribution of nauplii coincide with a mass rise of *Macrohectopus* to the surface layers.

There was observed an atypical distribution and reduced feeding activity of *Epischura* nauplii on a day with sharp pressure differences and high levels of geomagnetic activity.

DENSITY OF PLECOPERA IN THE KEDROVAYA RIVER (SOUTH OF THE FAR EAST OF RUSSIA) METARHITHRAL IN RELATION TO SELECTED ENVIRONMENTAL VARIABLES

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Approximately 17300 specimens of 14 species of stoneflies have been quantitatively sampled at riffle-pool structural unit of the Kedrovaya River metarhithral zone (43°05'88'' N, 131°33'12'' E) in the spring, summer and autumn seasons 1993-1994. The herbivorous stoneflies *Amphinemura verrucosa*, *Paracapnia khorensis*, *Taenionema japonicum* are clearly dominant on density in taxocenosis (56%, 18 and 15%, respectively). Multiple regression analysis showed significant correlation between this herbivorous stonefly species densities and water temperature, leaf litter, detritus, depth, and current. In the same time the models for predaceous stoneflies *Kamimuria exilis* and *Stavsolus manchuricus* have not described adequately the interactions of their density distribution and abiotic factors. Using redundancy analysis 5 selected environmental variables explain 83.3 % of the variability. The water temperature and leaf litter have been found the most important environmental factor explaining more 60% of variability in the species density distribution.

USAGE OF STATISTICAL INDICES FOR ICHTHYOCENOSES EVOLUTION ANALYSIS

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Shannon-Wiener index is a popular index of ecosystem resistance. Despite being criticized it is used more and more widely to estimate environment quality and to make prognoses.

This work is targeted at estimate of changes in ichthyocenoses resistance with subdominants biomass changed.

An increase in subdominant biomass which exceeds threshold level (90% and more of a higher level dominant biomass) sets a system to labile equilibrium and leads to an increase in speed of intersystem processes. If initial entropy level in the system is not high and a specie is absolute dominant, introduction of several invading species concurrent with aboriginal ones will lead, on the one hand, to a drastic increase in «potential» entropy due to an increase in number of species, and, consequently, to an increase in speed of intersystem processes; on the other hand, it will lead to strengthening in competition between system elements and to decrease in its stability. From this point of view, introduction of a species with better features in order to change an aboriginal species of a little value is a big mistake. In a misbalanced system processes, which were of a little probability in a balanced system, strengthen their roles. Due to this, in subarid zone numerous populations can be established by singular founders in closed lacustrine systems with small numbers of aboriginal fish species.

THE EFFECTS OF PETROLEUM CONTAMINATED SEDIMENTS ON BENTHIC ORGANISMS AND BENTIC COMMUNITY.

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The toxicities of petroleum contaminated bottom sediments were assessed by their affects upon nektobenthic crustaceans (*Hyalella azteca, Gmelinoides fasciatus*), midge larvae (*Chironomus plumosus, Ch. riparius, Ch. dorsalis*), molluscs (*Planorbarius purpura, Anisus albus*), olygochaetes (*Limnodrilus udekemianus, L. hoffmeisteri, Tubifex tubifex, Aulodrilus limnobius*) and upon structure of bottom community under the conditions of natural modelling.

Specific sensitivities and tolerances of benthic organisms to toxic impact were determined as well as the patterns and degree of colonization and reorganization of macrozoobenthic community in experimental microcosms with spiked petroleum sediments.

Among crustaceans most sensitive and less resistant were *H. azteca* (threshold effect level (TEL) – 0.1, LC50 – 0.23 g/kg of dry weight); among chironomids *Ch. riparius* (TEL – 0.08, LC_{50} – 13.5 g/kg dry wt.) was the most sensitive and less resistant ; among molluscs more sensitive was *P. purpura* (TEL – 0.05 g/kg); *P. purpura* and *A. albus* were equally resistant (LC_{50} – 7.84 g/kg). All studied olygochaete species were low sensitive and highly resistant (TEL – 0.2-5.0 g/kg, LC_{50} 18-25 g/kg).

As the most sensitive species in community were mayflies (*Ephemera vulgate, Heptagenia fuscogrisea*), leeches (*Erpobdella octoculata, Hemiclepsis marginata*) and bivalve molluscs (*Euglesa sp., Musculium terverianum, Sphaerium nitidum*). The species have not been foundeven in minimally polluted microcosms – 0.028 g/kg. The most resistant species, the chironomids (genus *Chironomus, Procladius*) and sexualy mature olygochaete worm (*Limnodrilus udekemianus*) occupied microcosms with a concentration of 7.95 g/kg.

PHYTOPLANKTON SUCCESSION IN URBAN WATER-BODIES OF ST. PETERSBURG AS AN INDICATOR OF THEIR ECOLOGICAL CONDITIONS

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The water-bodies located within the precincts of large cities, are of great importance as elements of city landscape and objects of recreation. Lake Niznee in the Suzdal lakes system and reservoir Sestrorecki Rasliv are the largest water-bodies in the territory of St. Petersburg. Escalating anthropogenic influence on their catchments due to intensive building and as a sequence increase of nutrient loading results in growth of phytoplankton biomass and succession of its dominating species. In the Niznee Lake as a result of increase in phosphorus content in 1995-1999 average for a season phytoplankton biomass has increased from 6.4 up to 11.2 г/m^3, and in 2003 - 2004 - up to 19-24 г/m^3. The role of diatoms in the total phytoplankton biomass gradually reduced from 30-76 % up to 10-18 %, and the share of blue-green algae on the contrary has increased from 2 up to 50-80 %. From 1998 mass development of blue-green alga *Planktothrix agardhii* began. In hypertrophic reservoir Sestrorecki Rasliv for 20 years (1980-2003) annual phosphorous loading has increased twice (up to 4.5 г/m^2), especially at the expense of mineral phosphorus. The phytoplankton biomass for 20 years has increased from 5 up to 45 g/m^3. In a course of succession blue-greens have completely substituted other groups of algae. Now *Planktothrix agardhii* is the main dominant in plankton that is prominent feature of urbanized water-bodies polluted with domestic and industrial discharges.

PLANKTONIC RESEARCHES IN THE WHITE SEA IN 2001-2004

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Hydrobiological investigations were carried out from May till November 2001-2004. Works were carried out on the net of stations of complex monitoring of the sea accepted in Northern branch of PINRO.

Phytoplankton. Fluctuations of an aggregate number of the phytoplankton seaweeds depending on the area of the sea are very great during all the seasons and can make one - two orders. The average biomass of the phytoplankton in 2001-2003 throughout the sea has made 345 mkg /l.

The contents of a chlorophyll «a» in 2001 made: in the spring - 1,891 mkg /l, in the summer – 1,044 mkg/l, in the autumn – 0,287 mkg /l.

Zooplankton. Average number of the zooplankton from the northern areas of the sea was not great practically during all seasons of the year, making in the spring - summer period of 300-4000 sp./m^3 at a biomass of 20-150 mg / m^3.

The content of the zooplankton from the Dvinskyi gulf and from the south-west part of the sea during the researched period made in the spring - summer period on the average 4000-20000 sp./m^3 at an biomass of 80-500 mg / m3.

The average biomass of the autumn zooplankton has made 15-110 mg / m^3.

BACTERIOPLANKTON COMMUNITY COMPOSITION OF TWO EUTROPHIC SIBERIAN RESERVOIRS

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Using 16S rRNA partial gene sequence analyses we have investigated the bacterial diversity of winter bacterioplankton of two neighbouring eutrophic Siberian reservoirs. The reservoirs are similar in phytoplankton community composition in spring and autumn but tend to differ in summer in exhibiting cyanobacterial bloom. 16S rRNA gene sequences retrieved from both clone libraries were mostly affiliated with phylogenetic groups *Actinobacteria*, в-*Proteobacteria*, and *Bacteroidetes*. A significant number of bacterial 16S rRNA gene clones including dominant clones were closely related to uncultured freshwater bacteria previously found in different and geographically isolated aquatic ecosystems.

During summer seasons of 2000-2001 dynamics of species composition of free-living bacterioplankton were studied in these reservoirs using 16S rDNA PCR-DGGE technique. Surprisingly, the cluster analysis of the DGGE data did not show any specific difference between bacterioplankton communities of blooming and non-blooming reservoir. During two summer seasons dominating bacterioplankton clones were the same in both reservoirs. Thus, we can conclude that the development of cyanobacterial bloom did not cause changes of the composition of dominant heterotrophic bacterioplankton species.

As found in our studies, species composition of free-living non-cultivated freshwater bacterioplankton appeared to be surprisingly conservative. This fact might be due to a great capacity of bacteria for very wide adaptation.

NEMATODES FROM DEEP-WATER OF KARELIAN LAKE KRIVOYE

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Lake Krivoye situated near the polar circle; the area of the lake is about 50 hectares, maximum depths 32 m. There is strong layer of silt on the bottom, except for sand littoral. Destinctive peculiarity of lake Krivoye is the existence only one species *Paramononcus alimovi* Tsalolikhin, 1990 (Nematoda, Mononchida, Mononchidae) from meiobentic animals at great depths. This species was found in the lake only from July through September (maximum number of specimens per 1 sq. m. was 300 000). The genus Paramononchus includes 2 species. Type species *P. arcticus* Ebsary, 1978 was described from northern lakes of Canada. The other species *P. alimovi* Tsalolikhin, 1990 was described from Lake Akulkino of Kola Peninsula. The genus *Paramononchus* is a holarctic circumpolar genus. Partenogenetic species of the genus are adapted to lower temperatures of water about 4-6 C. Reproduction period of *P. alimovi* coincide with the maximum of seston accumulation on the bottom of the lake. Probably seston is main (perhaps single) food for these nematodes despite the fact that mononchides are predatory nematodes. The intestine of. *P. alimovi* does not contain fragments of invertebrates and others inclusions. Cells of intestine filled by fat drops. We do not know mode of live of nematodes in others seasons.

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STUDY ON BIOTA OF SALT LAKES OF THE ALTAY AREA

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INTERACTIONS IN PELAGIC COMMUNITIES IN LARGE LAKES

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Food web structure, interactions and dynamics in various environmental conditions are fundamental questions in ecology. Their proper understanding supply sound basis for the evaluation of environmental problems and restoration of eutrophicated aquatic ecosystems. The understanding of the pelagic food web interactions and dynamics in large lakes is important for effective sustainable management of the lakes and their catchment areas. The distributions of many organisms are patchy in different spatial and temporal scales. Hydrodynamic constraints and biological phenomena – such as predator-prey relationships and temporally rhytmic behaviours – further complicate the situation.

In pelagic ecosystems autotrophic phytoplankton has key functions in energy flow and element cycling. Phytoplankton primary production is transferred to higher trophic levels in the food chain mainly through the activity of zooplankton. Zooplankton forms an important link between primary producers and fish, and may also directly or indirectly control phytoplankton biomass and production. In addition to the food resources, zooplankton densities are controlled by the feeding of planktivorous fish. Consequently, phytoplankton, zooplankton and fish constitute a cascade where predator-prey relationships and behavioral strategies of organisms are manifested in complex and dynamic ways over temporal and spatial scales.

The presented results build directly on our earlier work on trophic interactions in large lakes ecosystems, both in Lake Ladoga (Russia), as well as on the earlier research in Lake Saimaa complex (Finland). The observations will cover large water masses, often over definite environmental and trophic gradients. Those elements form a favourable framework to extract regularities in the distributions of organisms and their dependence on hydrodynamic factors and trophic interactions. Ecosystem, catchment and hydrodynamic models, long term monitoring data, as well as information on loading and contamination will be used to explain the interactions and responses.

