



## Monitoring of Primorsky Territory freshwater by public ecological agencies

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### Abstract

Public environmental monitoring and control of fresh waters in Primorsky Territory has been conducted since 2003 when the "Clean Water" Scientific-Public Coordination Center was created. The long-term program of water protection in the Russian Far East was formulated in compliance with the Russian Clean Water Project in 2003. The network of more than 60 public ecological agencies (PEAs) was coordinated through the Clean Water Center in which the trained teachers, schoolchildren, students and amateurs conducted research on the ecological condition of regional freshwater resources and studied the biodiversity of the unique biota of Primorye. The results of this public work are compatible with activities of professional scientists and state environmental agencies.

**Key words:** Scientific-Public Coordinative Center "Clean Water", Public Ecological Agencies (PEA), public environmental monitoring, Russian Clean Water Project

Primorsky Krai ("Primorye" or Maritime Province) is a region of Far East Russia with unique biota and river ecosystems. It is included in *Freshwater Ecoregions, Small Rivers, Palearctic, 181: "Russian Far East Rivers and Wetlands—China, Mongolia, Russia"* according to a recent classification of world ecoregions (World Wildlife Fund 2015a), playing a key role in preservation of biological diversity of Earth. Primorye is covered with a dense river network which has come under strong anthropogenic stress since the end of the 20th century. In spite of the fact that ecosystems of Ecoregion 181 have a WWF conservation status "Relatively Stable/Intact," (World Wildlife Fund (2015b), the situation has sharply worsened in recent decades, especially in the more densely populated territories. According to Galina Semykina, a specialist of Primorye monitoring management (Primhydromet), "in the region there is neither pure, nor conditionally pure surface water. There are polluted and very polluted reservoirs and rivers. In the Ussuri River basin, for example, polluted water constitutes about 68%; the other 32% is very dirty. As for the rivers of the basin of the Sea of Japan, 47% of the reservoirs in it are polluted and very polluted and of the rivers and streams 42% are dirty and very dirty and 11% are extremely polluted" (Semykina 2015).

To reduce this loss of ecological integrity of the rivers and lakes in our region, continuous management of water ecosystems is necessary, especially in places with dense population and in zones of high industrial activity. The current governmental control of fresh water conditions in Russia is insufficient (Morse *et al.* 2007; Vshivkova 2006) and, without change, the situation will hardly improve in the near future. Scientists and citizens of Primorye have chosen an alternative way to do this—to develop a system of public control and monitoring.

The Russian Clean Water Project (RCWP; Vshivkova *et al.* 2003) was created in 2003 for the development of policies that will protect freshwater sources in Russia with the cooperation of private, scientific, and governmental institutions. The "Clean Water Center" (CWC) is a non-profit scientific-public coordinating organization established in 2003 with the sponsorship and support of the Institute of Biology and Soil Science, Far East Branch of the Russian Academy of Sciences (IBSS). The goal of the RCWP and the CWC is to develop rapid bioassessment technology using macroinvertebrates suitable for monitoring freshwater ecosystems in the southern

regions of the Russian Far East (RFE). The CWC established a network of public ecological agencies (PEAs; groups of concerned citizens, specially educated teachers, ecologists, students, school students, and other volunteers) throughout the RFE to provide extensive monitoring of its surface freshwaters. These local public ecological agencies conduct bioassessments and submit their results to the CWC. Following analysis by CWC scientists, the data and conclusions are passed to federal and regional nature-protection departments, who investigate the sources of pollutants and develop strategies to help mitigate their impacts (Morse *et al.* 2007; Vshivkova & Morse 2006). The RCWP rapid bioassessment protocols are based on some that are currently used in the U.S.A., adapted to regional conditions and the local fauna (Vshivkova, in press).

Currently in Primorye there are about 60 PEAs which intensively investigate the ecological condition of streams and rivers and study the freshwater biota (Figs 1–9). Public experts pay special attention to studying indicator organisms of the EPT complex (Ephemeroptera + Plecoptera + Trichoptera) under the leadership of IBSS experts: Tatyana Tiunova (mayflies), Valentina Teslenko (stoneflies), and Tatyana Vshivkova (caddisflies).

