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RUSSIAN ACADEMY OF SCIENCES
FAR EASTERN BRANCH
THE FEDERAL AGENCY OF SCIENTIFIC ORGANIZATIONS
INSTITUTE OF BIOLOGY AND SOIL SCIENCE
A.V. ZHIRMUNSKY INSTITUTE OF MARINE BIOLOGY
PRIMORSKY AQUARIUM
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PRIMORSKY BRANCH OF THE HYDROBIOLOGICAL SOCIETY AT RUSSIAN ACADEMY OF SCIENCES

ABSTRACT BOOK

3rd INTERNATIONAL SYMPOSIUM OF BENTHOLOGICAL SOCIETY OF ASIA

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The 3rd International Symposium of Benthological Society of Asia is held in Vladivostok, Russia, from 24 to 27 August 2016, then from 27 to 31 August 2016 is continuing as The First International Youth Freshwater Ecology School. Various aspects of freshwater and marine biodiversity, biology and ecology problems are in the focus of the Symposium papers. Special attention has been paid to conservation of waters in the urban and wildlife areas of Asian region. Water quality and transboundary water ecosystem monitoring and control are considered at the international point of view as well as questions of ecological education and involving of public to water resources protection. The future international cooperation in different branches of benthological fundamental and applied sciences is discussed.

The book will be interesting for specialists in biology, ecology and biogeography, for practical workers, students and public deal with the water ecosystems protection, monitoring and control.

Co-Conveners: Academician of RAS Yu.N. Zhuravlev,
Dr. N.K. Khristoforova (FEFU) & Ph.D. T.S. Vshivkova (IBSS FEB RAS)

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WELCOME SPEECHES

FROM THE PRESIDENT OF THE BSA (2015-2016)

Dear Colleagues, dear members of the BSA,

First, let me thank you all for your coming to Vladivostok to participate in the 3rd Symposium of the Benthological Society of Asia, the Society whose members dedicate their life and work to the comprehensive study of the water life and solving the most important problem with which mankind is faced now − the problems of nature pollution, the unreasonable water managing leading to exhaustion of natural resources and degradation of water ecosystems.

Let me also appreciate the previous BSA presidents Drs. Kazumi TANIDA and Tae-Soo CHON, and the General Secretary of the Society Dr. Yeon Jae BAE who make great inputs for creation and development of our Society! We also thanks to all who strongly support us on the way the 3rd Symposium organization: Far Eastern Branch of Russian Academy of Sciences and the Far East Federal University administration, the Russian Foundation for Basic Investigation, as well as the Federal Agency of Scientific Organizations, and, of course all members of Organization Committee.

I am glad to see in the Symposium the famous mature professors, our pride and example for imitation, the outstanding scientists, as well as young participants who did the first steps on the scientific road toward new discoveries and achievements. Many of you overcome so long way by airplane or ship, by car or the train – and have reached Vladivostok to take part in our Symposium where we are going to discuss benthological problems, share knowledge and ideas and, as now saying, drawing of our development roadmap for the future.

I would like to emphasize that the Asia region is playing an increasing role in the world. We admire the rapid economic development of Asian countries. And professional hydrobiologists as no other in the world, know that economic development brings the ever-growing environmental problems, the solution of which is impossible without the joint efforts of all people and scientists.

We hope that Vladivostok today will establish a solid powerful platform for the future international cooperation, and give a good opportunity for development of the Benthological Society of Asia that bring an essential input in fundamental and applied branches of the world. I wish to all of us the great success in our very interesting and important for the Asian continent work!

Viktor BOGATOV
The BSA 2015-2016 President

FROM CONVENERS OF THE BSA-2016 SYMPOSIUM

Dear colleagues and guests,

We are greatly honored and pleased to welcome you all to the 3rd International Symposium of the Benthological Society of Asia!

Thank you for coming. The Benthological Society is a young, but very ambitious and quickly developing society. We want us, regardless of race, creed or circumstance to achieve our joint aims together. Our mission is to provide fundamental and practical base for the further development of the benthological science in Asia with our assistance and collaboration. Because the Symposium this year helds in Russia, Vladivostok, the most part of participants are Russians and we hope this part in future will not be lessened.

We thank our Organizers: the Far Eastern Branch of the Russian Academy of Sciences and the Far Eastern Federal University for the great support and the given opportunity to hold this meeting in the beautiful FEFU campus, for support of two, as we think, very important educational events: Visiting Professors Program "Golden Benthological Week", and International Youth Freshwater Ecology School. We hope that these projects will be continued in the future and become regular.

We are very honored to have so many outstanding professors here, but especially we would like to appreciate Dr. John Morse that he is with us today. He is a person who did so much for blossoming of Asian benthology. He is not Asian, but his efforts to the developing of fresh-water sciences in Asia, in growing up young specialists, students and higher schoolchildren need no introduction. The "Asian Gardener" - he was named by his followers and it is so true. We also very appreciate his efforts in our uniting on the way toward the Clean and Beautiful Future.

It's a pleasure to see so many of you here!

Yuri ZHURAVLYEV
Nadezhda KHRISTOFOROVA
Tatyana VSHIVKOVA

PLENARY SESSION

(KN1) FRESHWATER ECOSYSTEMS OF THE SOUTHERN REGION OF THE RUSSIAN FAR EAST AND GLOBAL CLIMATE CHANGE

V.V. BOGATOV[1]*, A.S. FEDOROVSKIY[2]

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The freshwater ecosystems of the Southern Region of the Russian Far East (SRORFE) are under the influence of extreme environmental phenomena (especially catastrophic floods and droughts). It is expected that in the 21th century global changes (such as global warming, deforestation due to logging and fires, *etc*.) will change the natural flooding cycles, likely increasing the peaks of floods, but decreasing of the probability of heavy rains during the dry season. High floods in SRORFE can lead to the rapid depletion of river biota, and can cause the long-term mean water hyper-eutrophication in water bodies. Drier summers will increase the probability of forest fires, lowering water regimes of rivers and increasing nutrient load in the water. The loss of forest cover due to logging and fires will change the water balance, which in turn will cause an imbalance of nutrients within ecosystems with rivers drying, fish spawning grounds drying in summer, and freezing in winter. In the face of a global environmental change, increasing anthropogenic pressures and in the absence of protective measures it is expected that there will be significant loss of biodiversity of freshwater ecosystems.

Key words: *Climate change, freshwater ecosystems, floods, eutrophication, fish production*

The Southern Region of the Russian Far East (SRORFE) is mainly a mountainous and forested region (Fig. 1). This territory is on the temperate climate latitudes with intensive cyclonic activity which is stimulated by distinct monsoon trend. It is not a classic South-East Asian monsoon; over the study area, in the summer period, it feeds the west cyclones with a warm and wet air, therefore, up to 80–90 % of the annual precipitation comes as rain. In the winter, Siberian anticyclone slow down the west transfer and the influx of monsoon air, therefore, causing this period to be dry and cold. Extreme climate conditions become even stronger effected by the tropical cyclones from the South and the South-East of Asia that come in here rather weakened (usually in a late summer or an early autumn) but still causing catastrophic floods.

The main feature of the modern climate change is a global warming, the phenomenon which has been recognized at the end of the 20th and the beginning of the 21st centuries. The deviation of the mean annual anomalies of the surface temperature in Russia shows the most intense warming trend starting sometime around 1976 (Fig. 2). The average increase in warming for the country as a whole constitutes about 0.43 °C/10 yrs that is more than twice the rate of global warming. It became markedly different interseasonal trends at the same time (Yasyukevich *et al*., 2014). Besides, in the recent years, in Russia and in the SRORFE we observed both an abnormal high-water and low-water seasons. As an example, the region experienced some large hydrological events of rare frequency. Among them:

- an abnormal low-water of 2008 and an extraordinary flood in the autumn of 2013 of the Middle and the Lower Amur (the Amur River is the tenth largest river among the rivers of the World in terms of basin area – 1 885 000 km^2);

- an extremely high water flow in the south of the region in the autumn of 2012;
- an extremely high water levels in the Khanka Lake (the biggest freshwater body in the SRORFE: area about 4070 km^2 at the mean water level) during 2014–2016.

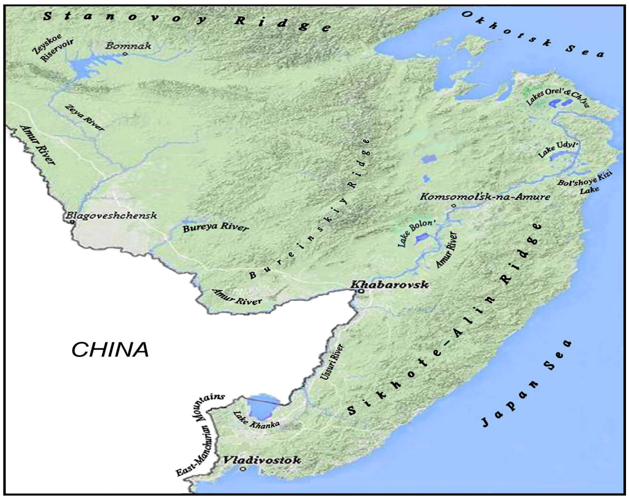

Figure 1. The map of the South Region of the Russian Far East.

The inflow volume in 2012 was 200-1000% of the mean annual flow, and many rivers were covered by ice in a previously unobserved full-bank flow. The frequency of this event was estimated as once in approximately 500 to 1000 yrs (Gartsman *et al*., 2014), likely not as rare as the Amur River 2013 event. Hydrological extremes are nonlinear responses to climate fluctuation and may represent initial changes in the hydrological regime of the whole region.

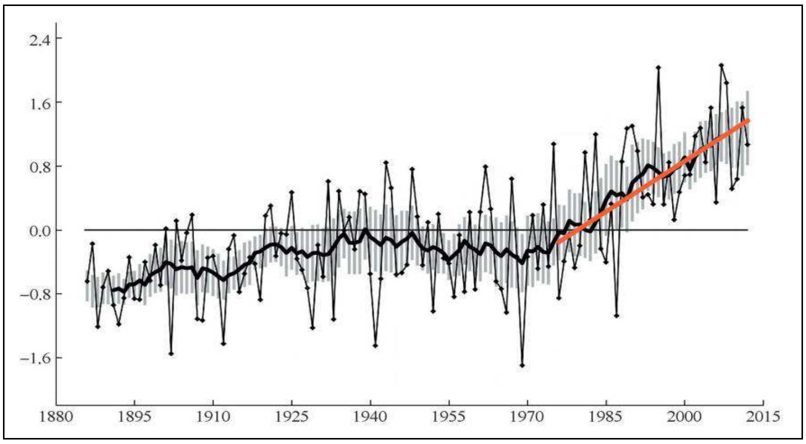

Figure 2. The deviation of the mean annual anomalies of surface temperature averaged for the Russian Federation from 1886 to 2012 yrs: the anomalies are calculated as a deviation from the mean temperature for 1961–1990; the thick line shows a smoothed data (11-yr moving avg.); the vertical segments show the 95 % confidence interval for the 11-yr moving avg.; the red line is a trend for 1976–2012 (From Yasyukevich *et al*., 2014).

The goal of our investigation is to explore the main feature of the structure and functions of freshwater ecosystems in the monsoon climate focusing on the reaction of aquatic communities to the hydrological extremes in the SRORFE.

Analysis of the results demonstrates the important influences of the discharge regimes dynamic and the extreme flow on phyto- and macroinvertebrate community structure. When catastrophic floods do not occur, river systems develop "continuous" integrated structural and functional characteristics (such as number of species, the Shannon index of phytoplankton and zoobenthic community trophic structure of invertebrates, the ratio of production and destruction of organic matter, the ratio in seston organic particles of various origins) typical for communities existing in rivers with strong currents from the source to the mouth (Alimov *et al.*, 2013). As in other river basins around the world, whose upper catchment areas are well forested, the upper reaches of rivers in the mountains play a significant role in the biotic balance of allochthonous organic matter (Vannote *et al.*, 1980). Lower from the headwaters, the ecosystem's organic balance becomes autochthonous.

Variations in water regimes of rivers in the region determine the dynamics of phyto- and zoobenthic communities as well as the fish life cycles. During major floods, massive accumulations of sediment destroy benthic communities, killing many organisms and setting them a drift. A particularly large impact on the biota dependent on sediment drawn by mountain streams occurs where such deposits constitute the bulk solid flow (movement of sediment in runoff). Consequently, the phyto- and zoobenthic biomass can be reduced by large catastrophic floods by an order of magnitude. A single major flood can result in a 30 % decrease in the annual production of the invertebrate biomass (Bogatov, 1994).

Our researches have shown that moderate fluctuations of the water level have no great effect on the development of phyto- and zoobenthic communities. The density of the organisms is restored rather quickly. However, during conditions of anomalously prolonged summer conditions lasting for over 1 to 1.5 months, some mountain and foothill reaches, without a dense riparian canopy, develop an extensive algal proliferation, which has an adverse impact on the populations of Ephemeroptera, Plecoptera and Trichoptera, while the populations of Chironomidae strive. In the upper reaches of the rivers where riparian canopies are partially or fully developed, no extensive development of algae occurs. Here, and especially in the open reaches of the rivers, the trophic relations in the communities of benthic invertebrates become highly competitive because of a very limited amount of allochthonous organic matter reaching the stream. As an example, the main detritivorous amphipods become predators and cannibals (Bogatov, 1994).

The blossoming of the diatom algae occurs even during a low snow winters under the ice cover. After the low snow winters, the spring floods are very small and the eutrophication process gets further extended. After the spring floods, the amount of the chlorophyll «a» (*Chl-a*) in the salmon rivers is anywhere between 2 and 30 $mg \cdot m^{-2}$. When the spring floods are absent or very small, the concentration of *Chl-a* may reach 7000 $mg \cdot m^{-2}$. During a low-level and a higher temperature of water year, we observe the mass mortality of the Pacific Salmon (Fig. 3). In the floodplain lakes, the concentration of *Chl-a* may vary between 8 and 260 $mg \cdot m^{-3}$ (Bogatov *et al.*, 1995). The degree of algal development increases as water level decreases. In anomalously low water, the lakes, such as Innokent'yevskoe, Padali and Mylka (Lower Amur River basin), lose their connection with the main Amur River channel. During this period an abundant development of cyanobacteria is observed, which is often accompanied by a mass mortality of fish.

Figure 3. Mass mortality of Pacific Salmon (Tum' River, Sakhalin Island, July 2001) (Photo by V. Bogatov).

In the Low Amur, the fish productivity is directly connected to the primary productivity of phytoplankton. It was shown that the average fish catch equaled to 0.12–0.15 % of the annual primary productivity: this is the relationship between primary productivity and the concentration of *Chl-a* on the bottomland lakes. Based on the observed relationships, we were able to establish the theoretical curve of the annual fish productivity and the concentration of the *Chl-a* in the Low Amur River basin. This picture shows that fish productivity increases up to a certain amount of the chlorophyll mass – about 70–80 $mg{\cdot}m^3$ (Fig. 4). If it exceeds that amount, it brings a secondary pollution effect (Bogatov, 1994; 2003; Bogatov *et al.*, 1995).

The regular alternation of low and high water periods favorably influences the general ecological situation in the rivers and the bottomland lakes (Bogatov, 1994; Bogatov *et al.*, 1995). Such alternation allows support for rather high biological diversity of freshwater communities. It is expected that in the 21th century the global changes (global warming, deforestation due to logging and fires, *etc.*) will change the natural cycles of floodings, likely increasing the peaks of floods but decreasing the probability of heavy rains during the dry season. High floods can lead to the rapid depletion of a river phytoplankton and zoobenthos, and can cause the long-term mean water hyper-eutrophication in water bodies. Drier summers will increase the probability of forest fires (Fig. 5), whilst, lowering water regimes of rivers and increasing nutrient load in the water.

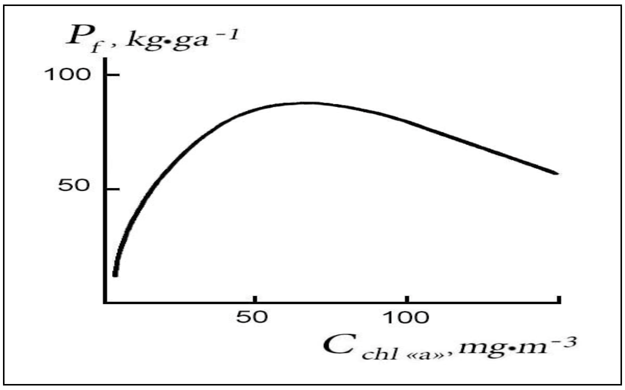

Figure 4. Connection between concentration of chlorophyll «a» ($C_{hl«a»}$, $mg{\cdot}m^{-3}$) and fish productivity (P_f, $kg{\cdot}ga^{-1}$) in the Amur River Basin (Bogatov, 2003).

Continuous droughts are always a reason of forest fire, frequency and intensity of which grows due to the modern climate change. These impacts are particularly important for the SRORFE: the most fire-prone area in the Russian Federation. During recent 20–30 years, the frequency of forest fire increase by 30–50 % in the Siberia and the Amur basin (Yasyukevich *et al.*, 2014). In the Lower Amur, more than 60 % of the basin has in some way been affected by fire in the last 40–50 years (Bogatov, 2014). In addition, from 1973 to 2010 years was twice enlarged the areas of mass reproduction of pests in the forests that increase the process of injury and destruction of forests (Yasyukevich *et al.*, 2014).

Figure 5. Forest lands in the northern parts of the Sikhote-Alin Mountains (Photos by V. Bogatov).

Forest vegetation acts as the most powerful geological factor that renders exclusive influence on the water flow of the rivers, the quality of water, as well as, the physical properties of the soil and the atmosphere (Gartsman & Lebedev, 1968; Bogatov, 2014, *et al.*). The broadleaved-deciduous Korean pine forests are especially effective in this case (Zhiltzov, 2008). The loss of forest cover due to logging and fires will change the water balance, which in turn will cause an imbalance of nutrients within ecosystems with rivers drying, fish spawning grounds drying in summer, and freezing in winter. On the damaged with fire areas, a water protection and soil conservation function of forests will be considerably reduced, but will expand the processes of a steppe formation and desertification (Tsvetkov & Buryak, 2014). In the face of global environmental change, increasing anthropogenic pressures and in the absence of the essential measures of environment protection the significant loss of freshwater biota diversity of the SRORFE is expected.

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(KN2) PERSPECTIVE OF INTEGRATIVE BENTHOLOGICAL SCIENCES FROM GENES TO ECOSYSTEMS

T.-S. CHON

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Due to unprecedented economic growth and population aggregation the natural waters is highly react to natural and anthropogenic disturbances in local and global scales. Stressful and disturbing agents are highly diffusive in aquatic environment, affecting the status of biological organisms (*i.e*., distribution and abundance) severely. Among aquatic invertebrates, the benthic organisms are highly vulnerable to disturbances and are a suitable indicator group for environmental changes. In a separate line, related sciences have been rapidly developed in technical aspect, including genomics, informatics, modeling, and mathematical biology. Application of related research to benthological sciences in a broad scope is foreseen in the near future. In this presentation the recent progress of research on benthic organisms is outlined across the life system hierarchy from genes to communities. At the gene level, genetic data with or without sequencing information were analyzed to address gene-environment relationships using methods in informatics. At the individual level interfacing techniques and computational approach were utilized to provide objective evaluation of water quality based on individual behavior modeling. At population and community levels the species abundance patterns were structurally analyzed to serve as an objective reference system in presenting complex response patterns to environmental changes. New indicating systems were further devised for in-depth biodiversity maintenance based on community structure property. Eco-evolutionary processes were further implemented to present speciation in adapting to biological and environmental selection pressures in environment through modeling.

Key words: *aquatic organisms, communities, indicators, environment*

(KN3) **FUTURE DEPENDS ON US**

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The Russian Far East occupies more than one third of the country, where the permafrost covers 40 % of the territory. This is a very large poorly populated region, but extremely rich in mineral and forest resources, and especially water resources. Many rivers flow here: Kolyma, Indigirka, Ussuri, Bira among them; two gigantic rivers Amur and Lena that are the world's tenth longest ones; and thousands of small streams and lakes. At last few years, the Russian Government primarily focuses on the economical progress of this vast region, giving attention to the "points of economic growth" or the territories of the advanced development (TAD). In 2015–2016 the "porto franco" privileged regime has been legislatively authorized for Vladivostok and 15 municipal districts of Primorsky Kray, and just recently – for ports Vanino in Khabarovsky Kray, Korsakov in Sakhalin, Petropavlovsk-Kamchatsky in Kamchatka, Pevek in Chukotka, that ultimately is aimed on strengthening of the Northern Marine Waterway.

The development of mining (gold and other ores, strip coal mining) leads to the river pollution by suspended matter and heavy metals. The fast growth of port activities will be accompanied by unpreventable pollution of the coastal zones by oil and gas. During last few years many rivers are highly polluted, being regularly included in the Environment Impact Statement Government Reports, such as Dachnaya, Komarovka, Rakovka (Primorsky Kray), Chernaya (Khabarovsky Kray), Kolyma (Magadan Region) Rivers, and others. Another issue is connected with indiscriminateness of controlling environmental units, and very low level of "environmental" education and mentality of some individuals who are trying to build large private cottages in stream buffer or preserve zones.

To prevent the danger of inevitable environmental cataclysm, urgent approaches should be realized. The first step would be the strict government control of all waste products: coming to the air, water (continental and marine), and soil. Another way is an ecologisation of manufacturing technologies. The third and the most important step is ecological education, training and enlightenment, which should begin from the very childhood. Sporadic examples of real solutions may be given, such as bulker port and woodworking manufactory in Vanino, refinery in Komsomolsk-on-Amur in Khabarovsky Kray, which encourage us to think about the best future.

Key words: *economical progress*, *environment pollution, government control, ecological education*

(KN4) CADDISFLY RESEARCH IN ASIA: WHAT WE KNOW AND NEED TO KNOW

J.C. MORSE

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More than 6600 extant species of Trichoptera are known from Asia and the rate of discovery of species previously unknown to science continues to accelerate. The importance of biodiversity discovery remains very high for caddisflies in Asia, especially in southern Asia. However, because of their importance for discovery of species traits, the necessities for descriptive work on the larval stages and for revisionary work to infer phylogenetic relationships are especially urgent. Knowledge of biological traits of Asian species of caddisflies and other freshwater macroinvertebrates is becoming an essential aspect of modern bioassessment programs. However, before that knowledge can be obtained we must first be able to recognize the larvae of at least the more common species. Inference of the historical relationships of these species will then guide research into their diverse biologies and ecological requirements. A new emphasis on these research agendas will greatly improve the likelihood for success with Asian surface water pollution management in the years ahead.

Key words: *Trichoptera, traits, larvae, phylogeny*

(KN5) ACHIEVEMENTS AND PERSPECTIVE OF INTERNATIONAL COOPERATION IN HYDROBIOLOGICAL RESEARCHES IN ASIA

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Prior to the 1970s, scientific research on the biota of inland and marine waters in the Russian Far East was conducted by Russian scientists sporadically, mainly in summer by specialists of the institutes located in the European part of the country. International collaboration was conducted generally through personal correspondence and exchanges of scientific literature by mail. The Far Eastern Center of the Russian Academy of Sciences (RAS) was created in 1970, renamed in 1987 to the Far Eastern Branch of the RAS (FEB RAS). To encourage further development of hydrobiological academic science in the Far East Russia, the Institute of Marine Biology of the FEB RAS was created by the outstanding marine hydrobiologist A.V. Zhirmunsky, and the Laboratory of Freshwater Hydrobiology was established by V.Y. and I.M. Levanidovs' in the Institute Biology and Soil Science of the FEB RAS. As a result, research on the Far East aquatic ecosystems became extensive, intensive, and regular. Since that time, the FEB RAS and Far Eastern universities began developing international relationships with scientific institutions of Asia and other parts of the world. These relationships became particularly active after perestroika, when Russia opened itself to the world. International research, expeditions, exchanges of specialists, and implementation of joint programs became the normal, everyday practice of our scientific work. A number of international research projects including the International Kuril and Sakhalin Islands Projects were undertook to research the transboundary water ecosystems.

Key words: *benthology, international cooperation, Asian region*

ABSTRACTS

(O1) DIVERSITY OF FRESHWATER SNAILS IN HOT SPRINGS OF KAMCHATKA

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The Kamchatka Peninsula (northeastern Asia) abounds in hundreds of thermal springs many of which are accessible but others more challenging to reach. Many springs are situated on the territory of nature reserves. The species communities of thermal springs attract specific interest due to their importance in studying the evolution of the biosphere (Bolotov *et al.*, 2012). According to the opinion of many researchers, these communities are similar to those that existed and dominated in the early stages of life development on Earth. The diversity and ecological patterns of gastropods inhabiting the geothermal springs of the northern Palaearctic Region are not well known. There are a few publications concerning the ecology and taxonomy of gastropod populations in certain geothermal areas of Kamchatka, *e.g.*, the Khodutka Lake, Tumrok Ridge and Valley of Geysers (Khmeleva *et al.*, 1985; Kruglov & Starobogatov, 1989; Kruglov, 2005; Lobkova *et al.*, 2012). Here we report the results of the integrative taxonomical study of freshwater snails in the family Lymnaeidae from twelve geothermal areas of the Kamchatka Peninsula. We also examined four nominal lymnaeid species that were described from the Khodutka geothermal lake and Tumrok hot springs (Kruglov & Starobogatov, 1989; Kruglov, 2005). The alleged species status of these endemics has been re-assessed by means of the integrative approach combining the molecular taxonomic methods with the traditional methods based on shell and soft body morphology. The biogeographical consideration has also been taken into account. The phylogenetic reconstructions were made by using both mitochondrial (COI) and nuclear (ITS2) DNA markers. As a result, we have found only three biological species of Lymnaeidae in these hot springs, *i.e.*, *Ladislavella tumrokensis*, *Radix auricularia* and *Radix kamtschatica* instead of nearly ten nominal taxa accepted previously. The geothermal populations of these taxa actually represent intraspecific ecological morphs (ecotypes), which are well adapted to life in geothermal habitats. Their adaptations include shortened life span, decreased body size, high morphological variability as well as perennial reproduction (Bolotov *et al.*, 2012). Our findings highlight that populations of different gastropod species inhabiting hot springs may exhibit analogues in morphological, physiological and biochemical traits due to convergent evolution in extreme environment.

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Key words: *Lymnaeidae, geothermal habitats, adaptations, ecotypes, Kamchatka Peninsula*

(RT1) "LET'S ARRANGE VLADIVOSTOK CITY SPRINGS TOGETHER!": IMPLEMENTATION OF THE SOCIALLY IMPORTANT PROJECT BASED ON CONSOLIDATION OF SCIENCE, PUBLIC, BUSINESS AND CITY AUTHORITIES EFFORTS

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The solving of the drinking water problem – one of priority tasks of the 21st century. From that not only quality of mankind life, but also existence of life on Earth, depends. Not centralized sources of water supply such as city springs, wells, small streams play the important role not only as reserve sources of water, but carry out esthetic functions, giving to city landscape unique shape and beauty. However, now they are often littered, thrown, and nobody takes care of them. The city, as a rule, has neither time nor money to arrange small water objects. But this problem can be solved by the combined efforts of the public and government institutions in cooperation with scientific institutes, and ecologically oriented business which can render to public initiative groups the consultative and financial support, especially at carrying out analytical works of estimation of water quality and works on improvement of the adjacent territories.

Example of such promising cooperation is the socially important Project "Let's arrange Vladivostok Springs Together" was started since 2012 by the Scientific-Public Coordination Center "Clean Water" with help of business LLC Efes-RUS, public organizations: NGO "Green Cross", The Fund for Citizens' initiatives "Rossia", science: (academic institutes of Far Eastern Branch of Russian Academy of Sciences, Far Eastern Federal University), and was supported by regional and Vladivostok city governments. Within this social program, seven springs have been equipped, quality of their water was estimated, surrounded territory was cleaned up and improved. Employees of LLC Efes-RUS, members of ecological organizations, citizens, especially young, took active part in improvement of springs together. Business has provided the main financial support of the project that promoted carrying out the most expensive work: design and garbage removal, construction works and water quality analyses. By now this public initiative has been turned into more grandiose project – creation of "Vladivostok Eco-Park" on Muravyev-Amursky's peninsula occupied by Vladivostok agglomeration.

The project and study was granted by Amursky Filial of WWF, LLC Efes-RUS and Green Global Foundation (№ 58-006).

Key words: *public initiatives, cooperation efforts, clean water, springs, Vladivostok*

(P1) AQUATIC INSECTS FOR THE KOREAN TRADITIONAL PAPER ARTS

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Paper has been used not only as a recording tool for letters but also as a medium for art works such as painting. Since ancient time, Korean people invented and used easy-storable and long-term preserable paper which is made of barks of paper mulberry tree. This Korean traditional paper is called "Han-ji". Besides function of recording, Han-ji also has a feature of fusion-art in modern days. Various materials including biological organisms can be combined with Han-ji in preparation of the art works. In this presentation, I showed for the first time how aquatic insect adults such as dragonflies, damselflies, and mayflies, can be harmonized with Korean traditional Han-ji art work. The art work preparation procedures are as follows: 1) Tie a bunch of paper mulberry and boil it in an iron pot until it gets soft; 2) Peel off the barks and dry them; 3) When dried, steep it in the water and step on it; 4) Select the white inside skin; 5) Add lye, boil it again for > 3 hours, and squeeze the mixture with compressor; 6) Mash the paper mulberry roots and squeeze it to get a bottle of sap (PAM); 7) Mix them all together (squeezed inside skin and PAM) with water; 8) Scoop the mixture water with sieve (№ 1–8 is the normal procedure of Han-ji production); 9) When scooping the mixture water, insert insect specimens (flattened whole body or body parts such as wings) and dry them in a flat table. However, careful attention must be paid to dealing with fragile insect specimens. Additional painting or illustration can be applied on the incerted Han-ji when it is dried. Insect wings particularly emphasize beauty of the unique silhoette of the Han-ji art work. Procedures of the Han-ji art work production are presented herein with examples of the art work.

Key words: *Han-ji, Korean traditional paper arts, aquatic insects, paper mulberry*

(P2) NOTE ON THE HABITAT, BEHAVIOR, MORPHOLOGY, AND GENETIC INFORMATION OF TADPOLE SHRIMP (CRUSTACEA: NOTOSTRACA: TRIOPSIDAE) IN NORTHWESTERN MONGOLIA

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The order Notostraca, commonly called tadpole shrimp, is one of the ancestral lineages of branchiopod crustacean. Many species in this group are well known inhabitants of temporal aquatic habitat of dried lands. They are also referred as "living fossil" due to almost no morphological changes over long geological time period. In contrast, their constant fine-tuned adaptation to their environment has been reported in terms of the diverse reproductive systems and morphological characteristics among different species. Here we examined habitat structures, morphological characteristics (*e.g.*, allometry), swimming behavior, and genetic information (mitochondrial DNA COI gene) of tadpole shrimps in northwestern Mongolia to understand various biological aspects to lead evolutionary stasis and adaptation to their specialized habits. Tadpole shrimps were sampled using a hand net in the temperate grassland in northwestern Mongolia from July to August in 2014, 2015, and 2016. Ethanol preserved individuals were used for the genetic analysis. They occurred mostly in lentic and lotic habitats of grassland during summer, particularly rainy season. Habitat sizes were varied from the small temporary pools to the marginal areas of slow-flowing streams. Poor water quality in the most habitats was observed with organic pollutants from livestock wastes. Specific swimming behavior – backstroke movement near the water surface and crawling behavior in the bottom of the pool habitat was observed in most species. We further examined the same features in a long tail tadpole shrimp (*Tripos longicaudatus*) from Korean peninsula to compare habitat use and morphological differences. Detailed information about general biology of tadpole shrimp in Mongolia establishes a base point for the future work on the adaptation of tadpole shrimp in the specialized dried land habitat.

Key words: *Tadpole shrimp, Triopsidae, habitat, swimming behavior, allometry, COI*

(O2) TAXONOMIC REVIEW OF THE CRANEFLY GENUS *TIPULA* (DIPTERA: TIPULIDAE) IN KOREA

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The cranefly genus *Tipula* Linnaeus, 1758 (Diptera: Tipulidae) contains up to 2790 species in 40 subgenera distributed in all biogeographical regions. The richest fauna is known in the Palaearctic region with 1224 species. The Korean *Tipula* was recorded for the first time by Alexander in the early 20th century and immature stages were studied relatively recently by Korean taxonomists. According to "Checklist of Korean Aquatic Insects (2014)", 30 species in 12 subgenera are recorded in Korea. We reviewed all known species of Korean *Tipula* with additional species new to Korean Peninsula, and provided a male key to the species of *Tipula* in Korea.

Key words: *Tipulidae, Tipula, Taxonomic review, Korean Peninsula*

(P3) DISTRIBUTION AND COMPOSITION OF BENTHIC MACROINVERTEBRATE COMMUNITIES IN THE DAM AREAS AND TRIBUTARIES OF THE FOUR MAJOR RIVERS IN KOREA

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Distribution and composition of riverine benthic macroinvertebrate communities are largely affected by the changes of physical and chemical properties caused by dam construction. Sixteen dams were recently constructed on the four major rivers (Han River, Geum River, Yeongsan River, and Nakdong River) in South Korea. We investigated benthic macroinvertebrate communities from the 16 dam sites and 12 tributary sites of the four major rivers in June, August, October, and December of 2015. Benthic macroinvertebrates were quantitatively sampled using a ponar grab (30×30 cm, 3 replicates) in the center of the dam areas (center) and a dredge sampler (40×20 cm, 2 replicates) in the shoreline of the dam areas (shoreline) and tributaries. As a result, a total of 136 species (mean 5.6 species per site) of benthic macroinvertebrates were sampled from the study sites. Species richness (mean # of species) was relatively higher in the tributary sites (except in the Geum River) than in the center or shoreline sites; on the other hand, density (mean # of individuals) was relatively higher in the center sites than in the shoreline or tributary sites. Dominant species were Chironomidae spp. and Oligocheata spp. in all the dam sites (except in the Han River: *Pectinatella magnifica* and *Corbicula fluminea*). The density of Chironomidae spp. was higher than that of Oligocheata spp. in the Han River and Geum River sites, whereas it showed similar level in the Yongsan River and Nakdong River sites. In this study, we identified the species of Chironomidae and Oligochaeta by using the DNA barcode library which was newly established through this study. We also provided factors affecting distribution and composition of benthic macroinvertebrates communities caused by dam construction. This is the first comprehensive study of benthic macroinvertebrates in the dam areas of the 4 major rivers in South Korea.

Key words: *benthic macroinvertebrates, Chironomidae spp., Oligochaeta spp., dams, large rivers, South Korea*

(O3) ADDITIONAL DATA ON SMALL BIVALVE FAUNA (PISIDIOIDEA) OF THE KHINGANSKY STATE NATURE RESERVE (AMURSKAYA OBLAST, RUSSIA)

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Small bivalve mollusks of the families Sphaeriidae, Pisidiidae, Euglesidae (Bivalvia: Pisidioidea) were collected in the Khingansky reserve during the period 2006–2015. Natural water bodies of different ecological types, lakes and rivers, creeks and fens were studied by first author in the plain, foothills and mountainous parts of reserve.

Almost 500 shells and specimens were fixed in 75 % alcohol; the collection is now deposited at the Institute of Biology and Soil Science FEB RAS, Vladivostok.

Shells and specimens were investigated by conchological, anatomical and SEM methods based on second author original study. Conchological characters include shell outline, sculpture, features of hinge, ligament, muscle scars and pores; the most important structures are illustrated on the SEM photographs. Anatomical characters were studied in situ and figured with a camera lucida. We used Russian taxonomic system.

At present, fourteen species of small bivalves from six genera and three families Pisidioidea were found. The Sphaeriidae are represented by three species, the Pisidiidae by one species, the most numerous were the Euglesidae, with ten species by five genera.

In the mountainous and plain parts only one species *Amureuglesa khurbaensis* (Zatrawkin, 1987) was found, occurring in different types of waters. This endemic species of the genus *Amureuglesa* from the family Euglesidae was described by M.N. Zatravkin from upper and middle part of the Bureya River basin.

Two endemic species, *Euglesa koltschomensis* Zatrawkin, 1987 and *Henslowiana izzatullaevi* (Zatrawkin, 1987), were found in the rivers. Five bivalve species with fragile shells lives in fen water bodies: *Musculium creplini* (Dunker, 1845), *Cyclocalyx cor* (Starobogatov et Streletzkaja, 1967), *C. hinzi* (Kuiper, 1975) *C. johanseni* (Dolgin et Korniushin, 1994), *C. lapponicus* (Clessin in Westerlund, 1873).