THE FAUNA OF GASTROPODA OF INLAND WATERS OF THE WESTERN SIBERIA

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The faunal composition of Gastropoda of the Western Siberia inland waters has been determined. Malacological collections kept in several scientific institutions were the basis of the study: the Museum of Siberian Water Molluscs (Omsk, Pedagogical University), the Zoological Institute RAS (Sankt-Petersburg), the Institute of the Plant and Animal Ecology RAS (Ekaterinburg), the Institute of Biology and Biophysics of Tomsk State University. Besides, collections of Drs. V.N. Dolgin and D.A. Razmashkin were examined. According to Ya.I. Starobogatov (1986), the area of our investigations is divided into three faunistic provinces: Irtyshian, Middle Obian and Lower Obian. The species list includes 133 gastropod species belonging to 9 families: Viviparidae (1 species), Valvatidae (25), Hydrobiidae (14), Bithyniidae (8), Acroloxidae (1), Lymnaeidae (39), Physidae (8), Bulinidae (4) and Planorbidae (33). 117 of them inhabit Irtyshian province, 70 – Middle Obian and 60 – Lower Obian.

Some general peculiarities of latitudinal variability of the water Gastropoda diversity were found. The numer of species in the local fauna decreases from the southern to the northern parts of the Western Siberia and reaches its minimum to the north of Arctic circle. A portion of species that have a Siberian origin grows in the same direction. As a whole, the fauna of Gastropoda of the Western Siberia inland waters has the european character with participation of some species of Eastern Siberian and Central Asian origin. 8 species are endemics of the Western Siberia.

IMPACT OF GEOTHERMAL ECOSYSTEMS ON THE SURROUNDING OCEAN SPACE

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VERTICAL PHYTOPLANKTON DISTRIBUTION IN TWO VALAAM ARCHIPELAGO SMALL LAKES

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Investigations were conducted on two small lakes on the Valaam island from June till September in 2002-2004. Vertical sampling of phytoplankton was conducted on the most deep stations, on the transparency horizons from the surface to the bottom by Bogorov-type sampler. The lakes are characterized by high density and biomass phytoplankton, differing in dominat species, seasonal dynamics and Shannon's Index. Phytoplankton biomass in the Germanovsky lake was from 0,1 to 34,3 g m^{-3}, in Igumensky lake - from 0,9 to 20,5 g m^{-3}. In the Germanovsky lake green algae dominate most part of the season, and their development takes place in the surface horizons. In the Igumensky lake blue-green algae dominate with the maximal quantity on the horizon of 2-3 transparency (about 3-6 m). In this work showed that the variety was wider than the one received during long-term season investigations based on integral sampling data.

STRUCTURE OF ZOOBENTHOS IN THE RIVERS AND LAKES OF KAMCHATKA

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Rivers and lakes in Kamchatka are spawning and nursery recreations of Pacific Salmon; species dependency the period of juvenile feeding in the rivers and lakes takes from 2-3 months to several years. In the lakes salmons (mostly sockeye salmon) at the stage of yearling use to feed in littoral zone on benthos invertebrates during several months until to leave for pelagic zone; in the rivers that is during fresh water period in the whole. The benthos fauna of bottom communities of rivers and lakes consists mostly of insect larvae, vermes, inferior and superior crustaceans. In the rivers usually the abundance dominance is represented by chironomids, whereas the biomass dominance - by *Plecoptera, Ephemeroptera* and *Trichoptera.* In the fresh-water lakes the principal role in forming the benthos fauna is by chironomids and olygochaetas. In the brackish-water lakes situated close and connected to the sea the most abundant are amphipods, mollusks, olygochaetas and chironomids. The basis of feeding of salmon yearlings consists of chironomids (at different stages including larva, pupa, imago), older juveniles also intensively consume *Plecoptera* and *Ephemeroptera* representatives.

ZOOPLANKTON OF LARGE LAKES OF CHANY AND BARABINSK (WEST SIBERIA)

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Chany, Sartlan, Ubinskoye large lakes in the south of West Siberia are currently susceptible to drying. As the result of decreasing water content, the mineralization of water in the lakes is increasing.

All species of zooplankton in the lakes are representatives of generative-limnetic complex that have adapted to the conditions of the increased water mineralization. The simultaneous decline in the number of species and the increase in mineralization level ("brackish water paradox") is a specific feature of the reservoirs of such type. This process is the most intensive in the Chany lake, which has a wider salinity range than the other lakes.

In the course of drying the forms of plankton in the lake have been replaced by other forms: the zooplankton complex that was typical for lakes in the middle of the XX century has been replaced by the pond-lake complex, where the share of pond species is more than 70 %.

The lakes are mesotrophic reservoirs. The Ubinskoye lake has recently increased its status from trophical to eutrophic due to the fish kill. The Chany lake, on the contrary, has decreased it due to the fact that the population of the Amur morph of the goldfish has augmented there, which has diminished the food supply of this water reservoir.

PRESENT PROBLEMS OF BIO-DIVERSITY OF WEST SIBERIAN FISHES

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Every year from January to April in Ob River basin develops large zone of hypoxia under ice cover, which extends over hundreds kilometers of Low and Middle parts of the river-bed.

Asphyxia and Super-Cooling Syndrome depress the fish vitality and often become reasons of aquatic animals death. In contrast with Europe fish fauna of Western Siberia undergo the negative influence of winter hypoxia on the species variety. At the same time fish species diversity of the region is essentially larger than that for Eastern Siberia. During XX century there were introduction of alien species from Europe and Far East in water systems of Western Siberia. However positive results were achieved only in the latter half of the century. Since 70-th environmental conditions became favorable for introduced bream, pike perch, Amur crucian, carp and some other species. At present introduced fauna have vital importance in fish community of many rivers and lakes of the region. For example, in large lakes between Ob and Irtish rivers (Chany, Sartlan and Ubinskoe) and in Upper Ob River they are prevalent part of dominant complex.

Reorganization of fish community in changing environmental conditions reveal actuality of comprehensive study of biological diversity of Western Siberia.

INTERRELATIONS BETWEEN DIVERSITY AND SOME INDEXES OF ZOOBENTHOS COMMUNITIES DEPENDING ON NATURAL CONDITIONS AND ANTHROPOGENIC INFLUENCE

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On the basis of study of zoobenthos from water objects located in Finish Lapland, northeastern Norway, Murmansk Region, (Russia), it is shown, that as a whole the positive correlation between the Shannon diversity index and total biomass of communities is characteristic. However this relationship becomes negative in eutrophic lakes at achievement of total biomass of littoral communities up to ~ 0.8 -1.0 g/m^2, deep-water zoobenthos - 4.0-4.8 g/m^2. The same positive correlations are observed in anthropogenic acid waters, as well as in lakes contaminated by toxic heavy metals.

In general, in toxic and acid waters the negative correlations between the Shannon index and relative biomass of invertebrate predators is characteristic. In contrast, it becomes positive in eutrophic and in ecological stable lakes. The relationships between the Shannon index and the average body mass of an individual in the communities are usually positive (irrespective of environment conditions).

Thus, the relationships between the Shannon index and total biomass, also some structural indexes of communities not always coincide with the data given in the literature. This fact we explain to that in the present work northern lakes and streams are surveyed. The necessity of account of a type of anthropogenic influence is obvious.

SPECIFICS OF BACTERIAL PLANKTON DEVELOPMENT IN KANEV RESERVOIR DURING WINTER AND SPRING PERIODS

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Based on the data collected from upper part of Kanev reservoir during 1992-2003, the dynamics of bacterial plankton content during late fall and winter peaked in December and reached the minimum in February. On the contrary, the growth speed constant (K_t, day^{-1}) was negative in December. Despite the low water temperature, K_t increased to 0.11-0.30 day^{-1} during mid-January / beginning of February and till the end of the winter, which was apparently related to adaptation of bacterial plankton to winter conditions and domination of psychrophil bacteria.

A significant accumulation of nitrates – up to 1.0 – 1.2 mg N/L – was noted in the reservoir during winter, this process being activated each year at different dates (end of November, December or January).

Ecological significance of these findings is as follows. Under the conditions of reservoir freezing-over, the early end of period of bacterial adaptation to low temperatures as well as the increase of nitrate concentration may facilitate the deep deficit of dissolved oxygen and other negative effects by the end of winter. If the active process of nitrate accumulation in water begins before the freezing-over, the depletion of oxygen for nitrification is compensated by atmospheric re-aeration of water.

THE ROLE OF HIGH AQUATIC PLANTS IN FORMATION OF LAKE TELETSKOYE LITTORAL ZOOCENOSES

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Lake Teletskoye is the deepwater reservoir situated in the south of West Siberia. In spring of 2004 about 141 taxons of bentos and periphyton macroinvertebrates and 26 types of mesozooplankton were revealed in Lake Teletskoye macrophytes. Macrofauna of macrophytes zooperiphyton (zoophytos) was richer and more original (109 taxons of invertebrates including 58 original ones) than fauna of bentos in macrophytes (68 and 20 taxons, accordingly) but zoobentos number (4,1 thousand specimen/m^2) and biomass (10,1 g/m^2) significantly exceeded quantitative parameters of zoophytos (0,47 thousand specimen/m^2 and 2,6 g/m^2).

Zoobentos number and biomass in soft bottom of macrophytes unesentially differed from similar parameters outside the macrophytes zone (3,9 thousand specimen/m^2 and 8,6 g/m^2). However, zoobentos species diversity in the bottom under plants (68 taxons) was much higher than on open sites (32 taxons). The similar tendencies of increase in taxonomic diversity of invertebrates in macrophytes (26 kinds) in comparison with open sites (16 kinds) under insignificant differences in quantitative parameters were revealed for zooplankton as well. Thus, phytocenoses during minimal macrophytes development period had a slight effect on quantitative development of zoocenoses but influenced on its qualitative structure.

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THE GROSS PRIMARY PRODUCTION OF MICROPHYTOBENTHOS ON KYIV SITE OF KANIV RESERVOIR

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Microphytobenthos is on importance in intrawaterbody processes. However Winberg (1960) remark remains actual till today that the production of microphytobenthos and periphyton is given not enough attention or occasionally it is neglected.

The investigation has been performed in lower pool of the Kyiv Hydroelectric Power Station. Daily mode of operations the Kyiv Hydroelectric Power Station (2 water venting at day) affect to hydrological regime, intrawaterbody processes and certainly microphytobenthos structure.

The values of gross primary production of microphytobenthos and destruction in ground sedimentation fluctuate over a wide range and high factors of a variation are detected. It's confirms a large degree of relation these parameters from many factors interdependent and operational in a complex.

Maximum values of primary production of microphytobenthos have been registered under stable hydrological conditions, where the fluctuation of water levels and current velocity have smaller influencing to the development of bottom algae communities.

It was ascertained that the values of gross and net primary production both on sites without thicket of macrophytes and on sites with thicket decrease under influence of the raising of water line.

The parameters of a destruction on sites without the thicket are considerably increased.

DEPENDENCY OF THE PRODUCTION FEATURES MOUNTAIN LAKES OF THE URAL FROM CONDITIONS OF THEIR SHAPING

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At present attention world community was called to problem of the global change surrounding. Activity of the person is powerful transforming factor to natural waters. In connection with need of the forecasting of the processes of eutrofication special importance gains the determination of the empirical dependencies between trophic factors. Will analysed perennial author data (1991-2004 y.), got on different waters of the mountain Ural, located within one lake area and having cognate origin and alike age.

Clear dependencies are received between composition of the algaes and contents biogenous elements. The installed straight line dependency between the general biomass of the phytoplankton and correlation of the mineral forms of the nitrogen and phosphorus (B=-1,13 + 0,89 * N/P, r=0,69), between the number blue-green and green algaes and correlation of the mineral nitrogen and phosphorus (Ncyanophyta =-769E4 + 2123E2*N/P, r=0,74; Nchlorophyta =-117E4 + 27255*N/P, r=0,82). Revealled inverse dependency between transparency of water and contents of mineral phosphorus (S= 2,97 – 4,92*Pmin, r=-0,38) comparable with given for the other region (Trifonova and others, 1986). The number of diatomic algaes is found in inverse dependency from value BPK_5 (Nbacillariophyta=1523E3 – 25E3*BPK_5, r=-0,53).