"Clean Water Center" experts participate in international youth events training young people of basic knowledge of freshwater monitoring and principles of freshwater protection activity (Figs 6–7).

Research by the school students has added 31 species to the list of Trichoptera of the Bikin River basin and these children have discovered a new locality for the rare species *Electragapetus martynovi* Vshivkova & Arefina 1996 (Glossosomatidae). Thanks to collecting by these young, inquisitive ecologists, systematic lists of freshwater invertebrates have been compiled for previously unstudied or poorly studied territories, especially newly established protected areas such as the Sredneussuriysky Wildlife Area, "Bikin" National Park, "Udege Legend" National Park, "Gulf East" Protected Area, "Leopard's Land" Nature Reserve, and "Bolonsky" Nature Reserve. It is interesting to note that a list of 345 freshwater invertebrate taxa was passed to the "Bikin" National Park administration by schoolchildren just before the official opening of the Park (Fig. 5). More than 150 water projects were completed during 2003–2015 and more than 500 juniors were involved in research and practical work on freshwater bioassessment. Of course, the professional identification of collected material is carried out by schoolchildren together with experts, but sorting invertebrates to the main groups and the amphibiotic insects to orders has been accomplished by the schoolchildren independently (Figs. 3–4, 8).

Members of PEAs are teachers, schoolchildren, and older students who are very interested in protection of our lakes, streams and rivers. They show much ability in public monitoring work and they help professionals and government monitoring managers to get adequate information about the biota and the ecological condition of Primorye freshwater resources. An ecological map of surface freshwater conditions is being prepared based on the data of local PEAs. Often schoolstudents take part in carry out of public ecological expertises (Figs 4, 9).

Results of the PEA work have been presented in the annual Far East Ecological Conferences of Students and Schoolchildren on "Man and the Biosphere" which has been meeting since 2003 in the IBSS (Sibirina *et al.* 2009) (Fig. 10). Some results authored by teachers and students have been published in scientific journals (Vshivkova *et al.* 2005) and in Abstracts of the Conference which have been published annually since 2013. It is planned that in the near future the Conferences will become international and will open doors for young colleagues from throughout the Asian-Pacific region.

After finishing school, some children have entered universities choosing ecological professions. Upon graduation, some of them have taken positions in universities and academic institutions. There are 7 former PEA schoolchildren who are now scientists in the IBSS, 5 of them have defended doctoral dissertations.

The members of the Primorian PEA branch regularly take part in the regional Russian National Competition for Junior Water Projects and each year the winners of the regional competition present their projects in the national competition in Moscow before the Ministry of Natural Recourses of the Russian Federation.

Thus, a successful public infrastructure has been created in Primorye to conduct purposeful monitoring of surface freshwaters (and the environment in general) under the leadership of qualified experts, scientists, and representatives of the Far East nature protection management authorities. This infrastructure gives hope that a comprehensive system of protection for our surface freshwaters will be built also at the district, regional and federal governments in Russia, but public system is already acting today



**FIGURES 1–5.** 1, Schoolchildren of Vladivostok conducting field work to estimate the water pollution of Razdolnaya River, a Russian-Chinese transboundary river;  
 2, Summer training in Amurskaya Oblast under the leadership of T.S. Vshivkova;  
 3, Ecological camp on Putyatín Island (South Primorye): collecting and sorting of aquatic macroinvertebrates;  
 4, Estimation of the ecological impact on the Partizanskaya River;  
 5, Youth expedition to study freshwater invertebrates of the Bikin River.



**FIGURES 6–10.** 6–7, Workshop on freshwater bioassessment for Russian and Chinese school students in frame of international Youth Ecological Conference in Khabarovsk, 23 July 2013; 8, Workshop on aquatic invertebrates for school students of Nakhodka ("Fishermen Village" Youth Project), 3–10 August 2013; 9, Public ecological expertise on the estimation of ecological state of Solyonaya Pad Lake (North Primorye) with school students participation (Public Ecological Agency "Stonefly"); 10, Far Eastern Conference of Students and Schoolchildren "Man and Biosphere," Institute of Biology and Soil Science, FEB RAS, Vladivostok, March 2011.

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