Three species were listed in the Khingansky Reserve for the first time: *Cingulipisidium nitidum* (Jenyns, 1832), *Euglesa casertana* (Poli, 1791), *Henslowiana lilljeborgii* (Clessin in Esmark et Hoyer, 1886). The majority of species are distributed in the Holartcic and Palaearctic Region (57 %), while the other species have distribution in the Amur River basin (43 %).

We thank Denis V. Fomin (A.V. Zhirmunsky Institute of Marine Biology FEB RAS, Vladivostok) for help with SEM work and Nadezhda V. Kuznetsova ("Khingansky" State Nature Reserve) for assistance with map. This study was supported by "Khingansky" State Nature Reserve (V.V. Kopylov). This work was partly funded by grant № 15-I-6-011-o (Principal Investigator Dr. V.V. Bogatov).

Key words: *small bivalve mollusks, Khingansky Reserve, Pisidioidea*

(P4) ASSESSING THE ENVIRONMENTAL CONDITIONS OF RIVERS ON THE NORTHERN COAST OF LAKE LADOGA BY STRUCTURE OF ZOOBENTHOS

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Lake Ladoga is the largest in Europe and the northernmost among world large lakes. The discharge of 48 thousands of rivers in its basin provides ~85 % of its water budget input. The objective of this study is to assess the ecological conditions of rivers in the Karelian (northern) coast of Lake Ladoga by structure of zoobenthos. The study was carried out on six rivers, including Khiitalanjoki (62 km length), Tokhmajoki (64 km), Syuskyuyanjoki (34 km), Uksunjoki (125 km), Vidlitsa (66 km), and Olonka (144 km). Samples were taken in August 2013. To assess the biotope heterogeneity, the areas located in the upper reaches of the rivers and in their mouth zones were chosen, with different depths (0.2–0.7 m), flow velocities (0.1–0.7 m/s), water discharges (0.2–1.8 m^3/s), and different anthropogenic impacts. River water quality was assessed by the composition of indicator species with using the Pantle-Buck Index modified by Sládecek.

We found 78 species of zoobenthos. The larvae of insects and Bivalvia mollusks are the most common as it is typical for the fauna of rivers of Eastern Fennoscandia. Dominating complex consist of *Enchytraeus* sp., *Erpobdella octoculata* (L., 1758), *Margaritifera margaritifera* (L., 1758), Sphaeriidae g.spp., *Baetis rhodani* (Pictet, 1843), *Serratella ignita* (Poda, 1761), *Paraleptophlebia submarginata* (Stephens,1835), *Onychogomphus forcipatus* (L., 1758), *Leuctra fusca* (L., 1758), *Oulimnius tuberculatus* (Müller, 1806), *Sialis fuliginosa* Pictet, 1836, *Rhyacophila nubila* Zetterstedt 1840, *Cheumatopsyche lepida* (Pictet, 1834), *Hydropsyche siltalai* Doehler, 1963, *Polycentropus flavomaculatus* (Pictet, 1834), *Chimarra marginata* (L., 1767), *Brachycentrus subnubilus* Curtis, 1834, *Halesus digitatus* (Schrank, 1781), *Potamophylax latipennis* (Curtis, 1834), *Atherix ibis* (Fabricius, 1798), Simuliidae gen. spp., Chironomidae (Orthocladiinae) gen. spp.

The structure of bottom communities in upper reaches is most similar to that observed before in the streams of Fennoscandia, which are not subject to anthropogenic load. A specific feature of these reaches is the wide occurrence of caddis flies *Chimarra marginata*, which have been observed in Russia only in several rivers flowing into Lake Onega and Lake Ladoga. A significant abundance of freshwater pearl mussel (*Margaritifera margaritifera*), one of the most dependent on water quality and vulnerable species, whose area is now shrinking deserves particular attention.

The analysis of the saprobiological structure of hydrobiocenoses showed that the most diverse indicators are β-mesosaprobs (66.7 %) and oligosaprobes (28.6 %). As χ-oligo- and oligosaprobes, typical of highly humified streams, are permanent in the dominating complex, especially, in upper river reaches, it is quite natural that the values of Sládecek index varied mostly within the χ-oligo- and oligosaprobic zone. In the lower reaches of rivers are the highest saprobity indices, corresponding to β-mesosaprobic zone and, thus, suggesting moderate pollution. However, here they are also less than the values typical for polluted rivers in the North European Russia. The values of saprobity indices obtained in other examined river reaches correspond to clear water on the scale of water quality (purity class II).

Key words: *saprobity, water quality, bottom communities*

(P5) ZOOBENTHOS OF RECREATIONAL LAKE INGOL, KRASNOYARSK REGION, RUSSIA

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Results of the Ingol Lake benthos survey in August 2002–2003 are presented. Ingol Lake is situated in the ridges of Kuznetskiy Alatau (312 m above sea level) within 30 km to the west from the Sharypovo town. Ingol Lake is poorly flowing lake. The area of its water surface is 4.06 km^2. The length – 3.5 km, maximum width is 1.5 km. Average depth is 21.1 m, maximum depth 37.5 m. Ingol Lake and the surrounding territory have such a combination of natural resources that put this area in a special place among recreational centers not only in Sharypovo town and Krasnoyarsk region but in Russia also. Sapropelic muds are found in the western part of the lake. In the end of 1930s valuable species of fish were placed into the lake. Nowadays there are 3 originally species (*Rutilus rutilus lacustris*, *Esox lucius*, *Perca fluviatilis*) and acclimatized species (two forms of vendace *Coregonus albula*, *Coregonus lavaretus maraenoides*, *Leuciscus idus*, *Abramis brama orientalis*). In 1950, the potential possibility of Ingol Lake for fish acclimatization was investigated and hydrologic and biotic conditions of lake were studied by V.N. Grese (1955).

The Ingol Lake bottom can be visible at a depth of 10 meters and it is mainly the stony or sandy-stony bottom. There are overgrown of the charophytes on grey silt in parts of eulittoral and sublittoral zones. They occupy 30 % of the bottom surface between isobaths 0.5–12 m. Here the maximum values of density (18.3 thousands specimen/m^2) and of biomass (10.08 g/m^2) of a benthos were registered. In a sublittoral zone at a depth of 12–20 m *Fontinalis* are developed on black silts. As a whole, in the littoral zone the average value of the benthos density is varied in range of 14.8±3.5 thousands specimens/m^2, biomass – 8.84±1.27 g/m^2. The most abundant here mayflies (38 %), subdominants are aquatic mites (22 %). In biomass *Amphipoda* and *Hirudinea* are prevailed (each is 20 %). In a profundal zone the aquatic plants disappearing in the depth more than 20 m. There the homogenous distribution of bottom invertebrates is noted. Average value of the benthos density is 4.80±0.23 thousands specimens/m^2, biomass – 2.56±1.73 g/m^2. Here the most abundant *Chironomus* larvae (52 % of the density and 58 % of the biomass), subdominants are *Amphipoda* (27 % N and 25 % B, respectively). At the maximum depth of 30–36 m only *Chironomus* larvae are noted. Totally, 53 species from 8 classes, 30 families have been discovered among our collection. The maximum values of Shannon-Weaver Index – $\overline{H}_N$=3.03 bit are registered for the benthic communities of the littoral zone (52 species). In the profundal zone only 3 species are registered and the index value decreasing to $\overline{H}_N$=0 bit. As a whole, the lake benthos density has averaged 7.64±7.16 thousands specimens/m^2. The average biomass is 5.70±3.14 g/m^2, that is similar with results of Grese (1955) when the average biomass was 4.28 g/m^2. According to the classification of lakes on the basis of the benthic biomass (Kitaev, 2007) the Ingol Lake belongs to the category of the mesotrophic lakes.

Key words: *benthos, biomass, biodiversity*

(O4) BIODIVERSITY OF MAYFLIES (INSECTA: EPHEMEROPTERA) IN THE REGION OF AURES (ALGERIA): TAXONOMY, ECOLOGY AND BIOGEOGRAPHY

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This research, devoted to the study of systematic, biogeography and ecology of Ephemeroptera, is a modest contribution to the knowledge of this group of benthic macroinvertebrates. To contribute to the knowledge of the Algerian lotic waters, a faunal analysis of the waterways in the eastern region of Algeria, namely the massive of Aures, was performed. The Aures is a transverse bead of about 7000 km². It extends between the parallels 34°45' and 35°30' North and longitude 5°45' and 7° to the east of the international meridian. It is placed at the junction of two major groups that make up the Saharan Atlas in Algeria as well as in Tunisia and that extends in an east-west direction parallel to the Tell Atlas itself follows the southern shores of the Mediterranean Sea. This study was started from January 2008 to December 2009 on 16 sites in three watersheds belong to the great watershed of Chott Melghir: Abdi Wadi, El Abiod Wadi and El Hai Wadi. Sampling of the settlements was performed a semi-quantitatively and qualitatively through the Haveneau net, every month.

The surveys carried out in the three wadis allowed us to develop a systematic repertory of 12 species of mayflies. 4 families were identified: these are the Leptophlebiidae and Caenidae belonging to the suborder of Rectracheata and infra-orders Lanceolata and Pannota respectively; the Heptageniidae relate to suborder of Setisura and the Baetidae return to the suborder of Pisciforma. The Baetidae are the most abundant family and the most diverse with 8 species including *Baetis sinsepinosus*, an Algerian endemic and recorded for the first time in our study area in the headwaters. Caenidae family is represented by two species of which, *Caenis* cf. *macrura*, is an Algerian endemic is not met since 1928 by H. Gauthier. The Leptophlebiidae and Heptageniidae are rarely represented with a single species for each.

Each species of Ephemeroptera shows ecological preferences for different types of environment. Thus, the species *Baetis pavidus* adorned the more eurytope and more eurythermal. The most species are thermophilic such as: *Labiobaetis neglectus*, *Ecdyonurus rothschildi*, *Choroterpes (Ch.) atlas*, *Caenis luctuosa*, *Cheleocloeon dimorphicum, etc.* The *Baetis* gr. *rhodani* prefers the fresh waters of the permanent sites situated in high altitude.

Key words: *Ephemeroptera, endemic, systematic, ecology, biogeography*

(P6) TROPHIC STRUCTURE OF MACROZOOBENTHOS COMMUNITIES IN LAKES WITH DIFFERENT SALINITY, THE SOUTH OF THE OB-IRTYSH INTERFLUVE

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In 2003–2011, in the framework of comprehensive limnological studies, the benthic macroinvertebrates of the southern Ob-Irtysh interfluve lakes were investigated. These lakes are located in the steppe and forest-steppe zones of the South of Western Siberia, within Altai Krai and Novosibirsk Region. General water mineralization in the lakes under study was between 0.33 and 140 g/dm^3. All in all, 49 lakes were investigated. The analysis of trophic structure and dimensional characteristics of macrozoobenthos of lakes with different salinity in the southern Ob-Irtysh interfluve was carried out. Based on the predominant type of feeding in the studied lakes four main trophic groups of aquatic organisms were specified according to A.V. Yakovlev's classification (2000): 1) collectors-detritus feeders, facultative filterers; 2) scrapers; 3) shredders; 4) predators. The influence of water salinity and other environmental factors on the taxonomic composition, number and biomass of macrozoobenthos were analyzed earlier (Bezmaternykh & Zhukova, 2013; Vdovina & Bezmaternykh, 2016).

It is shown that the ratio of different trophic groups in benthic communities changes as the water increases. In oligo- and subsaline lakes, all specified trophic groups were found. The most numerous were collectors-detritus feeders (51 % and 50 %, respectively); they were followed by predators in terms of the number of types (30 % and 29 %), shredders (12 % and 11 %), and scrapers (7 % and 10 %). With the increase of water mineralization in hyposaline lakes, the proportion of collectors-detritus feeders decreased (39 %), the proportion of predators (35 %) and shredders (18 %) increased, and the proportion of scrapers (8 %) slightly changed. In meso- and hypersaline lakes, the number of trophic groups declined, a group of scrapers disappeared, the proportion of predators (25 %) decreased, and the role of shredders increased (38 %). The collectors-detritus feeders ceased to play a leading role, their share along with shredders was 38 %.

The cluster analysis of the trophic structure of benthic invertebrates has combined the studied lakes in the following sequence. The highest similarity in trophic structure is observed between the fresh–oligo- and subsaline lakes, then are adjacent hyposaline lakes, and the lowest similarity is observed in the highly saline meso- and hypersaline lakes.

The trophic structure of macroinvertebrate communities within the lakes of different salinity changed depending on the bottom type. In general, the portion of predators was lower on sandy bottoms, than on the silty ones. On silty bottoms, when water salinity increases, a gradual increasing and then decreasing of the scrapers and shredders proportion was observed. On sandy bottoms, with increasing water salinity a trend towards increasing of shredders proportion as well as decreasing the proportion and gradual disappearance of scrapers was noted.

It is revealed that the average of individual biomass of macrozoobenthos in the studied lakes was determined by bottom type rather than water mineralization. This indicator differed significantly for various types of bottom: it was much higher on the silt than on the sand.

Key words: *macrozoobenthos, trophic structure, salinity, lakes*

(P7) NEW DATA ON KAMPTOZOA FROM THE KARA SEA

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Kamptozoa, or Entoprocta, is a phylum of invertebrate animals which remains poorly studied in the Seas of Russia. Only about 20 species were described from the Russian Arctic Seas, mainly from the basin of the White Sea. A diversity of entoprocts in the Kara Sea still remains unstudied. In this research entoprocts lived as epibionts of polychaetes and sipunculid worms were studied. Material was collected during 128 Expedition aboard RV "Professor Shtokman" in August–September, 2014 and 63 Expedition aboard RV "Akademik Mstislav Keldysh" in September–October, 2015 to the Kara Sea. Solitary entoprocts from the Loxosomatidae family have been found on elytrons and chaetae of the notopodia of *Eunoe* sp. and *Bylgides* sp. (Polynoidae); on the gills, the parapodia and in the groove between the notopodia and the neuropodia of *Aglaophamus malmgreni* (Nephtidae), and on the body of *Phascolion strombi* (Sipunculida). Five species from two genera were found: *Emschermannia ramificata* Borisanova, 2016; *Loxosomella antis* Krylova, 1985; *Loxosomella brumpti* (Nilus, 1909), *Loxosomella harmeri* (Schultz, 1895); and one new species, *Loxosomella* sp.n. *Emschermannia ramificata* was found in the groove between the notopodia and the neuropodia of *Aglaophamus malmgreni*. This species has been described only from the Kara Sea for now. All studied representatives were attached to a substratum by several long psedvostolons. Only two individuals with buds were noted, but many representatives were found with developing larvae in calyxes. *Loxosomella antis* was found on the chaeta of the notopodia of polynoids *Eunoe* sp. and *Bylgides* sp. This species was previously described from the White Sea on the chaeta the notopodia of *Antinoella* sp. (Polynoidae). *L. antis* is very usual epibiont of studied polynoids and the representatives of this species were found great numbers. The distinctive feature of *L. antis* is a presence of special epithelial pockets on each side of calyx. Buds develop in these pockets. Individuals with buds have not embryos in calyxes, while up to 16 embryos were found in calyxes of not budding individuals. *Loxosomella harmeri* was found on the elytrons of Polynoidae (on the edge of elytrons and also on the internal and theouter surfaces). *L. harmeri* was earlier described from the White Sea and the North Sea. The individuals from the Kara Sea differ by a little longer stalk. Buds emerge from lateral areas, up to three buds on one side. Embryos were not observed. Several individuals of *Loxosomella brumpti* were found on the back end of the body of sipunculid worm *Phascolion strombi*. *L. brumpti* was earlier described from the Barents Sea. One individual was found with one young bud. Embryos were not observed. *Loxosomella* sp. nov. was found on the tips of dorsal cirri and sometimes on the tips of gills of *Aglaophamus malmgreni*. This is small species with total body length up to 200–300 µm. Stalk of the species is very short (20–40 µm) with expanded basis which covers a tip of a cirri or a gill. Calyx bears 8 tentacles. Buds form from the frontal area of calyx, up to 5 buds are developing simultaneously. Large buds with well-developed foot. Some individuals were found with one or two developing larvae on each side of calyx, some individuals with large oocytes in ovaries. This species is similar to *Loxosomella brachystipes* Franzén, 1973 found on the gills of *Aglaophamus virginis* in South Ocean. *L. brachystipes* also has very small stalk with attachment disc, but it differs by budding area, tentacle number and position on the gills.

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Key words: *Entoprocta, epibiont, Loxosomatidae, new species*

(P8) THE BENTHIC ORGANISMS IN FEEDING OF CHARS

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The benthic invertebrates form the basis of char food of the genus *Salvelinus*. The chars are widely distributed throughout the Holarctic Region, they are essential in some reservoirs and can be the only component of fish communities in arctic lakes of Eurasia and North America, and play a key role in the structure of freshwater ecosystems of the Arctic and Pacific basins.

We used the parasites as biomarkers of animal consumption to study char's food, because they live into fish for a few months to several years. It is allows to investigate the composition of the fish diet regardless of the season and the rate of digestion of food. The chars inhabit lakes and lake-river systems but among them are diadromous forms with anadromous migration. The emergence of this group occurred in the high mountain and alpine lakes, arctic periglacial lakes during deglaciation and the formation of the northern lake-river systems. This laid the foundation for development of the original relationships between chars, whitefish and invertebrates in these lakes, and connection of the planktonic and benthic food chains. Both young and mature chars of almost all species serve as main consumers of benthos in lacustrine and river-lakes ecosystems and in the sea. The analysis of char parasite fauna makes it possible to identify their main food items: amphipods of the families Gammaridae and Pontoporeiidae, isopods, ostracods, branchiopoda crustaceans, larvae, pupae and imago of amphibiotic insects (chironomids, trichopterids, ephemeropterids, plecopterids, tipulids), bivalves of the family Sphaeriidae, gastropods (Lymnaeidae, Valvatidae and others), oligochaetes, and also mysids, crabs, polychaetes – in marine environments.The juveniles of most species of chars live in rivers and streams during their first years of life. Benthic and drifting organisms serve as the main food for salmon fry. Together with residential mature Dolly Varden char, *Salvelinus malma*, they feed on drifting organisms. The chars also consume larvae of the amphibiotic insects in the river mouths flowing into the lakes and in the coastal zone of lakes. The juveniles of lacustrine chars in the Kronotskoe Lake feed on larvae of ephemeropterids and, as a result, of being infected with nematode *Salmonema ephemeridarum*. The finding of trematode *Phyllodistomum umblae* serve as an indicator of fish feed on small bivalves sphaeriids, and consuming gammarids leading to contamination with nematode *Cystidicola farionis*. The chars use all available benthos of rivers. Across the Primorye the residential char, *Salvelinus malma*, is fluvial benthivorous, its food consists of amphipods, larvae of amphibiotic insects and oligochaetes (Ermolenko *et al.*, 1998). Only in the upper reaches of the Ussuri River Dolly Varden began to eat fish due the poor forage, but also consumes above-mentioned invertebrates.

The favorite char's food in many lakes of Kamchatka is crustaceans *Gammarus* cf. *lacustris*, *Pontoporeia affinis*, gastropods and bivalves of the genera *Lymnaea*, *Valvata*, *Cincinna*, *Boreoelona*, *Anisus*, *Sphaerium*, *Pisidium*, *Euglesa*, *Lacustrina* and others (Prozorova & Shedko, 2003), which serve as intermediate hosts of cestode *Cyathocephalus truncatus*, acanthocephalan *Echinorhynchus salmonis*, nematode *Cystidicola farionis*, and of different species of trematodes (Boutorina *et al.*, 2011; Gorovaya & Boutorina, 2007). The Arctic char, *Salvelinus alpinus*, in arctic and mountain lakes of Europe uses the larvae of amphibiotic insects, mollusks and planktobenthos (gammarids, branchiopods and others).

Key words: *amphipods, pupae, larvae and imago of amphibiotic insects, mollusks, ostracods*

(RT2) THE UNIVERSITY OF CALIFORNIA NATURAL RESERVE SYSTEM'S HISTORY AND THE UCNRS SAN JOAQUIN MARSH RESERVE STORY

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The University of California Natural Reserve System (UCNRS) is a network of protected natural areas throughout California. Its 39 sites include more than 756560 acres (306168 hectares), making it the largest university-administered Reserve system in the world. Most major state ecosystems are represented, from coastal tide pools to inland deserts, and lush wetlands to Sierra Nevada forests. The Reserves also serve as a gateway to more than a million acres of public lands and several are managed in partnership with state and federal agencies. Founded in 1965 to provide undisturbed environments for research, education, and public service, the Natural Reserve System contributes to the understanding and wise stewardship of the earth. Nearly 500 university classes use the Reserves annually and since 2010 over 700 peer-reviewed scientific reports and published papers have arisen from Reserve-based research.

The 202 acre (82 hectares) UCNRS San Joaquin Marsh Reserve was purchased by the University in 1970 and protects some of the last remnants of wetlands that once covered much of Orange County, California's flood plain. The Reserve supports a variety of wetland habitats, including marshlands, shallow ponds, and channels confined by earthen dikes. Dry upland habitats with a restored coastal sage scrub community rise on the periphery of the Reserve. The marsh is a critical stopping place for over 100 migratory bird species using the Pacific Flyway, and more than 200 bird species have been sighted in the Reserve, including a number of endangered or threatened species.

Ecological restoration is an important way of sustaining and improving Reserves, and at the San Joaquin Marsh, 55 acres of wetlands have been created by ecological restoration and the removal roads, 3 acres of riparian woodland, and 3 acres of upland coastal sage scrubland have been created. Roughly 40 % of the historic roads have been removed (over 3000 feet) or closed. Future plans include allowing seawater to flow into the lower areas of the Marsh, so that as sea level rise occurs and salt marsh habitat is lost in Newport Bay downstream, upstream replacement habitat will be established. This is important for the highly endangered Ridgway Rail, a bird whose primary population in the United States is in the Newport Back Bay, and also for sustaining salt marsh habitat as an important element of the watershed.

Key words: *University of California Natural Reserve System, wetland restoration, UCNRS San Joaquin Marsh Reserve*

(O5) TRACE ELEMENTS IN THE BODY OF STURGEON IN THE CASPIAN SEA

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The Caspian Sea is a unique pool of the world. He represents the largest closed body of water with the peculiar conditions Wednesday. When the Caspian ecosystem suffers a direct impact streamflows, transporting composed of various pollutants, including heavy metals.

Sturgeon species of fish, including the Russian sturgeon (Acipenser gueldenstaedtii) and Persian sturgeon (Acipenser persicus), are considered the main wealth of the Caspian Sea. This is the most valuable relict species are on the verge of extinction and sensitively respond to water pollution.

Due to the fact that the Russian and Persian sturgeon feed on benthic organisms, almost complete trophic chain reservoir, in their organs and tissues effects accumulation of heavy metals contained in forage sites lower food links and in soil and water.

The purpose of these studies was to determine the levels of essential elements (copper, zinc, iron, manganese) in the various organs and tissues of Russian and Persian sturgeon caught in the Caspian Sea, and their basic food items (the goby-Sandpiper, silverside Caspian, *etc.*). Were also analyzed soil samples from the Northern Caspian Sea.

Determination of heavy metals produced by atomic-absorption spectroscopy using atomic absorption spectrometer MGA-MD 915 was made. Concentration studied elements expressed in mg/kg dry weight. The results were subjected to statistical processing.

Analysis of the results of the studies demonstrated the complexity of chemical elements accumulation in fish. The bioaccumulation of metals water organisms depends on their specific features, physiological state, as well as from Wednesday. When the metals in the body of the Russian and Persian sturgeon is unevenly distributed, depending on the functional characteristics of bodies involved in metabolic processes, and their cumulative characteristics. As a result of data analysis for quantitative content of heavy metals studied in organs and tissues of both Russian and Persian sturgeon revealed the following descending series according to their accumulation in the body:

$$Fe > Zn > Cu > Mn$$

It has been shown that accumulation of essential elements in benthic organisms is closely related to their concentration in substrate. The varying degree of accumulation of metals in the body of the Russian and Persian sturgeons depends on heavy metals level in the forage sites such as goby-Sandpiper and silverside Caspian.

Keywords: *Russian sturgeon, Persian sturgeon, Caspian Sea, bioaccumulation, trace elements*

(O6) CONCORDANCE IN BIOLOGICAL CONDITION AND BIODIVERSITY BETWEEN DIATOM AND MACROINVERTEBRATE ASSEMBLAGES IN CHINESE ARID-ZONE STREAMS

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Aquatic assemblage responses to abiotic variables should differ in a water body, and concordance should be low with different response trajectories to stressors as the most plausible reason restricting their concordance. We developed MMIs to compare assessments between diatom and macroinvertebrate assemblages in Chinese arid streams. We evaluated concordance of MMIs and β-diversity between assemblages in their response to environmental disturbances. Concordance in assessments between the two assemblages was weak. Test sites with impaired diatom and macroinverterbrate MMI scores had higher nitrate concentrations and physical habitat disturbance than test sites with unimpaired MMI scores. The natural-variation adjusted diatom MMI was sensitive to gradients in maximum velocity, discharge, and O-E_{COD} concentrations. The macroinvertebrate MMI responded strongly to water depth, maximum velocity, and O-$E_{nitrite}$ concentrations. Diatom β-diversity associated with O-$E_{nitrite}$ concentrations and maximum velocity was different from that of macroinvertebrate β-diversity. Assessment of ecological condition and response trajectories of MMI and β-diversity to disturbances differed between diatom and macroinvertebrate assemblages. This supports use of multiple biological assemblages with differing ecological and biogeographical traits in assessments of biological condition and biological diversity.

Key words: *MMI, diversity, natural variability, stressors, random forest*

(O7) AMPHIBIOTIC INSECTS OF SMALL RIVERS OF THE TEREK RIVER BASIN (CENTRAL CAUCASUS)

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The Caucasus is a region of particular interest for studying the diversity of rheophilic communities of amphibiotic insects. Researches, carried out in the Terek River basin earlier, were originally devoted to applied problems (assessments of natural forage of fish of small agricultural reservoirs) (Selegenenko, 1976, *etc.*), are nowadays focused also on studying and conservation of the aquatic ecosystems biodiversity. So far, we have gained a substantial collection material on a number of aquatic animal groups. The studies were conducted for certain groups of aquatic organisms, in particular, caddisflies, mayflies, stoneflies, dragonflies, bugs, beetles, gnats, *etc.* (Kornoukhova, 1976, 1996; Cherchesova, 1987, 2003, 2004; Cherchesova & Zhiltsova, 2006; Khatukhov & Yakimov, 1997, 1998, 1999, 2000, 2001; Shapovalov *et al.*, 2012, and so on).

In the North Caucasus streams, the aquatic insects dominate in the benthos of mountain rivers both in a quantitative sense and in number of species. The specific structure of hydrobionts is typical for many of mountain rivers. The dominant groups in the benthic samples are often represented such as in this example: Ephemeroptera – 36 %, Trichoptera – 27 %, Plecoptera – 18 % and Diptera – 14 %. The share of representatives of Odonata and Coleoptera fluctuates from 0.5 to 5 %, depending on a watercourse type (Shapovalov, 2011). Amphibiotic insects in the small river benthos and spring creeks of the Central Caucasus, along with amphipods, are a major component of freshwater ecosystems. The basis of zoobenthos of spring creeks is made by amphipods (the genus *Gammarus*), which is in the springs all year round; the gradual decline of biomass associated with the summer aquatic insects emergence.

Biomass of zoobenthos in the bottom communities of small streams is upper than in rivers. and it annually varies from 2.5 to 3.5 peaks in streams, while in the rivers the biomass is fluctuated stronger reaching 6–7 peaks. The background groups in the zoobenthos of plain rivers reaches are dipterans (in particular, larvae of Chironomidae) and caddisflies (mainly *Hydropsyche*). However, their number is low and rarely reaches a few hundred ind/m².

The fish food supply of mountain sites of the rivers is also poor and is represented mainly by Orthocladiinae larvae. In June and July the density in mountain streams is about 380–450 ind/m² and biomass hardly reached 0.5–1.3 g/m². The biomass is depended from amphibiotic insects phenology (emergence of insects) and also from sudden changes of water discharge during high and low water.

In the result of the study it was revealed that more than 600 species of aquatic invertebrates inhabit small rivers and spring creeks of the region, and the essential part of which is aquatic insects – stoneflies, dragonflies, mayflies, water bugs, water beetles and dipterans. More than 50 % of the species composition is represented by dipterans.

Key words: *streams, springs, aquatic insects, North Ossetia*

(O8) BIOACCUMULATION OF METALS BY MACROPHYTOBENTHOS: THE RELATION BETWEEN BIOACCUMULATION COEFFICIENTS AND ENVIRONMENT CONCENTRATION

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Data on the animals used in monitoring of heavy metals in the water environment it is shown (DeForest *et al*., 2007) that there is a negative link between concentration of minerals in the environment (water) and a bioaccumulative factor (BAF). BAF is the relation of an element concentration in organism (mkg/g dry mass) to its dissolved concentration in water (mkg/ml) (DeForest *et al*., 2007). It is known that water organisms possess a number of the mechanisms capable to resist to excess amount of metals by regulation of the speed of a filtration (Alimov, 1981), an increase in time of isolation from the environment in the closed shell, active regulation (White & Rainbow, 1982), kinetics of metals accumulation on the saturation mechanism (Simkiss &Tailor, 1989), disposal of excess of metals during the critical periods of life of organisms with part of weight (spawning, a postspawning state – Kavun, 1990), storage in granules in an inactive form (Brown, 1982). All these mechanisms, except the last ones, explain well a decrease in value of a BAF at increase in metal pollution of the environment. Advantage of the seaweed – bioindicators is that they aren't capable to be isolated from the environment. Polysaccharides of a cellular wall of seaweed are depot of heavy metals, link metals by strong covalent and ionic bond. This part of metals is removed from the plants only at destruction of tallom. Such a bond allowed researchers to claim that seaweeds are to a lesser extent capable to regulate the chemical composition, including the concentration of heavy metals. The relation between BAF of seaweed and concentration of the dissolved metals in the environment has been investigated in our work by the data from literature. It is shown that reliable negative bonds observed for Fe, Cr, Mn, Zn, Cu and Ni. For Pb, Cd and Hg bond is insufficiently expressed though the tendency remains (table).

Table. Coefficients of correlation between BAF of seaweeds and water metal concentrations (*the coefficient is reliable, α=0.01;**the coefficient is reliable, α=0.05, n – the number of a sample)

	Hg	Cd	Pb	Cr	Cu	Zn	Fe	Mn	Ni
R corr	-0.16	-0.22**	-0.01	-0.22	-0.68*	-0.50*	-0.53*	-0.45*	-0.43*
n	31	137	130	69	137	74	59	40	39

In order a reliable negative bond between BAF and content of metals in water existed in seaweeds, the mechanisms of avoiding of the increased concentration of metals should exist. The mechanisms of passive (by a gradient of concentration) and active removal of metals in plants are studied very insufficiently, though their existence is supposed (Burdin & Zolotukhina, 1989; Burdin *et al.*, 1990). It is known that seaweeds allocate a large amount of organic substances – lifetime metabolites, which quantity makes from 3 to 50 % of everything synthesized during a day of substance (Haylov & Burlakova, 1966). The quantity of lifetime metabolites, including polysaccharides, phenolic substances, lipids increase in stressful situations (Voskoboynikov *et al*., 2007). Formation around a tallom of a layer of the lifetime metabolites capable to binding and, thus, deactivating metals out of an alga in a stressful situation of pollution, matches for the role of the mechanism of disposal of excess of metals.

Thus, it is possible to claim unambiguously that seaweed, despite a visible lack of mechanisms of control of accumulation of metals, actually cope with it not worse, than animals.

Key words: *heavy metals, microelements, seaweeds, bioindicator, bioaccumulative factor*

(O9) HISTORICAL CHANGES OF FRESHWATER MOLLUSKAN FAUNA IN EASTERN JAPAN CAUSED BY ANTHROPOGENIC ACTIVITIES

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Recent human activities including destruction of habitats, pollution, and transportation of non-native species have caused major impacts on freshwater ecosystems and serious decline of biodiversity of freshwater fauna. However, it remains unclear how human activities before civilization have affected freshwater ecosystems. Community structure and species composition of freshwater ecosystem would have been altered by also pre-industrial agriculture and transportation of nonnative species through cultural exchanges. In the present study, we tested this hypothesis using freshwater molluskan fauna in eastern Japan. We estimated species composition of the ancient molluskan fauna by investigations of subfossils found in ancient ruins. In addition, molecular phylogenies were also used to estimate population histories.

A number of ruins of before the fifth century have been discovered in the eastern parts of Japan. Some of these ruins include shell mounds composed of freshwater Mollusca. We estimated species composition of the freshwater molluskan fauna of more than 1500 years ago by examining the records of species composition of these shell mounds. Although the molluskan species occurred from the ruins were mostly those collected for food, these are still useful to estimate diversity of freshwater fauna in eastern Japan before civilization.

The shell mounds of the middle Johmon ruins approximately 5000 years ago included species such as *Viviparus japonica* and *Sinanodonta lauta* in high frequency. However, these shell mounds included no specimens of *Viviparus chinensis* and *Sinotaia quadrata,* which are the most dominant species in the current freshwater molluskan fauna of the eastern parts of Japan. In these regions, *V. chinensis* first appeared in the shell mounds of approximately 3000 years ago and *S. quadrata* in those of approximately 1700 years ago. These findings suggest that *V. chinensis* and *S. quadrata* were very rare or absent in the eastern parts of Japan before the priods of 3000 years ago. These species have increased density or expanded their distributions after c.a. 2500 years ago when paddy rice was introduced to these regions. The increase of density or distribution ranges of *V. chinensis* and *S. quadrata* are most likely to be caused by the spreads of paddy fields, because both of these species are the most abundant species among the mollusks found in the paddy fields. Molecular phylogenetic analyses of these species using mitochondrial DNA suggest that *S. quadrata* was anthropogenically introduced from Asian cintinent and *V. chinensis* expanded its distribution range fairly recently. These findinds support the hypothesis of historical changes of faunal composisiton as a result of human activity before civilization.

Key words: *nonnative species, shell mounds, Viviparus*

(P9) POPULATION DYNAMICS OF PIKEPERCH (*SANDER LUCIOPERCA*) IN LAKE PEIPSI-PSKOV (PIHKVA)

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Pikeperch (*Sander lucioperca*) is an important commercial fish species in Lake Peipsi-Pskov (Pihkva). We have analyzed its stock size and population parameters using as the input dataset commercial fishery statistics including catch dynamics, age and length-weight compositions since 1980 to 2009. The fact of relative isolation of Lakes Pskov (Pihkva) and Peipsi along with independent fisheries in these two water bodies gives grounds for separate analysis of two subunits of the pikeperch stock.

Retrospective analysis of stock dynamics and fishing mortality was carried out by means of Virtual Population Analysis (VPA) with tuning based on catch per unit of effort (CPUE) data.

The results indicate that the average pikeperch stock size in Lake Pskov (Pihkva) was 0.998 mln individuals, biomass – 534.6 tons; in Lake Peipsi those values were 23.9 mln individuals and 4436.8 tons, accordingly. Abrupt increase of pikeperch stock was observed in the middle of 1980. Maximum stock biomass in Lake Pskov (Pihkva) was registered in the period of 1988–1990, in Lake Peipsi – in the period of 2001–2003.

Age groups from 1+ to 5+ make a main contribution to the stock biomass in both lakes. Total stock size changes are controlled by dynamics of recruits (age 0+). Maximum abundance of recruits was observed in 1985, 1988, 1991, and 2005 in Lake Pskov (Pihkva) and in 1991, 2001, 2005 in Lake Peipsi. The relation between appearance of large cohorts in two lakes turns out to be rather weak (r=0.26). This suggests that the recruitment in different lakes may be controlled by different factors.

Fishing mortality of pikeperch has maximum values for the adult age groups (from 7+ to 9+) and has positive trend which indicates the increasing of fishery pressure to pikeperch population.

Calculation based on the application of equilibrium dynamic pool model using Thompson-Bell algorithm showed that yield per recruit (YPR) is close to maximum values. The one in Lake Pskov (Pihkva) is 277.4 g/recruit at instantaneous fishing mortality F=0.58 year^{-1}. In Lake Peipsi maximum YPR is 285.3 g/recruit at F=0.70 year^{-1}. The fishing mortality at the end of investigated period (averaged for 2005–2009) is 0.46 year^{-1} in Lake Pskov (Pihkva) and 0.43 year^{-1} in Lake Peipsi.

Key words: *Lake Peipsi-Pskov (Pihkva), stock assessment, population dynamics, pikeperch*

(O10) MICROSPORIDIAN PARASITES FOUND IN THE HEMOLYMPH OF ENDEMIC AMPHIPODS FROM DIFFERENT LOCATIONS OF LAKE BAIKAL

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Microsporidia are obligate intracellular parasites that cause infection all eukariotic organisms. The number of described species of microsporidia includes some 187 genera and over 1400 species. Almost half species of microsporidia are infected aquatic organisms and about 50 genera are infected aquatic arthropods. These parasites have an influence on the sex ratio of arthropod populations, the behavior of the host and the host population dynamics.