Thereby, correlation of the mineral forms of the nitrogen and phosphorus is a significant criterion of feeding level of mountain lakes of the Ural.

DYNAMICS AND ROLE OF DIFFERENT SYSTEMATIC SECTION OF ALGAE IN THE COURSE OF FORMATION OF BIOMASS OF PHYTOPLANKTON IN LAKE PSKOVSKOYE-CHUDSKOYE (PEIPSI)

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For the period in question (i.e. 1970-2004) in the plankton of pelagial of Lake Pskovskoye-Chudskoye (3555 kmI; mean depth 7,1 m), 475 taxons of algae from the following sections have been found: *Cyanophyta* – 102, *Chrysophyta* – 12, *Bacillariophyta* – 153, *Xanthophyta* – 7, *Cryptophyta* – 4, *Dinophyta* – 3, *Euglenophyta* – 18, *Chlorophyta* – 176. In Lake Pskovskoye mean seasonal (i.e. May-October) biomass of phytoplankton (19.4 g/mi) is higher than in Lake Chudskoye (12.9 g/mi) 1.5 times.

Due to *Bacillariophyta* on average 50.6 % of the total biomass of phytoplankton was formed in Lake Pskovskoye and 60.4 % - in Lake Chudskoye.

Correspondingly 37.6% of total biomass of phytoplankton fell to the share of *Cyanophyta* in Lake Pskovskoye and 26.0% - in Lake Chudskoye.

These two sections of algae in general determine the overall character of dynamics of biomass of phytoplankton in the waterbody.

Representatives of *Chlorophyta* formed on average at about 9.0 % of biomass of phytoplankton in each lake.

Totally not more than 2.9 % fell to the share of *Cryptophyta* and *Dinophyta.*

The role of *Xanthophyta* and *Euglenophyta* amounted to tenth and hundredth of a percent of the total biomass of phytoplankton.

THE SEVASTOPOL BAY ECOSYSTEM (THE BLACK SEA) STATE INFERRED FROM CHANGES IN PHYTOPLANKTON AND NUTRIENTS VARIABLES DURING 2000-2004

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[3] Zoology Department, Trinity College, Dublin 2, IRELAND
[4] Institute of Biological Sciences, University of Wales, Aberystwyth, U.K.

The present state of the shallow Sevastopol Bay ecosystem was examined by means of a seasonal and interannual monitoring surface data set from 3 stations with different expected anthropogenic influence. After preliminary analysis of seasonal dynamics, special attention was given to data obtained during 2 monthly intervals: warm (from May to September) and cold (from October to April) to reveal interannual fluctuations and trends. Interannual changes of chlorophyll *a*, phytoplankton, phosphate, nitrate, silicate and oxygen concentrations testify to moderate trophic level, comparable with level of the north-western shelf, and absence of any eutrophication signs in investigated areas of Sevastopol Bay. The wind mixing is most likely the main factor determining variability of nutrient concentrations in bay's surface layer during a year and absence of primary production nutrient limitation in warm period which is common for the open Black Sea.

The study was supported by INTAS grants INTAS-03-51-61-96 and INTAS-03-51-65-41.

SEASONAL DYNAMICS OF HYDROCHEMICAL AND PHYTOPLANKTON CHARACTERISTICS IN A SHALLOW HYPERSALINE LAKE AT CAPE KHERSONES (THE SOUTH-WEST CRIMEA) IN 2004/2005

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[2] Marine Hydrophysical Institute, Kapitanskaya 2, Sevastopol, UKRAINE
[3] Institute of Biological Sciences, University of Wales, Aberystwyth, U.K.
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Seasonal dynamics of chlorophyll a, phytoplankton, nutrients, oxygen, salinity, pH and temperature were analyzed in a small (0.02 km^2), hypersaline lake of marine origin at Cape Khersones near Sevastopol. It is separated from the Black Sea by the narrow, stony isthmus of about 15 m width through which is a permanent infiltration of sea water. The lake depth does not exceed 85 cm in winter and 60 cm in summer. The surface water samples were collected 2 times every month. The lake ecosystem is characterized by the early season formation of the floating mats of *Cladophora siwaschensis*, moderate seasonal dynamics of surface chlorophyll *a* (annual mean, AM= 2.3±1.34 mg m^{-3}), phosphate (AM= 0.74 ±0.32μM), nitrate (AM = 1.76 ±0.91 μM), oxygen saturation (AM = 102.3 ±26.3%), pH (AM=8.74 ±0.31), and considerable annual changes of temperature and salinity (from -0.15 to 28.5^{0}C and from 37.76 to 70.76‰, correspondingly). Annual mean primary production of the lake phytoplankton (~ 260 mgC m^2yr^{-1}) is higher than production of Sevastopol Bay and north-western shelf, the same order of values as in the shelf of the Black Sea Bulgarian sector, but less than in-Danube shelf.

The study was supported by grants INTAS-03-51-61-96 and INTAS-03-51-65-41.

GROWTH PECULIARITIES OF GIANT AND AVERAGE ENDEMIC TRICLADS OF BAIKAL

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Endemic Baikal planarians (Tricladida Paludicola) include a unique group of giants (up to 200mm long), whereas most common littoral species are 3-20mm long. Fixed specimens of both groups were analyzed to find out the correlation between linear triclad dimensions and their mass. Appropriate indices of giant abyssal planarians *Rimacephalus pulvinar, Rimacephalus arecepta, Sorocelis hepatizon* (105 specimens), as well as small littoral triclads *Baikalobia variegata* and *Baikalobia copulatix* (180 specimens) have been measured. The length and mass ratio is defined by a routine equation $w=ql^b$ (Alimov, 1968), where w–mass of the animal, l–linear dimensions, q, b–coefficients. Coefficients for each species taken alone were found to be constant, but species-specific: for *R. pulvinar* q= 0.2973, b=2.262; for *R. arecepta* q=2.6184, b=1.9103; for *S. hepatizon* q=0.1874, b=2.6918; for shallow-water triclads *Baikalobia variegata* and *Baikalobia copulatix* - q=0.8908, b=1,5 and q=0.2819, b=1.5339, respectively. Commonly accepted that giant worms originated from small littoral forms (Porfirieva, 1977). We assumed therefore that the mass/length correlation curve should continue analogous curves for small forms. However, analysis shows that the body length-mass curves become widely separated for giant and average planarians. This is testimony to significant differences in growth peculiarities, life cycles, and, indirectly, - in life span of the representatives of both groups.

LITTORAL PHYTOCENOSES OF LAKE TELETSKOYE (RUSSIA)

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In May-June 2004 the most abundant bushes of macrophytes in Lake Teletskoye were found in Kamga and Kyga bays and nearby the tributary mouths. The cenoses of semisubmerged *Equisetum fluviatile, Carex acuta*, *Eleocharis palustris* and submerged species *Potamogeton perfoliatus, P. gramineus, Batrachium divaricatum* and *B. eradicatum* prevailed and occupied near 30% of littoral zone. The semisubmerged vegetation (300 specimens/m^2) and biomass (1300 g/m^2 in moist weight) were dominant over the submerged ones (165 specimens/m^2 and 800 g/m^2, respectively). The increase in phytoplankton biodiversity and abundance was observed just in the bushes of macrophytes or nearby in comparison with pelagic zone (about 44 algae species in some samples, number – up to 380.5 th.cell/l). *Dinobryon divergens*, *Chrysococcus rufescens*, *Mallomonas tonsurata var. alpina, Chroomonas acuta* and *Pandorina morum* hold the lead among other species in number and biomass. The epiphyton biomass on *Carex sp.* didn't exceed 0,004 mg/cm^2. Maximum of biomass was observed on the smooth submerged plants *B. divaricatum* and *P. perfoliatus*, minimum – on the tough semisubmerged plants *E. palustris* and *E. fluviatile*.

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MICROPHYTOBENTHOS OF THE LAKE PLESCHEEVO

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Lake Pleshcheevo is situated in the Southern part of the Yaroslavl Province. It's area is 51.5 square kilometers, average depth is 11m, maximal depth is 25m. In order to study microphytobenthos of the lake, samples had been taken by means of stratometer from different depths along three transects in 2001. Sampling depths depended on the insolation (Secchi depth) at the sampling time. The latter was 0.2Z, 0.5Z, 1Z, 2Z, 3Z, where Z is water transparency. The samples were further fractionated by separating cells capable of phototaxis.

Set of highly abundant edificator species which characterizes the lake ecosystem have been described. It was composed of species insensitive to water salinity, alcaliphylic organisms and beta-mesosaprobic indicators. Large abundance of cold-water and brackish-water species was found to be peculiar to the lake. Saprophytes in general were abundant temporarily and at restricted areas thus indicating sites of local pollution. The production capacity of microphytobenthos is determined by the following quantitative parameters determined: cell numbers varied from 20.7 to 983.4 mln.cell/m2, biomass was within 0.06-13.7 g/m2 and chlorophyll varied within 0.6-16.8 mkg/m2 .Maximal production was found to occur at 0.5 - 1 Z.

LIST OF PARTICIPANTS

PROF. G.G. WINBERG
MAIN BIOGRAPHIC DATES

Born: 31 May 1905 in St. Petersburg

1910 - family moved to Moscow

1922 - George graduated from school and joined Biological department of Physical-mathematical division of The Second Moscow State University

1924 – moving to Biological Department of The First Moscow State University (Lomonosov' University)

1924-1925 - the first limnological studies at Bolshovskaja and Zvenigorodskaja field stations of the Moscow University

1927- George graduated from the University and continued education via doctorate graduation at Zoological Institute of The First Moscow State University, with Professor Nikolay Koltsov and Dr. Sergey Skadovsky as tutors

1928- the first scientific publication titled "Study on variability in Scapholeberis mucronata and Scapholeberis microcephala from waterbodies in vicinity of Zvenigorodskaja hydro-physiologigal station" Mat.of Zvenigorodskaja hydro-physiologigal station, Moscow P:462-468

1930-1935 - he started work as assistant of Prof. E.S. Bauer and studied cell physiology

1931-1940 - returning to hydrobiology investigations at Kosino Limnological station

1932, 23 May - the World first experimental estimation of phytoplankton primary production (in Beloe lake)

1934 - publication of the first results on the phytoplankton primary production estimation in lake "Opyt izuchenija photosinteza i dyhanija v vodnoj masse ozera" (The first results of photosynthesis and metabolism estimation in water column) Proceed. of Kosino Limnol. Station, V. 18, P.5-24 (In Russian, English summary)

1935-1937 – publication of 17 fundamental papers on productivity and metabolic activity in aquatic organisms, creation of a personal scientific paradigm on biological productivity

1938 - Doctorate degree in hydrobiology (without defense, on the basis of scientific publications only)

1940-1943 - a prisoner of Stalin's Gulag (KomiLAG, north of European Russia)

March 1943- September 1944 - soldier in army, at the Leningradsky, than Pribaltijski fronts

1944- returning to science as a scientific officer at Borok Limnological Station, now Institute of Biology of Inland Water, Yaroslavskaja district

1946 - defense of processor habilitate dissertation titled "Biotic balance of chemical matters and energy in lake" in Moscow Institute of Fish Industry

1947-1948 - a professor and the chair in Minsk State University, Belorassia

1948-1950 - the next repression by Stalin's regime resulted in fallen down from professor to a field worker at a fish-culturing farm in Byelorussia country side

1950-1967 - returning to academic career as a professor and the chair in Minsk State University,

1956- publication of his first fundamental book «Metabolism and feeding in fishes" translated in English and published in Canada in 1960

1960 – publication of his second fundamental book "Primary production in natural water bodies", translated in English and published in USA in 1961

1965 – publication of his third fundamental book "Fertilization of fish ponds" (with V. P. Ljahnovich as coauthor), translated in English and published in Canada than in Poland

1967 –1987- moving to Leningrad and foundation the Laboratory of Freshwater and Experimental Hydrobiology in Zoological Institute, The Russian Academy of Sciences, USSR

1967- 1969 – convener of freshwater section in International Biological Program

1968 г. – editing of a collective monograph "Methods of calculation of production in aquatic animals", translated in English and published in London with G.G. Winberg and E.T. Edmondson as editors

1971 - Chair of scientific committee at Limnological Congress 1971 in Leningrad

1971 - G. G. Winberg was elected as President of The Russian Hydrobiological Society

1976 –election as Correspondent-member of the Academy of Sciences of USSR

1977 - Thienemann-Naumann medal getting as an award from SIL at XX Limnological Congress in Copenhagen

1987 - death in 5 days after leaving the Chair of created by him Laboratory due to hard attack

НАУЧНЫЕ ТРУДЫ Г.Г. ВИНБЕРГА

МОНОГРАФИИ, СТАТЬИ, ТЕЗИСЫ ДОКЛАДОВ

1928

Исследования по изменчивости *Scapholeberis mucronata* и *Scapholeberis microcephala* из водоемов в окрестностях Звенигородской гидрофизиологической станции // Применение методов физической химии к изучению биологии пресных вод / Тр. Звенигородской гидрофизиол.ст. – С 462-468. (В соавт. с К.М. Сидоровым.)

