INTERNATIONAL PROJECT:

T.S. Vshivkova, Stribling J.B., Flotmersch J.E., Morse J.C.

«Planning Initiative for Regional Surveys of Aquatic Resources in East and North-East Asia region (ENEA)»

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OUTLINE

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Planning Initiative for Regional Surveys of Aquatic Resources in East and North-East Asia region (ENEA)

I. Introduction

Resilience and adaptability of society to ongoing global change is enhanced by healthy ecosystems, making the monitoring, assessing, and understanding the conditions of ecological resources have important to global well-being, human health, and economic stability. Successful management of water resources on a global scale, by definition, necessitates international collaboration and cooperation, especially in cases of large trans-boundary waterways such as exist in East and North-East Asia (ENEA). The United States (U.S.), Europe, Australia, many countries of Latin America have established bioassessment model document and share technology and data. The ongoing effort in the Hindu-Kush Himalayan (HKH) Region called "The ASSESS-HKH Project" (www.assess-hkh.at) is focused on biological monitoring of the river systems of Nepal, Pakistan, India, Bangladesh, and Bhutan. These collaborative efforts have increased the ability of participating nations to manage, or begin to manage, aquatic resources on large geographic scales. One of the highest priorities in expanding this global effort is integration of ecological and biological monitoring and assessment efforts among countries and regions of eastern and northeastern Asia, which includes China, Russia, Mongolia, Japan, and North & South Korea (ENEA countries).

A. What is biological assessment?

All streams and rivers are susceptible to cumulative impacts from upstream human-induced disturbances including chemical and organic pollution, dams, channelization, overharvest, invasive species, and land use. The aquatic life of streams and rivers (fish, insects, plants, shellfish, amphibians, reptiles, etc.) integrates the cumulative effects of multiple stressors generated by both point source and non-point source (NPS) pollution. Biological surveys and assessments, consisting of sampling and analysis and other direct measures of aquatic life, are the most effective way to measure the aggregate impact of these stressors on aquatic ecosystems. The most common organisms groups that are used by routine biological monitoring and assessment programs are benthic macroinvertebrates (BM): aquatic insects, snails, mollusks, crustaceans, worms, and mites), fish, and/or algae. Of these groups, benthic macroinvertebrates are most commonly used because the bioassessment documents are most well-established, the level of effort required for field sampling is reasonable, and taxonomic expertise is relatively easily accessible. It is anticipated that fish and/or algae would be added to the routine program after it becomes established with BM.

B. Why does Russia need to be involved?

The Russian Far East (RFE) is an important component of the East and North-East Asia region (ENEA) and their participation is imperative. Several large trans-boundary water bodies exist in Siberia and the RFE along the border of the People's Republic of China (China) - the Amur River (also shared with Mongolia), the Razdolnaya (Suifen or Suífēn Hé) River, and the Khanka (Xīngkǎi Hú) Lake Basins; the Tumangan (Tumen or Tumyntszyan) River borders three countries – Russia, North Korea, and China. To effectively monitor these waters, it is necessary for the RFE and their neighboring countries, to which they are ecologically joined, "to speak the same language". Morse et al. (2007) called for coordination of efforts to develop and implement consistent and comparable environmental monitoring methods to evaluate status and trends of water resources conditions in the face of water pollution. This need is heightened by the rapidly growing populations in these regions.

Joint international work toward this goal will help develop and introduce a common bioassessment system for ENEA countries, and help scientists and bioassessment experts introduce a system of watershed monitoring that effectively supports the needs of governments, water resources managers, non-governmental organizations, and the public. Relating these results to parallel efforts in other parts of the world will serve to inform decision makers on aquatic resource conditions, and refine priorities globally in support of safe and sustainable communities.

II. What are the primary goals of the initiative?

The goal of this initiative is twofold. The first part is to help establish a foundation for collaborative and cooperative ecological monitoring of trans-boundary/international waters of the East North-East Asia (ENEA) region. The second part, and target of this initiative, is the reporting output of the First ENEA Aquatic Resource Survey. This would be the first in a long-term series of consistent and routine ecological assessments for the ENEA, with known uncertainty, and produced with appropriate and sufficient quality assurance and quality control (QA/QC).