Lake Baikal is the deepest and one of the oldest lakes in the world. Among macroinvertebrates the first place by the number of species in the lake is occupied by amphipods. Amphipods in the lake are represented by more than 350 endemic species and subspecies. Amphipods inhabit almost all depths and all types of substrates in Lake Baikal. The age and geographic isolation of this group of organisms makes it possible to study the relationships between parasites and hosts, evolution and genetic diversity of the parasites. The subject of our investigation is to test endemic deep-water and littoral Baikalian amphipods on microsporidia contamination. In our study we used molecular-genetic techniques (SSU rDNA (small subunit ribosomal DNA) sequencing) to detect the microsporidia in the hemolymph of several endemic amphipod species from Lake Baikal. We have obtained 20 nucleotide sequences of DNA microsporidia length of 653 bp from *Acantagammarus loppaceus longispinus*, *A. maculosus*, *Pallasea cancellus*, *Eulimnogammarus verrucosus*, *E. cyaneus*, *E . marituji*. Phylogenetic tree was constructed with Mega 6.1 software on the base of these sequences and four separate clusters were identified. The first and third clusters are presented by polyphyletic genus – *Microsporidium* (microsporidia DNA sequences from the hemolymph of next amphipods: *A. maculosus*, *P. cancellus*, *E.verrucosus*, *E. cyaneus*). Also, the third cluster includes genus Enterocytospora, which previously were not identified in Baikalian amphipods. The second cluster is united microsporidia DNA sequences belonging to the genus Dictyocoela (found in species: *A. loppaceus longispinus*, *P. cancellus*, *E. verrucosus*, *E. marituji*). The fourth cluster is combained the sequences related to the genus *Nosema* (found in species: *E. verrucosus*). Also we conducted assessment of individual infection of amphipods by microsporidia, because for contamination of microsporidia we analyzed amphipods from different habitats Lake Baikal (Bolshie Koty Bay and Listvenichny Bay), and the hemolymph samples used for the PCR analysis were mostly pooled from several individual amphipods (1–50 individual in sample). *E. verrucosus* from Bolshie Koty Bay also showed low level of individual infection by microsporidia equal to 0.8–1 %. At the same time, all amphipod species collected in Listvenichny Bay (*E. verrucosus*, *E. marituji*, *P. cancellus*) had high percent of infected individuals compare to Bolshie Koty: 5–16 %. One of the explanations of this fact can be environmental changes in the littoral of Lake Baikal observed in recent years (particularly along the coastline of Listvenichny Bay). This is due to factors such as the: change the composition of flora, high anthropogenic load and high concentrations of sewage components – thermotolerant coliform bacteria (320 CFU/100 ml).

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Key words: *Baikalian amphipods, Microsporidia, SSU rDNA*

(O11) STRUCTURE AND ELECTRICAL PROPERTIES OF SILICA-ORGANIC CRYSTAL-LIKE COMPOSITE SPICULES FROM GLASS SPONGES

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There are around 600 species belong to the classes of so called glass (Hyalospongia) or six radial (Hexactinellida) sponges. These sponges occur in marine waters in all oceans at depths from 10 to 6770 m with low temperatures; therefore, they grow very slowly and live for hundreds of years. Glass sponges are very ancient animals and highly unusual in that their major tissue component is a giant "syncytium" that ramifies throughout the entire body. They have amazing diversity of spicules. Organosilicic spicules of the glass sponges are composed of chemically inert materials. Mineralized remnants of siliceous spicules composed of chemically inert materials are preserved in sedimentary rocks and provide evidence of the ecological state of the ancient biosphere. The physic properties of organosilicic spicule materials (microdensity, Yung module, light transmission) are close with amorphous silica, but they have birefringence, that indicates their high ordered anisotropic crystal-like nature. Spicules demonstrate their capacity for thermoluminescence and triboluminescence. The generated light emission may be used by symbiotic bacteria on the spicule surface. Also they have electrical resistance and are able to piezoelectric effect. Piezoelectric properties of organosilicon spicules seems to be due to their complex multilayered organization. There is mechanical tension between layers in different parts of spicules, which is removed upon destruction of the spicule. The discovery of triboluminescence in spicules of deep-sea hexactinellid sponges suggests that the spicules may provide photons to the photosynthesizing symbionts living in them. It is likely that under certain conditions the sponge itself may provide its own symbionts with light energy. The discovery of piezoelectric effect in living composite organosilicon materials may contribute to the creation of biomimetic materials capable of generating light emission. This, in turn, may be used in various technical constructions for the transformation of energy.

Key worlds: *glass sponges, Hexactinellida, silicaorganic spicules, piezoelectric effect*

(O12) STUDIES OF LAKE FLOODING DYNAMIC USING SATELLITE AND AERIAL IMAGERY

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Today the modern methods for freshwater monitoring using satellites (ST) have moved to a new level. Now it is possible to observe water bodies coastlines, depth of its freezing, levels of water using, strength and duration of the wind surge, and other important parameters with ST. For the definition of lake boundaries only enough pictures with good resolution and coordinates, but for other tasks the specialized equipment and a complex mathematical apparatus are required. Thus, to determine the ice thickness it is necessary to obtain images made at different radio frequency bands (Mitnick & Kuzlyakina, 2013). The wind speed at the surface of reservoirs is possible to determine by calculation of the frequency difference between the wave crests (Mitnick & Mitnick, 2005). To determine the lake water level it is necessary to use the ST altimeters. According to the response time from the water surface with the highest accuracy it is possible to determine the lake water level. There is a special ST monitoring international program for large lakes – DAHITI. In this web-site it is possible to find much information about the Khanka Lake water level dynamic (Trusenkova & Mitnick, 2016), as this lake is included in the list for the ST monitoring. The most interesting studies of water ecosystems, in my opinion, it is determination of change of the gravitational field (GF) in the areas of the water reservoirs diversion. The fact is that, depending on the snow thickness or ground water volume at a given point the GF is changing (Mitnick & Hazanova, 2016). For definition of dynamics of change of the GF the system from two STs rotating around the earth on a certain interval from each other is used. In case of increase or decrease of the GF intensity under the first ST, it either slow down, or accelerates. And it is possible to determine the GF changes based on these changes and define the water volume is on the earth surface but also in its inside. There are some cases when using of STs isn't suitable but quadracop (QC) can be recommended – when it is necessary to make observation quickly and get pictures with high resolution, when cloudy weather stays or at night. Today the ST pictures can be obtained with the good resolution, but the maximal size of a studied point, even on the most modern ST systems, will be not less than 0.1 m^2. The using of QC is possible in case of clouds, at night, and quality of obtained pictures is much higher than those getting by ST. There are some negative sides of the QC using: impossibility to use it in rain and strong wind, near airports, military objects *etc*. The Khanka Lake flooding study with QC has shown its efficiency and preferences. For example, ST pictures did not show the considerable lake area expansion at flooding, but this expansion was obviously shown by QC. Use of ST images was improper for the real coastline determination because in a case when thickness of water doesn't exceed 0.5 m, in ST pictures the water surface was shown as terrestrial. The places with dense coastal or floating vegetation are also identified by ST as a solid surface but it was not in reality.

Key words: *quadcopter, satellite, observation, water ecosystems*

(O13) COMPARATIVE ANALYSIS OF CADDISFLY (INSECTA, TRICHOPTERA) HERBIVORES AND PREDATORS METABOLITES BY NMR

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The study of metabolic processes is a very important area of science. Understanding of the metabolic processes can open a wide range of applications. As cell activity of any aerobic organism needs two components oxygen, and the oxidation products, metabolic chains in the small-sized organisms can be similar to the largest representatives of animals. Moreover, these mechanisms may be similar modified at specific conditions when type of food may be changed. It should be assumed that in the man upon the transition from a meat diet to a complete vegetarian the same processes as insects, birds, *etc*. take place. Investigating of more primitive life forms than higher mammals easier to understand the physiology of all animals (Drozdov & Drozdov, 2015). The physiology of the animals more developed in evolutionary sense includes a cascade of adaptive mechanisms that complicates the understanding of functioning of all organisms in general. It is difficult to understand when one mechanism is switched off, and another is being switched on. In insects, such as, for example, caddisflies, the range of adaptive mechanisms are much less and that simplifies researches on metabolic mechanisms. Using the NMR methods (nuclear magnetic resonance) to study of metabolic processes was began recently, in 1984, by Jeremy Nicholson who showed that it is possible to define existence of a diabetes in patients by the nuclear magnetic resonances spectroscopy methods (Holms & Antti, 2002; Lenz & Wilson, 2007). Since that moment the nuclear magnetic resonance researches took the important place in studying of processes of metabolism together with the mass spectrometry. In 2007 within the program "Human Metabolome" the scientists of the University of Alberta (Canada) have described 2500 metabolites of the human biological system (Wishar *et al*., 2007; Wishar *et al*., 2009). In recent years the interest to insect metabolism study is increasing. Thus in 2006 with use of the NMR methods the walking sticks metabolism was studied (Aaron *et al*., 2006). In 2008, the changes in the metabolite composition of the tobacco sphinx caterpillars have been investigated (Chitchol Phalaraksh *et al*., 2008). Modern techniques let even to investigate the lipid metabolism noninvasively and *in vivo* (Schilling *et al*., 2012). The goal of our work is the studying of the metabolic composition of caddisflies according to the used food. The different taxon of caddisflies may be close evolutionarily but differ on the metabolic types which depends on food type. By now it is not fully known, what is primary reasons in the nutrition physiological changes of the organism – physiological changes of an organism in general, or changes of intestinal microorganisms which take active part in the food fermentation.

Key words: *metabolic processes, caddisflies, nuclear magnetic resonance (NMR) spectroscopy methods*

(O14) AQUATIC INSECT COMMUNITY MONITORING IN MYANMAR: TRANSFORMATION OF RIVER AND IMPORTANCE OF ENVIRONMENT ASSESSMENT

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Myanmar is one of the most biodiverse countries in Asia and is biogeographically interesting area; however, anthropogenic activities such as deforestation, mining, river regulation and agriculture have resulted in environmental degradation and biodiversity loss. Since the law on the preservation of the river water quality has not been enacted, continuous biomonitoring plays an important role. In addition, the exact identification of the occurrence species is still very poor. We have conducted qualitative macroinvertebrate sampling in the 2^{nd}–3^{rd} orders gravel bed stream in the Southern Chin State which is located in the southernmost of the Arakan Mountains since 2012. As for Trichoptera, the twenty one species belonging to 15 genera and 10 families has been recorded for the first time, and most of them are originally from Indo-Himalaya mountains. Among many of the river environment has been degraded by human action, it is evidence that this region is biologically valuable, and the identified species become indicators for environmental conservation. However, effect of shifting cultivation on outflow of sediment to the river is increasingly concerned. In many other regions, new hydroelectric dams are being planned or constructed without an environmental impact assessment. In both academic and social aspects, biomonitoring of aquatic insect community is very important.

Key words: *anthropogenic impact, biomonitoring, environment conservation, Myanmar*

(O15) GENE-ENVIRONMENTAL ASSOCIATION OF STONEFLIES ACROSS ENVIRONMENTAL GRADIENTS IN JAPAN

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Global climatic change threatens to transform biodiversity and habitat ranges of organism through natural selection. Number of genes and various environmental factors related to climatic change may drive this adaptive change. Therefore, modelling of genome-wide association between genes and environments are necessary to predict the ecological consequences of global climatic change. Restriction-site Associated DNA sequencing (RAD-seq) is a powerful new method to generate huge genome-wide sequencing data. This approach can be applied to non-model organisms to sequence thousands of loci for hundreds of individuals rapidly and at low cost, regardless of the genome size and previous genomic knowledge. We generated a genomic-wide sequencing libraries of *Nemoura* sp.n., *Obioteryx femoralis* and *Rhabiopteryx japonica* of stream insect stoneflies (Plecoptera) using RAD-seq of allopatric populations collected at 4 geographical regions throughout Japan: Sapporo, Sendai, Gifu and Matsuyama. We examined evolutionary processes of local adaptation and genomic evolution along national wide climatic gradients in Japan. DNA extracted from each individual were use for library construction with specific index for Illumina Hiseq 2500. *De novo* assembly, read alignment and SNP discovery were conducted using stacks v 1.32 pipeline. The RAD library yielded 309 779 500 reads with 150 bp average length. A total of 4000 SNPs were allelic associated with altitude. Our findings highlight the power of recent genomics approaches to resolve patterns of gene flow in stoneflies.

Key words: *genomics, altitude, Plecoptera, Japan*

(O16) ALDERFLIES (INSECTA: MEGALOPTERA) OF MONGOLIA, WITH A NEW DISTRIBUTION OF *SIALIS LEVANIDOVAE* VSHIVKOVA, 1980

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The Megaloptera of Mongolia has been studied during 1979–1995, by foreign scientists and however, there is no complete species data about this genus in our country. Our study is reporting *Sialis* species including data of aquatic insect projects conducted in Mongolia and other literatures. There are three species recorded in Mongolia, with a new distribution of species *Sialis levanidovae* Vshivkova, 1980. We are identified 288 individuals collected from 65 sites throughout Mongolia. Identification keys for three species of males are provided.

Key words: *Sialis, distribution, identification key, Mongolia*

(O17) EGG DEVELOPMENT AND THERMAL ADAPTATION IN THREE EPHEMERID MAYFLIES (EPHEMEROPTERA: EPHEMERIDAE: *EPHEMERA*) INHABITED DIFFERENT ALTITUDINAL GRADIENTS IN KOREAN STREAMS

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Egg developmental features including hatching rate, duration, developmental rate, thermal threshold, and required amount of heat, were experimented to evidence thermal adaptations in three ephemerid mayflies, *Ephemera orientalis*, *E. strigata*, and *E. separigata*, which show a unique pattern of distribution along altitudinal gradient in Korean streams. Eggs of *E. strigata* and *E. separigata* were incubated at six different constant temperatures between 0 °C and 30 °C with 6 °C interval in 1999, and those of *E. orientalis* between 10 °C and 35 °C with 5 °C interval in 2003. Hatching success rates within threshold temperatures were 76.72−93.86 % in *Ephemera orientalis*, 80.52−93.79 % in *E. strigata*, and 91.49−95.77 % in *E. separigata*. Mean hatching rates increased slightly as the temperatures increased in all the species, but the difference was significant ($F_{3,\ 16}=11.91$, $p<0.01$) only in *E. strigata*, particularly at 6 °C. Cumulative hatching rates at each temperature showed a sigmoid relationship to the time in all the species, but they showed somewhat longer hatching durations at lower temperatures. Egg developmental rates showed a linear relationship to temperature in all the species with high determinant coefficient ($r^2=0.9878$ for *E. orientalis*, $r^2=0.9578$ for *E. strigata*, and $r^2=0.9628$ for *E. separigata*), but the slopes were different depending on the species ($y=-0.0833 + 0.0086x$ for *E. orientalis*, $y=-0.0109 + 0.0052x$ for *E. strigata*, and $y=-0.0089 + 0.0046x$ for *E. separigata*). The derived thermal threshold of egg development in *E. orientalis* (9.2 °C) was much higher than that in *E. strigata* (2,11 °C) or in *E. separigata* (1.92 °C). Total amount of accumulate degree days (ADD) was significantly different ($F_{2,\ 9}=18.72$, $p<0.01$) between the species (242.69 in *E. separigata*, 221.83 in *E. strigata*, and 115.69 in *E. orientalis*. In conclusion, the egg developmental features of these *Ephemera* species well explain their altitudinal distributions in Korean stream channels. Egg development experiments are replicated in 2016 to investigate temporal differences of thermal adaptation induced by environmental changes for last 13–17 years.

Key words: *egg development, altitude gradients, thermal adaptation, ephemerid mayflies*

(P10) STONEFLIES (INSECTA: PLECOPERA) FAUNA FROM THE GAPYEONG STREAM WITH NEW ONE SPECIES AND TWO NEW RECORDS

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The order Plecoptera is a relatively small taxon of insects with approximately 3500 species in the world. However, the stonefly fauna of the Korean peninsula is still incompletely known. Plecoptera were investigated from Gapyeong steam in Gyeonggi-do, Korea, from 2012 to 2014 using Malaise traps. Specimens are preserved in 80 % alcohol. As a result, the specimens comprised 14 identified species, including one new species and two new Korean records; *Amphinemura coreana* Zwick, 1973, *Amphinemura Steinmanni* Zwick, 1973, *Haploperla maritima* Wu, 1929, *Nemoura geei* Wu 1929, *Nemoura papilla* Okamoto, 1922, *Nemoura problematica* Zwick, 1973, *Paraleuctra cercia* Okamoto, 1922, *Perlomyia levanidovae* (Zhiltzova) 1975, *Perlomyia mahunkai* (Zwick) 1973, *Perlomyia smithae* Nelson & Hanson, 1973, *Perlomyia* sp. KO1 Murányi *et al*., 2014, *Perlomyia* sp.n. and *Sweltsa colorata* Nelson & Hanson, 1973. The unknown male of *Perlomyia* sp. KO1 is described. *Nemoura problematica* Zwick, 1973 *stat. n*. is considered as senior synonym of *N. jilinensis* Zhu & Yang, 2003 *syn. n*. The total number of Plecoptera species known form Korea now equals 85.

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Keywords: *Plecoptera, new species, new records, Gapyeong steam, Korea*

(O18) THE ROLE OF MICROORGANISMS IN TRANSFORMATION OF SELENIUM IN NATURAL WATERS

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Microbial communities involved in key processes of transformation of selenium in natural waters. In prokaryotes, selenium is readily metabolized and participate in a full range of metabolic functions including assimilation, methylation, detoxification, and anaerobic respiration (Stolz *et al.*, 2006).

The oxyanions selenate and selenite are the dominant forms of selenium that are naturally found in freshwater and saltwater. The distribution of the different species may vary with the environment, but typically soluble selenate and selenite are found in the oxic zone and the insoluble Se(0) is more abundant in the anoxic zone (Heider & Boeck, 1994). In addition, the selenium in sea water is associated with dispersed organic matter, the main source of which are dying of plankton organisms (Golubkina *et al.*, 2012).

Oxyanions of selenium are terminal electron acceptors in anaerobic respiration, forming distinct nanoparticles of elemental selenium: $SeO_4^{2-} \rightarrow SeO_3^{2-} \rightarrow Se^0$.

Although selenite oxidation occurs in oxic water, the sole presence of dissolved oxygen is not enough to transform selenite into selenate. Selenite oxidation is enhanced by factors that favour the abundance of strong oxidants in the water column, such as redox-active transition metals (iron and manganese) and the presence of selenite-oxidizing bacteria (Maher *et al.*, 2009).

Oxidation of elemental selenium to selenite by *Bacillus megaterium* was described in 1981 (Sarathchandra & Watkinson, 1981).

Marine phytoplankton forming the volatile organic compounds dimethylselenide and dimethyldiselenide. Nutrient evaporation of selenium from sea water in the atmosphere is estimated at 5000–8000 tons per year (Nriagu, 1989; Fordyce, 2012).

Key words: *transformation of selenium in natural waters, assimilation, methylation, anaerobic respiration*

(O19) ASIAN CADDISFLIES (INSECTA, TRICHOPTERA): PAST, PRESENT, AND FUTURE

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Asia is the largest part of the world with exceptionally high landscape and geographical diversity. It includes several biogeographical regions: Palearctic (West and East), Oriental, and Afrotropical; traditionally these regions are related to the general framework by Wallace (1876), although the growing data on Trichoptera distribution and faunas challenge this scheme. The Oriental region including more than 4000 described extant species of Trichoptera is the richest among all biogeographic regions. Palearctic region is rather species rich; its subdivision into East Palearctic and West Palearctic is apparent although the Palearctic regional borders as well as border between East and West Palearctic are debatable. The data show that West Siberia, Turkey, and West Iran have West Palearctic faunas, and the faunas of Central Asia are very different from the related faunas of Eastern Siberia, Northern China, Korean Peninsula, Japan, and Far East of Russia. Presence of the Afrotropical faunas is minimal in the ultimate south-west of Asia. The present distribution of faunas is explainable by the existing barriers preventing the faunal exchange. These barriers are the regions with unfavorable landscapes: deserts, oceans, large swamps, areas of mineralized waters. Trichoptera are known in the sediments of Asia from the Mesozoic; the oldest remains of modern Amphiesmenoptera after split of the stem-group Protomeropina (ancestral Amphiesmenoptera) represented by wing imprints were found in the Triassic of Central Asia. The past faunas represented in sediments mostly as wings and body fragments are sometimes difficult to interpret because of lack of proper characters; nevertheless, larvae of Brachycentridae, Leptoceridae, adults of a few extant (*e.g.*, Glossosomatidae, Phryganeidae) and extinct (Baissoferidae, Vitimotauliidae, Dysoneuridae) families, and various Trichoptera larval cases are known since the Upper Jurassic and Low Cretaceous of Siberia. Numerous findings of the fossil Mesozoic Trichoptera were recently described from the Cretaceous beds of China. Another excellent source of knowledge of the fossil Trichoptera is the resins known from the Middle Cretaceous (Burmese and Taimyr ambers); its analysis meets the criteria of modern taxonomy, so the direct comparison with the extant faunas is possible. The composition of Mesozoic amber faunas of Asia show its similarity to the Cenozoic faunas of the European amber deposits. The development of Trichoptera faunas in the Cenozoic is poorly known, although the local Miocene fauna of Stavropolie (northern piedmonts of the Caucasus) rich in Limnephilidae reveals similarity to the modern faunas of the region. Future development of faunas is dependent on climatic change and human impact. The global warming brings warmer winters and more wet climates favoring to Trichoptera in the larger part of Palearctic; a few faunistic barriers might be shifted northwards. Central Asia, contrary, would have lesser glaciation and some desiccation decreasing the Trichoptera diversity. Human impact in the tropical areas brings deforestation and pollution and, hence, the most urgent need is to describe the tropical Trichoptera faunas of Asia before they will be damaged by civilization.

Key words: *fauna, caddis-flies, Asia, biogeography*

(P11) FIRST RECORD OF *GYNACANTHA BASIGUTTATA* (ODONATA: AESHNIDAE) FROM KOREA

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The aeshnid species *Gynacantha basiguttata* Selys, 1882 is reported for the first time in Korea. The genus *Gynacantha* Rambur, 1842, within subfamily Aeshninae and family Aeshnidae is represented by 87 species world-widely, especially in the tropic and subtropic regions, and two species are known from Korea including the newly recorded species *G. basiguttata*.

G. basiguttata, a listed species in IUCN Red List of Threatened Species as "Least Concern (ver. 3.1)" grade, is collected in Jeju Island. The genus is large in size and among the migratory Odonata, so this species might migrate from tropic or subtropic country. In this study morphological description and taxonomic key of *G. basiguttata* are provided.

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Key words: *Gynacantha basiguttata, Aeshnidae, Korean Odonata*

(P12) BIOCHEMICAL INDEXES AS INDICATORS OF QUALITATIVE CONDITION OF ZOOBENTHOS IN THE RIVER BOLSHAYA (WEST KAMCHATKA)

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Zoobenthos is the major source of food for juvenile Pacific salmon in river ecosystems (Levanidov, 1969; Chebanova, 2002; Travina, 2008). In the basin of the Bolshaya River on the west coast of Kamchatka the diet of juvenile Pacific salmon usually consists of larvae and pupae of Chironomidae, Plecoptera, Ephemeroptera and Trichoptera (amphibiotic insects), crustaceans and terrestrial insects. The quality of the forage organisms depends on the complex of factors, including the trophic, hydrological, seasonal and climatic conditions in each particular year, the stage of the life history and the amount of marine nutrients provided into freshwater environment from salmon carcasses when spawning is finished (Chebanova, 2008; Wipfli & Baxter, 2010). Biochemical composition and the composition of fatty acids in particular, is one of the most important indexes giving information about quality of benthic invertebrates. For now the data on the composition of the fatty acids of lipids in freshwater zoobenthos, comparing to the data about marine zoobenthos, are very poor (Sushchik, 2008). The purpose of this work was to estimate seasonal and interannual dynamics of the biochemical indexes for benthic invertebrates dominating in juvenile Pacific salmon feeding in the basin of the river Bolshaya. The objects of the research were the larvae (Chironomidae, Plecoptera, Ephemeroptera, Trichoptera*)* collected for the period from spring to autumn in 2012–2015 in the middle part of the river Bolshaya.

The specifics of seasonal and interannual dynamics of biochemical characteristics of the benthic invertebrates is demonstrated. Analysis of the seasonal dynamics of the biochemical characteristics of larval (Chironomidae, Plecoptera, Ephemeroptera, Trichoptera*)* has indicated that spring zoobenthos (in April–May) typically has maximal lipid deposits (15–26 % in dry substance) and minimal (13–19 %) in summer. In June and August the forage organisms demonstrated reduction of the lipid deposits in view of transforming size-age composition in the course of reproduction of amphibian insects. Autumn deposits (in September–October) were 17–23 % higher comparing with the summer level. Among the forage organisms examined the maximal level of lipids was revealed in Chironomidae larvae. The dynamics of the lipid content in muscle tissue of juvenile Pacific salmon in the basin of the Bolshaya River in studied period (spring–autumn) was similar to the dynamics of zoobenthos. It is found that the qualitative characteristics of the benthic invertebrates are influenced indirectly by trophic chains and escapement of spawning Pacific salmon in the Bolshaya River. An impressive growth of the body weight of the forage organisms and the lipid content (8–12 % higher) of the forage can be seen in spring (in April–May), next year after abundant spawning escapement of Pacific salmon, when the part of acids, which are markers of feeding on diatoms (in particular 16:2ω–4, 20:5ω–3), gets 5–10 times higher *vs.* the other fat acids, that indicates of increasing production due to biogenic substances of the oceanic origin. Differences in the levels of fatty acids, which are markers of feeding on bacterioplankton or detritus are also revealed for this period in the fatty acid composition of zoobenthos lipids. High escapements of adult Pacific salmon for spawning in the Bolshaya River provide a high level of biogenic substances, which in turn determine functioning of all trophic levels of the ecosystem.

Key words: *freshwater zoobenthos, biochemical indexes, seasonal and interannual dynamics*

(P13) **MICROBIAL COMMUNITIES IN THE THERMAL WATERS OF KAMCHATKA**

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Thermal springs of Kamchatka are one of the places where thermophilic bacterial communities develop very actively. However, at the moment there is no information about the role of microbial communities in Kamchatka in the accumulation of various elements and the formation of minerals. In this context, the aim of the work was to investigate the role of microbial communities in the accumulation of various elements and the formation of minerals in Malki, Nachiki and Verchne-Paratunskie thermal springs of Kamchatka.

Samples of microbial mats were collected in the period August–September 2015. In order to study the deposition of minerals the microbial mats were packed with the preservation of the structure, and then in the laboratory they were divided into layers and dried. The phase composition of minerals was determined using X-ray phase analysis on the diffractometer D-8 Advance, Bruker. Samples for analysis of contents of microcomponents were additionally preserved and their identification was performed by using mass spectrometer inductively coupled plasma Agilent 7500c (Agilent Technologies, Inc., USA).

The results showed, that Malki thermal springs was characterized with a high content of Li (84.9 mg/l), Mn (13.2 mg/l) and Rb (27.8 mg/l), in Nachiki thermal springs found dominance the content of Ca (20.5 mg/l), Si (120 mg/l), Verchne-Paratunskie thermal springs were distinguished with a high number of Li (of 151.6 mg/l), Zn (5.8 mg/l) and As (5.4 mg/l). The mineralization of water ranged from 0.7 to 1.2 g/l. In the microbial mats of Kamchatka were prevalent saprophytic bacteria, that decomposes organic matter, and there were dominated by bacteria of the genus Bacillus. Microbial mats in the process of their life were able to accumulate different elements and form minerals. Was discovered relatively high content of Mn, Fe, Pb in microbial mats from all thermal springs that were studied. According to the results of X-ray phase analysis was shown that calcite, quartz (in all studied sources), magnetite (Malki, Verchne-Paratunskie thermal springs), anortite (Nachiki), plagioclase (Verchne-Paratunskie thermal springs) were identified among the minerals of the microbial mats. The results that were obtained show, that microorganisms play an important role in the cycle of silicon and also in deposition and dissolution of silicate minerals and amorphous solids.

This work was supported by grant RNF № 14-17-00415.

Key words: *microbial communities, thermal springs, Kamchatka, minerals*

(O20) MOLECULAR PHYLOGENY OF THE BASAL CLADES OF ORTHOCLADIINAE (DIPTERA: CHIRONOMIDAE)

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A number of genera have been described in the non-biting midge family Chironomidae, but phylogenetic relations, in particular, among the basal clades of the subfamily Orthocladiinae are not well studied. These ancestral Orthocladiinae include *Brillia* Kieffer, 1913, *Tokunagayusurika* Sasa, 1978, *Euryhapsis* Oliver, 1981, *Xylotopus* Oliver, 1982, *Plhudsonia* Saether, 1982, *Irisobrillia* Oliver, 1985, *Eurycnemus* van der Wulp, 1874, *Tokyobrillia* Kobayashi & Sasa, 1991, and *Pseudobrillia* Niitsuma, 1991. Later in 1992, Saether synonymized *Tokunagayusurika* Sasa with *Propsilocerus* Kieffer, 1923 and noted a close relation of *Plhudsonia* Saether,1982 with *Diplocladius* Kieffer, 1908. Saether and Wang in 1992 established the *Brillia*-group, *sensu lato*, which is composed of 11 genera of ancestral Orthocladiinae: *Austrobrillia* Freeman, 1961, *Brillia*, *Elpiscladius* Harrison & Cranston, 2007, *Eurycnemus*, *Euryhapsis*, *Irisobrillia*, *Neobrillia* Kawai, 1991 (=*Pseudobrillia*), *Phludsonia*, *Tokyobrillia*, *Uirassubrillia* Mendes et al, 2013, and *Xylotopus*. Cranston in 2012, in a phylogenetic study of the higher taxa of Chironomidae, included five genera (*Austrobrillia*, *Brillia*, *Elpiscladius*, *Propsilocerus*, *Xylotopus*) of ancestral Orthocladiinae, but no detailed phylogeny between them was provided. In this study, the basal clades of Orthocladiinae including members of *Brillia*-group together with the genera *Diplocladius* and *Propsilocerus* are phylogenetically analyzed using partial mitochondrial DNA sequences (COI gene), and a cladogram of the *Brillia*-group is presented.

Key words: *Brillia-group, Chironomidae, ancestral Orthocladiinae, molecular phylogeny*

(P14) DAILY VERTICAL MIGRATION OF AQUATIC ORGANISMS IN LAKE BAIKAL

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Daily vertical migrations of hydrobionts residing in bottom-dwelling and pelagian organisms are widespread phenomenon occurring both large continental lakes, and seas and oceans. The migrations are that bottom-dwelling organisms leave their coverts and head to water column at twilight. The causes of that phenomenon have remained unclear. One group of researchers suggest that night migrations serve as a way of spreading, searching of partners, and feeding. Another group supposes that migration activity is caused by tidal motions, lunar cycles, gain of amount of positive temperatures to accelerate pubescence. Same phenomenon is witnessed in Lake Baikal as a big ocean-like water reservoir. The migration complex of Lake Baikal contains such animals as benthic amphipods, sculpins, pelagic amphipod *Macrohectopus branickii*, harpacticoids, cyclops, and copepods (mainly *Epischura baikalensis*). The most suitable model group to investigate the daily vertical migration is amphipods. To investigate this phenomenon in Lake Baikal we use the underwater video recording system. The points of observation are chosen on flat platform at depth 10–15 m. The observations of migration complex in some points have occurred repeatedly. The video recording lasts 15 minutes on bottom. During the raising camera records one minute video at appointed points from the bottom. The obtained records were divided into 5 minutes parts, which were divided into 1 minute record. Each one-minute record is analyzed. For this purpose, the video is stopped each 5 seconds to calculate the animals which are presented at freeze frame such as benthic amphipods, fishes, pelagic amphipod *Macrohectopus branickii*. To obtain the data of species composition of migrating amphipods and amphipods that stay on the bottom, it was used the dredge and the plankton net.

During the conducted investigations it was described five behavioral patterns of hydrobionts at the time of daily vertical migrations. The first pattern was observed opposing Selenga River shallow water. It is characterized by very low numbers of specimens, amphipods are found in 0.02 specimens per freeze frame/5 minutes, and fishes are found in 0.04 specimens per freeze frame/5 minutes. The second pattern is characterized by bigger number of amphipods, on average 7.49 specimens per freeze frame/5 minutes and comparatively low number of fishes 0.03 specimens per freeze frame/5 minutes. The next pattern is noted by high number of both amphipods (3.15 specimens per freeze frame/5 minutes) and fishes (95.35 specimens per freeze frame/5 minutes). At the beginning the amphipods prevailed, then their number decreased, and the number of fishes grow. The next pattern is characterized by the fact that except benthic amphipods (8.38 specimens per freeze frame/5 minutes) and fishes (1.11 specimens per freeze frame/5 minutes), it was witnessed the pelagic amphipod *Macrohectopus branickii* (41.95 specimens per freeze frame/5 minutes). It is unsual depth for this species. The fifth pattern is characterized by the high number of semi-pelagic amphipods *Micruropus wohlii wohlii* and subspecies *M. wohlii platycercus* (on average 81.92 specimens per freeze frame/5 minutes). Also it was shown fishes (1.29 specimens per freeze frame/5 minutes) and *Macrohectopus branickii* (0.16 specimens per freeze frame/5 minutes).

This study was supported by Russian foundation for basic research (project № 16-04-00786) and Grant of Irkutsk State University for young researchers (№ 091-15-232).

Key words: *daily vertical migration, amphipods, benthos*

(O21) TO THE PROBLEM OF BIOMONITORING AND ASSESSMENT OF SURFACE WATER QUALITY IN THE NORTH-EAST OF THE FAR EAST RUSSIA

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Mining and fishing industries, forming the economical basis in the North-East (NE) of the Far East Russia, make significant impact on the river systems in the region, many of which fall into the top category of commercial fishing importance. The intensive industrialization of running waters could help to create a necessary basis for their biomonitoring. However, difficult climatic conditions, inaccessibility of the most part of the territory and a range of concurrent circumstances have prevented this researching trend from getting any substantial development. As a result, at present, biomonitoring of running waters in the region inevitably comes across a number of difficulties.

Undoubtedly, the main problem is the low level of knowledge about local hydrobionts of water courses and water bodies. Since the late 19th century the faunistic researches based on facultative and incidental collections have been dominating in the region. Seasonal and ecological researches dealing with the question of structure-functional organization of macrozoobenthos communities are almost completely absent. Moreover, the available data are presented geographically in a very scattered way, because the sampling locations usually coincide with either the most populated areas or the areas of mining. Nowadays the most studied waters in the Russian NE can be considered the watercourses of the Tauy Bay coast line, whereas the hydrobiological information about the remaining small and big rivers of the Magadan region and the Chukotka peninsula are generally presented as reconnoitering.The North of the Far East Russia is the territory of continues, discontinues and sporadic permafrost. The influence of cryogenic process causes the local erosion of river bodies and permanent redeposition of alluvium due to the fluctuations of river water supply, and it also increases the dynamics of the habitat of macrozoobethos communities. According to the results of a recent research in a typical Tauy Bay river with an average size of the river basin – the Ola River – the dynamics of habitat forms a high level of variability in the structure-functional organization of macrozoobenthos communities in spatial, seasonal and interannual aspects. The investigation has shown that throughout its length (166 km) the Ola River represents a rithral with subzone epi-, meta, and hyporithral. The subzone of metarithral covers the most part of the river bed (about 100 km). Meanwhile, the changing of species composition and the structure of macrozoobenthos communities inside this subzone show that it is inhabited with no fewer than three different communities. Also the research has revealed that within-year variability of communities' biomass can change from 10.5 to 182 times, and interannual variability is significant too. The dynamics of quantitative data is characterized by a bicuspidate graph, depending on summer and winter periods. The communities can be classified according to the prevailing magnitude of summer or winter density and biomass in macrozoobenthos developing. The obtained results point out that the opportunities of flowing water biomonitoring in the NE FER at present are very limited. In our opinion, the existing approaches to assessment of surface water quality must be seriously reconsidered. We should particularly pay attention not only to indexes and criteria but to methodological aspects either. For example, the revealed variability of seasonal density and biomass does not allow to use only one-time selection of quantitative samples.