Планктонологические и физико-химические исследования Попова пруда // Применение методов физической химии к изучению биологии пресных вод / Тр. Звенигородской гидрофизиол.ст. – С.352-365.

Предварительное сообщение о результатах гидробиологического и физико-химического обследования Петровских озер Тверской губернии // Применение методов физической химии к изучению биологии пресных вод / Тр. Звенигородской гидрофизиол.ст. – С. 215-239. (В соавт. с С.Н. Скадовским и А.П. Щербаковым).

1929

Vorläufige Mitteilung über Resultate hydrobiologischer und physikalisch-chemischer Untersuchung einer in Twer Gouv. gelegner See-Grruppe (Petrowskije Seen) // V Arch. Int.Ver. Limnol. – Bd.4. – S.564-587. (Mit S.Skadowsky, A. Scherbakoff).

1933

О некоторых особенностях действия ионов на биологические объекты // Биол. журнал. – Т.2.- Вып. 6. - С.519-527.

1934

К вопросу о металимниальном минимуме кислорода // Тр. Лимнол. ст. в Косине. – Т.18.- С.137-142.

Методика определения органического вещества и опыт калорической оценки кормовых запасов водоема // Тр. Лимнол. ст. в Косине. – Т.18. - С.25-39 (В соавт. с В.Ивлевым, Т.Платовой, Л.Россолимо).

Опыт изучения фотосинтеза и дыхания в водной массе озера. К вопросу о балансе органического вещества. Сообщ. 1 // Тр. Лимнол. ст. в Косине. – Т.18. - С.5-24.

Результаты гидробиологического обследования прудов-холодильников электростанций // Экология малярийного комара / Тр. Тропич. ин-та. - С. 157 – 167 (В соавт. с О. М. Виноградской, М.С. Владимировой, П.И. Павловой.)

1935

К методике измерения дыхания капилляррespирометром // Биол. журн. – Т. 4. - № 6. - С. 1061 - 1076.

К методике определения органического вещества. Опыт калорической оценки кормовых запасов водоема // Тр. Лимнол. ст. в Косине. – Т.20.- С. 25 – 40 (В соавт. с В.С. Ивлевым, Т.Н. Платовой, Л.Л. Россолимо).

Опыт изучения фотосинтеза и дыхания водной массы озера. К вопросу о балансе органического вещества. Сообщ. 2 // Тр. Лимнол. ст. в Косине. – Т.20. - С.5–24 (В соавт. с А.И. Ивановой).

Отчет санитарно-биологического отряда Тропического института по исследованию прудов-холодильников // Материалы по гидрологии, гидрографии и водным силам СССР. - Вып.29, сер. 3, сб.2. М.-Л .: «ОНТИ». - С. 60 - 70.

1936

Интенсивность обмена и продолжительность жизни *Drosophila*. Сообщ. 3. Интенсивность дыхания, размеры и продолжительность жизни *Drosophila simulans* // Арх. биол. наук. – Т.38. - Вып. 3. - С.657-663.

Интенсивность обмена и температурная адаптация // Успехи соврем. биол. – Т.5. – Вып. 2. - С.371.

Некоторые общие вопросы продуктивности озер // Зоол. журн. – Т.15 – Вып. 4. - С.587-603.

«Проницаемость» и обмен // Успехи соврем. биол. – Т.5. – Вып. 2. - С.360-362.

Температурный оптимум развития // Успехи соврем. биол. – Т.5. - № 5. - С.560-561.

1937

Интенсивность дыхания коловратки *Anurea aculeata* Ehr // Бюл. эксперим. биологии и медицины. – Т. 4. – Вып.5. - С.464-467.

Интенсивность обмена и продолжительность жизни *Drosophila*. Сообщ. 5. Влияние на обмен и продолжительность жизни температуры развития // Бюл. эксперим. биологии и медицины. – Т. 3. – Вып.1. - С.5-7.

Интенсивность обмена и продолжительность жизни трех видов *Drosophila* // Зоол. журн. – Т.16. – Вып. 2. - С.311–323 (Совместно с А.П. Щербаковым).

Наблюдения над интенсивностью дыхания и фотосинтеза планктона рыбоводных прудов. К вопросу о балансе органического вещества. Сообщ.3 // Тр. Лимнол. ст. в Косине. – Т. 21. – С.61-74.

Некоторые наблюдения на гумусовых озерах (Петровские озера). К вопросу о балансе органического вещества. Сообщ. 4 // Тр. Лимнол. ст. в Косине. – Т. 21. - С.75-87.

Температура и размеры биологических объектов // Успехи соврем. биол. – Т.6. – Вып.1. - С.32-51.

Metabolic intensity and longevity of *Drosophila* // Bull. de Biol. Et Medicine Experimentale. – V.3. – N 1. – P.5-7.

Rate of respiration of the rotifer *Anurea aculeata* Ehr // Bull. de Biol. Et Medicine Experimentale. – V.4. – N 5. – P.452-455.

1939

К изучению продуктивности водоемов // Научно-метод. зап. Главн. упр. по заповедникам. – Вып. 4. - С.39-51.

Наблюдения над фотосинтезом и дыханием водной массы глубокого озера. К вопросу о балансе органического вещества. Сообщ. 5 // Тр. Лимнол. ст. в Косине – Т. 22. - С.144–153 (В соавт. с З.И.Кузнецовой).

Основы биологии // Пособие для высших педагогических учебных заведений / Под ред. В.Дорфмана и А. Парамонова. - М.: Уч.-пед. изд-во Наркомпроса РСФСР - 275с. (В соавт. с В. Дорфманом, Б.Морозовым, А.Парамоновым, И.Эскиным).

Суточные колебания количества растворенного кислорода как метод измерения величины первичной продукции водоемов // Тр. Лимнол. ст. в Косине – Т. 22. - С.128-143 (В соавт. с Л.И.Яровициной).

Физиологические и экологические особенности представителей донной фауны // Зоол. журн. – Т.18. – Вып.5. - С.842 -857.

1940

Об измерении скорости обмена кислородом между водоемом и атмосферой // Докл. АН СССР – Т.26. - № 7. - С.674-677.

On the measurement of the rate of exchange of oxygen between a water basin and atmosphere // Comptes Rendus (Doklady) de l'Academie des Scienes de L'URSS. – V.26. – N7. – P.666-669.

1946

Биотический баланс вещества и энергии озера // Дисс. … докт. биол. наук (Рукопись). - М. – 630с.

Интенсивность дыхания бактерий // Успехи соврем. биол. – Т.21. - №3. - С.401-413.

Размножение бактерий и поглощение кислорода в воде // Микробиология. –Т.15. - Вып.6. - С. 499 - 508 (В соавт. с Л.И. Яровициной).

1948

Биотический баланс Черного озера // Бюл. Моск. о-ва испыт. природы. Отд. биологии. – Т.53. – Вып. 3. - С.10-19.

Пассивный анаэробиоз и микроаэрофильный обмен беспозвоночных // Успехи соврем. биол. – Т.25. – Вып. 1. - С.107-122.

Эффективность утилизации солнечной радиации планктоном // Природа - № 12. - С.29-35.

1949

Интенсивность обмена у простейших // Успехи соврем. биол. – Т.28. – Вып. 2. - С.226-245.

1950

Интенсивность обмена и размеры ракообразных // Журн. общ. биол. – Т.11. - № 5. - С.367-380.

К количественной характеристике роли планктона в круговороте веществ в озерах // Докл. АН СССР. – Т.73. - № 5. - С.1037-1039 (В соавт. с И.С.Захаренковым).

Материалы к количественной характеристике макробентоса Волжского отрога Рыбинского водохранилища // Тр. биол. ст. «Борок» им. Морозова. – Вып.1. - С.139-163.

1951

Биомасса планктона и растворенное органическое вещество в воде озер // Бюл. Моск. о-ва испыт. природы. Отд. биол.. – Т.61. - Вып.2. - С.24-37 (В соавт. с Т.П.Платовой).

О пигментах «зеленой бактерии» // Докл. АН СССР. – Т.76. - №6. - С.909-912 (В соавт. с Т.Н. Годневым).

Случай летнего замора рыб в озере // Природа. - № 3. - С.65-67.

1952

Биологические основы минерального удобрения рыбоводных прудов // Успехи соврем. биол. – Т.34. – Вып. 1. - С.52-81.

Некоторые наблюдения над «зеленой бактерией» // Микробиология. – Т.21. - № 2. - С.139-145 (В соавт. с Т.Н. Сивко).

1953

Интенсивность обмена у мальков карпа // Докл. АН СССР. – Т.89. - № 6. - С.1119-1122 (В соавт. с Л.Е.Хартовой).

Некоторые общие вопросы продуктивности озер // Зоол. журн. – Т.15. - С.587-603.

Общее число бактерий и скорость потребления кислорода в водах разной степени загрязнения // Микробиология. – Т.22. - № 3. - С.294-303 (В соавт. с М.С.Ломоносовой).

Определение содержания хлорофилла в планктоне // Весці АН БССР. Сер. біял. навук- № 3. - С.61-74 (В соавт. с Т.Н.Сивко).

Отбор проб воды без батометра (контроль кислородного режима водоемов) // Рыбное хоз-во. - № 4. - С.54-55.

Прения по докладам // Тр. Совещ. по вопр. прудовой рыб. ихтиол. комиссии. – М.: Наука. – С.48-52.

1954

Биологические основы эффективного применения минерального удобрения прудов // Тез. докл. на совещании по рыбоводству (научные проблемы искусственного разведения проходных и полупроходных рыб и развитие прудового рыбоводства). [Москва, 16 - 18 дек. 1954г.] - М. - С.98-103.

Исследования потребности в минеральных удобрениях рыбоводных прудов БССР // Уч. записки. Сер. биол. (Белорус. ун-т). – Вып.17. – С.207-220.

Итоги изучения методов интенсификации в производственном рыбхозе // Уч. записки. Сер. биол. (Белорус. ун-т). – Вып.17. – С.222-255 (В соавт. с А.И.Щелкановой).

Материалы к гидрохимической характеристике озер Нарочанской группы // Уч. записки. Сер. биол. (Белорус. ун-т). – Вып.17. – С.11-19.

Некоторые количественные данные по биомассе планктона озер БССР // Уч. записки. Сер. биол. (Белорус. ун-т). – Вып.17. – С.20-37.

Радиоактивный углерод и фотосинтез морского планктона // Природа. - № 5. - С.92-94.

Содержание хлорофилла как показатель количественного развития фитопланктона // Третья экол. конф.: Тез. докл. Ч. 4. - Киев. - С.70-74.

Токсический фитопланктон // Успехи соврем. биол. – Т.38. – Вып. 2. - С.216-226.

Удобрение прудов [О повышении рыбопродуктивости водоемов] // Природа. - № 1. - С.105-108.