III. Why is the initiative important?

The importance of this initiative can be shown from several perspectives. International, transboundary cooperation in monitoring and assessing aquatic resources is of utmost importance for helping:

1) understand the status of natural resources on broad regional scales,

2) assist in their sustainable management, protection, and restoration,

3) standardize freshwater biomonitoring bioassessment documents for sampling, analyzing, and databasing to facilitate international communication,

4) recommend pollution thresholds for macroinvertebrate communities that will be legally enforceable by courts in the participating countries [to be at least as important as chemical and microbiological data], and

5) inform and support public initiatives for freshwater conservation.

IV. How do we get there?

This is a large undertaking that will require long-term, multi-year commitments from one or more natural resources agencies in each ENEA country. It is expected that there are at least 5 years of necessary interactions (Table 1) among agencies and countries to attain the first spatially comprehensive survey of aquatic resources for this region.

Table 1 Phases of coordinated actions needed to realize a freshwater survey for East and North-East Asia Region.

Schedule	Activity	Purpose
2009-ongoing	Conferences, workshops	Information transfer
2012-2013	Technical workshops	Orientation to bioassesment documents for field sampling, laboratory processing, data management, data analysis, and reporting
2014-2015	Demonstration projects	Use to illustrate the bioassessment model document application and assessment output for 6 “small” watersheds, one each in China, Japan, North and South Korea, Mongolia, and Russia

2016	Monitoring design	Develop data quality objectives, secure international agreements
	Program design	Establish roles and responsibilities (national, agency, and individual), secure international agreements
2017	Implementation	First East and North-East Asia (ENEA) Freshwater Survey

A. Conferences, Workshops (info transfer)

There are already some ongoing discussions among aquatic ecologists in several of the countries, with a focus on broadening trans-boundary collaboration in aquatic resource monitoring and assessment. Scientists from the Far Eastern Branch of Russian Academy of Sciences, Institute of Biology and Soil Sciences (IBSS FEBRAS) in Vladivostok have participated in several international ecological forums (2008-09), North American Benthological Society (NABS) conferences, the International Workshop of Water-quality Biomonitoring and Assessment (in China), the upcoming First Benthological Society of Asia meeting (in Japan), and Russian Hydrobiological Society Meeting, Vladivostok, 2009; Conference "Ecological modernization of Russia", Moscow, 2010; The International Scientific-Practical Conference "Siberian Rivers", Krasnoyarsk, 2011 , in Russia. These kinds of conferences and workshops are necessary to begin raising awareness of the initiative, and to attract interest in collaboration through participation. In addition to printed materials, such as publications, reports, brochures, and other information materials, these kinds of workshop will likely be an ongoing feature of the monitoring and assessment program. They should be staged in each country as often as possible by scientists and collaborators of the participating national, regional, and local agencies, or citizens' groups.

B. Workshops (Training/Orientation, and Technology Transfer)

Over a 2-year period (2012-2013), there would be a series of workshops to explain field, laboratory, and data analysis documents, data management and data analysis procedures, and reporting using the draft model documents for testing their effectiveness in regions of ENEA. Multiple topics could be covered in each workshop, each of which would last anywhere from 2-3 days to a full week and would include a combination of classroom-type lectures, and field and laboratory procedures, as appropriate.

1. Purpose(s) of biological monitoring, quality assurance/quality control, and data quality objectives

This workshop would describe the technical rationale for biological monitoring and assessment, and include the foundations of biological indicators in water resource quality regulations of the US and the European Union. It would also spend substantial time presenting concepts related to quality assurance/quality control (QA/QC), and the data quality objective (DQO) process as the basis for monitoring program design.

2. Field Bioassessment Documents/sampling

Presenters will use a combination of lecture and field time to cover descriptions of standard operating procedures (SOP) for sampling benthic macroinvertebrates and visual-

based physical habitat assessments. Sampling approaches necessary for documenting field sampling precision will be described in lecture and demonstrated in the field, as well as necessary sample labeling and field data sheet preparation. As appropriate, methods will be discussed for fish and algae, although will likely not be demonstrated in the field.