Key words: *problems of biomonitoring, macrozoobenthos, North-East of the Russian Far East*

(O22) BIOASSAY OF WATER POLLUTION

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In 1970–1980s water pollution has been increased as a result of the active development of industry in some countries and at the whole world due to industrial effluent into rivers, lakes and coastal marine areas. Negative effect on biota was sufficient and evident. However, the chemical and physical methods of analysis were not accurate enough to give the quantitative results. Moreover, those methods were able to determine just particular elements or compounds, even nowadays with very high modern and sensitive equipment. In reality, bio-organisms have been influenced by the combination of pollutants of different nature. Thus, when chemical and physical methods give the diverse picture on specific components influence, the organisms reflect the whole waste impact, being the best predictors of environment pollution. Until now, some peculiar species have been chosen from the whole number of organisms as the best reflectors, widely used as indicators.

Bioindicators are divided into several groups according to the nature of their reaction on pollutants. Some of them respond appearing or disappearing in hydrobiont community. As a rule, the more contaminated community, the lower its biodiversity. At last, in environment polluted with specific component, the only one species can survive giving a vast biomass and quantity. For example, nothing but Polychaeta *Capitella capitata* can stand in bottom sediments polluted by oil.

Microorganism closely connected with used substrate are the best indicators of the environment state. When the water reservoir contains oil and petrochemicals, the quantity of oil-oxidative bacteria grow quickly, being the perfect reflector of the oil pollution even without visual slicks. Another example are phenol compounds and phenol-destructor bacteria.

Accumulative organisms as indicators of heavy metals pollution are widely used in environmental monitoring, and brown algae are the mostly adequate mirrors of the life conditions. Alginates in cellular walls and inter-cellular space of these species bend the heavy metals into stable complex. Species of *Fucus* and *Sargassum* algae genera are very popular as accumulative indicators in the Pacific and Atlantic coastal areas.

Test-organisms used in laboratories are the most recent achievements. As a rule, eggs or larvae of some species are mostly vulnerable immature stages in living cycle, and cannot prevent negative external effect. Their response is expressed as death, inhibition or abnormal forms of individual growth.

Key words: *bioindicators, biodiversity, test-organisms, environmental pollution*

(P15) PHYLOGEOGRAPHY OF SCOPURID STONEFLIES (INSECTA, PLECOPTERA, SCOPURIDAE)

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Plecoptera is a small order of insects which has aquatic nymphs. They probably diverged well over 300 million years ago, and there are over 2000 species in 16 families worldwide, distributed across all continents except Antarctica. Two suborders, Arctoperlaria and Antarctoperlaria are generally accepted to be within this order. Each suborder is primarily distributed within the northern and the southern hemispheres, respectively. The vicariance pattern between these suborders is believed to be linked to Pangea's break up into Laurasia and Gondwanaland during the Late Jurassic, *i.e*., 170 Ma. This relationship between the suborders has also been basically supported by morphological, molecular phylogenetical and ethological studies.

However, there is a problem in the phylogenetic position of the smallest family, Scopuridae. Scopurids are endemic to East Asia (*i.e.*, the Japanese Archipelago and the Korean Peninsula). Eight species belong to the sole genus *Scopura*. In previous morphological studies, Scopuridae are placed within Arctoperlaria. However, according to molecular phylogenetic studies it belongs to Antarctoperlaria. Furthermore, ‘drumming’ behavior, which is recognized as being a typical and functionally important mating behavior in arctoperlarian stoneflies, has not been observed in the scopurid stoneflies, despite their distribution within the northern hemisphere. So, Scopuridae is a ‘key taxon in understanding the sequence of evolutionary paths and diversity in Plecoptera. In these previous studies, it has considered that Scopuridae originated in the cold regions of Eurasia and migrated to Japan about 0.6 million years ago. However, their actual path of migration and precise origin remains unclear. A more accurate estimation of the evolutionary history of scopurids will contribute valuable information to the discussion concerning the higher level phylogeny of the order Plecoptera.

In this present study, the phylogenetic relationships of the scopurid stoneflies, collected from an area covering their almost all distributional range, were analyzed using the nuclear DNA Histone H3 region, and the mitochondrial DNA 16S rRNA and COI regions. Almost identical affinity relationships were supported by both the analysis of nDNA and mtDNA. Scopurid stoneflies were clearly separated into two discrete clades, a pattern suggesting that scopurid stoneflies immigrated to Japan from two directions; 1) from Far East Russia into northern Japan, and 2) from the Korean Peninsula into western-central Japan.

Key words: *Scopuridae, molecular phylogeny, biogeography*

(P16) APPLICATION OF THE DNA COMET ASSAY FOR THE ASSESSMENT OF THE GENOTOXIC EFFECT OF POLLUTION ON MARINE INHABITANTS

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Pollution of marine coastal zone produces multiple consequences at the marine inhabitants. That is why it is necessary to introduce into the ecotoxicological monitoring a new system of criteria based on an analysis of key biochemical parameters (molecular markers), allowing to obtain an integrated estimation of the organism state under the effects of adverse environmental factors. Some chemicals entering aquatic environments have the potential to induce DNA damage. There are persistent organics such as polycyclic aromatic hydrocarbons (PAHs) and metals, which can damage DNA either directly or indirectly via the production of free radicals or after metabolic activation. That is why DNA damage is one of the most important biomarkers of genotoxic effects of pollution. The assessment of DNA damage by the single cell gel electrophoresis (Comet assay) has been described as a useful nonspecific general biomarker of stress in marine organisms. The destruction of the DNA molecules in somatic cells may lead to disfunction of the individual cells, tissues and organs, followed by violation of life processes and death of the organism. The ecological significance of DNA damage to germ cells (gametes) is much higher, by their involvement in the reproductive success (a reduction in fertilization ability, with development failure and offspring problems) and long-term population changes.

The aim of our work was the estimation of the genotoxic effect of polluted marine water on the somatic and germ cells of marine invertebrates. Genotoxic damage, expressed as DNA strand breaks, were measured in isolated gill and digestive gland cells from the mussels *Crenomytilus grayanus* (Dunker, 1853) and sperm cells of the sand dollar *Scaphechinus mirabilis* (Agassiz, 1863), using the Comet assay. Mollusks and water samples for bioassay were collected in the Nakhodka Bay (Peter the Great Bay, Japan Sea). In addition to genotoxic approach the bioassay using sand dollars gametes was carried out due to its' wide application in the ecotoxicological studies of the marine environment. The results of embryoassay revealed the disturbances of the embryonic and larval development of *S. mirabilis* in the water from all the studied stations. Analysis of DNA integrity showed that after the sperm cells exposition in tested water the percentage of DNA in the comet tail (% DNA_t) and the Genetic Damage Index (GDI) were 1.5–2 times higher than the control level. In the cells of the mussels' tissues the level of the DNA damage was also significantly higher than the control values. In the cells of mussels from Cape Krasny and Kozmina Bight more than 30 % of DNA was defragmented. The GDI in the gill cells varied from 1.34 to 2.49, in the cells of the digestive gland) – from 2.05 to 2.35. The results confirms that in the water of the Nakhodka Bay presents some pollutants for which the DNA molecules are one of the main targets. They possess the potential genotoxic effect for marine inhabitants.

Key words: *genotoxicity, DNA-assay, Crenomytilus grayanus, sand dollars sperm cells, embryos and larvae*

(O23) DIVERGENCE TIMES AND HYBRIDOGENIC REPRODUCTION OF KOREAN COBITIDS

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The high endemism and species richness of freshwater fishes across multiple taxonomic groups in the Korea Peninsula raise a question how these patterns could evolve. The geographic and topographic setting of the Korean Peninsula with high mountainous terrain leading to multiple watersheds and isolated river drainages may explain these patterns well. Nevertheless an important point is that the current geography and topography of the peninsula have evolved for a long geologic time with variation in the mode of time and space. It is, therefore, still remains unsolved which environmental changes are responsible for which diverging processes of freshwater fish taxa over time. Here, we will present following topics: (1) the molecular phylogeny of Korean cobitids, (2) divergence times among lineages that are divided into three representative subdistricts bordered by mountain ranges and sea, and (3) genetic consequences of naturally occurring hybridogenic diploid-triploid complex between *C. hankugensis* and *I. longicorpa*.

Key words: *Korean Peninsula, Cobitidae, diversification, hybridogenesis*

(P17) COMMUNITY STRUCTURE OF BENTHIC MACROINVERTEBRATES FROM WOLAKSAN NATIONAL PARK, WITH TWO SPECIES OF FIRST RECORDED CERATOPOGONIDAE (INSECTA: DIPTERA) FROM REPUBLIC OF KOREA

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Community structure of benthic macroinvertebrates in Wolaksan National Park was surveyed. The surveys were carried out at 54 sites from April to August, 2015. Each surveyed site was divided into 4 types of valley: Songgye valley (SG, eight sites), Seonam valley (SA, eighteen sites), Yongha valley (YH, fourteen sites) and the other Wolak valley (WA, thirteen sites). As a result of the survey, totally 165 species, 78 families, 19 orders, 7 classes and 5 phyla were found. There were 95 species (WA valley) to 131 species (SA valley) from each type of valley, and the average numbers of species from each site were 24.9 (±11.3) species in WA valley, 30.4 (± to14.2) species in SA valley, 31.6 (±8.2) species in YH valley and 34.6 (±7.3) species in SG valley. The average of BMI (Benthic Macroinvertebrates Index) for the evaluation of biological water quality was 90.8, which means the highest grade, so the aquatic habitat of Wolaksan National Park is being retained stably.

In this study, two species firstly recorded for the Republic of Korea, and Ceratopogonidae (Diptera) were identified from SG vally and YH vally, so the two species were provided additionally.

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Key words: *benthic macroinvertebrates, Wolaksan National Park, Ceratopogonidae*

(O24) PREDICTION OF URBAN MOSQUITO OCCURRENCES BASED ON METEOROLOGICAL FACTORS USING A CLASSIFICATION AND REGRESSION TREES

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Mosquitoes are major insects with regard to urban sanitation. Therefore, understanding their occurrences are important to public health. In this study, we ained to predict occurrences of urban mosquitoes using meteological factors with use of a classification and regression trees (CART). Mosquito field data were obtained from local government (Yeongdeungpo-gu) in Seoul, Republick of Korea. We classified monitoring sites into two categories (waterside and non-waterside) reflecting the differences of their habitat conditions. And the meteorological data were obtained from the Korea Meteorological Administration. The results classified abundances of mosquitos to several groups based on the meteorological and habitat conditions. Finally, our study presents the efficiency of CART for the prediction of urban mosquito occurrences relating to the meteorological factors.

Key words: *prediction of the mosquito occurences, urban zones, meteorological factors, public health*

(P18) COMPARISON OF CHEMICAL TOLERANCE LIMITS AND TROPHIC GRADIENTS IN TWO FISH POPULATIONS

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Trophic and tolerance gradients on the ranges of ambient nutrients (N, P) and other water quality were tested on two species of *Zacco temminckii* (Z_t) and *Zacco platypus* (Z_p). For water chemistry, trophic gradients and biological integrity model analysis, 76 streams and rivers were sampled during the study. The populations of Z_t had a narrow tolerance with a low limit (< 300 μg L^{-1}) over a phosphorus gradient, whereas the Z_p occurred in high TP up to 1180 µg L^{-1}. There was a 4-fold difference in mean TP between two species and the tolerance range of phosphorus in Z_p was significantly greater than in Z_t (t=5.25, p<0.001). The chemical tolerance of two species had a similar pattern in nitrogen and other chemical parameters. The proportion of insectivores co-occurred with Z_t was > 40 % and was nearly two times greater (p<0.001) than was that co-occurred with Z_p. The omnivores co-occurred with Z_p were significantly greater (t=9.74, p<0.001) than those co-occurred with Z_t. The model values of IBI co-occurred with Z_t were significantly greater (t=13.67, p<0.001) than those of Z_p. Overall data suggested that Z_p have a wide range of chemical tolerance as tolerant species, trophic preference of omnivores, and survived even in degraded environments, whereas Z_t have other trophic extremes of sensitive species, trophic preference of insectivores, and the low-nutrient regions with high IBI model values.

Key words: *fish tolerance, trophic guild, fish population, chemical gradient*

(P19) ECOLOGICAL HEALTH ASSESSMENTS OF URBAN STREAMS USING A MULTI-LEVEL MODELLING APPROACH

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The objective of this research was to evaluate ecological stream health using a multi-level approach of molecular-level to community-level of fish in urban streams. Single-cell gel electrophoresis (comet assays) on DNA-level impairment indicated significantly ($t=5.678$, $p<0.01$) greater tail intensity, expressed as % tail-DNA, in the S_i than in the S_c and genotoxic response was detected in the downstream reach. ethoxyresorufin-*O*-deethylase (EROD) assay, as a physiological bioindicator, was 2.8 fold higher ($p<0.05$, NK-test after ANOVA) in the S_i. Tissue analysis by necropsy-based health assessment index (NHAI) showed distinct internal organ disorder in three tissues of liver, kidney, and gill in the S_i Population-level analysis using sentinel species of *Zacco platypus* showed that regression coefficient (b) was 3.012 in the S_i vs. 2.915 in the S_c, indicating a population skewness of the downstream. Community-level health, based on index of biological integrity (IBI) was evidently impaired in the S_i along with physical habitat modifications by qualitative habitat evaluation index (QHEI). These multi-level approaches may provide better understanding on the impaired stream ecosystems.

Key words: *stream health, biological integrity, fish assemblage, ecological health*

(P20) RESTING STAGES OF FRESHWATER ALGAE FROM SURFACE SEDIMENTS IN PALDANG DAM LAKE, REPUBLIC OF KOREA

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Although the studies on marine cysts are quite frequent, information on resting stages of freshwater algae are rather scarce. The present study focused on the identification of resting-stage algae from freshwater sediments in Paldang Dam Lake, an important source of water for South Korea. We examined the morphological characteristics of resting-stage specimens and identified them by germination experiments or DNA analysis. Surface sediment samples were collected from 12 sites in Paldang Dam Lake from July 2009 to June 2010. Thirty-five resting stage morphotypes were identified: 19 chlorophytes, 6 dinoflagellates, 5 diatoms, 2 cyanobacteria, 2 euglenoids and 1 cryptophyte. Resting-stage and vegetative cells of five chlorophyte morphotypes could not be identified by morphology. These specimens were identified by molecular sequence analysis based on the nuclear-encoded SSU rDNA sequences of *Polyedriopsis*, *Oogamochlamys* and *Chlamydomonas*. Our samples included resting-stage of the potentially toxic species *Cylindrospermum stagnale*, the first recorded sighting in Korea. Resting-stage assemblages were dominated by diatoms, which ranged from 560 to 2750 $cells \cdot g^{-1}$. Resting-stage of diatoms and cyanobacteria were abundant along the eastern shore toward the southern part of Paldang Dam Lake, where there have been periodic algal blooms.

Key words: *resting-stage algae, morphology, freshwater, surface sediment*

(O25) A NEW RECORD GENUS OF CHIRONOMIDAE FROM ORIENTAL CHINA (INSECTA, DIPTERA)

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The genus *Xylotopus* Oliver is newly recorded from Oriental China. The pupal stages of *Xylotopus par* (Coquillett) is redescribed. The generic diagnosis on pupal stages is emended. A worldwide key to the males and a distribution map are given.

Key words: *Xylotopus, new record, pupal exuviae, Oriental China, Chironomidae*

(O26) COMPUTER VISION AND LOCOMOTORY BEHAVIORS IMPLEMENTED IN DETECTION OF WATER POLLUTANTS IN NATURAL ENVIRONMENT

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Computer vision and animal behaviors have been efficiently implemented in detection of chemical disturbances and further used to water quality monitoring. The locomotory tracks of indicator species (*e.g.*, *Chironomus riparius*, *Daphnia magna*, *Oryzias melastigma*) were continuously recorded by the computer vision technique before and after exposure to water chemicals in low concentrations (*e.g.*, heavy metals, insecticide, petroleum hydrocarbon). The abnormal behaviors of observed individuals were recognized through computational methods. The movement tracks were patterned in a heuristic manner by using the Self-organizing map (SOM). Abnormal behaviors were more frequently observed after the treatments of the chemicals. The present study demonstrated that computational methods such as SOM could be used as an in-situ behavioral monitoring tool by revealing behavioral patterns of indicator specimens.

Key words: *computer vision, animal behaviors, self-organizing map, water quality monitoring*

(P21) THE PECULIARITIES OF MACROZOOBENTHOS COMMUNITIES OF THE GEYSERNYA RIVER (KRONOTSKY NATURE RESERVE, KAMCHATKA, RUSSIA)

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The mountain Geysernaya River is about 4 km long and located in a deep canyon collecting water of thermal sources throughout its basin. The water temperature in summer low water period is fluctuates in a range 22−38 °C, in winter and flooding period from 14 to18 °C. At water temperature 23 °C , pH=8.5, and mineralization 343 mg/L, the content of lithium (*Li*) is in 17 times, arsenicum (*As*) in 11 times, silicium (*Si*) in 4.6, and stibium (*Sb*) in 3 times higher the maximum permissible concentration (MPC) for drinking water.

In Geysernaya River 68 species of invertebrate were revealed: Ephemeroptera – 5, Plecoptera – 4, Trichoptera – 11 species, and Diptera – 48 species (from them 37 species of Chironomidae). Maximal macrozoobenthos density reaches 15000/m^2, and biomass 61.73 g/m^2. In a bottom community at Pearl Geyser, the larvae of Ephemeroptera consist of 7.2%, Trichoptera – 11.3%, and Chironomidae – 82.5% of the total number of hydrobionts. In June and August caddisflies *Hydropsyche newae* Kolenati is dominated in bottom communities: biomass, B=60.5 g/m^2, density, N=11800/m^2 were registered in 09.06.2011; and B=30.3 g/m^2, and N=2614 /m^2 – in 13.08.2011. Peaks of *H. newae* adults appearance were registered since 20 May to 10 June, and then, in 13 August. In October caddisflies species *Brachycentrus americanus* Banks was a dominant species (B=11.8 g/m^2, N=5417 /м^2), and *Glossosoma intermedium* Klapalek (B=5.3 g/m^2, N=347 /м^2), *Hydropsyche kozhantschikovi* Martynov (B=2,1 g/m^2, N=208 /м^2), *Hydropsyche newae* (B=1,1 g/m2, N=486/м^2) were subdominants. Other species were collected in smaller number: mayflies *Baetis vernus* Curt., *B. bicaudatus* Dodds, *B. pseudothermicus* Kluge, *Cinygmula putoranica* Kluge; stoneflies *Arcynopteryx polaris* Klap., *Capnia levanidovae* Kawai, *Taenionema japonicum* (Okamoto), *Pictetiella asiatica* Zwick et Levanidova; caddisflies *Onocosmoecus unicolor* Banks, *Apatania stigmatella* (Zetterstedt), *A. zonella* Zetterstedt. Before 2007 caddisflies *Arctopsyche ladogensis* Kolenati, *Brachycentrus subnubilus* Curtis, *Micrasema gelidum* MacLachlan, *Hydatophylax nigrovittatus* MacLachlan were found in the river that time, but after this year we did not find them at all. Among Chironomidae, eurytopic *Eukiefferiella claripennis* (Lundbeck) was more often, their mass pupation were registered monthly since May to October. Such chironomids as *Cricotopus* gr. *silvestris* and *C.* (s. str.) *tibialis* (Meigen) were not often as well as *Micropsectra polita* and *Paratanytarsus grimmii* which were found in riffles and at banks with slow water; dipterans *Palpomyia* gr. *flavipes* (Ceratopogonidae) and young stages of Tipulidae were rare; in places of thermal water incomes, *Scatella costalis* (Ephydridae) and *Symplecta hybrida* (Limoniidae) were often collected. The most heat-resistant species are caddisfly *Hydropsyche newae* and chironomids *Eukiefferiella claripennis*, their larvae were most abundant at 22–28 °C, but also were found on stony substrates at Pearl Geyser where water temperature in active geyser phase reaches 70 °C. Thus, in Geyzernaya River, in spite of significant thermal and chemical pollution, the bottom communities with high density, biomass and species variety can be developed. Some tolerant species have here two or more generations per year that is unusual for severe Kamchatka climate.

Key words: *thermal sources, aquatic invertebrates, density, biomass, geyser, species composition*

(O27) THE LAST TWO MOLTING PROCESSES OF MAYFLY *PARAFRONURUS YOUI* AND POSSIBLE EMERGENCE EVOLUTION (EPHEMEROPTERA: HEPTAGENIIDAE)

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Molting processes of last instar nymph and subimago, longevity of subimago and imago of *Parafronurus youi* is observed and filmed in laboratory for the first time in China. The videos show clearly this species emerges in the afternoon (*ca.* 5:30 PM to 8:00 PM) on the object surface in water. The subimago can live 14 to19 hours while imago can survive for 3 to 4 days in lab. The data in the present paper and others do not provide clear evolutionary patterns of mayfly emergence location or time but a possibility maybe present: both the primitive mayfly nymph and adult can live and emerge on moist land, then adapt to aquatic habitats.

Key words: *mayfly, emergence, molt, subimago, China*

(P22) ROLE OF HEAT SHOCK PROTEINS IN ADAPTATION OF BAIKAL DEEPWATER AMPHIPODS *OMMATOGAMMARUS FLAVUS* AND *O. ALBINUS* TO DIFFERENT DEPTHS

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Baikal amphipods (Amphipoda, Crustacea) can serve as a unique model system to study questions of adaptation and evolution. Amphipods in the lake are represented by more than 350 endemic species and subspecies, which inhabit almost all deeps and types of substrates, and are characterized by the high adaptive radiation. One of the peculiarities of Lake Baikal is the presence of ultra deep zones (up to 1640 m), which are inhabited by the only in the world freshwater deepwater endemic fauna due to the vertical distribution of oxygen and highly oxygenated abyssal zone. The aim of the present research was to investigate the role of the universal cellular stress marker – Hsp70 (heat shock protein) in the adaptation to different depth zones in two deepwater amphipod species – the eurybathic scavengers *Ommatogammarus albinus* (Dyb.) and *O. flavus* (Dyb.).

Amphipods were collected in the area of settlement Bolshie Koty in winter by deepwater traps with rotten fish, submerged to several depths from 50 to 1000 m from on-ice-stations. Immediately after the retrieving of deepwater traps amphipods were fixed by flash-freezing in liquid nitrogen. Basal levels of Hsp70 (heat shock protein) were measured using PAGE (polyacrylamide gel electrophoresis) with the following Western blotting using bovine monoclonal anti-Hsp70 antibody (produced in mouse) and alkaline phosphatase-conjugated secondary antibodies (antimouse IgG:AP Conj.). Amount of Hsp70 isoforms was analyzed with 2D-PAGE and the following Western blotting with the antibodies mentioned above. Only two studied species dominated in traps retrieved from all studied depths, which corresponds to the known data, indicating that these two species are main deepwater scavengers in benthic communities of Lake Baikal (Bazikalova, 1945). Analysis of traps content demonstrated the prevalence of *O. flavus* from 50 to 150 m and the prevalence of *O. albinus*, starting from 300 to 1000 m. No *O. albinus* was found in the trap from 50 m. Thus, we can conclude that *O. albinus* inhabit a deeper zone than *O. flavus*. The results demonstrate, that the basal level of Hsp70 in *O. flavus* was 3.3-fold higher ($P<0.05$), than in *O. albinus*. This is in accordance with our previous data, showing that the level of Hsp70 in Baikal endemic amphipods is gradually decreasing with the depths of the species habitat (Timofeyev, 2010). The basal level of Hsp70 in *O. flavus* retrieved from 50 m was almost three-fold lower ($P<0,05$) than that of *O. flavus* retrieved from 300 m. Showed differences demonstrate that Hsp70 plays a role in distribution of this deepwater eurybathic species to different depths. Detailed analysis of protein profiles using the proteomic approach followed by Western blot analysis showed 8 isoforms of Hsp70 in *O. albinus*. As it has been shown by our previous research (Bedulina *et al*., 2013), littoral thermotolerant Baikal amphipod species *Eulimnogammarus cyaneus* (Dyb.) has at maximum 5 isoforms of this protein. The reason of the bigger amount of Hsp70 isoforms in a deepwater species will be investigated in future researches. Thus, it has been shown for the first time that Hsp70 participate in adaptation of eurybathic deepewater endemic Baikal amphipods to the big depths of Lake Baikal and their distribution within the vertical depth gradient.

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Key words: *Baikal amphipods, HSP 70, adaptation*

(O28) REVIEW OF THE ARCHAIC NYMPHOMYIID-FLY (DIPTERA, NYMPHOMYIIDAE) FROM THE RUSSIAN FAR EAST AND BORDERING TERRITORIES

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The Nymphomyiidae is archaic, highly specialized and poorly studied family of nematocerous Diptera, members of which apparently are phylogenetic and geographic relicts. These very small flies, 1.5–2.5 mm long, occur in rapidly flowing, small, stenothermal streams, submountain and mountain rivers.

The family Nymphomyiidae was separated by famous Japanese dipterologist M. Tokunaga after describing *Nymphomyia alba* Tokunaga from Central Honshu of Japan (Kibune Stream in Kyoto) (Tokunaga, 1932). At the present time there are known 9 species of the single genus *Nymphomyia* Tokunaga in the world: *N. alba* Tokunaga, 1932 (Japan, Russian Far East – Kunashir Island), *N. walkeri* Ide, 1964 (East Canada and U.S.A.), *N. brundini* Kevan, 1970 (East Himalaya), *N. levanidovae* Rohdendorf *et* Kalugina, 1974 (Russian Far East – South Primorye and upper streams of Bikin River), *N. rohdendorfi* Makarchenko, 1979 (Russian Far East – Primorye Territory, Amur River basin, Kolyma River basin, Chukotka Region), *N. dolichopeza* Courtney, 1994 (U.S.A.), *N. holoptica* Courtney, 1994 (Hong Kong), *N. kaluginae* Makarchenko, 2013 (Russian Far East – Zeya River basin of Amur River basin), *N. kannasatoi* Makarchenko *et* Gunderina, 2014 (Japan – Honshu, Russian Far East – South Sakhalin). Additionally, pupae *Nymphomyia* sp. recently discovered in Northern Mongolia, Altai (Hayford, Bouchard, 2012). Also known one fossil species *N. succina* Wagner *et al*., 2000 from the Eocene (Baltic amber) (Wagner *et al*., 2000), and subfossil larvae of *N.* gr. *rohdendorfi* from Oron Lake of Irkutsk Region (unpublished data of I. Enushenko).

Analysis of the material collected during the last 10 years in the Far East and the bordering territories has allowed to expand or modify the data on the distribution of known species, to identify new species, and to determine the errors in the identification of some species. So, *N. rohdendorfi* was found additionally in the upper reaches of the Anadyr River, in the basin of Malyi Anyui River and in some streams of Upper Kolyma River basin. It turned out that *N. rohdendorfi* was incorrectly determined by me (Makarchenko *et al*., 1989) to Southern Sakhalin and after further study of female morphology and DNA analysis proved that there, as well as on the Honshu Island of Japan, inhabits new species, which has been named as *N. kannasatoi*. Previously, I thought that *N. rohdendofi* occurs the Amur River basin from Low Amur to Zeya River and in Zeya River basin lives only *N. kaluginae*. But in 2015 *N. rohdendorfi* for the first time was found in one of the tributaries of Zeya River.

In addition to morphological studies of Far Eastern Nymphomyiidae for *N. alba*, *N. levanidovae*, *N. kaluginae*, *N. kannasatoi* and *N. rohdendorfi* the partial COI gene sequencing of adults, pupae and larvae were carried out. These sequences could be used as diagnostic characters – molecular markers of investigated species, namely for separating of larvae of close related species which can not be distinguished by morphology. Data on biology of Far Eastern species of Nymphomyiidae are given too.

Key words: *Diptera, Nymphomyiidae, taxonomy, distribution, biology, DNA barcoding*

(O29) SEASONAL DYNAMICS OF PSAMMON IN BOLSHIYE KOTY BAY (SOUTHERN BAIKAL)

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In Lake Baikal, there is a unique splash zone. The part of it is represented by sandy beaches whose fauna (psammon) is poorly studied. The first studies on Baikal psammon were performed in the 1980s (Arov, 1987). We continued these investigations since 2008. The elevated anthropogenic effect on the coastal zone of the lake and impressive changes in the communities of flora and fauna occurring in recent years (Timoshkin *et al.*, 2016) necessitate to perform investigations of the pre-critical state of the communities, including meiopsammon of the lake. The aim of this work was to study composition and specific characteristics of ecology and dynamics of meiopsammon in Bolshiye Koty Bay (Southern Baikal). The material was sampled with a plastic tube 6 cm in diameter at a distance of 0.5 m from the shoreline from four beaches in the bay in 2008–2013.

We identified the following taxonomic groups inhabiting the sandy beaches: Nematoda, Oligochaeta, Harpacticoida, Cyclopoida, Tardigrada, Turbellaria, Rotifera, Ostracoda, Acariformes, Cladocera, Bathynellidae, and Plecoptera. Some hydrobionts were brought to this area from the littoral zone during storms: benthic Polychaeta, Amphipoda, Bivalvia, Gastropoda, and Hirudinea; larvae of Chironomidae and Trichoptera; planktonic *Epishura* and Cladocera. The most common and abundant were Oligochaeta (42 % general abundance), Tardigrada (15 %), Cyclopoida (14 %), and Nematoda (12 %). Sheveleva *et al.* (2013) analyzed species diversity of some groups. Baikal psammon is specific because of some species are endemic to the splash zone. Grain size of sediments plays a leading role in psammon distribution (Gier, 2009). We regularly recorded the highest abundance of communities on the beach with a median particle diameter (Md) of 1.7 mm. On other beaches, the sediment grain size was either coarse (Md 3.4 and 3.6 mm) or fine (Md 1.2 mm). Nematodes dominated in the biotopes with fine sediment grain size, whereas other beaches were dominated by Oligochaeta and Tardigrada. The majority of organisms concentrated at the layer of 6–9 cm from the bottom surface. Average abundance of psammon was $160\pm20 \times 10^3$ specimens/m^2. Annual maximal abundance of communities was high – approximately 2×10^6 specimens/m^2. So high values of abundance have not been recorded before in the lakes of Eurasia. Moreover, Tardigrada dominated in the communities. That was unusual. In spring, the community abundance was low – 20×10^3 specimens/m^2, whereas in one of the summer months it reached its maximum (400×10^6 specimens/m^2), and in autumn its abundance decreased again. Abundance was also high in May in the years with early ice breaking. Oligochaeta and Tardigrada formed the peaks of abundance. The percentage of Oligochaeta and nematodes was higher in spring and autumn months. However, by the middle of summer it dropped due to the increase of abundance of other groups. Tardigrada and cyclops dominated in the warmest months – July and August. Thus, taxonomic composition of the community at the group level has not changed in comparison with that studied 30 years ago (Arov, 1987). But we recorded very high values of abundance that had never been recorded before in Baikal and other lakes of the continent. Moreover we first studied the seasonal abundance dynamics of psammon.

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Key words: *Baikal, psammon, seasonal dynamics*

(O30) STRUCTURE OF ANTENNAL SENSILLA IN RHYACOPHILIDAE (INSECTA: TRICHOPTERA)

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Data on structure and distribution of sensilla on male antennal surfaces of 16 species of Rhyacophilidae (Insecta, Trichoptera) reveals 2 level position of cuticular microstructures: longer trichoid structures belong to the higher level, and short sensilla comparable in length with the cuticular microtrichia belong to the lower level. Some types of higher microstructures are similar to the scales of Lepidoptera and might make a coverage without any sensory significance; others are receptors like chaetoid sensilla and conical grooved trichoid sensilla. Lower level is more diverse; typically there are smooth curved trichoid sensilla, 2 types of pseudoplacoid sensilla (forked and mushroom-like), as well as basiconic and coronal sensilla.

The forked pseudoplacoid sensilla are found only in 2 species from the *vulgaris* group (*Rhyacophila obliterata*, *Rh. nubila*); in *Rh. nubila* these are 2 lobes on a short stalk, whereas in *Rh. obliterata* structure and number of these lobes varies: there might be from 2 to 4 lobes in one sensilla, and the shape of lobes in some instances shows a transition to the mushroom-like type. These data suggest a transition from mushroom-like type to forked within the *vulgaris* group. Ultrastructure of lobes revealing elongated pores in grooves also supports the morphologic similarity of these sensilla types. Some species of *Rhyacophila* have modified coronal sensilla combining the structure of basiconic and coronal types: the periphery of such a sensilla has a comb of spines characteristic to the coronary sensilla at distal side, and a low smooth ridge typical to basiconic sensilla at the proximal side; this character might suggest the structural similarity of these two types of sensilla and perhaps indicate the archaic nature of Rhyacophilidae. Two basal segments of antenna, scape and pedicel, are devoid of pseudoplacoid, smooth curved trichoid, basiconic, and coronal sensilla. Basal segments of flagellum, contrary, are the most rich in sensilla. The number of sensilla significantly decreases towards the apex of antenna, and the terminal segment is generally devoid of any sensilla of low level except for rare forked sensilla. Smooth curved trichoid sensilla have a tendency to make groups (analogs of sensory fields of other Trichoptera families) on the apical part of ventral surface of antennal segment. The groups gradually disappear towards the apex of antenna. These groups are loosely defined in some species like *Rh. obliterata*, where the smooth curved trichoid sensilla are frequent outside of the groups. Numbers of sensilla in the groups varies with maximum found in *Rh. lata*. Most species have smooth curved trichoid sensilla of equal length, although in *Rh. subovata* their size varies. The mushroom-like pseudoplacoid sensilla has the cap size 4.5–6 µm and generally similar in shape except for species of the *philopotamoides* group: *Rh. kaltatica* and *Rh. lepnevae* where the caps are asymmetrically elongate. There are differences in numbers of these sensilla with minimum in *Rh. lepnevae.* Females have found to have the same sensilla types and distribution as males in *Rh. nubila,* although numbers of the lower level sensilla were significantly smaller. Interpopulation variations studied for *Rh. nubila* and *Rh. obscura* having wide areals revealed uniformity in the first species and population differences in number of pseudoplacoid sensilla in the 2nd species. No peculiarities were found in the species of genus *Himalopsyche*.

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Key words: *sensilla, antenna, Rhyacophilidae, Rhyacophila*

(O31) MEIOBENTHIC DISTRIBUTION IN THE NORTH WATER AREA OF PRIMORSKY KRAI (SEA OF JAPAN)

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Brackish waters and estuaries are unique regions in the water area under the influence between fresh and marine waters. This study were investigated species composition, distribution, and patterns of change in the meiobenthic community in the environmental gradient of Presnoe Lake, Yuznaya Bay, Avvakumovka River`s estuary, Tikhaya Pristan Harbor. In water area salinity changed between fresh (0 PSU) to polyhaline (18–30 PSU) from 0 to 28.6 PSU. Samples were carried out in July and August 2013 and 2014. Total number is 31 stations.

Meiobenthic organisms in this aquatories are characterized by significant fluctuations in the density and taxonomic composition. Ten taxonomic groups Amphipoda, Chironomids, Bivalvia, Chironomidae, Harpacticoida, Nematoda, Oligochaeta, Ostracoda, Polychaeta, and Turbellaria were presented. Free-living nematodes were dominated in all stations, Harpacticoida or Oligochaeta has second density.

The density of the total meiofauna community ranged between 5000 ind/m² and 186500 ind/m². The density of free-living nematodes changed from 500 ind/m² to 161500 ind/m². Density of Harpacticoida was from 500 ind/m² to 17500 ind/m², Oligochaeta and Ostracoda have the same density changed between 500 ind/m² to 24500 ind/m². Density of polychaets, chironomids, mollusks were from 500 ind/m² to 4000–6000 ind/m².

Total meiobenthic biomasses were from 1.6 to 1608.7 mg/m². The greatest contribution of the biomass presented by polychaets and oligochaets, theirs biomass changed between from 12.9 to 1435 mg/m² and from 4.84 to 534 mg/m², respectively. Chironomids, amphipods and mollusks have average biomasses and low densities. Amphipods biomass was from 41.1 mg/m² to 320.1 mg/m², chironomids and mollusks were from 3.8 to 261.6 mg/m² and 9.3 to 132.7 mg/m². Nematodes and Harpacticoida have high densities, but low biomass, changed between 0.61 to 8.933.6 mg/m² and 1.3 to 33.6 mg/m², respectively. Ostracods have low density and biomass – from 2.6 to 9.3 mg/m².