1955

Значение фотосинтеза для обогащения воды кислородом при самоочищении загрязненных вод // Тр. Всесоюзн. гидробиол. о-ва. – Т.6. - С.46-69.

Итоги работ по изучению методов минерального удобрения рыбоводных прудов // Тезисы докл. научной сессии, посвященной итогам научно-исследовательской работы за 1954 год. – Минск. - С.58-59.

Круговорот фосфора в водоемах // Природа. - № 2. - С.86-88.

Опыт применения радиоизотопа фосфора при изучении удобрения прудов // Докл. АН СССР. – Т.100. - № 3. - С.575–578 (В соавт. с Т.Н. Годневым, В.И. Гапоненко).

Первичная продукция водоемов, ее значение и методы изучения // Юбилейная сессия, посвященная 150-летию Моск. о-ва испыт. природы. - М.: Наука. – С.1-4.

1956

Гидрохимическая характеристика пойменных водоемов среднего течения реки Припяти // Тр. Комплекс. экспедиции по изучен. водоемов Полесья. - С.32- 41.

Гидробиологический очерк озера Червонное // Тр. Комплекс. экспедиции по изучен. водоемов Полесья. - С.302-314.

Интенсивность обмена и пищевые потребности рыб. – Минск: Изд-во Белорус. ун-та. – 253 с.

Минеральное удобрение рыбоводных прудов // Минск: Изд-во Белорус.ун-та. - 22 с.

Некоторые итоги изучения потребности в удобрениях прудов БССР // Уч. записки. Сер. биол. (Белорус. ун-т). – Вып. 26. - С.185-199.

О зависимости интенсивности обмена у членистоногих от величины тела // Учен. зап. (Белорус. ун-т). – Вып..26. - С.243-254.

Общие задачи комплексной экспедиции по изучению водоемов Белорусского Полесья // Тр. Комплекс. экспедиции по изучен. водоемов Полесья. - С.3-16 (В соавт. с П.Г.Петровичем).

Первичная продукция планктона // Журн. общ. биол. – Т.17. - № 5. - С.364-376.

Фитопланктон как агент самоочищения загрязненных вод // Тр. Всес. гидробиол. о-ва. – Т.7. - С.3-23 (В соавт. с Т.Н.Сивко).

The metabolic intensity and food requirements of fish. - Fish Res. Board of Canada. Transl. Ser. – N 194. (? – по Скарлато и др.,1988 – канадское переиздание вышло в 1960-м г, что более правдоподобно)

1957

Биологические основы эффективного применения минерального удобрения прудов // Тр. совещ. ихтиол. комиссии АН СССР – Вып.7. - С.323-329.

Выступление в прениях по докладам на совещании по рыбоводству // Тр. совещ. по рыбоводству. – Т.7. - С.492-494.

Значение новых методов лимнологического исследования для разработки типологии озер // Пятая науч. конф. по изуч. внутренних водоемов Прибалтики (16-20 апреля 1957 г.): Тез. докл. – Минск. - С.6-9.

Значение фотосинтетической реаэрации в процессах самоочищения водоемов // Пятая науч. конф. по изуч. внутренних водоемов Прибалтики (16-20 апреля 1957 г.): Тез. докл. – Минск. - С.75-76.

Кормовая база промысловых озер Белоруссии // Тр. Белорус. отд. ВНИОРХ. – Т.1. - С.57-70.

Массовые культуры одноклеточных водорослей как новый источник пищевого и промышленного сырья // Успехи соврем. биол. – Т.43. - № 3. - С.332-351.

Общие особенности и гидрохимический режим Нарочанских озер // Пятая науч. конф. по изуч. внутренних водоемов Прибалтики (16-20 апреля 1957 г.): Тез. докл. – Минск. - С.9.

Очистка сточных вод в биологических прудах // Тр. совещ. по использованию и обезвреживанию сточных вод на земледельческих полях орошения. - М. - С.3–12 (В соавт. с А.П.Остапеней и Т.Н. Сивко).

Советская и зарубежная практика очистки сточных вод в «окислительных прудах» // Тез. докл. III Белорус. съезда гигиенистов, эпидемиологов, микробиологов и инфекционистов. – Минск. - С.33-34.

Содержание хлорофилла как показатель количественного развития фитопланктона // Вопр. экологии (Киевский ун-т). – Т.1. – Киев. - С.15-18.

1958

Зависимость интенсивности обмена от общих размеров тела у пресноводных брюхоногих моллюсков // Бюл. Ин-та биологии АН БССР за 1957г. – Вып. 3. - С.273-276 (В соавт. с Ю.С.Беляцкой).

Исследования по эффективности минеральных удобрений на опытных прудах прудхоза «Шеметово». Сообщ. 1. Общий очерк исследований на опытных прудах прудхоза «Шеметово» и гидрохимические особенности их // Гидробиологические исследования на рыбоводных прудах БССР / Тр. Биол. ст. на оз. Нарочь (Белорус. ун-т). – Вып.1. – Минск. - С.79-93.

Исследования по эффективности минеральных удобрений на опытных прудах прудхоза «Шеметово». Сообщ 2. Фитопланктон опытных прудов // Гидробиологические исследования на рыбоводных прудах БССР / Тр. Биол. ст. на оз. Нарочь (Белорус. ун-т). – Вып.1. – Минск. - С.93-112 (В соавт. с Ю.С.Беляцкой, Ю.И.Дорожкиным, Н.А.Дунке и др.)

Исследования по эффективности минеральных удобрений на опытных прудах прудхоза «Шеметово». Сообщ. 3. Первичная продукция планктона опытных прудов // Гидробиологические исследования на рыбоводных прудах БССР / Тр. Биол. ст. на оз. Нарочь (Белорус. ун-т). – Вып.1 – Минск. - С.113–126 (В соавт. с Л.Б.Кищенко).

Материалы по первичной продукции планктона рыбоводных прудов «Волма» // Гидробиологические исследования на рыбоводных прудах БССР / Тр. Биол. ст. на оз. Нарочь (Белорус. ун-т). – Вып.1– Минск. - С.23- 36 (В соавт. с А.В. Лещиной, В.Васильевой).

Некоторые новые методы изучения первичной продукции планктона озер и первые итоги их применения // Тез. докл. 6-ой науч. конф. по изуч. водоемов Прибалтики - Вильнюс. - С.6-8.

Общие задачи и некоторые методы гидробиологических исследований на рыбохозяйственных прудах // Гидробиологические исследования на рыбоводных прудах БССР / Тр. Биол. ст. на оз. Нарочь. – Вып.1. – Минск. - С.3-22.

Развитие некоторых водных организмов в культурах при разных активностях P^{32} // Гидробиологические исследования на рыбоводных прудах БССР / Тр. Биол. ст. на оз. Нарочь. – Вып.1. – Минск. - С.193–196 (В соавт. с В.И.Гапоненко).

Quelques questions concernant les methodes de 1'investigation de la production primaire du plankton, basee sur les travaux executes en URSS // Verb. Reunions. Conseil perman. internat. explorat. Mer. Rapp. Et ptoc. – V.144. - P.65-69.

1959

Значение новых методов лимнологического исследования для разработки типологии озер // Тр. Пятой науч. конф. по изуч. внутр. водоемов Прибалтики. - Минск. - С.5-13.

Значение фотосинтетической реаэрации в процессах самоочищения водоемов // Тр. Пятой науч. конф. по изуч. внутр. водоемов Прибалтики. - Минск. - С.251- 255.

Роль фито- и зоопланктона в процессах стабилизации органического вещества сточных вод в биологических прудах // Тез. докл. науч. конф. БНИСГИ, посвященной 40-летию БССР. – Минск. - С.21–24 (В соавт. с Т.Н. Сивко).

Соотношение интенсивности обмена и веса тела у пресноводных брюхоногих моллюсков // Зоол. журн. – Т.38. – Вып.8. - С.1146-1151(В соавт. с Ю.С. Беляцкой).

1960

Исследование первичной продукции водоемов // Вестник АН СССР. – Т.30. - №6. - С.138-139.

Методическое пособие по определению первичной продукции органического вещества в водоемах радиоуглеродным методом. – Минск: Изд-во Белгосуниверситета. - 27 с. (В соавт. с Ю. Г. Кабановой, О.И. Кобленц-Мишке, Н.Н.Хмелевой и др.).

Первичная продукция водоемов. – Минск: Изд-во АН БССР. - 329 с.

Сравнительное исследование первичной продукции планктона радиоуглеродным и кислородным методами // Докл. АН СССР. – Т.130. - №2. - С.446– 449 (В соавт. с В.Л. Калером).

Фотосинтез фитопланктона в биологических прудах полей фильтрации г. Минска // Докл. АН БССР. – Т.4. - № 11. - С.490–493 (В соавт. с Т.Н. Сивко).

1961

Биологические пруды в практике очистки сточных вод // Очистка сточных вод в биологических прудах. – Минск. - С.3– 42 (В соавт. с А.П.Остапеней)

Новые данные об интенсивности обмена у рыб // Вопросы ихтиол. – Т.1. – Вып.1. - С.157-165.

Современное состояние и задачи изучения первичной продукции водоемов // Первичная продукция морей и внутренних вод. – Минск: Изд-во Мин. высш., ср. спец. и проф. образов. БССР. - С.11-24.

Методы определения содержания хлорофилла в планктоне и некоторые итоги их применения // Первичная продукция морей и внутренних вод. – Минск: Изд-во Мин. высш., ср. спец. и проф. образов. БССР. - С.231– 240 (В соавт. с Т.Н.Сивко, Р.З.Ковалевской).

Участие фотосинтезирующих организмов планктона в процессах самоочищения загрязненных вод // Тез. докл. IX научн. конф. по изуч. водоемов Прибалтики. Рига, 14 - 16 сентября 1961. – Рига. - С.11-12 (В соавт. с Т.Н. Сивко).

Production primaire du plankton lacustre, étudiée a 1'aide de trois méthodes: d'oxygéne, du carbone radioactif et de la chlorophylle // Verh. Internal. Verein. Limnol. - Vol.14. - P.109-112.

Primary production of body of water // 10th Pacific Ocean Congress, Honolulu, Hawaii.

1962

Гидробиологические методы исследования продуктивности прудов // Тр. совещ. ихтиол. комиссии АН СССР. – Вып.14. - С.24-29 (В соавт. с В.П.Ляхновичем).

Первичная продукция озерного планктона, изученная тремя методами: кислородным, радиоуглеродным и хлорофильным // Биология внутр. водоемов Прибалтики / Тр. 7-й науч. конф. по изуч. внутренних водоемов Прибалтики (Петрозаводск). – М.,Л.: Изд-во АН СССР - С.186-192.

Энергетический принцип изучения трофических связей и продуктивности экологических систем // Зоол. журн. – Т.41. – Вып.11. - С.1618-1630.

Энергетический принцип изучения продуктивности и трофические связи в экосистемах // Вопросы экологии. - № 4. - С.13-15.

The significance of photosynthetic aeration in the oxygen balance of polluted waters // Int. J. Air. Wat. Poll. – Vol. 6 - P.267-275.

1963

Современное состояние удобрения прудов // Прудовое рыбное хоз-во. – М. - С.87-93 (В соавт. с В.П. Ляхновичем).

Суточный ход интенсивности газообмена пойкилотермных животных // Зоол. журн. – Т.42. – Вып. 11. - С.1593–1600 (В соавт. с Ю.С.Беляцкой-Потаенко).

Участие фотосинтезирующих организмов фитопланктона в процессах самоочищения загрязненных вод // Гидробиология и ихтиология внутренних водоемов Прибалтики / Тр. Ин-та биол. АН Латв. ССР. – Т.23; Рыбное х-во внутр. водоемов Латв. ССР. – Т.7. – Рига. - С.61–65 (В соавт. с Т.Н.Сивко).

1964

Гидробиологические, ихтиологические и рыбохозяйственные исследования в Белоруссии // Биологические основы рыбного хозяйства на внутренних водоемах Прибалтики / Тр. 10-й науч. конф. по внутренним водоемам Прибалтики (Минск, 6-10 мая 1963 г.) – Минск: Наука и техника. – С.5-13 (В соавт. с П.И.Жуковым, В.К. Домбровским).