3. Laboratory Bioassessment Documents

This workshop will be focused on sorting and subsampling of benthic macroinvertebrate samples, slide mounting of midges (Diptera: Chironomidae) and worms (Annelida: Oligochaeta), and on taxonomic identifications. QC procedures for both sorting and taxonomic identifications will be described in lectures, and demonstrated in the lab.

4. Data management

This workshop will describe those data elements that need to be captured for use in data analysis and ecological assessments, and the computer resources necessary to efficiently and effectively manage them. It will also provide instruction on QC procedures for assuring accurate data entry, and output formats necessary for data analysis.

5. Data analysis

Presenters will go over statistical and data analysis techniques for biometrics and biometric calculation, helping quantify stressor gradients and testing metric response to them, and for formulating and testing multimetric indexes. Predictive models, such as the River Invertebrate Prediction and Classification System (RIVPACS), will also be reviewed. This workshop will also provide basic overviews of techniques for using Geographic Information Systems (GIS) in monitoring design, tracking sampling crew progress, and determining sampling site drainage areas.

6. Reporting

This workshop will include description of the techniques for use of assessment results at multiple spatial scales, from site-specific, to sub-watershed, watershed, to regional or ecoregional. Use of cumulative assessments for producing area-wide and proportional estimates of biologically degraded river channel miles will be demonstrated, as will site-specific assessment for determining magnitude of degradation and most likely sources of stressors.

C. Demonstration projects (6 watersheds)

In the years 2013-2014, demonstration projects will be designed and implemented in each of the 6 ENEA countries. They will be performed on a single small watershed, approximately 3^{rd} - 5^{th} order; will use a stratified, probability-based site selection process, comparable field and laboratory bioassessment documents, and all data captured in a common and accessible data management system. A composite report including results from each project will be produced.

D. Program and monitoring design

Program and monitoring design will require 1-2 meetings or workshops during 2015 to discuss details of program management and responsibilities. Programmatic design for this effort will require determining which entity is the principal coordinator, data administrator, and holds primary responsibility for reporting. Monitoring design will focus on determining those questions sampling, analysis, and assessment are intended to address, and then, the quantity and quality of data needed to answer those questions. Results of these workshops will be the information necessary to develop a comprehensive sampling and analysis plan, completed with

roles and responsibilities, quality assurance (QA) procedures, quality control (QC) data and analyses, and acceptance criteria.

E. Implementation

One year after completing program and monitoring design (2016), fieldwork can occur, with results and reports in 2017.

V. Support requirements

We should contact Russian and US Academies and Ministries of Nature Resources and Ecology, as well as any environment monitoring agencies to support our program in general and especially workgroups in our respective countries for the first step of our basic research. We can also address our needs to ENEA subregional offices of the UN and other international NGOs to support our initiatives.

VI. International interest and collaborative potential

Russia:

Initiative Group:

- Institute of Biology and Soil Sciences, FEBRAS (Director Academician Y. Zhuravlev);
- International Center of Ecological Monitoring at IBSS FEB RAS (Head T.S. Vshivkova);

Managements and Institutions:

- Ministery of Natural Resources and Ecology of Russian Federation;
- Far Eastern Branch of Russian Academy of Sciences;
- Federal Agency for Water Resources (Moscow);
- Primorsky Interregional Territorial State Department of Hydrometeorology and Monitoring of Environment;
- Amur Basin Water Department of Federal Agency for Water Resources, Khabarovsk;
- The Primorsky State Regional Department for reproduction of water biological resources and fisheries management.

and corresponding organizations and managements of ENEA countries.

The international facilitate of the Project is the North-East Asian Subregional Programme for Environmental Cooperation (NEASPEC)

***For further information, contact*:**
Dr. Tatyana Vshivkova, Far Eastern Branch, Russian Academy of Sciences, Institute of Biology and Soil Sciences, Vladivostok, Russia (vshivkova@biosoil.ru);
Dr. James B. Stribling, Center for Ecological Sciences, Tetra Tech, Inc., Owings Mills, Maryland USA (james.stribling@tetratech.com);
Dr. Joseph Flotemersch, USEPA/Office of Research and Development, Cincinnati, Ohio USA (Flotemersch.Joseph@epamail.epa.gov);
Dr. John C. Morse, Clemson University, Clemson, South Carolina USA.