Key words: *meiobenthos, estuaries, brackish waters, free-living nematodes, Sea of Japan*

(P23) RESULTS OF VALUATION OF BENTHOS FROM DREDGING SAMPLES IN AVACHA BAY (NORTH WEST PACIFIC) IN 2014–2015

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The previous studies of macrozoobenthos in Avacha Bay were made in 1989. We monitored the dredged benthos of the deep part of Avacha Bay in April 2014 and May 2015. The works were performed according to standard methods of the collection of marine macrozoobenthos. As a result 10 stations study in 2014 there were 187 species of invertebrates revealed, and 169 species – in 2015. The average biomass of the dredged benthos in 2014 was 98.2 g/m^2 while a density of benthos was 118 $ind./m^2$. In 2015, the average biomass was 78.5 g/m^2 while a density – was 115 $ind./m^2$.

There were 6 taxocenoses were distinguished. Among them the taxocenosis of *Ampharete sibirica* (Polychaeta, Ampharetidae) is the first in density, and the second in density is the taxocenosis of *Axinopsida orbiculata* (Mollusca: Bivalvia).

Key words: *macrozoobenthos, benthic taxocenoses, Kamchatka*

(P24) DIVERSITY OF PROTOZOA AND WATER QUALITY AT NONG HARN, SAKON NAKHON IN THAILAND

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Investigation of protozoa diversity and water quality was conducted in Nong Harn, the second largest international wetland, located in Sakon Nakhon province in Thailand. Six sampling sites were collected in summer (March–April) and rainy seasons (August–September) of the year 2012. Twenty one species of protozoa were identified, and ciliated protozoa were dominant in terms of abundance. The findings revealed that the protozoa abundance in impaired sites was significantly different from that in reference sites. The differences of protozoa abundance depend on altered landuse, geographic setting, and water quality of each site. Based on water quality analysis, results show that human activities adversely affected water quality in impaired sites and had direct impact on protozoa diversity.

Key words: *Protozoa, water quality, Nong Harn*

(P25) TAXA TOLERANCE VALUES BASED ON MACROINVERTEBRATES OF NORTHEASTERN WETLANDS IN THAILAND

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Tolerance values (TVs) based on macroinvertebrates, one of biotic indices, have long been incorporated in bioassessment regimes around the world. However, TVs of living organisms in the tropics are merely developed, particularly in Southeast Asia. In bioassessment process of Thailand, TVs are borrowed from existing lists of TVs. This leads to a technical problem of unlisted TVs when new organisms are discovered. We collect 80 macroinvertebrate samples from 13 northeastern wetlands in Thailand; 59 samples are unlisted. To address the problem, we propose a quantitative method modified from Mekong River approach to develop TVs ranging from 0 (highly pollution sensitive) to 10 (highly pollution tolerant). The findings reveal that TVs based on macroinvertebrates living in northeastern wetlands in Thailand are significantly correlated with $BMWP_{THAI}$ and BMWP.

Key words: *Benthic macroinvertebrates, Tolerance values, wetlands*

(O32) DIFFERENT WAYS OF SPERM TRANSFER AMONG THE CAPNIIDAE (INSECTA: PLECOPTERA), AND ITS IMPORTANCE IN THE GENERIC SYSTEM OF THE FAMILY

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Among the stoneflies (Plecoptera), there are remarkable family level differences regarding mating apparatus and ways of sperm transfer. The family Capniidae owns a peculiar system of male mating organs, consist of primary and secondary organ for sperm transfer. The testes are connected to a structure called fusion plate, hidden beneath the paraprocts. During mating, the fusion plate is connected to the basal portion of the main sclerite of male epiproct and leads the sperm into its internal hollow. Then, as a secondary copulatory organ, the epiproct transfers sperm into female genital cavity.

During our ongoing project about the genus level revision of the Capniidae, we put special emphasis on the structure and function of the male epiproct. In the present paper we describe the ways of secondary sperm transfer through this complex organ, concluding that those are always of generic diagnostic value for supraspecific classification. However, suprageneric value of the different systems has remained unclear, and may be solved only by further molecular studies.

The most simple way of sperm transfer into female genital cavity happens with the aid of the sclerotized portion of main epiproct sclerite tip. As this type is usually occur in case of Capniidae genera of primitive epiproctal conformation, it should be considered as the groundplan of Capniidae sperm transfer.

In case if the structure called eversible crest present on the male epiproct, it is always the portion doing the actual sperm transfer. The eversible crest is a derived structure of the Capniidae, there are no homologous but parallel structures known among the related family Leuctridae. We found that the eversible crest can function three ways: everts dorsad in a fan-like shape, everts caudally in a globular shape, and everts caudally into a long, tubular projection. While the fan-like evertion occurs in several genera over the whole Capniidae area, the latter two are restricted to Asian taxa: globular evertion was found in *Eocapnia* and *Sinocapnia*, while the tubular projection was found only in *Apteroperla* and the *japonica* group of *Capnia* sensu lato. At least in case of the latter, complex spermatophore structures also occur, attached to the female genital cavity.

Key words: *epiproct, eversible crest, fusion plate, genus level taxonomy*

(O33) BIORESOURCES OF KUTTANAD WETLANDS – A BELOW SEA LEVEL SYSTEM WITHIN THE VEMBANAD LAKE, A RAMSAR SITE IN KERALA, INDIA

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Kuttanad formed an integral part of the Vembanad-Kole wetland system, one of the Ramsar sites assuming conservation significance. It had a total area of about 500 km^2 and lay below sea level. Salt water intrusion from the adjoining Arabian Sea in summer and flooding of the area during rainy season were regulated through the operation of barrage and spillway. The present study focused on generation of thematic maps on land use, documentation of floral and faunal resources, analysis of agroforestry systems and livelihood options of the people in the region. Thematic maps were generated using GPS and GIS. Floral exploration resulted in the documentation of about 490 species of angiosperms, 2 species of gymnosperms and 14 species of pteridophytes. About 12 mangrove species and 23 mangrove associates were recorded from 3 mangroves ecosites. A total of 60 species of weeds had been identified from the study area of which *Eichhornia crassipes* affected navigation apart from causing deterioration of aquatic habitats. The region also harbored 105 plant species of cultivated and lesser utilized resources and 67 species of medicinal plants. Sixty two species of fishes and 14 species of shell fishes were recorded during the study. The avian diversity accounted for about 56 species. Agroforestry operations were restricted to home gardens, owing to the lesser extent of land holding and higher density of population. Bio-fencing was a feature for protection and checking soil erosion. The main livelihood of Kuttanad people were paddy cultivation and coconut farming. Rice-fish culture, duck farming and mussel culture are practiced in many parts of Kuttanad. Extensive use of pesticides, fertilizers and improper discharge of sewage were the main causes of contamination in Kuttanad wetlands. The study highlighted the importance for proper management and conservation of this vibrant ecosystem.

Key words: *Agroforestry, Floral and faunal composition, Kuttanad wetlands, Livelihood, thematic maps*

(P26) AQUATIC INVERTEBRATE FAUNA OF SONG THANH NATURE RESERVE IN QUANG NAM PROVINCE OF VIETNAM

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The study analyzed the composition of the aquatic invertebrate fauna of Song Thanh Nature Reserve in Quang Nam province of Vietnam. Fourty eight qualitatively samples were collected at 12 sites by plankton net for the zooplankton and hand net for the zoobenthos in March and September 2015. 166 species has investigated in this study belong to 131 genera, 68 families, 16 orders, and 5 classes. The richest class is Insecta with 142 species, in contrast the Bivalvia class has only 1 species that it is *Corbicula baudoni*. The aquatic invertebrate fauna also is separated into two groups, including zooplankton and zoobenthos. 154 species are in the zoobenthos and 12 remaining species are in the zooplankton.

Key words: *aquatic invertebrate, fauna, Song Thanh, Nature Reserve, Vietnam*

(O34) ARE NEMATODE COMMUNITIES IN THE SAI GON RIVER HARBORS AFFECTED BY TBT?

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Free living nematode communities were investigated together with TBT compounds and some other environmental variables such as sediment total organic carbon, pH, salinity, conductivity, oxygen redox potential and humidity in the Saigon River harbors. The main purpose of this study was detection of tributyltin compounds (tributyltin oxide, tributyltin benzoate, tributyltin chloride, *etc*.) in sediments. TBT is well known a highly toxic biocide that has been used extensively to prevent biofouling. Now TBT pollution is a serious ecological problem in Vietnam like in whole world because of its accumulation in sediments, where it can remain and be released for up to 30 years, infiltration in the food chain, link to immuno-supression and imposex in organisms (mollusks, *etc*.), and other dangerous aspects.

Eleven harbors in the downstream of the Saigon River were selected to survey with one station as reference in the upper stream part for both dry and rainy seasons. The results showed that TBT compounds were relatively low compared to historical data from the same or adjacent estuaries. Nematode communities are typical for oligohaline range and quite high spatial and temporal variability in density and diversity. Distribution of these communities was more homogenized in the rainy seasons in comparison with the dry seasons.

Results of our studies indicated as well that highest TBT values lead to lowest nematode densities but no significant correlation between TBT compound with communities' diversity and non-selective deposit feeders.

Key words: *Nematode communities, environment, butyltins, Sai Gon River Harbors, Vietnam*

(P27) AQUATIC INSECTS OF THE MA RIVER IN THANH HOA PROVINCE, NORTHERN VIETNAM

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Aquatic insects were investigated from 12 major tributary streams of the Ma River located in Thanh Hoa Province in northern Vietnam. Twelve sampling sites were chosen by longitudinal gradient (one site from each tributary stream) and aquatic insects were sampled quantitatively by Surber net and qualitatively by hand net in October 2013 and April 2014. As a result, a total of 157 species of aquatic insects belonging to 125 genera, 51 families, and 9 orders were identified: 47 Ephemeroptera species, 32 Trichoptera species, 29 Odonata species, 18 Coleoptera species, 13 Diptera species, 11 Hemiptera species, 4 Lepidoptera species, 2 Megaloptera species, and 1 Plecoptera species. Three orders, Ephemeroptera, Trichoptera, and Odonata, predominated (68.8 %) in the aquatic insect fauna in terms of species richness. Community indices and functional feeding group data were provided.

Key words: *aquatic insects, fauna, Ma River, Thanh Hoa Province, northern Vietnam*

(O35) BIODIVERSITY AND ECOLOGICAL CHARACTERISTIC OF DIATOM FLORA OF ARGUN RIVER BASIN (UPPER AMUR, RUSSIA)

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The results of diatom species diversity study of the Argun River basin (Argun River, its seven tributaries, lake and artificial reservoir) in 2005–2006 years are presented. According to our own data, diatom flora of the Argun River basin represents by 219 species (239 infraspecific taxa, including type species), belonging to 3 classes, 14 orders, 26 families and 59 genera. Class Bacillariophyceae is the most numerous and contains 82.4 % of the total number of diatom algae found.

The dominant species complexes in the diatom communities was identified. Twenty four species and intraspecific taxa of diatoms were dominant and subdominant in periphyton communities: *Aulacoseira islandica* (O. Müller) Simonsen, *Diatoma vulgare* Bory, *Fragilaria vaucheriae* (Kützing) Petersen, *Ulnaria danica* (Kützing) Compère et Bukhtiyarova, *U. ulna* (Nitzsch) Compère, *Rhoicosphenia abbreviata* (Agardh) Lange-Bertalot, *Cymbella cistula* (Ehrenberg) Kirchner, *Gomphoneis olivaceum* (Hornemann) Dawson ex Ross et Sims, *Gomphonema parvulum* (Kützing) Kützing, *G. truncatum* Ehrenberg, *Gomphonema truncatum* var. *capitatum* (Ehrenberg), *Reimeria sinuata* (Gregory) Kociolec et Stoermer Patrick, *R. sinuata* f. *antiqua* (Grunow) Kociolek et Stoermer, *Cocconeis placentula* var. *euglypta* (Ehrenberg) Grunow, *Achnanthidium minutissimum* (Kützing) Czarnecki, *Navicula cincta* (Ehrenberg) Ralfs, *N. erifuga* Lange-Bertalot, *N. radiosa* Kützing, *N. viridula* (Kützing) Ehrenberg, *Amphora veneta* Kützing, *Nitzschia paleacea* (Grunow) Grunow, *Epithemia adnata* (Kützing) Brébisson, *E. adnata* var. *porcellus* (Kützing) R. Ross, *Rhopalodia gibba* (Ehrenberg) O. Müller.

Eighty three species, varieties and forms of diatoms are recorded for the first time for the algal flora of the Upper Amur basin.

Ecological and geographical characteristics of the diatom flora are the following: the prevalence of benthic species (77.8 % of the total number of taxa), indifferent to salinity (60.7 %), alkaliphilic (45.6 %), cosmopolitan (61.5 %) species, and oligosaprobous and betamezosaprobous – 30.2 and 27.2 %, respectively. Natural waters in the Argun River basin are classified as clean and slightly polluted (according to the Pantle-Buck's method, in Sladechek's modifications).

Key words: *diatom flora, the Argun River basin, the Upper Amur, the Pantle-Buck's method*

(P28) FEATURES PERIPHYTON DIATOM COMMUNITIES FROM THE STREAM OF VOLCANIC REGION (FALSHIVAYA RIVER, SOUTH-EASTERN KAMCHATKA, RUSSIA)

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The Falshivaya River source is located on the slopes of the volcano Mutnovsky; the river belongs to the basin of Falshivaya Bay (Pacific Ocean). The Falshivaya River is typical volcanic river from Kamchatka Peninsula. One of the most unique geothermal power stations in the world (Mutnovskaya) is located in the upper part of the river. Mutnovskaya GeoPS resets geothermal water to the Falshivaya River.

Changes of features of diatom communities in the upper and middle parts of the river depending on the temperature and chemical water parameters were studied. Diatom flora of the Falshivaya River represents by more 50 species, varieties and forms in August 2011. Dominants and subdominants diatoms were identified in periphyton communities. Dominants: *Gomphonema angustatum* (Kützing) Rabenhorst, *Planothidium lanceolatum* (Brébisson ex Kützing) Lange-Bertalot, *Nitzschia pusilla* Grunow; subdominants: *Nitzschia palea* (Kützing) W. Smith, *N. nana* Grunow *Encyonema silesiacum* (Bleisch) Mann, *Diatoma mesodon* (Ehrenberg) Kützing, *Pinnularia acidojaponica* Idei et Kobayasi.

Key words: *diatom communities, Falshivaya River, Kamchatka*

(P29) **DEVELOPMENTAL TOXICITY OF NICKEL ON *BOMBINA ORIENTALIS* (BOULENGER) EMBRYOS**

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The developmental toxicity of nickel was examined in *Bombina orientalis* embryos, a common amphibian in Korea. Based on a standard frog embryo teratogenesis assay the 168 hours LC50 and EC50 of nickel were 21.262 mg/L and 5.68 mg/L, respectively. At lethal concentration (100 μm) nickel treatment resulted in decrease in the space between gill filaments, swelling of epithelial cells, and abnormal fusion of gill filaments, which may attribute to embryonic death. At sub-lethal concentration (1–10 μm), nickel produced embryonic abnormalities including bent tail and tail dysplasia. Following exposure to 10 μm nickel for 168 hours tail length and tail muscle fiber density were significantly decreased in tadpoles. At 0.1 μm nickel, myosin heavy chain and myosin-binding protein C mRNA levels were significantly decreased in tail. Pre-muscular response to muscular response stage (stage 26–31) was the most sensitive period to nickel in terms of tail muscle development. At this time, MyoD mRNA was increased whereas myogenic regulatory factor 4 mRNA was decreased by 0.1 μm nickel, suggesting that myogenic differentiation was inhibited by nickel. Calcium-dependent kinase activities in muscular response stage embryos and myosin heavy chain mRNA and 12/101 muscle marker protein in tail of tadpoles were significantly decreased by nickel, which was restored by exogenously-added calcium. These results suggest that nickel could affect muscle development via disruption of calcium signaling during myogenesis in developing *B. orientalis* embryos.

Key words: *nickel, embryonic toxicity, muscle, myogenesis, amphibian*

(P30) CADDISFLIES (TRICHOPTERA) FROM MIRYANG AND CHEONGDO, KOREA WITH ONE NEW SPECIES AND FOUR NEW RECORDS FROM THE KOREAN PENINSULA

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Adult caddisflies were collected from 12 sites in Cheongdo-gun (Gyeongsangbuk-do) and Miryang-si (Gyeongsangnam-do) in the southwestern part of the Korean Peninsula, from August 28 to 30, 2015 by aerial sweeping and light trapping. Collecting sites in Cheongdo are located near the Ecological and Scenery Conservation Area of Mt. Unmun designated by the Korean government, and collecting sites in Miryang are close to the Ice Valley (Eoreumgol) where ice forms during hot summer months and melts after August. Although these areas are well conserved and supposedly have rich fauna, hardly any study of caddisflies has been undertaken there. We have recorded a total of 64 species belonging to 33 genera and 16 families including 1 new species throughout this expedition. We report the list of caddisflies in these areas, and describe the new species belonging to the genus *Paduniella* Psychomyiidae). Re-description of 4 species (*Polyplectropus malickyi* Nozaki *et al.*, 2010, *Tinodes furcatus* Li and Morse, 1997, *Cheumatopsyche tanidai* Oláh and Johanson, 2008, and *Diplectrona kibuneana* Tsuda, 1940) that are newly recorded from the Korean Peninsula are also provided.

Key words: *Trichoptera, fauna, new species, new records*

(O36) SMALL STREAMS – UNDER PUBLIC PROTECTION (EXAMPLE OF PUBLIC MONITORING AND CONTROL OF SUBURBAN STREAM, VLADIVOSTOK, PRIMORSKY KRAI)

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Distruction of the small rivers located in city or suburban zones – an important problem of our time. The small water objects which are not entered in the state water registers remain outside of the government control and attention, and, thus, almost completely are deprived of protection. It is tempting to have the house near a reservoir, rivers or lakes and, often, builders, without having the legal permission and construction licenses realize projects, in spite of the Water Code and other nature protection laws cutting trees in water protection zones and establishing there cottages illegally.

The solution of problems of illegal land alienation, cutting of suburb forest and other violations in water protected zones are very difficult because of resistance from the violators of the ecological legislation who are often supported by the corrupted officials and supervisory authorities. However correctly carried out public estimates with qualification of violations in compliance with the existing laws, competent appeals to control bodies, as well as drawing the public attention to the problems of the non-execution of obligations and the law by officials can break this situation and lead to the victory of law and justice. On the example of a small stream Chernaya River located in Vladivostok suburb, we researched a problem of illegal construction and deforestation the relict Vladivostok forest in the water protection zone, and also other ecological violations which were qualified in compliance with the federal nature protection and administrative codes. We have also developed algorithm of actions for public experts who are engaged in problems of freshwater resources protection. The work is performed as part of the scientific-public project "Investigation of the ecological state of streams and lakes located on the Muravyev-Amursky Peninsula and preparation of recommendations for their restoration" initiated in 2014 in frame of the "Russian Clean Water Project" (Vshivkova *et al*., 2003). Main objective of this program – development of public environmental monitoring, activization of scientific and public initiatives on protection of freshwater resources.

Key words: *protection, urban streams, deforestation, public monitoring*

(O37) BENTHIC COMMUNITY RESPONSES TO THE USED TIN-ORE MINE IN THE WESTERN SIKHOTE-ALIN STREAM (SOUTHERN FAR EAST, RUSSIA)

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Primorsky krai located at the south of the Russian Far East has more than 6000 rivers 91 of which have length more than 50 km. Small rivers form river systems and reveal ecological situation of the region. Small rivers multipurpose value, both for wild nature and for people, determines necessity to solve problems of their protection and usage of low cost monitoring to reveal main reasons of pollutions under increasing anthropogenic burden. Recently benthic community organisms have been even more often used as indicators of a condition of fresh-water ecosystems as they sensitively react not only to separate factors but also to the general ecological situation. This study's aim is to determine the level of long time impact of slimes storage site formed after closing in 1990 the tin–ore mine on the running from the western Sikhote-Alin macroslope Pravaya Pritochnaya river's benthic community structure characteristics.

The longtime studies of benthic communities at the high taxon's levels have been performed at the 10 km long part of the river. The benthic community had low number (707 p/m^2) and biomass (0.18 g/m^2) right near its slime storage site before the closing of the mine in 1989. Among groups revealed in the benthic community, only chironomidae dominated and there were not representatives of EPT (Ephemeroptera, Plecoptera, and Trichoptera) indicator group. The abundance and biomass of benthos increased by an order, the EPT largest index value was 5.9 % at the distance of 10 km from the slime storage site, the number of groups has risen to 13, gammaridae appeared among the dominants. All quantitative characteristics were much higher in the tributary of the river, outside the main pollutant zone, stoneflies were noted among the dominants. The great increase in the number and biomass of benthos were recorded for all sites of the river down the slime storage site after the closing of the mine in 1992. The number of benthos increased in 5 times, biomass – in 65 times, EPT index increased to 45.2 % near the slime storage site. Gammaridae dominated significantly in the benthic groups at all other sites. Characteristics of abundance and biomass increased in 2–3.5 times below slime storage site and the tributary of the river, among the dominants mayflies and caddisflies were noticed, and stoneflies – in the tributary in addition to gammaridae. In 1994–2008, the number of benthos at the slime storage site was 2301–8605 p/m^2, biomass 8.19–14.68 g/m^2, the EPT index was 27.6–80.5 %, among the dominant groups mayflies were recorded in 1994 and caddisflies in 1997. The qualitative composition of the dominants in other sites of the river remained virtually unchanged. Thus, the number and biomass of benthos have dramatically increased in the river near the slime storage site and in downstream and the number of taxonomic groups has increase as well at the first years after closing of the mine. The change in qualitative and quantitative characteristics of benthos in the longitudinal profile of the river in 1997–2008 associated with both natural and anthropogenic factors. It was acidification of water, influence of dust of dispelling soils from slime storage site and spread of its drainage water quantity and salinity of which are associated with the change of the water regime of the river. With drainage water and dust flows from the slime storage site the river receives, accumulates and transfers by water at a considerable distance the fine – disperse soils with a high content of heavy metals. Currently, the slime soils differ from soils of the river by increased concentrations of Cu and Pb and lower concentrations of Zn, Cd and Ni that are associated with their leaching, dissolution and removal from the surface of the slime storage site.

Key words: *small river, structure of benthic communities, tin mine, slime storage site, heavy metals South of the Russian Far East*

(O38) INTERTIDAL SNAIL *BATILLARIA ATTRAMENTARIA* (G.B. SOWERBY II, 1855) IN THE RUSSIAN FAR EAST AND ADJACENT AREAS

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The native latitudinal range of mud snail *B. attramentaria* (=*B. cumingi* (Crosse, 1862)) extends from 26.5°N in China (Fuqing, Fujian Province) to 46.6°N in Russia (Sakhalin Island). The most northern population of *B. attramentaria* on Asian continent is found in Olga Bay of Central Primorye (43.7°N). In the Russian Far East, Hokkaido, and continental coast of the Sea of Japan southwards Gangwon Province of South Korea *B. attramentaria* is the only batillariid species. In more southern regions that may be found in sympatry with 3 other congeneric species.

Shell shape and shell color variations of *B. attramentaria* in the Russian Far East were studied in comparison with that in Japan and South Korea. Like in western Honshu, in both Korean and Russian populations' darker morphs predominate in colder regions, so number of colour patterns decreases northwards. In South Korean populations we found all six colour variations of the species shell, described for Japanese specimens inhabiting eastern oceanic coast. In Jeju Island, southern extreme of studied area, blackish unbanded shells comprise 64–88 % of all individuals. In populations from Gangwon Province of South Korea nearly 80 % of specimens have dark shells with lacking of lighter bands. In Primorsky Krai percentage of specimens with blackish unbanded shells in different populations is 90–100 %. Batillariid shells with white line on the upper side of each whorl are recorded in narrow and running deep inland Novik Bay of Russky Island (Southern Primorye). In Central Primorye, Sakhalin, northeastern Hokkaido and southern Kuril Islands we found *B. attramentaria* with only dark unbanded shells.

Shell shape of the species is also wellcorrelated with the temperature of the population locality. In northeastern Hokkaido, Kuril Islands, Sakhalin and Primorye impacted by cold water currents Oyashio and Liman, respectively, *B. attramentaria* has tall (25–35 mm height) and slender shell with the apical angle 20–25°. Other regions, including South Korea, are inhabited by less tall (20–23 mm height) and wider ecological morph with the apical angle of the shell 28–33°. Such ecological morph of *B. attramentaria* is found near Gangneung in Gangwon Province of South Korea, impacted by warm East Korean Current.

Symbiosis (in a broader context) of *B. attramentaria* with Pacific oyster *Crassostrea gigas* attached to the snail shells is described. These species' association is common in shallow bays of Russky Island (Primorsky Krai).

Key words: *Batillaria attramentaria, shell shape, shell color variations, association with oysters*

(O39) MOLLUSKS OF THE MEKONG DELTA: PROGRESS IN BIOASSESMENT

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In December 2012 a 10-day field trip in the Mekong River Delta of Vietnam was conducted to assess the diversity and distribution of the freshwater mollusks fauna. Gastropods and bivalves were sampled at 25 stations, including connected with the Mekong R. system naturally protected Binh Thien Lake of An Giang Province. Several local markets and farms in the Mekong Delta area were visited to check freshwater mollusks as well.

Totally more than 50 species, in half Gastropoda and Bivalvia were found. Gastropod superfamily Viviparoidea is abundant in both flowing and lentic habitats. Bivalve genus *Corbicula* is a representative in the river channels and running-water lakes. Amblemid genus *Scabies* found in Binh Thien L. is new for the whole Mekong Delta.

The Binh Thien Lake is the biggest freshwater lake in the Mekong Delta endowed with the highest biodiversity in An Giang. The lake's area is about 1.2 km^2 in the dry season and expands up to 2.5 km^2 in rainy season. Maximum depth in dry season is about 4 m. The lake connects with the Binh Di R., which is muddy with alluvium during the high-tide season like other rivers in the Mekong Delta. Nevertheless the water of Binh Thien L. remains clear for all seasons, thanks to aquatic vegetation which acts as a natural filter. When study Bihn Thien L. benthic macroinvertebrate communities in 2008, its density was estimated at 40–1950 con/m^2. Biodiversity calculated by two indices was assessed as Margalef (d=0.26–2.62) and Shanon-Weiner (H'=0.27–3.13). In 2012 mollusk diversity of the lake was studied for the first time. Totally 15 gastropod and 10 large bivalve species in 14 families were found. Bivalves in 4 families Corbiculidae (*Corbicula*), Unionidae (*Ensidens*, *Hyriopsis*, *Pilsbryoconcha*), Amblemidae (*Contradens*, *Scabies*), Mytilidae (*Limnoperna*) *and* diverse gastropods belonging to 10 families are abundant in the lake. In Gastropoda two families Bellamyidae and Pilidae predominant.

The main impacts on the Mekong Delta mollusk diversity were identified as water pollution from industrial, agricultural and domestic sources, and dam construction. Harvesting for food, road construction followed by in-stream sand and gravel mining and deforestation play negative part as well.

Key words: *Mekong River Delta, freshwater mollusk fauna, biodiversity assessment*

(O40) ECOLOGICAL STRUCTURE OF DIATOM ASSEMBLAGES FROM THE SURFACE SEDIMENTS OF AMURSKIY BAY (SEA OF JAPAN)

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The Amurskiy Bay is an interior bay of the large Peter the Great Bay. Numerous streams and rivers enter to the Amurskiy Bay. The Primorye's largest river Razdolnaya rather greatly freshens (to 22–27 ‰) sea water in the innermost part of the bay (Rostov *et al.*, 2007). The total annual river runoff is up to 2.5 km^3 (Podorvanova *et al.*, 1989). The salinity in the bay, in general, not exceeding 32.5 ‰.

Samples of surface sediments (0–1 cm) were collected in Amurskiy Bay in 2010 during a cruise of the small ship Impulse. Bottom-sediment samples were taken with an Okean grader-type bottom grab. The thirteen samples collected along a north-south transect from depths of 7.8 to 23.7 m were examined. Diatoms from bottom sediments were isolated using a heavy potassium-cadmium liquid (Zhuze, 1962). The studied diatom flora is represented by 221 species and intraspecific taxa belonging to 83 genera. The bulk of the diatom flora was constituted by marine (72.4 %) and brackish (14.5 %) species, which also dominated in abundance. Freshwater diatoms, which were usually encountered in single numbers, contributed a noticeable proportion (11.3 %). A minor part of the flora (1.8 %) consisted of freshwater species that became extinct in the Neogene: *Aulacoseira praegranulata* var. *praeislandica* and *A. praegranulata* var. *praeislandica* f. *curvata*. In terms of the number of species, benthic species (121 species or 63 %) predominated among marine and brackish-water diatoms; among planktonic species, there were 55 neritic (28.6 %) and 16 oceanic species (8.3 %). Neritic species (66.4 %) dominated in abundance, benthic species (31.2 %) were subdominant, oceanic species were found in low numbers (2.4 %). The number of species and intraspecific taxa in the studied samples varied from 60 (stn. 39) to 116 (stn. 12). Most stations were characterized by a high abundance of the benthic estuarine species *Diploneis smithii* (7–21 %). Among benthic species, the following were found consistently but in single numbers: *Amphora proteus, Arachnoidiscus ehrenbergii, Auliscus sculptus, Campylodiscus angularis, Cocconeis scutellum, Diploneis subcincta, Grammatophora oceanica, Hyalodiscus scoticus, Lyrella lyra, Navicula directa, Pinnularia quadratarea, Surirella fastuosa, Trachyneis aspera.* The ecological structure of diatom assemblages from surface sediments in the Amurskiy Bay on the north-south transect was fairly uniform: neritic species were dominant (50.5–75.9 %), benthic species were subdominant (20–37.5 %). The share of oceanic species was 0–5.7 %. Freshwater species were recorded in single numbers (0.9–2.8 %) at almost all stations, except station 39, where they represented up to 7.5 %. This station was located at about 7 km away from the mouth of the Razdolnaya River, thus accounting for the increased content of freshwater diatoms in the sediments. Here, we found a noticeable quantity of extinct species of freshwater diatoms (5 %), which could apparently be introduced via river runoff from an adjacent land. Thus, this ecological structure of diatom assemblages is characteristic of a narrow shallow marine bay with a river mouth zone.

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Key words: *ecological structure, diatoms, surface sediments, Amurskiy Bay, Sea of Japan*

(O41) THE URBAN STREAM RESTORATION: HOW THE MACROPHYTE COULD PROMOTE THE RECOVERY OF BIODIVERSITY OF AQUATIC ORGANISMS

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The reclaimed water provided important water resources for the urban streams. The water quality severely degraded in the urban ditches because of the multiple high level nutrients and toxic pollutants. It is important to recover the water quality and re-built the healthy aquatic ecosystems based on the stream ecological theories. By field monitoring and controlled re-plantation in the urban streams, the succession of constructed aquatic community of macroinvertebrates was continually monitored. The efficiency and mechanisms of water quality recovery would be compared under different substrate composition, different contamination condition and type of macrophytes in the urban channelized streams. The main results showed that high levels of nutrient enrichment existed in the reclaimed water. Under this condition, the recovery of macroinvertebrate restoration was limited in comparing with natural streams. The communities of macroinvertebrates characterized with loss of sensitive taxa, limited abundance of moderate tolerant taxa, high relative abundance of gather-collectors and burrowers, and the low level of biodiversity. The positive correlation between the taxa richness of macrophytes and macroinvertebrates, and macrophyte cover and taxa richness of macroinvertebrates was confirmed by using linear regression analysis. Even though the nutrient enrichment dominated the community biodiversity of macroinvertebrate, however, the existence of macrophyte significantly increased the types of functional feeding groups and live types. Conductivity, ammonia nitrogen, chemical oxygen demands and dissolved oxygen were the dominant chemical parameters affected the biodiversity of macroinvertebrates. The working schemes of water quality recovery and healthy aquatic ecosystem construction would be provided for the urban ditches. The corresponding adjustment rules of systematic process for sustaining the healthy waterway would be submitted.

Key words: *river health, urban streams, macroinvertebrates, macrophytes, nutrient enrichment*

(O42) PRODUCTIVITY OF THE PACIFIC OYSTER *CRASSOSTREA GIGAS* THUNBERG FROM OYSTER CULTURE IN POSSJET BAY (SEA OF JAPAN)

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Data collected over 20 years from Possjet Bay of the Sea of Japan is the major oyster culture in Far East Russia. The cultivation of the Pacific oyster *Crassostrea gigas* involves collection of oyster larvae, spat rearing in collectors in summer of first years and growth for 1.5–2 years until they are an acceptable size (80–100 mm). The oyster shell height was from 80 to 180 mm. The highest growth rates were in Novgorodskaya Bay and Expedition Bay, where they reaches of commercial size at 1–1.5 year old. The total number and weight of oysters was about 0.5 million individuals weighing 100 tons.

The intensive development of oyster farming in the South Primorye in recent years has created conditions where it is becoming very important to determine the productivity of the farms. The development of Pacific oyster gonads, larvae, spat settling, feeding, growth depends on the water temperature and, particular, the variation of the temperature during years. The water temperature over 10 ^{o}C in spring and summer over the active period of gonads development and growth oyster. The critical temperature for spawning of Pacific oyster in Possjet Bay is 18 ^{o}C. Growth of larvae and spat settling generally occurs at temperature of over 15–18 ^{o}C. In the future these parameters will be used to project spat density and productivity of Pacific oyster.

Key world: *Pacific oyster, oyster culture, South Primorye*

(P31) PALLIAL GONOGUCT HISTOLOGY OF *SEMISULCOSPIRA* SPECIES (GASTROPODA: SEMISULCOSPIRIDAE) FROM KUSHU ISLAND (JAPAN)

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Mollusks of the family Semisulcospiridae (Gastropoda, Cerithioidea) play an important role in human life as the first intermediate host of Trematoda which are causative agents of serious human and animals diseases. Intermediate host mollusks are species specific, each species has unique biology, so it is necessary to identify mollusks species for understanding disease ecology. However, identifying the hosts using external morphology is extremely difficult because of conhological signs, the taxonomy and systematics of the mollusks have still some confusion among scientists.

Histological methods demonstrate anatomical differences in reproductive systems of mollusks (Nakano & Nishiwaki, 1989; Rasshepkina, 2007). In this investigation Semisulcospiridae mollusks from streams in Nagasaki Prefecture (Kushu Island) are studied. Speciments from 6 sites were collected; based on conhological features they were devided into four types. It was suggested that they belong to *Semisulcospira libertina*, *S. reiniana*, *Semisulcospira* sp. 1, *Semisulcospira* sp. 2. The pallial gonoduct (part of reproductive system located in mantle cavity) of ethanol fixed specimens was isolated, put in paraffin and dissected by standart procedure. Then it was stained by hematoxylin and eosin and examined under light microscope. The pallial gonoduct of the genus *Semisulcospira* was presented by medial and lateral laminae, with inter lamellar cavity between them. Inter lamellar cavity was widely opened into mantile cavity and close only proximally. The lateral laminae included brood pouch with embryos. Mollusks of all species had medial lamina consisting of seminal receptacle and pallial pocket covered by connective tissue. Seminal receptacle was filled by oriented along the falls spermatozoa, while pallial pocket contained disintegrated spermatozoa. Structure of pallial pocket was similar for all studied species: it was a tube with muscle walls. All studied species had similar structure of lateral laminae. Its proximal part had special histological structure called as "proximal portion of lateral laminae". The cells of the structure were stained dark with hematoxylin. Inspite of coloration the cells of proximal portion of lateral lamina had no mucus. The length of this gland of *S. libertina* was two times more then its seminal receptacle length. This gland of *S. reiniana* was small, less than length of seminal receptacle. There were significant differences in the shape and position of the seminal receptacle between *S. libertina*, *S. reiniana*, *Semisulcospira* sp. 1 and *Semisulcospira* sp. 2. The seminal receptacle of *S. libertina* was located under pallial pocket, closer to the inner part of medial laminae, while the seminal receptacle of *S. reiniana* was located on the right side of pallial pocket. Seminal receptacle of *Semisulcospira* sp. 1 was located very low, so that only pallial pocket was observed on the sections through proximal part.

On the base of our study of reproductive anatomy of Semisulcospiridae we regards the anatomical differences in position and shape of seminal receptacle have inter-species level for *S. libertine*, *S. reiniana*, *Semisulcospira* sp. 1 and *Semisulcospira* sp. 2. Our data are consistent with new phylogenetic analyses of Japanese *Semisulcospira* (Kohler, 2016).

The work was supported by JREX Fellowship for Young Researchers 2014.