Культивирование зеленых планктонных водорослей на сточной жидкости // Микробиология. – Т.33. – Вып. 3. - С.508-515.

Некоторые данные по содержанию хлорофилла в планктоне и первичной продукции Черного моря // Тр. Севастоп. биол. ст. – Т.17. - С.212–220 (В соавт. с Е.П.Муравлевой, З.З.Финенко).

Пути количественного изучения потребления и усвоения пищи водными животными // Журн. общ. биол. – Т.25. - № 4. - С.254-266.

Пути количественного исследования роли водных организмов как агентов самоочищения загрязненных вод // Радиоактивные изотопы в гидробиологии и методы санитарной гидробиологии. - М.- Л.: Наука. - С.117-134.

Современное состояние удобрения прудов // Биологические основы рыбного хозяйства на внутренних водоемах Прибалтики / Тр. 10-й науч. конф. по внутренним водоемам Прибалтики (Минск, 6-10 мая 1963 г.) - С.87-94 (В соавт. с В.П.Ляхновичем).

1965

Биотический баланс вещества и энергии и биологическая продуктивность водоемов // Гидробиол. журн. – Т.1. - № 1. - С.25-32.

Взаимозависимость интенсивности обмена и скорости роста животных // Физиологические основы экологии водных животных: Тез.докл. – Севастополь. - С.18-21.

Влияние на рост водорослей на сточной жидкости токсических и органических примесей // Изучение интенсивной культуры водорослей. – Прага. - С.272-288 (В соавт. с Т.Н.Сивко, Р.И. Левиной, Н.М. Крючковой).

Проблемы первичной продукции // Вопросы гидробиологии: Тез. докл. 1 съезда ВГБО, М., 1-6 февраля 1965 г. – М.: Наука. - С.67–68 (В соавт. с О.И. Кобленц-Мишке).

Продукция планктонных ракообразных в трех озерах разного типа // Зоол. журн. – Т.44. – Вып.5. - С.676–687 (В соавт. с Г.А.Печень, Э.А.Шушкиной).

Удобрение прудов. - М.: Пищ. пром-ть. - 271 с. (В соавт. с В.П.Ляхновичем).

1966

Биологические пруды в практике очистки сточных вод. – Минск: Беларусь. - 231 с. (В соавт. с А.П.Остапеней, Т.Н. Сивко, Р.И.Левиной).

Математическая модель водной экосистемы // Фотосинтезирующие системы высокой продуктивности. - М.: Наука. - С.213-223 (В соавт. с С.И. Анисимовым).

О подготовке гидробиологов // Гидробиол. журн. – Т.3. - № 4. - С.98-99.

Общие задачи и принципы организации советских работ по МБП по продуктивности пресноводных сообществ // Общие основы советской национальной программы работ по изучению продуктивности пресноводных сообществ. – М., Л.: Наука. – С.5-22.

Предисловие // Общие основы советской национальной программы работ по изучению продуктивности пресноводных сообществ. – М., Л.: Наука. – С.3-4 (В соавт. с С.И.Кузнецовым).

Проблемы первичной продукции водоемов // Экология водных организмов. - М.: Наука. – С.50-62 (В соавт. с О.И. Кобленц-Мишке).

Скорость роста и интенсивность обмена у животных // Успехи соврем. биол. – Т.61. – Вып.2 - С.274-293.

1967

Гидробиология пресных вод // Развитие биологии в СССР.- М.: Наука. - С.307-322.

Основные направления в изучении биотического баланса озер // Круговорот вещества и энергии в озерных водоемах. - М.: Наука. - С.132-146.

Особенности водных экологических систем // Журн. общ. биол. – Т.28. - № 5. - С.538-545.

1968

Взаимозависимость интенсивности обмена и скорости роста у животных // Биология моря, Киев. – Вып.15. - С.5-15.

Методы определения продукции популяции с растянутым периодом размножения // Методы определения продукции водных животных. – Минск: Вышейш. школа. - С.108-172 (В соавт. с Г.А.Печень, В.П. Грезе, Э.А. Шушкиной, Г.А. Галковской).

Методы расчета продукции популяций без постоянного пополнения // Методы определения продукции водных животных. – Минск: Вышейш. школа. - С.78–107 (В соавт. с Е.А. Яблонской и Ю.Ю. Бекманом).

Общие задачи определения продукции водных животных. Термины и обозначения // Методы определения продукции водных животных. – Минск: Вышейш. школа. - С.9-19.

Рост, скорость развития и плодовитость в зависимости от условий среды // Методы определения продукции водных животных. – Минск: Вышейш. школа. - С.45-77 (В соавт. с Г.А. Печень).

Nawozenie stawow //Panstwowe wydawnictwo Rolnlcze i Lesne (Z W.Lachnowicz).

1969

Значение гидробиологии в решении водохозяйственных проблем // Гидробиол. журн. – Т.5. - №4. - С.9-24.

Опыт исследования математической модели водной экосистемы // Тр. ВНИРО. – Т.67. - С.49-74 (В соавт. с С.И.Анисимовым).

Поток энергии в экосистеме эвтрофного озера // Докл. АН СССР. – Т.186. - №1. - С.198-201.

1970

Общие особенности экологической системы озера Дривяты // Биологическая продуктивность эвтрофного озера / Тр. Всес. гидробиол. о-ва.- Т.15. - М.: Наука. - С.185-196.

Особенности биологической продуктивности озер Кривого и Круглого // Отчетная научная сессия по итогам работ 1969 г. Тез. докл. - Л.: Зоологический ин-т АН СССР. - С.11-12.

Особенности биологической продуктивности и потока энергии в сообществе двух северных озер // Биологические процессы в морских и континентальных водоемах: Тез. докл. II съезда Всес. гидробиол. о-ва. – Кишинев. - С.14-15 (В соавт. с А.Ф.Алимовым, В.В.Бульоном, С.М.Вардапетян и др.).

Предисловие // Тр. Всесоюзн. гидробиол. о-ва. – Т.15. – С.7-8.

Energy flow in aquatic ecological system // Polskie Arch. Hydrobiol. – Vol.17(30). – N 1/2. - P.11-19.

Fishponds fertilization. – Canada. (With W.P. Lakhnowich).

1971

Биологическая продуктивность континентальных вод СССР // Бюл. Моск. о-ва испыт. природы. Отд. биол. – Т.76. - № 3. - С.34- 45 (В соавт. с О.Н. Бауэром).

Биологическая продуктивность озер разного типа // Биопродуктивность озер Белоруссии. – Минск: Изд-во Белорус. ун-та. - С.5-33 (В соавт. с В.А. Бабицким, С.И. Гавриловым и др.).

Биоценология водной среды // Природа. - № 6. - С.12.

Гидробиология // БСЭ. М.: Сов. Энциклопедия. 3–е изд. - Т.6. - С.475-477.

Линейные размеры и масса тела животных // Журн. общ. биол. – Т.32. - № 6. - С.714-723.

Некоторые результаты исследований продуктивности озер в Советском Союзе по Международной биологической программе // Гидробиол. журн. – Т.7. - № 1. - С.5-17.

Сравнительная оценка некоторых распространенных методов расчета продукции бактерий // Гидробиол. журн. – Т.7. - № 4. - С.86-96.

Biological productivity and energy flow in communities of two northern lakes // Limnologorum Conventus 18: Session in Leningrad, August 19-26, 1971: Abstracts of Communications. – L.: Nauka. - P.120-121 (With A.F.Alimov, N.G.Ozeretskovskaya, V.V.Boullion, T.V.Zharova, N.K.Kuzmitskaya, V.N.Nikulina, M.B.Ivanova, L.A.Kutikova, V.Ya.Pankratova, N.P.Finogenova).

Productivity and principles of the management of inland waters in the USSR // Freshwat. Biology. – Vol.1. – P.159-167.

Symbols, units and conversion factors in studies of freshwater productivity // Int. Biol. Program. - London, 23.

1972

Биологическая продуктивность озер Дальне-Зеленецкое и Акулькино // Отчетная научная сессия по итогам работ 1971 года. Зоол. ин-т АН СССР: Тез. докл. - Л.: Наука. - С.5-6.

Значение гидробиологии в решении водохозяйственных проблем // Теория и практика биологического самоочищения загрязненных вод. - М.: Наука. - С.7-12.

Исследования биологического баланса энергии и биологической продуктивности озер в Советском Союзе // Экология. - № 4. - С.5-18.

Обозначения, единицы измерения и эквиваленты, встречаемые при изучении продуктивности пресных вод. - Л.: Сов. Национальный комитет по МБП. - 35 с.

Цели и задачи гидробиологии пресных вод при комплексном использовании водных ресурсов // Водные ресурсы. - № 3. - С.76-102.

Biological productivity of different types of lakes // Productivity Problems of Freshwaters: Proc. of the IBP-UNESCO Symp. on Productivity Problems of Freshwaters (May 6-12, 1970, Kazimierz Dolny, Poland) / Ed. Z.Kajak, A.Hillbricht-Ilkowska. – P.383-404 (With V.A. Babitsky, S.I.Gavrilov, G.V.Gladky, I.S.Zakharenkov, R.Z.Kovalevskaya, T.M.Mikheeva, P.S.Nevyadomskaya, A.P.Ostapenya, P.G.Petrovich, J.S.Potaenko, O.F.Yakushko).

Biological productivity of two northern lakes // Verh. Int. Verein. theor. und angew. Limnol. – Vol.18. – – P.65-70 (With A.F.Alimov).

Etudes sur le bilan biologique, énergetique et la productivité des lacs en Union Soviétique (Edgardo Baldi Memorial Lecture). // Verh. Int. Verein. theor. und angew. Limnol. – Vol.18. – Pt.1. – P.39- 64.

Some interim results of Soviet IBP investigations on lakes // Productivity Problems of Freshwaters: Proc. of the IBP-UNESCO Symp. on Productivity Problems of Freshwaters (May 6-12, 1970, Kazimierz Dolny, Poland) / Ed. Z.Kajak, A.Hillbricht-Ilkowska. – P.363-381.

1973

Биологическая продуктивность двух субарктических озер // Продукционно-биол. исследования экосистем пресных вод. – Минск: Изд-во Белорус. ун-та. - С.125-147 (В соавт. с А.Ф.Алимовым, В.В. Бульоном, М.Б.Ивановой, Е.В.Коробцовой, Н.В.Кузьмицкой, В.Н.Никулиной, Н.П.Финогеновой, М.В.Фурсенко).

Введение // Биологические процессы и самоочищение на загрязненном участке реки (на примере верхнего Днепра). – Минск: Изд-во Белорус. ун-та, 1973. – С.5-11.

Предисловие // Многолетние показатели развития зоопланктона озер. – М.: Наука. – С.5 (В соавт. с Н.Н.Смирновым).

Успехи и состояние изучения обмена, роста, питания и продукции пресноводных беспозвоночных животных // Гидробиол. журн. – Т.9. - № 3. - С.123–129 (В соавт. с А.Ф.Алимовым, Г.А. Галковской, М.Б.Ивановой, Л.А.Китициной, Н.М.Крючковой, А.В.Монаковым, А.П.Остапеней, Г.А.Печень-Финенко, Н.Ю.Соколовой, Т.В.Хлебович).

Biological productivity of two subarctic lakes // Freshwater Biol. – Vol.3. – N 3. - P.177-197 (With A.F.Alimov, V.V. Boullion, M.B.Ivanova, E.V.Korobtzova, N.K.Kuzmitskaya, V.N.Nikulina, N.P.Finogenova, M.V.Fursenko).

1974

Значение математического моделирования для разработки научных основ рационального использования биологических ресурсов пресных вод. Проблемы долгосрочного планирования биологических исследований // Зоология. – Вып. 1. – С.25-44 (В соавт. с В.В. Меншуткиным).

Количественное изучение трофических взаимоотношений видов в экосистеме // Всесоюзное совещание по проблеме «Вид и его продуктивность в ареале»: Тез. докл. - Л.: Наука. - С.61-63.

Количественные показатели продукционного процесса в озерах и водохранилищах Советского Союза // Отчетная научная сессия по итогам работ 1973г. Зоологический ин-т АН СССР: Тез. докл. - Л.: Наука. - С.8-9 (В соавт. с А.Ф.Алимовым, М.Б.Ивановой).

Некоторые общие соотношения между биомассой планктонных фильтраторов и их пищей // Гидробиол. журн. – Т.10. - № 5. – С.109-112.

1975

Биологическое самоочищение и формирование качества вод // Задачи санитарной гидробиологии. – М.: Наука. – С.5-9.

Введение // Биологическая продуктивность северных озер. 1.Озера Кривое и Круглое / Тр. Зоол. ин-та АН СССР. Т.56. - Л.: Наука, 1975. – С.3-9.

Взаимозависимость роста и энергетического обмена у пойкилотермных животных // Количественные аспекты роста организмов. – М.: Наука. – С.7-25.

Гидробиология. Гл.9 // История биологии. – М.: Наука. – С.231-248.

Общая характеристика экосистем озера Кривого и озера Круглого // Биологическая продуктивность северных озер. 1.Озера Кривое и Круглое / Тр. Зоол. ин-та АН СССР. Т.56. - Л.: Наука, 1975. – С.207-218.

Общегидробиологическая основа санитарно-гидробиологических исследований // Биол. самоочищение и формирование качества воды. – М.: Наука. – С.5-9.

Особенности экосистем пресноводных водоемов (из итогов советских исследований по Международной биол. программе) // Изв. АН СССР. Сер. биол. - № 1.- С.83-93.

1976

Зависимость энергетического обмена от массы тела у водных пойкилотермных животных // Журн. общей биологии. – Т.37. - №1. – С.56-70.

Итоги исследований пресноводных сообществ всех трофических уровней // Итоги советских исследований по Международной биол. программе / Ресурсы биосферы. Вып. 2. – Л.: Наука. – С.145-157.

Соотношение между продукцией морских животных и «ростовой» и «поддерживающей» продукциями. // Океанология. – Т.16.- №5.- С.854-867.

Сравнительная оценка гидробиологических методов контроля качества вод. // Проблемы зоологии: Материалы научной отчетной сессии Зоол. ин-та АН СССР. – Л.: ЗИН АН СССР. – С.16-19.

1977

Введение // Определитель пресноводных беспозвоночных Европейской части СССР.- Л.: Гидрометеоиздат. – С. 3-7.

Гидробиология как экологическая наука // Гидробиол. журн. – Т.13. – Вып.5. – С.5-16.

Евтрофирование озер и первые итоги гидробиологических исследований на р.Тюп и Тюпском заливе озера Иссык-Куль. // Гидробиологические исследования на реке Тюп и Тюпском заливе озера Иссык-Куль. - Л.: ЗИН АН СССР. - С.132-139.

Интенсивность обмена при постэмбриональном развитии пойкилотермных животных // Проблемы экспериментальной биологии. – М.: Наука. - С.288-293.

Предисловие // Биологический режим водоемов – охладителей ТЭЦ и влияние температуры на гидробионтов / Тр. Всес. гидробиол. о-ва. – Т. 21. – М.: Наука. – С.3-5.

Сопоставление биомасс фито – и зоопланктона озер // Гидробиол. журн. – Т.13. - №6. – С.14-23.

Экология – задачи и перспективы // Природа. - №5.- С.3-11. (В соавт. с М.С.Гиляровым, Ю.И.Черновым).

1979

Зависимость между длиной и массой тела планктонных ракообразных. // Экспериментальные и полевые исследования биологических основ продуктивности озер. – Л.: ЗИН АН СССР. – С.58-79. (В соавт. с Е.В.Балушкиной)

Зависимость между массой и длиной тела у планктонных животных. // Общие основы изучения водных экосистем. - Л.: Наука – С.169-172. (В соавт. с Е.В.Балушкиной)

Зависимость скорости потребления кислорода коловратками от массы тела. // Общие основы изучения водных экосистем. - Л.: Наука. - С.21-25. (В соавт. с Г.А.Галковской).

Зависимость скорости развития коловраток от температуры. // Общие основы изучения водных экосистем. - Л.: Наука. - С.149-155. (В соавт. с Г.А.Галковской).

Опыт применения разных систем биологической индикации загрязнения вод. // Научные основы контроля качества поверхностных вод по гидробиологическим показателям: Труды сов.-англ. семинара. – Л.- С.124-131 (В соавт. с А.Ф.Алимовым, Е.В.Балушкиной, В.Н.Никулиной, Н.П.Финогеновой, С.Я.Цалолихиным).

Опыт применения разных систем биологической индикации загрязнения вод в СССР // Влияние загрязняющих веществ на гидробионтов и экосистемы водоемов: Мат-лы двух сов.-амер. симп. – Л. – С.285-292.

Предисловие // Экспериментальные и полевые исследования биологических основ продуктивности озер. – Л.: ЗИН АН СССР. – С.3.

Формирование представлений о продукции // Общие основы изучения водных экосистем. - Л.: Наука – С.114-119.

1980

Предисловие // Трофические связи пресноводных беспозвоночных. – Л.: ЗИН АН СССР. – С.3.

Условия корректного применения в биологии элементарных эмпирических формул // Количественные методы в экологии животных. – Л.: ЗИН АН СССР. – С.34-36.

General characteristics of freshwater ecosystems based on Soviet IBP studies // Functioning of Freshwater Ecosystems / Eds. E.D.LeCren, R.H.McConnell. - IBP 22. Cambridge University Press - P.481-491.

1981

Многообразие и единство жизненных явлений и количественные методы в биологии. // Журн. общей биологии. - Т.42. - №1. – С.5-18.

Предисловие // А.Ф.Алимов. «Функциональная экология пресноводных двустворчатых моллюсков». – Л.: Наука. – С.3-6.

Проблемы и организация гидробиологических исследований внутренних вод. // Гидробиол. журн. – Т.17. - №1.- С.3-11.

Соотношение между первичной продукцией и рыбопродуктивностью водоемов // Основы изучения пресноводных экосистем. – Л.: ЗИН АН СССР. – С.5-10. (В соавт. с В.В.Бульоном).

Успехи лимнологии и гидробиологические методы контроля качества внутренних вод. // Научные основы контроля качества вод по гидробиологическим показателям. – Л.: Гидрометеоиздат. - С. 16-45.

1982

Лаборатория пресноводной и экспериментальной гидробиологии // Зоологический институт: 150 лет. Л.: АН СССР. - С.182-194. (В соавт. с Л.А.Кутиковой).

1983

Биологическая продуктивность водоемов. // Экология. – №3. – С. 3-12.

Методические основы расчета характеристик роста водных животных. Зообентос и его продукция. // Методические рекомендации по сбору и обработке материалов при гидробиологических исследованиях на пресноводных водоемах. – Л.: ГосНИОРХ, ЗИН АН СССР – С.29-51. (В соавт. с А.Ф.Алимовым).

Предисловие // В.В.Бульон «Первичная продукция планктона внутренних водоемов». – Л.: Наука. – С.3-4.

Предисловие // Трофические связи и их роль в продуктивности природных водоемов. – Л.: .: ЗИН АН СССР. – С.3.

Развитие гидробиологии внутренних вод в Зоологическом институте АН СССР // Гидробиол. журн. – Т.19. - №2. – С.3-13. (В соавт. с М.Б.Ивановой).

Температурный коэффициент Вант-Гоффа и уравнение Аррениуса в биологии // Журн. общей биол. – Т.44. - №1. – С.31-42.

1984

Взаимозависимость общегидробиологических и рыбохозяственно-гидробиологических исследований //Сб. научных трудов ГосНИОРХ. – Вып.223. – С.3-10.

Некоторые необходимые уточнения приемов изучения роста животных // Гидробиол. журн. – Т.20. - Вып.6. – С.3-10.

Уровень энергетического обмена у многоклеточных беспозвоночных животных и у простейших // Докл. АН СССР. Т.274.- №2.- С.497-499. (В соавт. с Т.В.Хлебович).

Ecology – Its Tasks and Prospects // Man and Biosphere: Leafing through the “Priroda” journal - Moscow: Nauka Publishers. – P.7-17 (With M.Gilyarov, Yu.Chernov).

1985

Некоторые итоги практики применения продукционно-гидробиологических методов. // Продукция популяций и сообществ водных организмов и методы ее изучения. – Свердловск: Урал. центр АН СССР. – с. 3-18.

Общие особенности продукционных процессов в Нарочанских озерах // Экологическая система Нарочанских озер. – Минск: Изд-во Университетское. – С.269-284.

Предисловие // М.Б.Иванова «Продукция планктонных ракообразных в пресных водах». – Л.: ЗИН АН СССР. – С.3-4.

1986

Основы составления биотического баланса // Исследование взаимосвязи кормовой базы и рыбопродуктивности на примере озер Забайкалья. - Л.: Наука. - С. 188-193.

Предисловие // Б.Л.Гутельмахер «Метаболизм планктона как единого целого». – Л.: Наука. – С.3-4.

Продуктивность и рациональное использование озер Еравно-Харгинской системы // Исследование взаимосвязи кормовой базы и рыбопродуктивности на примере озер Забайкалья. - Л.: Наука. - С. 212-219. (В соавт. с А.Ф. Алимовым, А.А.Умновым, Д.С.Норенко).

Сравнительно-биолимнологические исследования: их возможности и ограничения //Сб. научных трудов ГосНИОРХ. – Вып.252. – с.4-18.

Эффективность роста и продукция водных животных // Эффективность роста гидробионтов / Сб. докладов сессии Белорусского отделения Всес. гидробиол. о-ва, посвященных памяти выдающегося ученого В.С.Ивлева. Минск, январь 1985. – Гомель. – с.20-61.

1987

Введение // Труды Зоологического института АН СССР. – Т. 151. – С.4-7. (Совм. с Б.Л.Гутельмахером).

Зависимость скорости онтогенетического развития от температуры // Тр. Зоол. ин-та АН СССР. – Т. 165. – С.5-34.

Современное состояние экосистемы Невской губы // Тр. Зоол. ин-та АН СССР. – Т. 151. – С.198-205 (Совм. с Б.Л.Гутельмахером).

1988

Концептуальные основы, перспективные задачи и вопросы кадрового обеспечения гидробиологических исследований // Гидробиол. журн. – Т.24. – № 3. – с.3-30.

1993

О принципиальной невозможности регулирования численности синезеленых водорослей с помощью рыб-планктофагов // Антропогенное перераспределение органического вещества в биосфере. – СПб: Наука. - С.130-132.

2000

Многообразие и единство жизненных явлений и количественные методы в биологии // Журн. общей биол. - Т.61. - №5. – С.549-560.

РЕЦЕНЗИИ, РЕФЕРАТЫ, КРИТИКА, ХРОНИКА, ПЕРСОНАЛИЯ

1936

Конференция по проницаемости // Успехи соврем. биол. – Т.5. - № 4. - С.745-748.

1937

Партеногенетическая мерогония. Реф. статьи: Ethel B. Harvey. Parthenogenetic merogony or cleavage without nuclei in *Arabica punctulata*. Biol. Bull., Vol. 71, N 1, p. 101-121 // Успехи соврем. биологии. – Т.6. – Вып.1. - С.188-192.

1938

По поводу работы В.А.Мейена, Г.С.Карзинкина и др. «Использование двухлетним карпом естественных кормовых запасов пруда» // Зоол. журн. – Т.17. – Вып. 5. - С.877-881.

1939

Конференция по экологии и физиологии рыб и водных беспозвоночных // Успехи соврем. биол. – Т.10. – Вып.2. - С.353-358.

Поглощение ионов пресноводными животными (новые работы А.Крога) // Успехи соврем. биол. – Т.10. - № 1. - С.162 -165.