Key words: *Semisulcospiridae, reproductive system, anatomical differences, phylogenetic analyses*

(O43) ABRUPT CHANGES IN THE MACROZOOBENTHOS COMMUNITIES OF STONY LITTORAL IN LAKE BAIKAL UNDER MASS DEVELOPMENT OF *SPIROGYRA* GREEN FILAMENTOUS ALGAE

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Mass development of non-typical for Baikal green *Spirogyra* spp. has been detected in coastal zone since 2010–2011, first, locally, in South Basin (Kravtsova *et al*., 2012; Timoshkin *et al*., 2014). Results of 2014 round-Baikal expedition evidenced, that *Spirogyra* occupied shallow water zone (depth range 0.5–2 m) along ca 50 % of the coastal perimeter. General characteristics of the ecological crisis in coastal zone of Baikal, which also includes mass benthonic cyanobacterial blooms, giant coastal algal accumulations, illnesses and mass extinction of Baikal endemic Lubomirkiidae sponges, mollusks, faecal pollution, *etc*. is given by Timoshkin *et al*. (2016). Several types of cyanotoxins were isolated and determined in benthonic samples (Belykh *et al*., 2015). The structure and composition of the macrozoobenthos communities (MC) of Baikal during last 87 years has been investigated on the example of the stony littoral zone (2–5 m depth). Most current and regular MC investigations have been performed on Berezovy ecological test site, "BTS" (South Baikal) since 2000 (Timoshkin *et al*., 2009). The depth range of 2–5 m is normally occupied by II and III algal belts (sensu Meyer, 1930), where green macroalgae *Tetraspora cylindrica* var. *bullosa*, the diatom *Didymosphenia geminata* and representatives of endemic green *Draparnaldioides* usually dominated. Mass development of *Spirogyra* spp. (40–60 % of wet phytomass) we detected on BTS at 2–4 m depth during 2013–2014. Multiyear analysis of the stony littoral MC of south-western coast of Baikal during summer-autumn seasons of 1928, 1945–1946, 1963–1968, 2000–2001, as in June 2013–2014, evidences on rather stable condition of the MC. The mean macroinvertebrate abundance varied within 32.6–45.7 thousand specimens/m^2, the biomass – within 91.61–333.25 g/m^2. Gastropods, amphipods, caddies flies always dominated. The share of the mollusks was as high as 63–92 % of the total biomass and 36–82 % of the total invertebrate abundance. However, during mass *Spirogyra* bloom in September 2013 this parameter increased significantly (79.8±34.9 thousand specimens/m^2), while the total biomass slightly decreased (141.67±88.31 g/m^2). Rocky substrate was covered by *Spirogyra* (50–80 % of the projective area), nonetheless, the MC taxonomic structure was not changed (except for the leeches, which were mostly absent on the spirogyra-covered rocks). But the dominant groups were changed drastically: oligochaeta (44 % of total abundance and 26 % of the total biomass) and amphipoda (23 % and 43 % respectively) became dominating on BTS in September 2013. Chironomidae abundance increased significantly: up to 13 % (2013) and even to 21 % (2014). *Vice versa*, the share of Gastropods decreased 6 times in 2013 and over than 10 times in 2014. Their biomass was equal to 17–18 % of the total one. Mean values of Trichoptera abundance decreased over than 4 times. In summary, the mass development of *Spirogyra* first of all influences (suppressed) the share of the oxiphylous groups of MC, such as Gastropoda and Trichoptera. Significant changes in the quantitative characteristics and structure of the MC, accompanied by increasing of the total invertebrate abundance (1.7 times) and decreasing of their total biomass (2.3 times) can be explained by increased share of the numerous, but small-sized Oligochaetes. Respectively, it shall be considered as an indirect evidence of the increasing of the total organic matter contents.

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Key words: *macrozoobenthos, Spirogyra, littoral zone, Baikal*

(O44) A MOLECULAR PHYLOGENY AND BIOGEOGRAPHY OF ASIAN FRESHWATER SNAILS OF THE FAMILY PLANOPRBIDAE (GASTROPODA, CLADE HYGROPHILA)

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The freshwater snails of the family Planorbidae are one of the most common and diverse group of freshwater gastropods. Recent advances in molecular studies have clarified phylogenetic relationships among planorbid taxa, particularly in tropical regions. However, the phylogeny and systematics of the family of remain unclear despite the fact that several of planorbid species of Eurasia are currently exposed to serious threats as the result of the degradation of freshwater ecosystems. For the present study, we investigated the molecular phylogenetic relationships among the species of Planorbidae in mainly Asia. The inferred phylogeny of the planorbid lineages is characterized by marked incongruences with the morphological species taxonomy.

Besides, we inferred the origin and route toward divergence from the phylogeny.

Key words: *freshwater snails, Planorbidae, Higrophila, biogeography*

(O45) HISTORICAL REVIEW AND NEW APPROACHES USING AQUATIC INSECT PREDATORS IN THE BIOLOGICAL MOSQUITO CONTROL IN THAILAND

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Thailand has experienced several vector-borne diseases such as dengue fever, malaria, and Japanese encephalitis which are transmitted by *Aedes*, *Anopheles*, and *Culex* mosquitoes, respectively. Despite of some limitation in application, biological mosquito control is encouraged because insecticide application is suspected to have many negative effects to natural ecosystems. According to comprehensive literature reviews, *Poecilia* spp. (guppy fish) was firstly introduced to Thailand in 1965 as a mosquito control agent followed by *Betta* spp. (Siamese fighting fish), and *Trichopsis* spp. (crocking gourami fish). Invertebrate predators such as a bacterium (*Bacillus thuringiensis israelensis* (Bti), a copepod (*Mesocyclop thermocyclopoides*), *Diplonychus* spp. (Hemiptera: Belostomatidae), *Enithares* spp. (Hemiptera: Notonectidae), *Ranatra* spp. (Hemiptera: Nepidae), and *Toxorhychites* spp. (Diptera: Culicidae) were also suggested as possible control agents to vector mosquito larvae. As a result of our field investigations in Thailand, mosquito abundant sites showed lower species richness of aquatic insects. Presence of predatory aquatic insects such as Odonata, Coleoptera, and Hemiptera provided higher species richness of aquatic insects which exhibited a fewer mosquito larvae. Based on field investigations in Thailand, aquatic insect predators such as *Hydrophilus* spp. (Coleoptera: Hydrophilidae) and *Diplonychus rusticus* (Hemiptera: Belostomatidae) were selected as mosquito control agents and their rearing methods were developed. Digital mosquito monitoring system (DMS) which was developed in other project was integrated with this biological control method to correctly determine the control timing. This study was supported by a research project provided by KEITI in 2016.

Key words: *biological mosquito control, aquatic insect predators, Digital mosquito monitoring system*

(O46) GLOCHIDIA MORPHOLOGY OF *UNIANDRA CONTRADENS* LEA, 1838 FROM VIETNAM

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The larvae of freshwater Unionidae species have a short, obligate parasitic stage (glochidium) in their life cycle. The present study is a morphological survey of the glochidial stage of *Uniandra contradens* Lea, 1838 (family Unionidae) from Mekong River basin (Điện Biên Province, Vietnam) made by light and scanning electron microscopy. There were some data on glochidia of *U. contradens* from Thailand (Panha, 1990; Panha & Eongprakornkeaw, 1995), investigation of glochidia morphology of bivalvia from Vietnam is made for the first time.

According to Brandt (1974) the genus name *Uniandra* is used in this paper instead of *Contradens*; classification of subfamilies is given after Whelan *et al.* (2011) and Huang *et al.* (2013). Previously *Uniandra contradens* together with many other Asian bivalves were recorded in subfamily Amblemidae (Panha & Eongprakornkeaw, 1995; and others).

The mature glochidia were collected from outer demibranchs of gravid female mussels and preserved in 70 % ethanol. For SEM they were dehydrated in 95 % ethanol followed by a few changes of absolute ethanol. The dried specimens were mounted on the specimen stubs with double sided sticky tap and then coated with gold.

Along with species from such Asian genera as *Pseudodon*, *Physunio*, *Solenaia* (subfamily Gonideinae), *Trapezoideus*, *Uniandra* (subfamily Rectidentinae) the glochidia of *U. contradens* are classified in the hookless group of bilaterally asimmetric larvae, with an unequivalve, unequilateral (terminology after Panha & Eongprakornkeaw, 1995) shells and large hook-like shell appendix structure (appendage) on only one of the two larval valves. Bivalvia of *Uniandra contradens* brood larvae in the outer demibranchs (ectobranchous). The mean glochidial shell height (*H*) and length (*L*) were 211.5±0.03 and 243.1±0.04 µm, respectively, with a glochidial index (*Gln*, estimated as *H*x*L* and both measured in mm) of 0.0505–0.0523. In comparison, glochidia of *U. contradens* from Thailand had *H*=210±0.05 µm, *L*=230±0.05 µm, with *Gln*=0.0484 (Panha & Eongprakornkeaw, 1995). Among species with bilaterally asimmetric larvae, glochidia of *Solenaia khwaenoiensis* were the biggest, with *H*=220±0.03 µm, *L*=280±0.04 µm, and *Gln*=0.0612 (Deein *et al.*, 2008), while glochidia of *Physunio superbus* were the smallest: *H*=170±0.03 µm, *L*=190±0.03 µm, *Gln*=0.00324 (Panha & Eongprakornkeaw, 1995).

Ventral rims of each glochidial valve of *Uniandra contradens* were covered by numerous lanceolate micropoints arranged in more or less complete tight rows. Maximal size of micropoints was 1.67 µm.

External surface of glochidial valves with numerous pores that were 1.77–2.1 µm in diameters. Exterior valve sculpture coarse, the same characteristic was recorded for *U. contradens* from Thailand (Panha & Eongprakornkeaw, 1995).

Key words: *glochidium, morphology, Uniandra contradens, Vietnam*

(P32) ULTRA-SCULPTURE OF GLOCHIDIA OF *CRISTARIA TUBERCULATA* (RUSSIAN FAR EAST) AND *CRISTARIA PLICATA* (CHINA)

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Morphology of glochidia of freshwater anodontine *Cristaria plicata* (Leach) from Dongting Lake, the second freshwater lake in China (Prov. Hunan), and *Cristaria tuberculata* from Khanka Lake, the largest freshwater lake in the Russian Far East, is examined by the light and scanning electron microscopy. The species status of the glochidia was established by the adult individuals, from the gills of which they were extracted. To prepare for work on a scanning electron microscope, mature glochidia were cleaned from the soft tissues in a 5 % KOH solution.

Glochidial shells of both *Cristaria* species are elongated vertically, as valve height (*H*) is always greater than its length (*L*), *H/L* ratio is 1.03–1.06 for *C. tuberculata* and 1.01–1.1 for *C. plicata*. Glochidia of the investigated species do not differ in size: *H*=270–295 µm (286.6±7.1) and *L*=270–290 µm (279±5.9) for *C. tuberculata*; *H*=265–310 µm (279.8±13.4) and *L*=250–270 µm (257±6.2) for *C. plicata*. Glochidia of *C. tuberculata* with bigger hooks: the length of the hook (*h*) is 107–115 µm (111.2±3.5) or 37–42 % of the valve length (*L*) while for *C. plicata* *h*=75–100 µm (86.8±7.9) or 29–37 % of the valve length.

The shells of glochidia consist of two layers (Kinzelbach & Nagel, 1986). The inner layer is thick, punctuated by pores, though their outer ends are covered by the thin outer layer that forms a special external microsculpture. This microsculpture of investigated species could be described as intermediate between the tight-looped and vermiculate because chaotic and unstructured loops are packed so tight, that only their tops are visible. Among tight loops very few microgranules are observed for *C. plicata* glochidia. In summary, glochidia of the investigated species have the same size differing by bigger hook in *C. tuberculata*; external micrisculpture features of glochidial shells of both investigated species are identical.

Key words: *microsculpture, glochidia, morphology, Unionidae, Cristaria*

(O47) POST-GLACIAL DISTRIBUTION OF THE BURROWING MAYFLY, *EPHORON NIGRIDORSUM* (EPHEMEROPTERA: POLYMITARCYIDAE), IN THE SELENGE RIVER BASIN, MONGOLIA

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Mongolia is in the transition zone between the Siberian taiga and the dry steppes and semi-deserts of central Asia and the climate is characterized by long and cold winters, short and hot summers, low precipitation, and high temperature fluctuations. *Ephoron nigridorsum* (Tshernova, 1934) is a polymitarcyid burrowing mayfly inhabiting in middle regions in rivers and streams, and lakes in Mongolia (*e.g.*, Soldán *et al*., 2009). The mayfly is suggested to be a univoltine summer life cycle with about 8 month egg diapause under the ice coverage of the river during period from November to April (Avlyush *et al*., 2013). Although diapause egg has cold-tolerance over the long and cold winter, the development of nymphs needs warm water temperature, 15–25 °C for about 4 months. The nymph is a filter feeder; they burrow U-shaped cavity in the substrates and feed on detritus suspended in the water. The preferred habitats were substrates composed of rocks, cobbles, or coarse gravels with variable smaller mineral fractions of finer sandy, muddy, or organic substrates beside, unlike mountainous stream and upstream region (Avlyush *et al*., 2013). The adults are extremely short stage and copulate, oviposit, and die for a several hours after emergence.

In this study, we examined the genetic structures and the demographic history of *E. nigridorsum* in Mongolian Selenge River basin from the late Pleistocene to the present by the genetic analysis. As a result, although high genetic diversity was observed, there was neither geographic cluster of haplotypes nor correlation between the genetic differentiation and geographic distance within the river basin. In addition, Bayesian Skyline Plot showed expansion of population size in cooling through the last glacial period and stable from post-glacial to the present. We hypothesized that the stable population expansion occurred during the last glacial period in the river basin where water temperature would have little decreased in summer in the period.

Key words: *COI, demographic analysis, phylogeography, population genetics*

(O48) ALTITUDINAL PATTERNS AND DRIVERS OF BENTHIC MACROINVERTEBRATES IN THE NEPAL HIMALAYA

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Globally, large number of taxa in different regions have been studied along altitudinal gradient. However, studies on freshwater macroinvertebrates are scarce and limited to certain region. Due to the longest bioclimatic gradients in the central Himalaya, the region hosts extraordinary biodiversity and also true for benthic macroinvertebrates. The present study aims to explore the altitudinal patterns in diversity of macroinvertebrate in central Himalaya. The area has been declared a biodiversity hotspot. The benthic samples were collected from 130 sites between the years 2005 and 2013 ranging from 70 m asl to 4000 m asl. The samples were collected only from ecologically good quality streams and rivers, *i.e*., without severe modification of the rivers. High taxa richness along the altitudinal gradients were extracted from the study and interpreted in relation to environmental variables. The result indicated that taxa richness of the macroinvertebrates follow humped curve, *i.e*., high taxa richness at the middle mountain where average annual precipitation is higher than other altitudinal bands. Other significant environmental drivers are further discussed. The study further envisage that the outcomes will help to delineate high biodiversity altitudinal bands and will be an asset for conservation of biodiversity.

Key words: *Species richness, elevation, macroinvertebrate assemblage, central Himalaya*

(P33) THE FEATURES OF ZOOBENTHOS OF OXBOW LAKES IN THE BOLSHOY YUGAN RIVER BASIN (MIDDLE OB REGION, SIBERIA)

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Oxbow lakes are a typical element of floodplains of large and medium-sized rivers in Western Siberia. These waterbodies are formed by meandering rivers and remain connected with them for long periods. Usually an oxbow lake connects with the river through a single channel; during seasonal floods water flows directly from the river into the lake through this channel. The distal, or "blind" end of an oxbow lake quickly becomes silted and overgrown with water plants, and the connecting channel at this end eventually disappears.

In 2012, we studied the zoobenthos of two oxbow lakes belonging to the floodplains of two rivers in the Middle Ob region: the Bolshoy Yugan Lake and its major tributary, the Negus'yakh Lake. In each of the lakes, sampling stations were located near the "blind" end (1), near the channel (3) and between them, in the middle (2). At each station, three samples were collected using a Petersen bottom sampler. We found 17 taxa of invertebrates in the Bolshoy Yugan oxbow lake and 19 taxa in the Negus'yakh oxbow lake. The similarity of taxonomical composition was estimated at 0.61 using the Sörensen index, which is not a high value. The distribution of taxa at the sampling stations in the two lakes is similar. The fewest taxa were registered in the middle stations (№ 2), in the oxbow lake of the Bolshoy Yugan, with 41 % of the total count, and in the oxbow lake of the Negus'yakh – 26 %. The maximal taxonomical richness was registered at both stations № 1, with 82 % and 68 %, respectively. The quantitative distribution of the zoobenthos in the two lakes was irregular and varied considerably between stations of the same lake. The mean number of zoobenthos in the oxbow lake of the Bolshoy Yugan ranged from 3.3 to 12.5 K specimens/m^2, and mean biomass – from 6.9 to 11.2 g/m^2. The mean number (0.2–5.6 K specimens/m^2) and biomass (0.2–9.9 g/m^2) in the Negus'yakh oxbow lake were considerably lower. The structure of the zoobenthos and its distribution between the sampling stations in the two lakes were similar. In Western Siberia, three groups of zoobenthos are the most important: oligochaetes, mollusks and chironomid larvae. In the studied waterbodies, mollusks and oligochaetes showed a low abundance and apparently do not play a significant role. Chironomid larvae (with *Chironomus* and *Camptochironomus* being the dominant genera) and dipteran larvae of the family Chaoboridae (*Chaoborus flavicans* Meigen) accounted for the bulk of abundance and biomass. The maximum number and biomass of zoobenthos in the Bolshoy Yugan oxbow lake was registered at sampling stations 1 and 3. Chironomid larvae formed the bulk of abundance (85–87 % by number and 63–87 % by biomass). The detritophages of genera *Chironomus* and *Camptochironomus* dominated. At the station 2, predatory larvae of *Chaoborus flavicans* dominated (78 % by number and 62 % by biomass). In the zoobenthos of the Negus'yakh oxbow lake, the highest values of abundance and biomass were recorded at the station 1, where chironomid larvae dominated (87 % by number and 94 % by biomass). Species of the genera *Chironomus* and *Camptochironomus* prevailed. At the stations 2 and 3 larvae of *Chaoborus flavicans* dominated (79–90 % by number and 84–94 % by biomass).

Key words: *zoobentos, oxbow lakes, Western Siberia, Bolshoy Yugan River, Negus'yakh River*

(O49) AQUATIC MOLLUSK FAUNA OF THE UPPER YENISEI RIVER BASIN (THE REPUBLIC OF TUVA, RUSSIA)

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Tuva lies in geographical centre of Asia and there is one of biggest watersheds in the world where the great Yenisei River starts its way. The Upper Yenisei River is one of a few rivers in Siberia with minor human transformation.

First data on the Upper Yenisei River mollusk fauna from Tuva were reported by V.N. Greze and I.I. Greze in 1957–1958; first checklist included seven species: *Radix ovata, Gyraulus albus, Valvata aliena, Anodonta anatina, Sphaerium scaldianum*, *S. lacustre*, *Pisidium amnicum*. Later in 1969, A.N. Gundrizer and M.A. Ivanova reported in a short publication about 31 species with special attention to the Upper Yenisei River basin.

Vast collections of aquatic mollusks made by the author during 1994 and 2004 in the Upper Yenisei River basin within the "Azas" State Nature Reserve in north-eastern Tuva. Almost 5000 shells and specimens were fixed in 75 % alcohol; the collection is now deposited at the Institute of Biology and Soil Science FEB RAS, Vladivostok.

Shells and specimens were investigated by conchological, anatomical and SEM methods based on original study. Conchological characters include shell outline, sculpture, features of hinge, ligament, muscle scars and pores; the most important structures are illustrated on the SEM photographs. Anatomical characters were studied in situ and figured with a camera lucida. At present, in total 108 aquatic mollusk species were found – 56 gastropods and 52 bivalves. Total fifty-six species belonging to 4 families and 6 genera of freshwater gastropods for the Upper Yenisei River basin are recorded. Gastropods fauna of the "Azas" State Nature Reserve includes 44 species.

Most recorded gastropods species (73 %) are Palaearctic and 20 % of all species have Siberian distribution.

Bivalves in the "Azas" State Nature Reserve and adjacent territories of the Todzha Hollow in the Republic of Tuva are represented by 52 species. Bivalve fauna in the reserve includes 49 species. Ten species in 5 genera of the Sphaeriidae were represented. Three species in 2 genera of the Pisidiidae were distinguished: *Europisidium tenuilineatum* (Stelfox, 1918), *Pisidium amnicum* (Müller, 1774) and *P. decurtatum* Lindholm, 1909. Thirty five species in 11 genera of the Euglesidae were represented: *Cingulipisidium*, *Conventus*, *Cyclocalyx*, *Euglesa*, *Henslowiana*, *Hiberneuglesa*, *Pseudeupera*, *Pseudosphaerium*, *Pulchelleuglesa*, *Roseana* and *Tetragonocyclas*.

Majority of bivalve species (75 %) are distributed in Palaearctic Region, while the other species have broad Holarctic distribution (19 %).

This study was supported by "*Azas*" *State Nature Reserve (I.V. Demkin). This work was partly funded by grant № 15-I-6-011-o (Principal Investigator Dr. V.V. Bogatov).*

Key words: *aquatic mollusks, Upper Yenisei River, gastropods, bivalves*

(P34) FROM TIBET TO DESERT: ON THE AQUATIC MOLLUSK FAUNA IN THE UBSUNUR HOLLOW OF TUVA AND MONGOLIA

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The aquatic mollusk fauna of the Ubsunur Hollow consists of twelve species, belonging to seven genera and four families. Three endemic *Odhneripisidium (Tuvapisidium)* species group (Bivalvia: Pisidiidae) were described by Y.I. Starobogatov, E.A. Streletzkaja and Z.I. Izzatullaev in Tuvan-Mongolian Tore-Khol' Lake. The focus of this report is to show species composition of aquatic mollusk fauna within the "Ubsunur Hollow" State Nature Biosphere Reserve (UNESCO list). During 1994 and 2015 small bivalves and gastropods were collected in lotic and lentic freshwater habitats.

Shells and specimens were fixed in 75 % alcohol; the collection is now deposited at the Institute of Biology and Soil Science FEB RAS, Vladivostok. Shells and specimens were investigated by conchological, anatomical and SEM methods based on original study. Conchological characters include shell outline of small bivalves, sculpture, features of hinge, ligament, muscle scars and pores; the most important structures are illustrated on the SEM photographs. Anatomical characters were studied *in situ* and figured with a camera lucida. Russian taxonomic system is used. As a result, the Gastropoda are represented by six species: *Lymnaea (Radix) auricularia* (Linnaeus, 1758), *L. (Galba) bowelli* (Preston, 1909), *L. (Orientogalba) hookeri* Reeve, 1850 (Lymnaeidae), *Armiger annandalei* (Germain, 1918), *Anisus (Gyraulus) acronicus* (Ferrussac, 1807), *A. (G.) terekholicus* Starobogatov et Prozorova, 1997 (Planorbidae). Six species of small bivalves belonging to four genera and two families (Pisidiidae and Euglesidae) were established. Three species from three genera of the Euglesidae were found in the Tore-Khol' Lake: *Euglesa (Casertiana) zugmayeri* (Weber, 1910), *Pseudeupera (Pseudeupera) subtruncata* (Malm, 1853) and *Cingulipisidium (Cingulipisidium) crassum* (Stelfox, 1918). Four species: *Lymnaea (Orientogalba) hookeri*, *L. (Galba) bowelli*, *Euglesa (Casertiana) zugmayeri*, *Armiger annandalei* were decribed in Tibet and recorded in the north part of central-asian deserts within Ubsunur Hollow.In regard to zoogeographical considerations, the malacofauna has a mixed composition. The widely distributed Holarctic and Palaearctic elements are *Lymnaea (Radix) auricularia*, *Anisus (Gyraulus) acronicus*, *Pseudeupera subtruncata* (Malm, 1853), *Cingulipisidium crassum* (Stelfox, 1918); while *Lymnaea* (*Galba) bowelli*, *L. (Orientogalba) hookeri*, *Armiger annandalei*, *Anisus (Gyraulus) terekholicus*, *Euglesa zugmayeri* and a member of the genus *Odhneripisidium* are the Asian species.

I thank Professor N.I. Putintsev (Tuvan State University) for start scientific expedition in Ubsunur Hollow and D.V. Fomin (A.V. Zhirmunsky Institute of Marine Biology FEB RAS, Vladivostok) for the help with SEM work. This study was supported by "Ubsunur Hollow" State Biosphere Reserve (V.I. Kanzay). This work was partly funded by grant № 15-I-6-011-o (Principal Investigator Dr. V.V. Bogatov).

Key words: *aquatic mollusks, Ubsunur Hollow, endemic species*

(P35) THE INFLUENCE OF THE FEED SPECTRUM ON THE NON-SPECIFIC MECHANISMS OF STRESS-RESISTANCE IN BAIKAL ENDEMIC AMPHIPODS SPECIES *GMELINOIDES FASCIATUS* (CRUSTACEA: GAMMARIDAE) DURING LONG-TERM LABORATORY EXPOSITION

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In the current study we estimated the influence of the feed spectrum on some non-specific mechanisms of stress-resistance in Baikal endemic amphipods *G. fasciatus* during the long-term (3 months) laboratory exposure. For this study animals were collected with a hand net near the village of Bolshie Koty (South Baikal N 51.903375, E 105.075639) in May 2014. The temperature of sampling and performed laboratory experiments was 6 (±0,5) °C. During the experiments animals were fed by three different types of feed. First group was fed by Tetramin feed for crustacean (Tetra, Melle, Germany). Second group was fed by mixture of vegetables (carrot and potato). Third group was fed by dried mixture of amphipods, gastropods and water plants (Baikal feed mixture, BFM), prepared manually. Some universal cellular stress markers were investigated upon laboratory exposition such as activities of antioxidative enzymes (peroxidase, catalase and glutathione S-transferase), and activity of energetic metabolism enzyme−lactate dehydrogenase accordingly to Bedulina *et al.* (2009), Timofeyev (2010). The feeding of *G. fasciatus* by Baikal feed mixture (BFM) led to decrease of peroxidase activity in 2 months of laboratory acclimation. In 3 months of laboratory exposure the activity of enzyme was significantly lower than the control level. The exposure with feeding by BFM led to short-term decrease of the catalase activity in 2 weeks of exposition. Further exposition of this species led to restore of catalase activity to control values and fluctuated at this level during 3 months of experiment. The feeding by BFM led to the decrease of the glutathione S-transferase activity in 2 weeks of exposure. Further exposition led to elevation of glutathione S-transferase activity to control level and fluctuated on this level during 3 months of experiment. In case of feeding by Tetramin, the rate of glutathione S-transferase activity was stable during first 2 weeks, and then the activity decreased to 1 month of exposure. Feeding by BFM led to a decrease of the lactate dehydrogenase activity which decreased in 2 weeks. Further exposition led to restore of lactate dehydrogenase activity to control level and fluctuated on this level during 3 months of experiments. The feeding by Tetramin led to decrease of activity in 3 months of exposure. Changes in enzyme activity during feeding of *G. fasciatus* by vegetables mixture was not observed because of early death of animals. As shown the results of the current study, the feed spectrum has a direct effect on the stress-resistance abilities of Baikal endemic amphipods *G. fasciatus* during laboratory exposition. This must be considered for experiments and experimental design for carry out ecological and physiological experiments.

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Key words: *acclimation, antioxidant system, amphipods, Gmelinoides fasciatus, Baikal, diet*

(O50) A NEW *NIGROBAETIS* SPECIES (EPHEMEROPTERA: BAETIDAE) FROM CHINESE MAINLAND

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The first valid *Nigrobaetis* species found in Chinese mainland has various pale markings and dots on dark brown body, simple gills and expanded labial palpi in nymph. In imago, it has only one pair of wings, purple compound eyes, contracted segment 2 and longer apical segment of forceps. Both nymphal and imaginal specimens of this species show some uniqueness. As a result, it is recognized and named as *Nigrobaetis punctatus* sp. nov. in the present paper. The solid association between immature and mature materials provides a good example to further classification on Baetidae in China.

Key words: *new species, China, mayfly*

(RT3) THE INTERNATIONAL FAR EAST YOUTH CONFERENCE "MAN AND BIOSPHERE" AND UNITING OF YOUTH FOR PROTECTION OF FRESH WATERS IN ASIA

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The International Far East Youth Ecological Conference "Man and Biosphere" has been organized by the Scientific-Public Coordination Center "Clean Water" in March, 2004 and further began to be carried out annually on the basis of Institute of Biology and Soil Sciences, Far East Branch of Russian Academy of Sciences. In 2015 it was decided to transfer the conference to the international status and in 2016 17 school students foreigners, pupils of the International Linguistic School of Vladivostok from South Korea and the USA have taken part in it. The Conference is the very popular youth forum in East Russia and more than 200 participants annually participate in it.

The regional stage of the Russian National Junior Competition of Water Projects is carried out within the Conference therefore many works are devoted to studying of freshwater problems: biodiversity of lakes and rivers, studying of anthropogenic influence on freshwater ecosystems, the problems of nature protection and so on. The results of public monitoring from various regions of the Far East are reported. Age structure of participants varies from the youngest school students (and even children of kindergarten age) to students of last courses of university. Therefore for adequate evaluation of works the jury considers reports and presentations grouping them according the age. Participation in the Conference may be internal or correspondence, and it allows to participate those young people who live very far or abroad.

We, organizers of the Conference "Man and Biosphere", invite the youth of Asia to take part in our annual forum in order to unite our efforts for protection of fresh waters in Asia, to make stronger the international cooperation in ecological researches and education. "Let's make the World clean!" – the motto of our Conference and the developing international public ecological movement on the way to the Green, Clean and Happy World.

Key words: *international cooperation, fresh waters, education, public ecological movement*

(O51) ZOOBENTHOS OF THE METHANE SEEPS IN DEEPWATER ZONE OF LAKE BAIKAL: DISTRIBUTION AND TROPHY

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In recent years more than 20 methane patchily distributed seepages were discovered in deepwater zone of Lake Baikal (Van Rensbergen *et al*., 2002; Granin *et al*., 2010; Cuylaerts *et al*., 2012; Khlystov *et al*., 2013, *etc*.). The most famous of them are hydrothermal vent Frolikha (300–400 m depth), oil-methane seep Gorevoy Utes (~900 m depth) and methane seep Sankt-Petersburg (at a depth of ~1400 m). The landscapes and habitats of animals in these regions are different. The bottom of vent Frolikha covered by fields of bacterial mats created by giant sulfur bacteria *Thioploca*, patches of pebbles and boulders, light-coloured sand, and pale grey silt and pelite. The bituminous hills ("volcanoes") of different size were found on the floor of oil-methane seep Gorevoy Utes. Some of these structures had a vertical tube on the top ("dropper"), from which oil oozed. The floor of methane seep Sankt-Petersburg was presented by mounds composed of massive layers of methane hydrates. Gas bubbles escaped from some mounds. The bottom had patches of both oxic and anoxic surficial sediments, jelly-like microbial mats formed above gas hydrate layers. Invertebrates of 8 meiobenthic taxa [Ciliata, Rotifera (in vent Frolikha only), Copepoda, Nematoda, Ostracoda, and small Turbellaria] and 5 macrobenthic groups [Porifera (in vent Frolikha only), giant Turbellaria, Gastropoda, Amphipoda, Chironomidae, and Oligochaeta) were recorded at these regions]. Most of these organisms were found early in other deepwater regions of the lake, and some of them only can be considered as seep or vent local endemics. We revealed a significant statistical dependence of meiobenthos abundance on the availability of microbial mats, but this was not the case for macrobenthos abundance. The most numbers of benthic macroinvertebrates were registered on solid substrates (pebbles, boulders, bitumen structures). The analysis of stable carbon and nitrogen isotopes in animal tissues showed that their life cycles are based on chemo- (methano-), photo- and mixotrophy. The trophic webs were estimated from 2 to 4 levels of the animals.

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Key words: *deepwater lake zone, methane hydrates, aquatic invertebrates, meiobenthos, macrobenthos*

(P36) EXPERIENCE WITH VARIOUS INDICES BASED ON BENTHIC MACROFAUNA FOR THE ASSESSMENT OF THE ECOLOGICAL STATUS OF ILE ALATAU STREAMS (KAZAKHSTAN)

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Usually, Woodiwiss Biotic Index was used for Ile-Alatau streams ecological state assessment by Kazakhstan Agency of Applied Ecology. As practice shows, using this index don't allow to evaluate ecological state of the streams sites adequately. So, it needs to find other appropriate biotic indices and metrics for the bioassessment purpose.

The aim of this study was to investigate allowance using different biotic indices for ecological state assessment of Ile-Alatau streams and to make recommendations for their using.

The sampling sites are situated in different zones: the mountain from 1000 to 1700 m altitude, the foothill 750–790 m asl, the plain about 500–600 m asl. There are several types of anthropogenic influence on the different sites of the streams: headwater, recreation activity, dams, urban, agricultural, channelized steam bed.

Trent Biotic Index (TBI), Extended Biotic Index (EBI), modified TBI for streams of Central Asia and Irtysh River basin, Biological Monitoring Working Party (BMWP), Average Score Per Taxon Index (ASTP) were chosen for ecological state assessment.

The analysis of the investigation results shows ASTP allows us to give the most adequate ecological state assessment of Ile-Alatau streams and can be recommended for practical using.

Key words: *biotic indices, ecological state assessment, Ile-Alatau streams*

(O52) INTEGRATING DNA BARCODES AND MORPHOLOGY FOR SPECIES DELIMITATION OF *POLYPEDILUM* KIEFFER (DIPTERA: CHIRONOMIDAE)

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The genus *Polypedilum* Kieffer occurs in all zoogeographical regions except Antarctic. It is one of the most species rich genus in Chironomidae, containing about 500 described species in the world and 92 species recorded in China.

This study aims to explore the utility of the mitochondrial gene cytochrome c oxidase subunit 1 (CO1) as the barcode region to deal with taxonomic problems in the genus *Polypedilum*. Totally 1650 sequences are involved, of which 260 from our lab and 1390 from Barcodes of Life Data (BOLD) and Genbank. Both NJ and ML tree well support 166 molecular clusters, 139 morphospecies, with match rate to 83.7 %. In addition, intra- and interspecific divergences are calculated, with the maximum intraspecific and minimum interspecific divergences 11.72 % and 1.60 %, respectively. Confidence interval numbers of molecular operational taxonomic units are 125–397, estimated from the methods of ABGD, jMOTU and PTP. Based on the result, 7–9 % are tentatively proposed as the threshold to delimit *Polypedilum* species.

The molecular data from present study shows that the shapes or location of wing spots, length or degree of anal point shoulders, the shapes of gonostylus, and setae on superior volsella can be regarded as interspecific variations. The study also indicates DNA barcoding is an ideal method to delimit sibling species, and associate counterpart females and gynandromorph with males in the genus *Polypedilum*.

Key words: *DNA barcodes, Chironomidae, Polypedilum, sibling species*

(P37) THE ACTIVITY OF THE TRANSFORMATION OF AROMATIC HYDROCARBONS BY MICROBIAL COMPLEX IN THE ESTUARY OF THE AMUR RIVER

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The pollution of coastal waters by different pollutants, including polycyclic aromatic hydrocarbons (PAHs), is a topical issue. PAHs being recognized as fare ground pollutants of the environment within the scientific community. The increase in concentration of pollutants in the estuaries of the rivers negatively effect biodiversity and reproduction of biological resources. That is why scientists pay attention to biological processes of self-cleaning taking place in the mixing zone of marine and fresh waters. It is microbiological communities that ensure destruction of the larger half of organic toxicants and hydrocarbons. The purpose of the investigation was to study the activity of microbial complexes towards aromatic substances in the mixing zone of marine and fresh waters of Amur estuary. We conducted microbiological research in bottom sediments taken from different sections of Amur estuary in the North and South directions from the estuary of the river as the salinity of the natural water changed.The activity of bacteriobenthos differed greatly in different sections of the Amur estuary. For example, bacteriobenthos was proactive to the limit on phenol in the zone of influence of the river flow and in the South of the Amur estuary before reaching Cape Lazarev. The transformation of naphthalene was observed in bottom sediments of the central part of Amur estuary where active sedimentation of suspended solids taken place. Low activity towards aromatic hydrocarbons in the South of the Gulf of Sakhalin and in Nevelski Strait is a vivid example of the influence of the river discharge on the formation of the quality of water in the Amur estuary. The bulk of suspend solid entering the estuary with the effluent is sedimented on the biochemical barrier. However, high activity towards phenanthrene was displayed by bacteriobenthos, functioning in the North-West of Sakhalin Island in the lagoon. This fact proves the natural origin of phenanthrene. In model research conducted with different concentration and types of salinity it was shown that transformation of phenanthrene takes place most actively in the rich marine environment. In model condition when adding 1–3 % salt into the medium for the cultivation of microorganisms the growth inhibition of bacteriobenthos taken in the estuary of Amur River is experimentally observed. The biomass accumulation by benthos communities, dwelling in the South of the estuary, happened most actively which confirms their adaption to natural salinity. Thus, salinity plays a vital role in the processes of self-cleaning taken place in the in the mixing zone of marine and fresh waters. The difference in the formation of the quality of water in the different section of the Amur estuary to the North and the South from the estuary of Amur River in the changing mode of found salinity was found out in this research. It was shown that during continuous microbiological transformation toxic coloured products deteriorating the quality of the water environment of the Amur estuary were formed. Unmetabolized aromatic hydrocarbons and toxic products of transformation including methylated analogs of benzol (analogs of hydroquinone and 1, 2-benzoquinone) are taken away from the Amur estuary into the Sea of Okhotsk and are deposited in shallow water. They are factors of ecological risk for the development of hydrobionts in coastal marine areas.