1947

Гидробиологическая конференция // Успехи соврем. биол. – Т. 23. - № 3. - С.465-469.

1956

Конференция гидробиологов Прибалтики // Зоол. журн. – Т.35. – Вып.10. - С.1599-1600.

Рецензия на кн.: Н.Н. Смирнов. «Англо-русский гидробиологический словарь» // Зоол. журн. – Т.35. – № 10. - С.1591-1592.

Рецензия на кн.: Труды Севанской гидробиологической станции, Т. 9–14 // Успехи соврем. биол. – Т.41. – Вып. 3. - С.381-387.

1957

Пятая научная конференция по изучению внутренних водоемов Прибалтики // Зоол. журн. – Т.36. – Вып. 10. - С.1595-1597.

Рецензия на кн.: Строганов Н.С. «Физиологическая приспособляемость рыб к температуре среды" // Бюл. моск. о-ва испытателей природы. Отд. биол. – Т.62. – Вып. 3. – С.91–96.

1959

Биологические исследования на внутренних водоемах Польши // Природа. - № 4. - С.73– 76 (В соавт. с В.П.Ляхновичем, Л.М. Сущеней).

IV съезд польских гидробиологов [Краков. Сент. 1958 г.] // Зоол. журн. – Т.38. – Вып.6. - С.957–958 (В соавт. с Л.М. Сущеней, В.П. Ляхновичем).

Biologische Utttersuchungen der Binnengewasser Polens // Naturwissensch. Beiträge. – Hf.9. – S.945-948 (Mit W.P. Liachnowitsch, L.M. Sustschenja).

1962

Рецензия на кн..: А.Г.Родина «Микроорганизмы и повышение рыбопродуктивности прудов» // Микробиология. – Т.31. - №5. - С.946-948.

1965

В.С.Ивлев (1907 – 1964) [некролог] // Бюл. МОИП. Отд. биол. – Вып.6. - С.146-150 (В соавт. с Я.А. Бирштейном).

Международная биологическая программа лимнологических исследований // Гидробиол. журн. – Т.1. - № 5. - С.70-72.

1966

Обзор симпозиума «Первичная продукция и продукция водных животных» (методы изучения и результаты применения) // Фотосинтезирующие системы высокой продуктивности. - М.: Наука. - С.168- 86 (В соавт. с О.И. Кобленц-Мишке).

Рецензия на кн.: Э. Макфедьен. Экология животных. Цели и методы. М.: «Мир», 1965, 375 с. // Журн. общ. биологии. – Т.27. - № 4. - С.508-510.

XVI Международный лимнологический конгресс [Варшава. Авг.-сент. 1965] // Гидробиол. журн. – Т.2. - №2. - С.70-72.

1967

Абба Евсеевич Гайсинович (К 60-летию со дня рождения) // Генетика. - № 4 С.164–166 (В соавт. с Б.Л.Астауровым, П.Ф.Рокицким).

1969

Международный симпозиум по методам определения бактериальной продукции пресных водоемов // Вестн. АН СССР. - №10. - С.81-82 (В соавт. с Т.В.Жаровой).

1970

Изменения в природной среде, вызванные человеком [По мат-лам межд. симпозиума. Лондон. Сент. 1969 г.] // Экология. - № 1. - С.106-109.

Симпозиум МБП/ЮНЕСКО по вопросам продуктивности пресных вод [г.Казимеж (Польша). Май 1970] // Гидробиол. журн. – Т.6. - №6. - С.119-127.

1971

Второй съезд Всесоюзного гидробиологического общества (Кишинев, 12-16 апреля 1971 г.) // Гидробиол. журн. – Т.7. - № 6. - С.110-115 (Совместно с Н.Ю.Соколовой, Ф.П. Чориком).

Семинар по математическому моделированию водных экосистем // Гидробиол. журн. – Т.7. - № 5. - С.131-134.

IV Генеральная ассамблея Международной биологической программы и симпозиум «Экологические основы управления внешней средой» // Экология. - № 2. - С.99-107.

1972

Комментарий к статье И.В.Козловой «Опыт расчета общей продукции зоопланктона на примере уральских озер» // Гидробиол. журн. – Т.8. - № 3. – С.134-136.

Памяти Вениамина Григорьевича Богорова [Некролог] // Гидробиол. журн. – Т.8. - №2. – С.132-133 (В соавт. с Л.С.Бердичевским, А.С.Богдановым и др.)

Проблемы биолимнологии на XVIII конгрессе МАЛ // Гидробиол. журн. - Т.8. - № 2. - С.88-109.

Рецензия на кн.: «Проект АКВА» - справочник по внутренним водам, подлежащим охране (Project Aqua – A source book of inland waters proposed for conservation. H.Luther, J.Rzyska. IBP Hadnbook № 21. Occ. pap. N 2. Oxford, Edinburgh: Blackwell sci. publ.) // Гидробиол. журн. – Т.8. - № 4. - С.112-113.

1973

По поводу статьи Ю.А. Колесника «Некоторые вопросы, связанные с ростом и интенсивностью обмена у животных» // Вопр. ихтиологии. – Т.13. - № 5. - С.927-929.

Пятое Совещание участников работ по Международной биологической программе секции пресных вод 22-26 мая 1972 г. на Нарочанской биологической станции Белрусского гос. Университета // Биол. внутр. вод. Инф. бюл. - № 19. – С.3-5 (В соавт. с И.М.Распоповым)

Рецензия на кн.: Hydrobiological studies. Ed. by J.Hrbacek and M. Straskrab. Vols. 2–3. Prague, 1973 // Гидробиол. журн. – Т.9. – Вып. 4. - С.127-129.

Совещание по пятой теме программы ЮНЕСКО «Человек и биосфера» // Экология. - № 4. - С.108-111.

1974

Евтрофирование и охрана вод [о работе симпозиума «Евтрофирование и охрана вод», Дрезден, ГДР, 16-20 окт. 1973г.] // Гидробиол. журн. – Т.10. - № 2. – С.129-134.

1975

Пятое совещание участников работ по МБП секции пресных вод // Информ. бюл. Ин-та биологии внутр. вод. - № 19. – С.3-5.

Рецензия на кн.: Биологический анализ качества вод // Гидробиол. журн. – Т.11. - № 1. – С.116-117.

1976

О шестом издании учебника «Зоология беспозвоночных» В.А.Догеля // Зоол. журн. – Т.55. – Вып.5. – С.790-792 (В соавт. с О.А.Скарлато, С.С.Шульманом).

Об итогах работ на пресных водах по Международной биологической программе. Лимнологические исследования в Японии. // Гидробиол. журн. – Т.12. - №4. – С. 105-117.

Рецензия на кн.: Л.М.Сущеня. Количественные закономерности питания ракообразных. Минск, 1975 // Журн. общ. биологии. - Т.37. - № 1. – С.151-154.

1977

Жизнь и научная деятельность Виктора Сергеевича Ивлева (1907-1964). // Ивлев В.С. Экспериментальная экология питания рыб. Киев: Наук. думка. - С.231-250.

Памяти Леонида Леонидовича Россолимо (1894-1977) // Гидробиол. журн. - Т.13. - №6. – С.121-122 (В соавт. с С.И.Кузнецовым, А.П.Щербаковым).

Третий съезд Всесоюзного гидробиологического общества [г. Рига, 11-15 мая 1976 г.] // Гидробиол. журн. – Т.13. - №1. – С.127-129.

1978

XX Международный лимнологический конгресс [Копенгаген, 7-14 августа 1977 г.] // Гидробиол. журн. – Т.14. - №2. – С.121-129.

1981

Алексей Викторович Жирмунский (к 60-летию со дня рождения) // Биология моря. - № 5. - С. 79-83.

1982

Трофодинамика копепод в морских планктонных сообществах. Рецензия на кн.: Т.С.Петипа. «Закономерности потребления и превращения вещества и энергии у особи». – Киев: Наукова думка, 1981 // Гидробиол. журн. – Т.18. - № 4. – С.101-106.

Зависимость метаболизма водных беспозвоночных животных от температуры. Рецензия на кн.: И.В.Ивлева. «Температура среды и скорость энергетического обмена у водных животных». – Киев: Наукова думка, 1981 // Гидробиол. журн. – Т.18. - № 3. – С.106-109.

Гидробиологические основы пресноводного рыбного хозяйства. Рецензия на кн.: D.Bartelmes. Hydrobiologische Grundlagen der Binnenfischerei. – Jena: VEB Gustav Fisvher Verlag, 1981 // Гидробиол. журн. – Т.18. - № 2. – С.96-97.

IV съезд Всесоюзного гидробиологического общества // Гидробиол. журн. – Т.18. - № 1. – С.3-8.

1983

Общие итоги изучения биологической продуктивности пресных вод по Международной биологической программе. Рецензия на кн.: The Functioning of Freshwater Ecosystems. Ed. By E.D.LeCren and R.H.Lowe-McConnell. Cambrige University Press, 1980. – 340 p. // Гидробиологический журнал. – Т.19. - №4. – С.74-90. (В соавт. с А.Ф.Алимовым, В.В.Бульоном, М.Б.Ивановой, В.Н.Никулиной, Н.П.Финогеновой).

Рецензия на кн.: D.Uhlmann. Hydrobiologie, Ein Grundriss für Indenieure und Naturwissenschafter. – Jena. – 1982 // Гидробиол. журн. – Т.19. - № 3. – С.108-110.

1984

Высокоинформативная книга. Рецензия на кн.: Мотыль *Chironomus plumosus* L. (Diptera, Chironomidae). Систематика, морфология, экология, продукция / Под ред. Н.Ю.Соколовой. – М.: Наука, 1983 – 312 с. // Гидробиол. журн. – Т.20. - Вып. 2. – с.97-99.

«Устойчивое неравновесие» живого. Рецензия на кн.: Э.С.Бауэр. Теоретическая биология. Будапешт: Изд-во АН Венгрии, 1982, 269 с. // Природа. - № 2. – С.120-122.

1985

Продукция, рост и продолжительность жизни гидробионтов. Рецензия на кн.: В.Е.Заика «Сравнительная продуктивность гидробионтов». – Киев: Наукова думка, 1983 // Гидробиол. журн. – Т.21. - №1. – С.91-97.

Г.Г.ВИНБЕРГ – О НЕМ

Библиография научных трудов профессора Г.Г.Винберга (К 70-летию со дня рождения). – Минск: Вышейш. школа, 1975. – 31 с.

Библиография научных трудов Г.Г.Винберга / Сост. Р.Н.Комаровская, Б.Л.Гутельмахер // Гидробиол. журн. – 1988. – Т.24. - № 3. – С. 96-107.

Брагинский Л.П. Большие проблемы малых водоемов. Рецензия на кн.: Г.Г.Винберг, В.П.Ляхнович. Удобрение прудов. Изд-во «Пищевая промышленность», М., 1965, 271 с., тир. 1500 экз. // Гидробиол. журн. – Т.2. – Вып.1. – С.71-73.

Водяницкий В.А., Сущеня Л.М. Рецензия на кн.: Г.Г.Винберг. «Первичная продукция водоемов». – Минск: Изд-во АН БССР. 1960 // Журн. общ. биологии. – Т.21. -№5. – С.390-392.

Ивлев В.С., Гербильский Н.Л. Рецензия на кн.: Г.Г.Винберг. Интенсивность обмена и пищевые потребности рыб. // Зоол. журн. – Т.36. – Вып. 5. – С.795-797.

Крючкова Н.М. Белорусская школа гидробиологов и ее достижения // Гидробиол. журн. – 1988. – Т.24. - № 3. – С. 84-95.

Профессор Георгий Георгиевич Винберг // Библиография научных трудов профессора Г.Г.Винберга (К 70-летию со дня рождения). – Минск: Вышейш. школа. – С.3-9.

Скрябина Е. Неутомимый исследователь: К 80-летию Г.Г. Винберга // Рыбоводство. – 1985. - № 3. – С.22.