Key words: *activity, bacteriobenthos, aromatic hydrocarbons, salinity, estuary*

(O53) SEASONAL DYNAMICS OF SPECIES STRUCTURE IN THE MAYFLY TAXOCENOSIS (INSECTA: EPHEMEROPTERA) OF THE KOMAROVKA RIVER – A SMALL FOREST STREAM OF SOUTHWEST SLOPES OF THE SIKHOTE-ALIN RIDGE (SOUTH PROMORYE, RAZDOLNAYA RIVER BASIN)

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One of the most interesting problems, happening in biological communities, the studying of changes of biocenoses in space and time, is considered. These changes and conditions of the communities can be described basing on different approaches. One of the most widespread approaches represents the description of biocenosis by means of the integrated quantitative indices which characterize not each species of the cenosis, but all community in general. The presented work *a priori* relies on such methodological basis. The mayfly taxocenosis (Insecta: Ephemeroptera) of the small forest Komarovka River flowing within the Ussuriisk Nature Reserve of V.L. Komarov (Southwest Primorye, Russia) was chosen as an object of the research.

Variability of the main integrated parameters in the mayfly taxocenosis of the Komarovka River is described: total biomass, species biodiversity, and the coefficient of nonuniformity in the range sequence of species abundances described by a geometrical row. These changes fluctuate depending on seasons and are not same in different sites of the river located along the longitudinal gradient – from its source to the mouth. High similarity between the mean empirical value of the coefficient of nonuniformity (0.879 ± 0.075) and the theoretical value which is = 1, is revealed. Statistically reliable distinctions between them are absent.

Key words: *taxocenosis, Ephemeroptera, changes of communities, integrated quantitative indices, the coefficient of nonuniformity*

(P38) A NEW SPECIES FROM TIBET, CHINA AND PUBLIC DATA FROM BOLD OF *DIAMESA* MEIGEN (DIPTERA: CHIRONOMIDAE)

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The new species *Diamesa wangi* sp. nov. from Tibet Autonomous Region, China, is described and figured as adult male and female. The adult male can be distinguished from other *Diamesa* species by the combined characters: aedeagal lobe hook-like, with a cluster of long hairs at the apex; inferior volsella finger-like and gonostylus strong, curved inwardly. The DNA barcode of *D. wangi* sp. nov. and the analysis of public data from BOLD are presented.

Key words: *new species, taxonomy, Tibet Autonomous Region*

(O54) MACROINVERTEBRATE COMMUNITY STRUCTURE IN GLACIER FED HIGH GRADIENT KALI GANDAKI RIVER OF NEPAL

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High gradient rivers are very crucial for sustaining ecosystems and ecosystem services that support people's livelihood. The Kali-Gandaki River originates from glaciers in Mustang, boarder of Tibet, is one of the major river systems in Nepal, supporting Chitwan National Park – a flagship protected area with globally important tiger and one horned rhino population. Multiple development plans including hydro-power dams are put forward in the river. Therefore, degradation of watersheds has begun to compromise hydrology and morphological characteristics of the rivers leading to potential cascades to aquatic biodiversity. Timely assessments of e-flows in the river are essential for better understanding of ecology of the rivers and human communities that depend on adequate and sustained water availability. Therefore, the current research aims to gather baseline data on aquatic biodiversity in three seasons namely; pre-monsoon, monsoon and post-monsoon. Further, protocols will be designed to assess accurately the impact of potential development activities in the river. In this conference, first results of the research will be presented.

Key words: *E-flow, macroinvertebrates, Kali-Gandaki*

(O55) PHYLOGEOGRAPHY OF PTERONARCYID STONEFLIES (INSECTA: PLECOPTERA, PTERONARCYIDAE)

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The family Pteronarcyidae, which is the largest bodied stonefly group, is distributed in East Asia and North America. However, these stoneflies do not inhabiting the Japanese Archipelago, even though they inhabit the Korean Peninsula and Sakhalin. It is curious to note, how these stoneflies distributed so close to the Japanese Archipelago but they have not spread there. From a phylogeographic point of view, it is very interesting that they have not been able to migrate and become established in the Japanese Archipelago. As such, this study into the phylogeographic and evolutionary history of Pteronarcyidae will play an important role in considering the establishment of stonefly fauna in the Japanese Archipelago. In addition, this study will contribute greatly to understanding the origin of other Japanese fauna, not only Japanese Stoneflies. The family Pteronarcyidae is composed of twelve described species that are grouped into two genera: *i.e. Pteronarcys* spp. (10 species), and *Pteronarcella* spp. (2 species). Larvae generally inhabit the cold rapids or riffle areas of fast-flowing rivers, and as emerged adults they are observed in the period leading up to mid-summer from late spring. In the summer season of 2015, we were able to collect pteronarcyid stoneflies over a wide forested areas in the United States (around the Rocky and the Appalachian Mountain Ranges, and around the Great Lakes). In addition, with regard to East Asian pteronarcyid stoneflies, we utilized formerly collected specimens, stored in the laboratory. We were able to use the sequence data sets of 10 species of all the 12 species, when also including GenBank data. We analyzed the mitochondrial DNA COI and 16S rRNA region, and the nuclear DNA 28S rRNA and histone H3 regions of the pteronarcyid stoneflies, in order to investigate their phylogeographic and evolutional history. In this presentation, we present a new perspective based on an unique aspect regarding the formation history of the Japanese Archipelago, and it's corresponding biogeography.

Key words: *Pteronarcyidae, biogeography, Japanese Archipelago*

(O56) RIVERINE BIOMONITORING IN JAPAN, AN INTRODUCTION OF THE PRESENT SITUATION

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In Japan, Beck-Tsuda method had been widely used for riverine biomonitoring using macroinvertebrates in the age from 1960 through 1980. After that time several attempts had been conducted to introduce European or American systems of biomonitoring, but they were not widely accepted in Japan. From 1975, Ministry of Environment and Ministry of Land, Infrastructure and Transport started the citizen-based biomonitoring using river macro-invertebrates, which was widely accepted by citizens, students and school children. Nowadays, the ministries propose 4 classes of water quality from clean water to highly polluted water and adopt 10, 8, and 6 macro-invertebrate taxa to indicate each class, respectively. More than 60000 people engage the nation-wide biomonitoring all over the Japanese rivers in every year. However, we failed to introduce more advanced systems of riverine biomonitoring, such as BMWP scores. Recently, Ministry of Environment is trying to introduce ASPT (average score per taxon) method to monitor river environment and we fixed the scores for the families of river benthic macro-invertebrates in Japan. Here, I introduce this more advanced monitoring system along with the citizen-based biomonitoring in Japan.

Key words: *biomonitoring, Beck-Tsuda method, BMWP, ASPT, family scores*

(P39) MACROZOOBENTHOS OF THE STREAMS OF THE BUREYA RIVER DOWNSTREAM IN THE CONSTRUCTION ZONE OF THE LOWER BUREYA HYDROELECTRIC POWER STATION (AMURSKAYA OBLAST, RUSSIA)

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The paper deals with the results of hydro-biological monitoring of the background state of the right tributaries (Sinel', Paykanchik, Big Simichi, Deya) of the Bureya River downstream and its mainstream below the dam at the Lower Bureya Hydroelectric Power Stations (HPS) in 2012–2014. It is shown that the tributaries that form the water quality of the Lower Bureya Reservoir, characterized by communities of benthic invertebrates with relatively high species richness, which is typical for the clean mountain and foothill rivers on the south of the Russian Far East. High diversity of mayflies, stoneflies, caddisflies, chironomids and stable community structures during the three-year period indicates the absence of human impact. On the results of our research the part of the Bureya River mainstream below construction of Lower-Bureya HPS is exposed to pollution. It was found that the species richness of invertebrates in the Bureya River mainstream is significantly lower than in Bureya River tributaries, indicating that anthropogenic influence the construction of Lower-Bureya HPS.

Key words: *macrozoobenthos, hydro-biological monitoring, the Lower Bureya HPS, Far East of Russia*

(O57) CADDISFLIES (INSECTA: TRICHOPTERA) OF FAR EAST RUSSIA

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Researches of the caddisfly biodiversity of the Far East Russia have a long story. The greatest contribution to studying of this group of amphibiotic insects was made by the outstanding Russian entomologists A.V. Martynov (Ivanov & Rasnitsyn, 2016), and I.M. Levanidova who has created, besides, Far East hydroentomological school and has given incentive for further investigation of this group for her followers (Vshivkova, 2014, 2016). As a result of the complex researches which have captured extensive territories of the Far East Russia, 449 species from 103 genera and 26 families are revealed (Vshivkova *et al*., 2015) and the preliminary analysis of geographical distribution of caddis flies within the Far East Russia have done. To compare Trichoptera faunas of different regions, the Serensen-Dyce's index has been used (Sørensen, 1948). On the basis of the faunistic similarity matrix the cluster analysis, and the analysis of the main coordinates have been carried out (Legendre & Legendre, 1998). Calculations are executed by means of the PAST program (Hammer, Harper & Ryan, 2001).

Key words: *biodiversity,fauna comparison, geographical distribution, cluster analysis*

(P40) CADDISFLIES (INSECTA: TRICHOPTERA) OF RUSSKY ISLAND (VLADIVOSTOK, PRIMORSKY TERRITORY)

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Russky Island is located in Peter the Great Bay in the Sea of Japan, to the south of Vladivostok (the smallest distance between continental part of the city and the island is 800 m). The Island is part of municipality the Vladivostok city and enters the Archipelago of the Empress Evgenia. From Muravyov-Amursky Peninsula where the main part of Vladivostok is located, the Island is separated by the Eastern Bosphorus Strait. From the West it is washed by Amursky Bay, and from the South and the East – by Ussuriysk Bay. In the southwest by Stark Strait it is separated from another big island of the archipelago – Popov Island. The Russky Island territory – 97.6 km ^{2}, length – 18 km, width – 13 km. The island was not too populated by 2010 but after construction of the FEFU campus, the population has considerably increased – now on the campus about 10 thousand people live. There are 17 streams more than 1 km long, 7 streams more than 2 km and one small river – the Russkaya River, more than 5 km long. There are some lakes on the islands, some of them are artificial. The largest lakes of a natural origin – Gluzdovsky (Akhlyostyshev) of 5 hectares and Izvestkovoye ("Parisovskoye"). Boggy sites meet in the lower part of the Russkaya River, and also at mouse of some other streams. Study of Island caddis flies has been begun by the author in 1977, and sporadic collections continue so far. The most interesting findings are: *Thermophylax tyoployensis* Nimmo, 1995 – the second find of this species (before it was noted only from the type locality, Tyoploye Lake, Evreyskaya Oblast); *Polyplectropus nocturnus* Arefina 1996 and *Rhyacophila imitabilis* Schmid, Arefina & Levanidova 1993 are rare species with local distribution in Far East Russia. As nature of Island is not strongly destroyed up to now, the environment and condition of streams as well as caddis fauna are still keep the natural look.

Key words: *caddisfly fauna, new finding, natural habitats*

(RT4) HYDROBIOLOGICAL INVESTIGATION ON THE FAR EAST RUSSIA: PAST AND PRESENT

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Review of hydrobiological investigations in the Far East of Russia is given. The main historical stages of the benthological researches are described, as well as activities of leaders in the field of freshwater and marine hydrobiology since early times so far.

The information about the international benthological large-scale projects in large water basins of Far East Russia (Amur, Ussuri, Razdolnaya, and Tumangan rivers, and Khanka and Khasan lakes), and in different regions of Far East Russia (Kamchatka, Sakhalin, Kurils, Khabarovski Krai and Amurskaya Oblast, Primorye); as well as about expedition in Asia (China, Japan, Mongolia, Nepal, New Zealand, Philippines, South Korea, Thailand, Vietnam) are given.

Also the big part of investigations were carried out with specialists from non-Asian countries: Austria, Belorussia, Canada, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Hungary, Iceland, Italia, Norway, Poland, Slovenia, USA, Ukraine, Slovakia, Slovenia, Switzerland, *etc*.

The presentation is illustrated with numerous pictures of Far Eastern nature, photos of outstanding scientists, with inclusion of the working moments: in laboratories, expeditions, scientific conferences and meetings.

Key words: *benthological sciences, history of hydrobiological investigations*

(O58) FRESHWATER MONITORING OF URBAN AND SUBURBAN STREAMS IN MURAVYEV-AMURSKY PENINSULA (VLADIVOSTOK, PRIMORSKY TERRITORY)

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Since 2015 within implementation of the scientific-social project "Researches of an Ecological Condition of Streams and Reservoirs of the Muravyev-Amursky Peninsula and Development of Recommendations for Their Restoration" studying of a number of the streams located in Vladivostok and its vicinity has been carried out. Two model streams: an urban (Vtoraya Rechka Stream) and an suburban (Chernaya Rechka Stream) were chosen for comparative research. The streams water quality was estimated with chemical-microbiological and modern freshwater bioassessment methods. The effectiveness of these methods are evaluated. Comparison of the reasons of the degradation of streams located in urban and suburban zones are carried out. The recommendations for the streams restoration and stream basin protection are offered.

Key words: *ecological monitoring**,** bioassessment, urban and suburban streams, water quality*

(O59) CLASSIFICATION OF WATER QUALITY USING BIOTIC INDEX OF BENTHIC MACROINVERTEBRATE IN YANGTZE RIVER DELTA, CHINA

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Biomonitoring has been a key component of water resource management worldwide. Index (*e.g.* biotic index, BI) based on macroinvertebrate's sensitivity to water pollution has been commonly used for water quality assessment by regulatory authorities in countries according to pre-defined classes. However, researches in developing regional water quality classifications based on BI are limited in China's monsoonal region due to lack of robust macroinvertebrate tolerance values (TVs) data. Using environmental data and recent well developed macroinvertebrate TVs, we aimed to develop the BI classification system of water quality in Yangtze River delta, China. We identified a total of 62 reference sites and 252 test sites using chemical reference criteria: total phosphorus (TP) <0.035 mg/L, total nitrogen (TN) <1.409 mg/L, and electronic conductivity (EC) <300 μs/cm. We used 5th percentile BI values of all-site (*i.e*., reference + test sites) to set the minimum BI values along the environmental gradient and 25th percentile BI values of reference-site to determine the bench mark of "excellent" class. We then defined the five–class of water quality based on all-site data: excellent (<4.17), good (4.17–5.63), moderate (5.63–7.09), poor (7.19–8.54) and bad (>8.54), and on reference-site data: excellent (<4.30), good (4.30–5.73), moderate (5.73–7.15), poor (7.15–8.58), and bad (>8.58), respectively. More than 95 % of test sites with obviously degraded TN, TP, and EC conditions had BI values <5.63. Our results provided an alternative approach for biological assessment of water quality. We demonstrated that BI is a promising and informative index for water resource management in China.

Key words: *biomonitoring and bioassessment, biotic index, tolerance value, water quality*

(O60) SPECIES-LEVEL RESOLUTION FOR A TRAIT-BASED APPROACH TO BIOMONITORING USING A GENUS OF BLACK FLIES (DIPTERA: SIMULIDAE: *SIMULIUM*)

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Determining a proper taxonomic resolution is important for bioassessment methods to balance the assessment needs most effectively against effort and funding. I compared efficiencies of species-level versus genus-level resolution to distinguish land use gradients based on the functional structure of black fly assemblages. Black fly qualitative samples were collected from 25 sites and identified to the species level. A total of 86 trait categories of 16 biological and ecological traits were compiled for 16 black fly species. Overall functional diversity distinguished semi-natural sites from the impaired sites. For individual trait categories, no biological traits differed significantly, but some ecological traits related to habitat association and saprobity were significantly different among different level of land-use intensity sites. Species-level resolution provides more information than genus-level, but does not improve discrimination of levels of land-use impacts.

Key words: *functional diversity, traits, bioassessment and species-level resolution*

(RT5) FRESHWATER ECOLOGY IN THE VLADIVOSTOK STATE UNIVERSITY OF ECONOMICS AND SERVICE

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The Department of Ecology and Environmental Management of Vladivostok State University of Economics and Service (VSUES) conducts during 18 years the preparation of students in specialties "Ecology" and "Ecology and Environmental Management". For successful employment of students we orient them to different areas within mega-science Ecology – theoretical and applied ecology, production environmental control at the entity, environmental assessment and audit, environmental management and environmental protection, inventories of natural resources, research activities, *etc*.

Since 2014 at the VSUES the applied-integrated training program for students (AITP) is entered. Its essence is that the student spends 6–7 months of senior class at the entity or research institution where they can improve and expand the knowledge obtained in the University. Two years later it was realized that AITP is very effective system: the work in real conditions lets students receive many practical skills demanded by modern science and production. Quite often, the students-probationers, are beginning to get some salary and then, the offer to work. It should be noted that AITP imposes increased requirements to quality of training of the student-probationer and also to the University departments which should develop wide and strong connections with entities where students would be able to receive real skills of professional job.

We have begun training of our student in freshwater ecology with series of lectures within The Invited Speakers Program. Such invited speaker already many years is T.S. Vshivkova, the senior researcher of .the Laboratory of Freshwater Hydrobiology, Institute of Biology and Soil Science FEB RAS. Other form of interaction was the School of Environmental Monitoring which is carrying out by T.S. Vshivkova in VSUES since 2010. To teach students the bases of freshwater ecology a special course of lectures and practical master classes "Freshwater Monitoring" was created by her especially for our Department. As a result some students have expressed big desire to specialize in the field of freshwater ecology and have prepared diplomas and term papers in this branch of ecology. Other result of successful introduction of freshwater ecology into scientific and educational activities of our University was the organization of the XIV International Symposium on Trichoptera in 2012 by VSUES and IBSS FEB RAS together. The University and academic science opened the doors not only for professional hydrobiologist of the world, but also for students, seniors and teachers of Primorye.

Key words: *education, freshwater ecology, applied-integrated training program for students*

(RT6) ECOLOGICAL PROJECT "ISLAND OF DREAM"

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In 2014 the ecological project "Island of Dream" was created by the initiative group of island tourism funs. The object of its implementation is the Reyneke Island. There is no a system of storage and export of waste in this island though the island is inhabited and belongs to Pervomaysky district of Vladivostok city. The cottages, recreation facilities, shops are in the island and, in addition, every summer the island visits a large number of tourists: over 4000 thousand people. The project is directed to liquidation of spontaneous dumps of garbage, promoting of technology of the selective garbage collection and conversion of waste, and also to increase of ecological literacy and attention of local people, tourists, representatives of business and administration to preserving purity and beauty of seaside islands. The Project participants: volunteers are residents of Primorsky Krai.

The main Project tasks: investigation of garbage dumps, cleaning, improving and gardening of the territory, collection and sorting of garbage, search and liquidation of buried trash, export of the sorted raw materials to the continent for conversion and utilization. By now 7 special "cleaning days", ten ecotours during 10 weekends, two nature protection camps "Seaside Island Volunteer Service" on Reyneke's island were organized.

About 4000 bags of the sorted garbage were taken out, 40 % of plastic, glass, aluminum have gone to processing, and the other part – to the complete utilization. 1500 ecological booklets were prepared and distributed, 10 boards with useful information are established. On the places of the former dumps the trees and shrubs were planted or some art objects are established.

The ecological damage caused to the island for many years is very big: in many places the soil almost completely consists of the garbage overgrown with a grass and a bush. The ecoproject favorably affects the island improves territory and marine coast. Thanks to increase of public ecological literacy, it is possible to avoid emergence of new ecological problems. The dumps deleted during the previous shares were not filled with new garbage, on these places the flowers and grass appeared. Taking into account the increasing of tourist business and the developing of farming it is obvious that our activities need to be continued and expanded.

Key words: *island trash, seashore cleaning, ecological education, voluntaries activity*

(P41) THE TRACE AND PATTERN OF LONGITUDINAL VEINS AT MAYFLY WINGBASE (INSECTA: EPHEMEROPTERA)

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The extant mayfly wingbase is sclerotized heavily and thickly in most cases, this hides the trace and trend of longitudinal veins which are very important to phylogeny and evolution of Ephemeroptera. Fortunately, some Chinese species in the genera *Siphluriscus*, *Siphlonurus*, *Ephemera* show clearly main points of them and a primitive pattern. It includes ScA is originally independent from C, R_1 and Rs have common stem but they bifurcate very basally. MA and MP also share single base stem. The stems of R and M either fused or run along closely at base. The fusion between Rs and MA is derived. CuA and CuP has a relatively long and strongly curved base which is always independant. Furthermore, the hindwing of *Siphlonurus davidi* has very clear and broad anal portion. In contrast, the wing of dragonfly has narrowed wingbase and M fusing with Cu. The ground-plan of mayfly wing is similar to Neoptera rather than Odonata.

Key words: *mayfly, wings, veins, evolution, China*

(O61) FEEDING OF *MESENCHYTRAEUS BUNGEI* MICHAELSEN – DOMINANT ENDEMIC ENCHYTRAEID (OLIGOCHAETA) IN LAKE BAIKAL SPLASH ZONE

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Baikal oligochaetes have been studied for about 100 years and the species list consists of over 200 species (Semernoy, 2004). Though one cannot state this difficult and outstanding invertebrate group is thoroughly investigated in terms of their ecology. Baikal oligochaetes' life cycles, features of the trophism and respiration are almost unknown.

The family Enchytraeidae is one of the most insufficiently known families of oligochaetes in Lake Baikal. Up to date, only two species have been described for the whole lake (Semernoy, 2004). It is surprising because enchytraeids are typical of freshwater habitats (Timm, 1996). Recently we have started an investigation of newly determined zone in Lake Baikal – splash zone (Timoshkin *et al*., 2011). Enchytraeids are common inhabitants of marine and lakes coastal zone where they are recorded in a huge mass (Dózsa-Farcas, 1998; Giere, 2009). Lake Baikal is not an exception: we found out the only one endemic species of Enchytraeidae, *Mesenchytraeus bungei* Michaelsen, 1901, dominates in abundance (92 % of total number) in splash zone Oligochaeta community of Lake Baikal (Zvereva *et al*., 2012). It swarms in detritus accumulated on the shores. *M. bungei* predominance indicates the species significant role in the lake ecosystem functioning; therefore, we have begun studying of its feeding. Feeding of *M. bungei* was studied by means of its pellets content examination. We collected worms in Bolshie Koty Bay (Southern Baikal) in different seasons of 2010–2012 and 2015. We examined only mature worms of the largest size group (3–4 cm long), 207 *M. bungei* specimens in total. They were kept in Petri dishes with 3 ml of bottled Baikal water in the fridge individually for 24 h. Then pellets from the dishes were used for the preparation of slides. We examined the slides under a microscope and estimated the percentage contribution of each food component in 10–20 microscopic fields per slide. We obtained the results on *M. bungei* feeding in terms of seasonality in different years. Diverse components in different ratio were found during the whole period of investigation, namely green algae (*Ulothrix zonata*, *Tetraspora cylindrica*, Cladophoraceae, *Spirogyra* sp.), higher plants debris (particularly, coniferous needles remains), diatoms (*Didymosphenia*, *Cocconeis*, *Hannaea*, *Cymbella*, *Navicula*, *Fragilaria*, *Synedra*, *Aulacoseira*), and varying animals remains (chitinous exoskeletons of crustaceans, oligochaetes, and insects). Some minor components, such as Cyanophyta, sponge spicules, pollen and colonial green algae, were also found. We subdivided all the content of pellets into plant and animal material, unidentified matter and soil particles and counted their percentage. Plant material appeared to be a dominant component (up to 55 %) in almost all seasons, whereas animal component rarely amounted to more than 30 %. Our analysis showed that *M. bungei* is a detritophage with a preference to phytogenous detritus. We also suggest a preference to filamentous green algae (particularly to *U. zonata*) for this oligochaete especially in early summer. Our research supposed to be logically continued studying the stable isotopes content of *M. bungei* to specify its trophic status. Usually it is difficult to interpret stable isotopes data without information on ecology of feeding. Our results may be regarded as the first data on feeding of Baikal enchytraeids.

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Key words: *Oligochaeta, Enchytraeidae, Mesenchytraeus bungei, Lake Baikal, feeding, splash zone*

VISITING PROFESSORS LECTURES "GOLDEN BENTHOLOGICAL WEEK" (EDUCATIONAL PROGRAM)

(VP1) HOW TO EVALUATE ECOLOGICAL STREAM HEALTH USING FISH BIOMARKERS AND BIOINDICATORS?

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Ecosystem health monitoring methodology in Korean government is developing for extensive evaluations and diagnosis of current ecological health of nationwide stream and river watersheds. The methodology was based on levels of fish community, but this presentation goes further extending up to physiological assays and the DNA levels of fish for the evaluations of stream ecosystem health. This is so called “ an Integrative Approach for Ecological Stream Health Assessments (IAESHAs)”. The method of IAESHAs was applied to a stream ecosystem using a multi-level organization from molecular level of biomarkers to community levels of bioindicators along with analysis of physical and chemical stressors. Water quality parameters of BOD, COD, TN, and TP *etc.* were measured and physical habitat health, based on Qualitative Habitat Evaluation Index (QHEI) model were analyzed. Also, Ecological stream health model, based on index of biological integrity (IBI) by fish assemblage, was developed for regional assessments and then applied to the stream. Six metric attributes of original 11 metrics were modified for a development of the model. Biomarkers of comet assay, blood chemistry, physiological parameters, and bioindicators such as organismal-, population-, community- level parameters were evaluated in this study along with eco-toxicity tests. Some stations impaired (stressed) in terms of stream health were identified by the IBI approach and also major key stressors affecting the health were identified using BOD, TN, TP, physical habitat evaluation, and eco-toxicity tests. The assessment approach of integrative ecological stream health would be used as a key tool for ecological restorations and species conservations in the degraded stream ecosystems and applied for elucidating major causes of ecological disturbances. Ultimately, this approach provides us an effective management strategy of stream ecosystems through establishments of ecological networks in various watersheds.

Key words: *ecosystem health; biomarker, bioindicator, multi-metric approach; fish, stream health*

(VP2) **HOW TO MONITOR FISH IN FISHWAYS?**

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The major objective of this research was to analyze ecological impacts of fish movements and migrations after the constructions of weirs and fishways as a part of the "National River Restoration (NRR) Project" in Korean government. I introduce various fish monitoring methodologies developed for an evaluation of fish migration impacts in fishways during 2011–2014. Also, some physical, chemical, and biological impacts, based on serial discontinuity concepts (SDCs) are introduced in this lecture, and the results of fish monitoring and field surveys in Korea are demonstrated. The specific targets of our research are summarized as follows. First, fish species distribution and compositions were evaluated in the tributaries and mainstem sites of Yeongsan-River watershed after the completion of the fishway and weir constructions in 2011. Second, the impacts of fish migrations and fish passage in fishways and weirs are discussed. Third, I traced the passage of migratory and non-migratory fishes using various fish tracking methodologies including Passive Integrated Transpondents (PITs) tags, ultrasonic telemetry, video recording, trap-setting, and ultra eco-sounder monitoring approaches, and evaluated some impacts of the weir/fishway constructions. Lastly, I established a "National Protocol of Fish Monitoring Methodology in Korean Fishways" for the surveys of the weirs and fishways in Korea. This research is just finished in December 2014. These outcomes are preliminary results now, but will contribute to ecological conservation of rivers and streams with weirs or fishways in Korea after the completion of our research.

Key words: *fishway, fish monitoring methodology, weir, fish migration*

(VP3) **APPLIED ECOLOGY IN RESTORATION AND MITIGATION SITES IN SOUTHERN CALIFORNIA**

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Compensatory mitigation is a means in the United States through which, when agreed to by regulatory agencies, a wetland or upland habitat may be "taken" – or removed – with the legal requirement of replacing the habitat eliminated by creating "compensatory" replacement habitat. The ratio of habitat eliminated to newly created habitat recreations varies greatly depending upon the rarity of the habitat and other factors, but in general the ratio of creation to take ranges between 3:1 and 10:1. In California this is critical because an estimated 91 percent of natural wetlands have been eliminated, so replacement is crucial. The ratio of creation to take is substantive because of the difficulty in creating true replacement habitats of the same quality of the original site, and the tendancy of mitigations to deteriorate and be poor replicates over time. Mitigation habitat replacement projects have a five year stair step of performance criteria they must meet, but after that time if they fulfill the achievement requirements, they will be signed off or authorized, and no further maintenance or other responsibility follows the developer. This concept is controversial and will be reviewed in the presentation, using a specific relatively successful case as an example.

The University of California Natural Reserve System's San Joaquin Marsh is a 202-acre site adjacent to the University of California, Irvine campus. In 1999 a 46-acre sequence of eleven ponds, a settling pond, and a pump station along the adjacent San Diego Creek flood control channel were created as Phase 1 of the Reserve's restoration plan. This highly successful project produced a sequence of "Experimental Ponds" including four pairs of matched ponds that are heavily used for teaching, as well as research. In 2009 a second phase of restoration efforts was initiated as mitigation compliance for a private developer partner. This element of the plan focused upon removing over 3000 feet of roads/levees in the Middle Marsh, adjacent to the Experimental Pond sequence, and the installation of new water control structures. Because of a remarkable Pacific Pond Turtle population of over 200 individuals, special precautions had to be employed during the road removal process. As mitigation for habitat taken along the road and levee edges, 1.87 acres of riparian habitat were created as a peripheral complement to the Upper and Middle Marsh areas, and 2.91 acres of new wetlands were established through the removal of road footprints. In 2014, the fifth year of the project was completed. Removal of unneeded infrastructure, in this case duplicate roads and levees, is the only way that sites like the UCNRS San Joaquin Marsh Reserve can increase their wetland acreage. Efforts like this encourage other Reserves and preserved sites to carefully scrutinize their infrastructure as a possibility for replacement with habitat.

Key words: *compensatory mitigation, UC Natural Reserve System San Joaquin Marsh Reserve*

(VP4) ENVIRONMENTAL EDUCATION: WHAT ECOLOGISTS NEED TO KNOW ABOUT COMMON POLLUTANTS AND THEIR HEALTH EFFECTS

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This presentation covers the broad concepts and principles used in organizing and assessing major environmental health problems associated with exposure to pollutants. An assessment of human health and the environment is used to establish safe levels in water, air, soil and food. Both quantitative and qualitative approaches to characterizing and controlling environmental pathways between contaminants and human receptors are used to develop risks to human health.

An overview of the following will be provided:

- common sources (*e.g.*, industrial accident, leaking tank),
- pollutant categories (*e.g.*, heavy metals, petroleum hydrocarbons, chlorinated hydrocarbons, radionuclides),
- exposure pathways (*e.g.*, inhalation, ingestion, dermal),
- toxic response factors (*e.g.*, exposure duration, age of target species) and
- health effects (*e.g.*, liver cancer and chloroform; neurotoxicity of lead and mercury).

Scientists working in ecology will develop awareness of common pollutant sources and categories, exposure pathways, and human health effects. Parallels between ecological degradation/persistence and human metabolism/bioaccumulation will be made.

The presentation is based on university courses and workshops that have been conducted at universities including the United States, Russia, Armenia, Bangladesh, and the Philippines and at 16 Department of Energy sites in the US.

Key words: *environmental health, exposure pathways, pollution*

(VP5) PROBLEMS OF CONSERVATION OF BIOLOGICAL DIVERSITY IN AQUATIC ECOSYSTEMS OF THE CENTRAL CAUCASUS

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The Caucasian region is of special interest for variety study the reophilic macrozoobenthos communities. The first researches conducted in the Terek River basin (Central Caucasus Mountains) had originally the application-oriented character (the estimation of the natural fish food supply of small agricultural reservoirs) and nowadays it is oriented also to problems of study and conservation of freshwater biodiversity of the region. By now the taxonomic revision of some key amphibiotic orders such as Trichoptera, Ephemeroptera, Plecoptera, Odonata, Heteroptera, Coleoptera have completed.

The northern slopes of Central Caucasus Mountains possess considerable resources of surface and underground water. The complicated crossed relief is characterized by obvious vertical zonation, variety of the microclimatic and soil factors which form different natural complexes and various landscapes. Thereby the region is very attractive both for the agriculture and industry, and for the recreation. The organization of the resorts, recreation areas and the touristic centers leads together with developing of industry lead to excessive anthropogenous influence and increasing impact on the water ecosystems. Well-organized ecological monitoring of freshwater ecosystems will help to control their condition and effectively manage them. The bioassessment with using of indicator organisms such as very sensitive amphibiotic insects can play a key role for quick and adequate estimation of water quality.

The invertebrate fauna of small streams and springs is represented by more than 500 species, the most of them are representatives of stoneflies, mayflies, caddisflies, beetles and dipterans, the latter group is more diverse (about 50 % of total aquatic species composition). The classification of the North Caucasus streams and their reaches are carried out on the base of species composition and structure of bottom communities.

Key words: *amphibiotic insects, freshwater ecosystems, bioassessment, anthropogenic influence*

(VP6) RECENT CHALLENGES OF BIODIVERSITY CONSERVATION: EXAMPLES OF NATIVE ECOSYSTEMS ON ISLANDS AND SUBURBAN ECOSYSTEMS ON MAINLAND IN JAPAN

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The major factors currently driving biodiversity loss are habitat destruction by human activity (*e.g.* forest cutting) and invasion of nonnative species. However, effects of these disturbances differ depending on the ecosystem. Thus, ecosystem managements without considering characteristics of the focal ecosystem may cause unexpected decline of the ecosystem.

First, I show examples of ecosystem of which species diversity is maintained by moderate level of disturbances caused by human activity under traditional Japanese culture. In such ecosystem, it is required to keep moderate level of disturbances for proper managements of the ecosystem. A decrease of disturbance increases the level of interspecific competition yielding extinction of competitively inferior species.

Second, I provide some examples of native ecosystems of which species diversity is partially maintained by positive effects of nonnative species. Impacts of nonnative species are particularly serious in isolated islands and lakes. Nonnative predators often cause serious extinction of endemic species of the islands and lakes. However, invasions of multiple nonnative species often produce complex networks of interactions among species including both native and nonnative species. For examples, nonnative top predators such as federal cats mitigate impacts of other nonnative predators such as black rats on native plants, insects and snails. In such systems, eradication of federal cats causes increase of black rats resulting in decrease of native species. This sort of mesopredator release effect is included in also lake ecosystems. For examples, eradication of nonnative predatory fishes yields increase of cray fishes resulting in decline of freshwater vegetation and insect fauna. In addition, vegetation of nonnative plants may mitigate impacts of nonnative predators on native prey species. Thick and dense litter of nonnative Casuarina trees provides habitats for native land snails and, at the same time, it protects snails from predation by nonnative rats.

These examples of complex interaction among human activity, nonnative species and native species suggest that conservation program should be carefully designed incorporating information of interaction among species. I provide some examples of conservation programs of native ecosystems considering positive effects of nonnative species. I show that designing and planning conservation projects based on adaptive managements are essential for appropriate conservation of biological diversity.

Key words: *biodiversity, ecosystems, nonnative species, human activity, conservation programs*

(VP7) FRESHWATER MONITORING IN MONGOLIA

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Freshwater ecosystems of Mongolia are subject to increasing and multiplying threats, including overgrazing, dams and irrigation systems, mining and gravel extraction, climate change impact and lack of water management policies and institutional framework. Freshwater biomonitoring is being carried out through the National Institute of Meteorology and Hydrology, Ulaanbaatar. The main purposes are to investigate the biodiversity of streams and lakes and to compare and evaluate water quality and ecology.
The important role in the freshwater monitoring play aquatic insects as they are very sensitive even to low water pollution.

Aquatic insect research in Mongolia is currently carried out at the National Institute of Meteorology and Hydrology and the Mongolian Academy of Sciences, and supported by the World Bank and the United States National Science Foundation (NSF) Biotic Surveys and Inventories Program.

Key words: *water pollution, freshwater bioassessment, aquatic insects*

(VP8) MECHANISMS OF COMMUNICATION IN AQUATIC AND AMPHIBIOTIC INSECTS

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Aquatic and amphibiotic insects use various signals for the intraspecific communication. Communication includes emitter of the signal, transmitting medium, and receiver if the signal. Usually these signals are used for attraction of mates or aggregation, although the aggressive signaling is also reported. The most ancient insect orders, Ephemeroptera and Odonata, use the visual stimuli for communication. Swarming males of mayflies rely upon their developed eyes for the female search and recognition. The territorial dragonflies and damselflies use the specific flight manner and coloration of wings and body as information sources for gender and species recognition. Among the Neopterous insects, the stone-flies (Plecoptera) have male drumming signals produced to attract the females. The aquatic Heteroptera are reported to use stridulation for producing sound signals underwater (Corixidae), and ripple communication is known in water striders (Gerridae) and giant water bugs (Belostomatidae). Communication in water beetles is poorly studied; ripples are supposed to be the principle communication channel in Gyrinidae, and other aquatic beetles should use the chemocommunication for the sex attraction and species recognition. Species of Megaloptera (Sialidae) use vibrations produced by males in their mating behavior just before copulation. Similar vibration were also reported for the amphibiotic Neuroptera (Sisyridae). The amphibiotic Diptera are well known for the swarming behavior in many Culicidae and Chironomidae. Large swarms of males use the sounds of wings for the species discrimination and general orientation in swarms; sounds also were reported as important stimuli for advanced Brachycera, so this acoustic communication might be a part of the Diptera ground plan. Communication of caddisflies (Trichoptera) is especially diverse. Larvae of some caddisflies (Hydropsychidae) use stridulation to protect their nets in water. Behavior of adults including pheromone, vibratory, visual, and tactile stimuli. These signals can be used simultaneously during mating. Evolution of the Trichoptera communication includes the gradual abandon and pheromones and vibrations and transition to visual stimuli caused probably by the pheromone saturation at high population density in some species.

Key words: *signal mechanisms, behavior, chemocommunication, stridulation, drumming*

(VP9) PHYLOGEOGRAPHY OF AQUATIC INSECTS IN EAST ASIA

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Asia is a region in the world boasting the highest levels of biota diversity. Factors contributing toward this include elements such as those listed: an altitude differential of nearly 9000 m, the presence of the "Asian Monsoon" climate derived from the Himalayan Mountains, the resultant abundant water environment especially in East Asia, the presence of multiple rivers of a globally significant scale, the intersections of several tectonic plates, hence the intense crustal environment, a fused biota derived from species originating from Gondwana and Laurasia, diverse island environments, and so forth. As a function of these factors interacting in a complex manner, multiple biomes have been become established throughout the Asian region. In this presentation, I would like to focus and discuss in particular on the biodiversity of the Japanese Islands which exhibit an extremely high degree of biodiversity for such a small island group.

The Japanese Islands are often referred to as a global hot spot region of biodiversity. With regard to species diversity, insects are no exception. To date, more than 30000 insect species have been identified in Japan, and yet around 100000 species of insects are considered to inhabit in this country. In my lecture, I outline background factors contributing to the degree of diversification in the Japanese insect fauna. Of course, the high degree of Japan's insect diversity is perpetuated as a result of many complex factors. Among these factors, the humid Asian monsoon climate and the geography that stretches out from north to south are important factors. Furthermore, the relevance of the extremely complex geological history is believed to be especially important. In particular, the independent origin of northeastern and southwestern Japan from the Eurasian Continent must have also contributed greatly to the establishment of biodiversity. In view of these circumstances, we introduce several case studies focusing on aquatic insects with low dispersal ability. In addition, we investigate the phenomenon of genetic differentiation and species differentiation deeply associated with the geological history of Japan. These selected species offer high potential to effectively investigate various evolutionary issues. That is, they are one of the typical "key taxa" in terms of phylogeography and evolutionary biology.

Key words: *Asia, biodiversity, molecular phylogeny, biogeography*

(VP10) ECOLOGICAL RESTORATION AND WATER MANAGEMENT STRATEGIES TO IMPROVE THE RIVER AND LAKE ECOSYSTEM IN REPUBLIC OF KOREA

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Since 1970s, South Korea has achieved a tremendous economic development as compressed growth and according to the industrialization and urbanization, supplying water for industry and living has been remarkably increased. Accordingly, multi-purpose dams have been developed for required water supply and 18 multi-purpose dams are under management at present in South Korea.

So far water quality environmental policy focus on preventing point pollution sources such as domestic sewage, industrial waste water. Also, due to the continuous occurrence of water quality accidents in large rivers during 1980s and 1990s, water management has caught people's attention and thus the government also expanded environmental organization and established short and long-term's water management policy, spending more money on water resource policy.

Despite a lot of efforts to preserve the water quality of rivers and lakes, there still exists a problem to be solved such as algae bloom, which is the result of an excess of nutrients. Recently, water quality management on rivers and lakes focus on nonpoint sources (NPS) since NPS is the leading cause of water quality deterioration. This happens in other countries around the world so that a new approach is needed to control NPS pollution. In South Korea, river and stream ecosystems have been significantly transformed through 4 rivers restoration project (2009–2012) and this is an issue that many researchers are debating. In particular, ecosystem has changed related to increase in the population of diatom and blue green algae during drought and summer seasons that have been caused a problem in terms of water usage. Especially, the environmental consequences of dam construction are numerous in terms of biological, chemical and physical properties of rivers and thus environmental impact assessment on restoration of ecosystem become important. Hence, a diverse approach has been applied to manage water resource, conserve ecosystem and preserve water quality in lakes.

Consequently, there is a need an application of management technique for restoring ecological structure and function of river, providing habitat and improving biological diversity, recovering river health, and maintaining of water usage and control. In this view point, an ecological restoration projects should be continuously carried out for recovering the health of aquatic ecosystem and providing a leisure space to public.

In this talk, several technique and application case studies of ecological restoration in South Korea are presented in the context of pre-and post-ecological impact due to the dam construction. Through the seminar, we can think and suggest water management strategies for Best Management Practices (BMPs) for water conservation and ecological restoration of rivers and lakes.

Key words: *environmental impact, water quality management, ecological restoration, algae control*

(VP11) ENVIRONMENTAL REMEDIATION PROJECTS: LESSONS LEARNED IN RUSSIA, KYRGYZSTAN, ARMENIA, IDAHO AND NIGERIA

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Mining and mineral processing are large sources of air and water pollution in the world. Globally, active mines, smelting, recycling, abandoned wastes and factories contaminate surface and subsurface water supplies and poison millions of children. In the USA, more than thirty years of aggressive public health programs have largely eliminated childhood lead poisoning due to mining/smelting, through strict polluter-pay cleanup policies. However, most USA industry has relocated to countries with less stringent pollution control laws. Today the world uses more lead, more children are poisoned, and the effects are more severe; with children dying of lead poisoning at rates not seen in the 20th century.

One of the largest cleanups in the USA has been ongoing at the abandoned Bunker Hill Company smelting complex in Idaho for 40 years. In 1995, a collaborative research project was undertaken between the University of Idaho, a private USA engineering company (TerraGraphics), and Far Eastern University to exchange Russian and USA investigation and remediation experiences at a similar mining/smelting operation in Dalnegorsk/Rudnaya Pristan in Primorski Krai. In 2005, a joint research/development program was established to adapt USA remediation techniques to other countries capabilities and implement cleanups through existing in-country institutions employing local staff, labor, and materials. In 2007, the first cleanup was implemented at Dalnegorsk/Rudnaya Pristan, based on the two universities' research efforts and TerraGraphics' remediation experience. Subsequently, progressively complex projects have been undertaken in collaboration with international NGOs at metals poisoning sites in the Dominican Republic, rural China, Senegal, and Nigeria. The Nigerian cleanup addressed an unprecedented epidemic in which more than 400 children died of acute lead poisoning and is the largest cleanup effort in Africa.

In 2012, TerraGraphics International Foundation (TIFO) was established as non-profit humanitarian NGO assisting communities in developing countries to address environmental health issues due to mining activities. TIFO continues to work in Nigeria and workshops and smaller collaborations have been conducted in Armenia, Kyrgyzstan, Bangladesh, Mongolia, and Peru. The success of the cleanup model in all countries requires community and government engagement, overcoming industry and bureaucratic resistance, adaptation of technical protocols and training to local cultural/socio-economic practices, and development of project ownership.

Key words: *environmental remediation, mining, pollution*

(VP12) FRESHWATER RESOURCES OF SOUTH ASIA: CHALLENGES AND PROSPECTS FOR FUTURE DEVELOPMENT

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South Asia countries comprise of India, Pakistan, Afghanistan, Nepal, Bhutan, Bangladesh, Sri Lanka, and Maldives. The basic details about their geographical features, population and freshwater resources found in them will be discussed. The importance of co-operation between South Asian countries and the establishment of South Asian Association for Regional Co-operation (SAARC) is highlighted. An idea will be given on the major rivers and other freshwater sources of these countries. The present statues of research in freshwater biology in South Asia will be highlighted. The prospects for future development in freshwater studies in South Asia and the need for the co-operation between all Asian countries to from a network are stressed.

Key words: *South Asia, freshwater resources, SAARC*

(VP13) LIVELIHOOD SECURITY OPTIONS OF THE NATIVE PEOPLE ASSOCIATED WITH FRESHWATER SYSTEMS OF TROPICAL SOUTH ASIA

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The tropical freshwater systems including wetlands represent a rich natural resource pool, which offer livelihood security to the local people in South Asian countries, at the same as providing indispensable ecosystem services. Freshwater bodies such as ponds, lakes and rivers of the tropical region are rich in nutrients and provide good habitat for phytoplanktons and zooplanktons. These ecosystems are habitats to several reptiles, amphibians and around 41 % of the world's fishes. Wetlands on the other hand harbor a wide variety of plants, animals, fishes and micro-organisms. The native people depend on these ecosystem goods and services for sustenance and economic gains. The major occupations associated with these systems are fishing, agriculture, and collection of natural resources of economic importance. Freshwater fishery resources are of great importance to the region, as it provides for the requirements of much needed cheap animal proteins for the people, at the same time as fetching good price in the market. Ponds and reservoirs provide an ideal setting for fish farming and floriculture. Rice cultivation in the flooded fields and its integration with fish farming are traditionally practiced. Agroforestry, with integration of pisciculture, floriculture, medicinal plant cultivation, duck and buffalo rearing, *etc.* is another notable land use system of practice, providing livelihood enhancement to local people. Further, the wetlands, riverine belts and fringe areas of reservoirs provide several floral resources of economic importance. These include fibres, medicinal plants, fodder, fruits, vegetables, oil seeds and dyes, all contributing to livelihood security.

Key words: *freshwater systems, tropical South Asia*

(VP14) NEMATODE COMMUNITIES PROVIDE A USEFUL TOOL FOR BIOMONITORING OF THE MEKONG ESTUARINE SYSTEM

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The Mekong Delta is the key region in Vietnam for economic development mainly in agriculture and aquaculture, since the area has a high annual production for domestic use and also for export. The economical importance of this area is thanks to the great Mekong River, that provides water and fertile alluvium for the delta. The economic development increased very fast in recent decades and it influenced strongly the environment, in particular the estuarine ecosystem since it is sensitive to impact. Moreover, the Mekong estuarine system is expected to be seriously impacted by climate changes and sea level rise as well as the lack of freshwater supply from upstream due to the construction of numerous hydropower dams for energy. Therefore, this area was especially paid attention to by the government and scientists in order to identify a better strategy for sustainable development.

Baseline information on nematode communities in the Mekong delta can be applied in environmental monitoring, and possibly also in more advanced studies for better understanding of the estuarine ecology. Nematode communities in 8 Mekong estuaries were investigated during the dry season. The aim of the study was to identify the structure and the diversity of the communities in relation to the main environmental characteristics. In each estuary, 3 to 4 intertidal sampling stations were identified at regular distances from the mouth to up to 45 km land inward. The nematode communities showed a strong correlation with sediment composition and to a lesser degree with chlorophyll *a* concentrations. Multivariate analysis resulted in the identification of 4 types of communities. We identified two types of *Desmodora* communities in the sandy mouth stations and two types of *Parodontophora* communities in the silty sand stations. One of the silt associated communities showed a preference for higher chlorophyll *a* concentrations, resulting in higher densities and higher diversity, mainly of monhysterid species. Because of the strong association between community structure and sediment composition, nematodes are a meaningful tool for monitoring changes in their environment. In case their community deviates from what is expected based on sediment it may serve as an early warning for disturbance.

With this study we increased our understanding of meiobenthic ecology of an important area such as the Mekong estuarine system, since this work is the first comprehensive study dealing with meiobenthos and nematode communities in this area. The methodology and approach in this work was traditional but provided important ecological information on nematodes at the community level. This work generated a momentum to strengthen our researches going further into the ecology of free living marine nematodes in this area, but also to further develop a biomonitoring program for the area. In this research, it was found that nematode characters and communities structure expressed to a great extent the ecological conditions in the Mekong estuarine area. Moreover, since the seasonal variation in nematode communities in the Mekong estuarine area is rather low, it supports the idea of using them as bioindicator for environmental monitoring. Other advantages of using nematodes as a tool for environmental monitoring in the Mekong delta is that they are relatively easily sampled and sorted, although identification at genus level needs expert training. Therefore, we conclude that nematodes can be used as a bioindicator which provide a powerful tool in environmental monitoring program in the Mekong estuaries.

Keywords: *Nematode communities, Desmodora, Paradontophora, environment, Mekong estuary, biomonitoring*

(VP15) STRUCTURE AND FUNCTION OF STREAM ECOSYSTEMS

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General functional, interrelated components are clarified on examples of Asian stream ecosystems. The modern methods of structural and functional characteristics of bottom communities and criteria of estimation of invertebrate communities ecological state are observed and discussed.

Key words: *benthic invertebrates, bottom communities, structure and fuction*

(VP16) TROPHIC RELATIONSHIPS IN STREAMS

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The lecture reviews some trophic patterns of Asian streams. The food resources availability, the relationship between production and importation, the establishment of feeding guilds, and the patterns of trophic structure of macroinvertebrate communities, with a particular emphasis on food webs, are discussed. The following aspects are emphasized: the importance of allochthonous material input to the aquatic system; the importance of detritus and algae as a link between the detritus and the grazing chain; the spatial and temporal variation in the trophic structure. The main achievements in trophic ecology of streams are discussed.

Key words: *trophic structure, stream, macroinvertebrates, functional feeding groups*

(VP17) THE FRESHWATER ECOLOGY IN CHINA

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Freshwater ecology is one of the most important aspects of ecology research. Freshwater ecology shared basic theories, technologies, and management of biodiversity conservation, water environmental restoration and water resources sustainability in rivers, lakes and reservoirs. Currently, most of the lakes suffered severe water contamination and eutrophication in the mainland of China. Meanwhile, the other human activities and global weather changes also affected the freshwater ecosystems dramatically during the last few decades with rapid increasing of economic development and urbanization. In considering the continue development and future challenges, ecosystem protection and restoration has been acted as the national development protocol. The opportunity and challenge for freshwater ecosystems protection would continually ask for the theoretical and technological applications. The freshwater ecology committee was officially established under the ecological society of China.

However, the freshwater ecology studies of China originated from limnology and fisheries researches. So not only the theoretical depth of lentic and lotic ecosystems, but also the research objects among phytoplankton, zooplankton, benthic algae, macroinvertebrate and fish communities were different. With supports of the critical patented projects in the control and management of the national polluted water bodies, the theoretical development and technological applications for freshwater ecosystems protection and restoration increased rapidly during the last ten years, especially for the lotic ecosystem. However, the gaps between the application needs and stores of knowledge also encouraged more research projects of freshwater ecosystems. With further hard working from both freshwater ecologists and management authorities, we optimistically expect the continue recovery of freshwater ecosystem health for the most contaminated water bodies during the next decade.

Key words: *freshwater ecology, MEP, MWR, lentic and lotic ecosystems*

(VP18) THE NATIONAL RIVER HEALTH PROGRAMS BY USING BIOLOGICAL INDICATORS FROM MINISTRY OF ENVIRONMENTAL PROTECTION AND MINISTRY OF WATER RESOURCES, CHINA

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Bioassessment has become a hot topic and could provide important information for river management and restoration. During the last ten years, both Ministry of Environmental Protection (MEP) and Ministry of Water Resources (MWR) try to develop multiple biological indices using different categories of aquatic organisms. Traditionally, MEP was mainly in charge of water environmental management, and MWR was mainly in charge of water resource management. Biological indicators of benthic algae, macroinvertebrates and fish communities were recommended to use for the river health assessment of two ministries. The main steps for development of multiple biological indices were similarly including the selection of sensitive indices, optimization of core indices, setting target and critical values for core indices, and calculation of final scores of health condition. MEP prefers to use same core indicators for accurately comparing among different watershed. However, MWR prefers to assess the river health condition using local biological indicators for accurately assessment. River health condition scores were assigned to five categories of critical, bad, fair, good, and excellent. The differences between two methods would not be discussed. The most important thing is that both of ministries begin to consider using biological indicators for the further river management. Thus, we optimistically expect that multiple biological indices would be used to integrate the management of water resources, water environment, and ecosystems and restoration strategies.

Key words: *river health assessment; multiple biological index; bioassessment; target and critical values; management, MEP, MWR*

(VP19) HYDROBIOLOGICAL MONITORING IN KAZAKHSTAN

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The hydrobiological service of surface waters has been created in Kazakhstan in 1975 as a subsystem of the Federal Service of the Environmental Monitoring and Control in Kazakhstan and have been carried out by the Hydrometeorological Service. By 1990 the rivers and lakes of Ural, Irtysh, Ili, Syr Darya river basins, and also rivers of drainless regions of the Central Kazakhstan have been covered by the researches. Hydrobiological supervision included researches of bacteria- and phytoplankton, periphyton, zooplankton, and macrozoobenthos. By now the network of the regular hydrobiological monitoring performed by the hydrometeorological service covers lakes and rivers of the East Kazakhstan (the Irtysh River basin) and Karagandinsky (the Lake Balkhash and the drainless rivers of the Central Kazakhstan) regions. Regular study of the aquatic biota of lakes and rivers is performed also within the production environmental monitoring for the determination of fish catch limits. In recent years the works directed to widening of a network of hydrobiological monitoring on transboundary water objects have been carrying out.

The main document regulating hydrobiological monitoring is the Ecological Code which contains not only legislative, but also methodological and methodical guides. Some aspects of hydrobiological monitoring are in the Instructions, Rules and other documents which are developed according to the Ecological Code.

Key words: *freshwater ecological monitoring, Kazakhstan*

(VP20) SOME EXAMPLES OF SIMPLE KEYS AND ILLUSTRATION OF AQUATIC INSECTS OF JAPAN

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In 1991, Tanida et al launched the "Aquatic Insects of Shiga Prefecture, Japan" which included about 200 taxa of aquatic insect larvae and some adults of Shiga Area with keys, line drawing and ecological information. The booklet contained 4 full color pages and 56 pages of line drawings *etc*. The booklet was widely used not only junior high school students but also for university classes and citizen use. We are planning to revise the booklet with scientific names and new type of pictorial keys. I will provide the some examples of contents showing simple pictorial keys and illustrations.

Key words: *aquatic insects, Ephemeroptera, Plecoptera, Trichoptera, line drawings*

(VP21) ECOLOGICAL CRISIS IN THE COASTAL ZONE OF LAKE BAIKAL (EAST SIBERIA): SHORT DESCRIPTION AND REASONING

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Interdisciplinary investigations of Baikal shallow waters have been performed in 2001–2016. Special attention is paid to the splash zone (SZ) since 2010. SZ of the most Eurasian lakes**,** as an above-water part of the coastal zone, remains "terra incognita" and has significant value in terms of both: fundamental and practical sciences. Meanwhile, it become conventionally accepted that SZ provides most accurate evidence of immediate ecosystem's response to the current anthropogenic pressure. The term "splash zone" is commonly used by marine biologists in intertidal zonation, denoting a part of the littoral zone subject to water splashes. A similar zone with a variety of environmental gradients, defined by abiotic factors also exists on Baikal extending from the water's edge to the slope foot. It is ca. 2000 km long, the lower margin of the SZ extending 10–30 meters landwards and back as a result of the water level rise. Investigation of the SZ as a significant constituent of the lake ecosystem sets a new trend for limnological studies on Baikal and large Eurasian lakes (Timoshkin *et al*., 2011). Intense microbiological and biogeochemical processes have been described in this ecotone (Timoshkin *et al*., 2012 a, b), which functions as a natural buffer and filtrating zone. The following main results were obtained at the first time: classification, seasonal dynamics of the qualitative and quantitative characteristics of the coastal accumulated materials (CAM) and their benthonic infauna (*ab. cit*.), landscape-ecological zonation of the test site (Potyomkina *et al*., 2012; Levasheva *et al*., 2012); microbiological, hydrochemical and biogeochemical characteristics of the interstitial pore waters of the SZ and near bottom waters of coastal zone (*ob. cit*., Tomberg *et al*., 2012; Kulikova *et al*., 2012); seasonal dynamics of algae, meio- and macrozoobenthos of the pore waters of SZ (Bondarenko *et al*., 2012; Popova *et al*., 2012; Zvereva *et al*., 2012; Sheveleva *et al*., 2013); elemental composition of dominant species of Baikal sponges, water lichens, macrophytes, gastropods and trichopterans (Kulikova *et al*., 2007; 2009; 20011; 2012; Paradina *et al*., 2011; 2012 *etc*.).

Several negative ecological phenomena have been detected in Baikal coastal zone:

1. Significant changes in the macrophyte belt composition, development and stratification were described (Kravtsova *et al*., 2011; 2014; Timoshkin *et al*., 2014; 2015; 2016). In 2013–2015, a mass bloom of *Spirogyra* was detected with maximum biomass in autumn in the shallow water zone throughout much of the lake[1]: Baikalsk, Slyudyanka, Kultuk towns; along the Old Baikalian Rail Way; Listvyanichnoe, Obuteikha, Bolshye Koty, Peschanaya, Babushka Bays; Goloustnoe settlement (South Baikal); some areas of Maloe more Strait; Maksimikha Bay (Middle Baikal); Nizhneangarsk, Severobaikalsk towns; Ayaya, Senogda, Onokochanskaya and Boguchanskaya Bays (North Baikal). Also in 2014, the mass development of *Spirogyra* was noted on Ol'khon Island at two localities (*i.e*., the ferry harbor

[1] It is easier to indicate areas where the alga was not found: Bol'shoi Ushkani Island, most of the coastline of Ol'khon Isl. (except for Perevoznaya Bay and a coast opposite Khuzhir), and the northwestern coast that stretches from Elokhin Cape to Maloe More Strait.

in Perevoznaya Bay and Shamanka Bay opposite the town of Khuzhir on Ol'khon Island). By 2015, mass growth of *Spirogyra* was reported at several new localities along the west coast of South Baikal (Emelyanikha, Sennaya Bays and a coast opposite Polovinnyi Cape) as well as Maloe More Strait (*i.e*., coastal zone off Sakhyurte Settlement and Kargante Bay). In summary, *Spirogyra* spp. developed massively and even dominated the benthic macroalgal community along much of the eastern coast, and in many places along the western coast of Lake Baikal. Interestingly, the maximum development of *Spirogyra* – a comparatively thermophilic algae (optimal temperature for growth is *ca*. 20 °C), was detected during autumn (September–October) with water temperatures ranging within 4–8 °C. Two of sites (*i.e*., Listvennichnyi Bay in south basin and Tyya–Senogda coast in north basin) investigated to date were characterized by year-round mass blooms of *Spirogyra* spp. which sometimes include other filamentous algal species (such as *Oedogonium* sp., *etc*.) that previously were non typical for open parts of Lake Baikal. Mass development of *Spirogyra* has also been detected since May–June 2016 in the littoral opposite of Baikalsk City (at 3–6 m depths) and several wooden harbors (Khuzhir, Bolshye Koty settlements). It means, that the number of areas with the all-the-year round *Spirogyra* spp. mass development is gradually increasing. The *Spirogyra* morphotype, which has simple cell walls, 4 chloroplasts in the beginning of the filament vegetation (later on they became homogeneously distributed within the algal cell), attached to the rocks by rhizoids, has been dominating in these areas of the lake's rocky littoral within 2013–2016. As a rule, this morphotype of *Spirogyra* has patchy distribution in the coastal zone (especially sharply expressed along to the western and Olkhon Island coasts), the blooms are mostly concentrated opposite of the settlements and recreation centers (without any sewage water purification systems).

Spirogyra blooms underwent drastic day and night variations of the near bottom temperature (for example, from 8 to 17.3 °C, HOBO logger data, measured every 30 mins within August 2015, Bolshye Koty Bay, at 3 m depth; Timoshkin, unpublished). At the 3 areas mentioned above the alga proliferates even under very low winter (around 0^0C at the depths of 2–7 m) and comparatively low permanent temperatures at the depths below 20 m (*ca*. 3.4 °C). According to Prof. M. Shimaraev (pers. comm.) the surface water temperature at 5 monitoring stations have negative tendency within the last 13-year long cycle (*i.e.*, since 1995–2000). It clearly evidences, that the temperature shall not be considered as the key factor, limiting the *Spirogyra* mass development in Lake Baikal.

Rosgidromet data show (www.lin.irk.ru), that the lowest water level (455.27 m) was detected in 1981. No any crisis consequences, such as mass proliferation of non-typical algae or the mass Lubomirskiid sponge extinction were found. Afterwards the Lake's water level fluctuated within the limits (456–457 m) determined by Russian Government Regulation No 234. In conclusion, neither global warming nor the cases of the comparatively low water level provide us any arguments to consider them as the key factors, influencing mass *Spirogyra* development in Baikal coastal zone. Moreover, the minor, but permanently entering the coastal zone nutrient additions from non-purified sewages provide possibility to overcame the depths of 20 (North Baikal) or even 30 (South Baikal – I.V. Khanaev, pers. comm.) meters! The alga should be considered as a perfect indicator of the sewage water contamination in oligotrophic ecosystems such as Baikal.

2. Giant amounts of the coastal accumulated material, mostly consisting of algal detritus, has been detected in the north and south tops of the Lake and opposite of Maksimikha settlement (Barguzin Bay). Several blooms represented by non-typical for the lake's ecosystem filamentous algae of *Spirogyra* genus. Intensive development of macrophytes in Maksimikha Bay was due to *Cladophora* sp. (*glomerata*?) (*ca*. 50 % of the total wet biomass), Characeae,

Elodea and other higher water plants. The strongest blooming of *Spirogyra* was found in the Northern Basin, opposite of Severobaikalsk city. Wet biomass of this algal CAM in the autumn of 2013 reached up to 90 kg/m^2. All mentioned regions belong to the near-shore settlements or bays – natural harbors for numerous vessels. The blooms shall be considered as the clear evidence of “indirect” eutrophication in many particular regions of the coastal zone. Evidently, the natural buffer and filtrating ability of Baikal’s SZ is limited. Abundant amount of nutrients can reach the interstitial and near-bottom water layers through the ground of the SZ and cause the blooms. The distribution pattern of the fecal indicating bacteria (see below) strongly support this supposition and can be used as good sewage tracers. Due to the huge size of the lake and permanent intense water-wind activity (mixing) high nutrient concentrations often can not be detected by commonly accepted hydrochemical analyses in the surface and near-bottom water layers.

3. Increase of the typical Baikalian macroalgae productivity in some areas of the shallow water zone. According to the world literature, it should be considered as the first symptom of the eutrophication.

4. Mass development of the «saprophytic» (proliferating on sponges and died macrophytes, see below) and «free-living» blue-greens in several areas of the lake. Significant amount of the Oscillatoriales filaments have been first found by the author in the drudge benthonic samples, taken from 10–15 m depth, southern of Peschanaya Bay (South Baikal), in summer of 2013 and 2014. In 2015–2016 their mass blooming found as well in the shallows of Bolshye Koty, Barguzin bays, *etc*. (*Phormidium*, *Oscillatoria*, *Tolypothrix* spp. and others). Most unusual is the mass penetration of the *Tolypothrix*, *Oscillatoria* and other cyanoprocaryote spp. into the first algal belt, usually created by green filamentous alga *Ulothrix zonata*. In September 2015 the blue-greens abundantly developed on the shore line rocks and nearby at Bolshye Koty. Abundant *Tolypothrix* colonies were observed there already in the end of June 2016.The «saprophytic» representatives of *Phormidium* and *Oscillatoria* genera, dwelling in Baikal, are not able to fix the atmospheric nitrogen. Their development is limited by nitrogen. This limitation does not exist near the dying sponges macrophytes. Their destroying bodies extract abundant nutrients (=special type of eutrophication!) (I.V. Tomberg, O.A. Timoshkin, unpublished), which can be easily utilized by the «saprophytic» blue-greens what provides possibility for their mass proliferation. *Vice versa*, the most evident reason of "free-living" blue-green proliferation (which are able to fix N) is "indirect eutrophication" first of all due to enrichment by non-organic phosphorus.According to O.I. Belykh (pers. comm.), both types of the cyanoprocaryotes are able to produce different toxins (including saxitoxins). Such abundant blooming of Oscillatoriales in general and within the first algal belt in particular has never been detected in the lake before.

5. Mass Gastropoda extinction (mostly – representatives of *Lymnaea* genus) is described in 2013–2014: billions of the died shells found on the sandy beaches between Tyya River and Senogda Bay at the north top of Baikal. These "cemeteries" are located along the areas of the most abundant *Spirogyra* development and influenced by sewages from Severobaikalsk City. Less abundant *Lymnaea* shell accumulations found along the splash zone, off Maximikha settlement in Barguzin Bay (June 2015).

6. Mass extinction and several kinds of diseases of endemic Lubomirskiidae sponges at the scale of the entire lake were described in 2013–2014 (Bormotov, 2011; Timoshkin *et al*., 2014; 2015). All 3 ecological forms of the sponges (branched, encrusting, globular) can be sick. Over than 50 dives performed in 2014, 40 – in 2015. Depending on area, from 30 to 100% of branched *Lubomirskia baikalensis* specimens were found to be either sick or damaged and died. According to Dr. Ch. Boedecker (pers. comm.), in most of the studied areas of South

basin (September 2014) the sick sponges were mostly found at the depths above 15–20 m. However, deeper leaving sick specimens of the branched sponges were found already in June 2015. It was described, that the most distributed sponge illness is accompanied by mass development of the "saprophytic" blue-greens of *Phormidium* genus (Timoshkin *et al*., 2014; 2015). Their filaments are comparatively large, cherry-red and mobile. Light-microscopic analysis evidences, that each affection patch on the sponge surface consists of 1–2 dominating blue-green species (90–95 %). Different deformations and damages of the external surface of the sponge body (=beginning stages of its extinction) in most cases (50–80 %) happen prior to the mass blue-green development. According to preliminary data, the branched sponges, dwelling in the South Basin (Listvyanichny, Bolshye Koty Bays, off Chernaya River mouth) are most of all affected by illness. For example, almost 100 % of *Lubomirskia baikalensis* specimens, dwelling off Chernaya River mouth along the standard bottom transect (South Baikal, 1 m wide and 10 m long; 3–12 m deep) were either damaged, or thick and died (A.B. Kupchinsky, S. Aurich, pers. comm.). Much less damaged or even healthy *L. baikalensis* specimens were found in September 2014 around the north-western coast; area, approximately located between Elokhin Cape and Bolshye Olkhonskye Vorota. To my mind, the most probable reason of the Lubomirskiidae mass extinction is the physiological abnormalities in the relations between the sponge endosymbionts (such as green *Zoochlorella*) and the tissues. Some precise processes and nutrient exchange mechanisms between algal symbionts and the sponge cells, elaborated during the long coevolution and coexistence in the oligotrophic waters, may be easily broken due to miserable but permanent addition of the sewage nutrients. It may cause the destruction of the sponge bodies, which has been detected so frequently. Analogous processes, causing the mass death of another sedentary Metazoan group – corals (which as well coexist with endosymbiotic blue-green algae), also inhabiting oligotrophic ecosystem of the ocean, are happen due to miserable but permanent eutrophication process (Yamamuro *et al*., 2003; Bell *et al*., 2014).

7. High concentrations of the fecal indicating bacteria have been determined in the surface and near-the-bottom water layers along the coasts opposite the settlements. The same is true for the interstitial waters (especially – under the coastal accumulated algae) of the splash zone. For example, the enterococci concentrations often exceed 2000 colony forming units per 100 ml (V.V. Malnik, pers. comm.). The governmental schemes of the limnological monitoring of the deep large lakes of the planet are often not effective due to "superconcentration" of the efforts exclusively on the pelagial. In order to detect, understand and properly describe the anthropogenic changes of the ecosystems at the full scale we have to include the monitoring of the coastal zone (the splash and near-shore zones including) and, especially – of the benthonic communities. As distinct of planktonic communities, the precise investigations and monitoring of zoobenthos is almost "extinct direction" in limnological surveys of many countries.

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Key words: *monitoring of the coastal zone, macrophytes, freshwater algae***,** *invertebrates***,** *seasonal dynamic, anthropogenic pressure*

(VP22) USING A FUNCTIONAL-TRAIT-BASED APPROACH WITH BENTHIC MACROINVERTEBRATES FOR FRESHWATER QUALITY MONITORING

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Many different single metrics and indices as well as multimetric indices have been developed based on taxonomic approach and used for biomonitoring programs based on the benthic macroinvertebrate community in different countries.

A Trait-Based Approach (TBA) is an alternative to traditional taxonomic approaches and is a potential method to reveal changes in communities due to disturbance and define structure of biological communities (Dolédec *et al*., 1999, 2008; Charvet *et al*., 2000; Usseglio-Polatera *et al*., 2000; Statzner *et al*., 2001; Gayraud *et al*., 2003; Bady *et al*., 2005; Poff *et al*., 2006). Trait based approach provides a consistent method for assessing community responses to environmental gradients because species traits are less constrained by biogeography than species composition. That’s why; TBA was developed in Europe and has been an increasingly applied biomonitoring practice other countries.

Communities of insects and other macroinvertebrates (animals without backbones visible with the unaided eye) that live in lakes and streams (benthic) are commonly used to indicate the quality of the water. Communities in clean water generally include more species with different traits than do communities in polluted water and the species composing clean-water communities are typically less tolerant of pollutants. Biomonitoring programs using benthic macroinvertebrates are usually more reliable and more cost-effective for assessing water quality than traditional chemical analyses (Barbour *et al*., 1999; Dolédec *et al*., 1996, 2006).

Functional differences among the species in a community are an important determinant of ecosystem processes. When biological communities are altered by environmental changes, only species possessing certain traits are likely to persist and those traits can be diagnostic of the stressors. Species have traits that are uniquely adapted to their ecological niches.

TBA was derived from a "habitat template" concept (Southwood, 1977; Towsend & Hildrew, 1994). Southwood (1977) outlined the habitat template concept, which states that ecological strategies of a species have evolved in response to the characteristics of habitat, and that these strategies are reflected in quantifiable life-history and biological traits. Towsend and Hildrew (1994) made the *a priori* prediction (hypothesis) of expected species traits in terms of autecological interaction between organism and their abiotic environment. The main hypothesis was that present-day habitat conditions should be matched by present-day traits in the organisms. The habitat template concept specifies two basic dimensions: Temporal heterogeneity indicates frequency of disturbance, and spatial heterogeneity indicates the provision of refugia for buffering against disturbance. The general prediction is that traits conferring population resilience (promoting refuge use and recolonization success, such as r-selected traits including many descendants per reproductive cycle, short generation time, small body size, short life span, parental care, or presence of relatively invulnerable life stages, asexual reproduction, *etc*.) or resistance (related to survival, such as firm attachment to substrates, high body flexibility, streamlined or flattened body form, dormancy or diapause, housing against desiccation, *etc*.) would be more common in temporally variable and spatially homogeneous habitat (Towsend & Hildrew, 1994). Poff (1997) described the function of trait filters across hierarchical landscape scales ranging from microhabitat to watershed or basin for a mechanistic understanding of species-environment relationship. Only species possessing appropriate traits are likely to filter into certain environmental conditions at different scales (Poff, 1997). A trait is a measurable property or characteristic of an organism that influences its performance. Morphological, physiological and behavioral characteristics such as body size, lifespan, feeding and reproductive strategies, mobility, *etc*. can be quantified and analyzed statistically to assess environmental conditions.

Species traits can also be used as measures of community functional diversity (Petchey & Gaston, 2006). The Functional Diversity index (FD) is a functional trait measurement usually described by three indices: functional richness, evenness, and divergence that can describe how much volume of functional space is occupied by species, how much space is filled, and how traits deviate from the center of trait space (Mason *et al*., 2005). A number of different FD indices have been proposed to quantify different aspects of functional diversity (Mouchet *et al*., 2010; Schleuter *et al*., 2010; Casanoves *et al*. 2011).

There is no bioassessment technique for water quality assessment that is specific for Asia. A Functional-Trait-Based bioassessment technique is potentially applicable not only for Mongolia but also throughout Asia, because the Mongolian freshwater insect taxa are generally cosmopolitan, distributed throughout this region.

Key words: *benthic macroinvertebrates, freshwater quality monitoring, TBA, Mongolia*

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