

REPORT OF WG 21 ON NON-INDIGENOUS AQUATIC SPECIES

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The Working Group on *Non-Indigenous Aquatic Species* (hereafter WG 21) held its second meeting October 26–27, 2007, under the co-chairmanship of Ms. Darlene L. Smith and Dr. Vasily Radashevsky. A list of participants and meeting agenda can be found in *WG 21 Endnotes 1* and 2.

Country/Agency reports (Agenda Items 2)

Canada

Fisheries and Oceans Canada (DFO) is the federal government agency responsible for marine non-indigenous species in Canada. The DFO non-indigenous species program consists of three elements: research, monitoring and risk assessment. DFO has also worked with the National Science and Engineering Research Council of Canada to establish a national research program called the Canadian Aquatic Invasive Species Network (CAISN). CAISN includes scientists from 19 Canadian universities and several DFO laboratories. The primary species of concern include: European green crab, tunicates (5–7 species), New Zealand mudsnail and perciform fishes in freshwater.

People's Republic of China

It is estimated that there are about 140 marine alien species in China. Mariculture and international shipping are the two main vectors by which non-indigenous species are introduced to China. *Spartina alterniflora* and *Spartina anglica* were introduced in 1979 to protected beaches and had spread extensively causing major ecological damage. *Mytilopsis sallei* has also been introduced and is causing serious damage to the mariculture industry and native species. Another non-indigenous species is *Crepidula onyx* which reduces biodiversity and fouls pisciculture cages. Some harmful algae blooms species are suspected to have been introduced to the China seas via ballast water.

They have caused economic losses to aquaculture and fisheries operations with serious environmental and human health impacts.

China has established the following targets by the year 2010:

- To develop a basic understanding of the present status of marine alien invasive species in coastal China, such as exotic species and their distributions, invasive species distribution and impacts, *etc.*;
- To establish prevention and control systems for marine alien invasive species;
- To establish methods to assess the impacts of marine biological invasions.

By the year 2015, through strengthening the study of marine exotic invasive species ecology, a basic understanding of mechanisms of invasion will be built up. Meanwhile, technologies for elimination and control of invasive species will be developed to control or reduce the impacts resulting from a few dominant invasive species.

Republic of Korea

In 2007, harmful algal blooms (HABs) occurred from August–September (a total of 44 days). These included *Cochlodinium polykrikoides* from the South Sea to Japan/East Sea, and *Chattonella* spp. in Chonsu Bay (Yellow Sea). Total damage was about \$US 12 million, mostly to halibut, red bream, *etc.*

Research activities associated with HABs and invasive species include:

- Rapid detection of *Cochlodinium* using sandwich hybridization and whole cell hybridization;
- Development of molecular techniques for detection of *Pfiesteria* and *Pfiesteria*-like sp.;
- National Census of Marine Ecosystem (conducted by “Law of Marine Ecosystem Conservation and Management”; the 1st phase

- is from 2006–2015 (10yrs), and the budget of US\$1.5 million for 2007);
- National Institute of Marine Bioresources (established by “Law of Marine Ecosystem Conservation and Management”; the construction period is from 2007–2013 (5yrs), with the total budget of US \$150 million, and the budget of US\$ 25 million for 2008);
- Marine invasive species: Preparation of “Manual for Field Study”; barnacle monitoring (Ulsan port, Guryongpo port); general observation at Baekryung Is. (Yellow Sea), Ulreung Is. (Japan/East Sea) and Chuja Is. (South Sea);
- Development of ballast water treatment and monitoring (conducted by KORDI under “Marine Environment Management Law”, with the budget of US\$ 0.2 million);
- Development of ballast water treatment system and preparation of “Field Manual of Ballast Water Monitoring”.

Russia

The current status of non-indigenous fish species distribution and abundance in Peter the Great Bay was given. There are 19 non-indigenous fish species found in this area. The general conclusions of this work are:

- A composition of non-indigenous fish species in the estuaries of Peter the Great Bay was determined. Due to a significant part in biomass of all the fishes (e.g., 10% and 13% in the ichthyofauna of Artemovka and Razdolnaya Rivers, respectively), they are of great importance in the functioning of estuary ichthyocenes of the rivers.
- In the early 2000s, Khanka bitterlings *Acanthorodeus chankaensis*, lookup *Culter alburnus*, lazy gudgeon *Sarcocheilchthys czerskii*, *Sarcocheilchthys* sp., Soldatov's catfish *Silurus soldatovi*, European pike-perch *Sander lucioperca* and northern snakehead *Channa argus* were introduced into the Razdolnaya River.
- Silver carp, bigheads, grass carp and European pike-perch form ephemeral, not numerous populations that include only adult individuals. Rounded gudgeon,

Khanka bitterlings, *Acanthorodeus* sp., Korean sawbelly, lazy gudgeon, northern snakehead and lookups have formed independent populations in Razdolnaya River. The quantity of lookups in Razdolnaya River has now reached a commercial value.

United States of America

Three main agencies in the United States are responsible for managing marine invasive species: National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA), and the U.S. Fish and Wildlife Service (F&WS). Some of the major invaders on the U.S. Pacific Coast are:

- European green crab (dominant competitor; regulates the structure of benthic communities through predation; at high densities limits the distribution of some benthic invertebrates);
- Various species of tunicates (high potential for environmental and ecosystem damage; overgrow and displace native sea grasses, sponges, hydrozoans, anemones, limpets, oysters, mussels, scallops, barnacles, bryozoans, and other species of sea squirts; negative effects on aquaculture industry);
- Snowflake coral (threatens Hawai'i's \$30-million-a-year black coral industry; hull fouling and aquarium trade).

NOAA along with the U.S. F&WS, and the U.S. Maritime Administration, in cooperation with various States, conducts research on ballast water treatment technologies at two facilities, one located at the Great Lakes and one located in NOAA's North West Region.

The Aquatic Nuisance Species Task Force, headed by NOAA and the U.S. F&WS, supports development of management plans for aquatic nuisance species in the United States. Resources for research are limited, with the majority going towards management. A major focus now is rapid response planning. Hazard Analysis of Critical Control Point (HACCP) is currently being investigated as a model for responding to invasive species.

EPA is focused on the results of a recent court decision requiring the Agency to regulate ballast water discharge, including all boats with outboard motors. EPA will use the discharge standards of the International Maritime Organization.

Dr. Mark Sytsma gave a presentation on the status of a *Spartina* spp. invasion on the Pacific coast of the United States and provided details of the management and eradication programs.

Science presentations (Agenda Item 3)

Three presentations were given by WG 21 members from the People's Republic of China, the Russian Federation and Japan:

- Lijun Wang: *Assessment of the genetic impact of introduced Strongylocentrotus intermedius on native sea urchin populations;*
- Vasily Radashevsky: *Studies on invasive species in the Far-Eastern Part of Russia;*
- Hiroshi Kawai: *Biogeography and trans-ocean introductions of the green algae Ulva spp. from/to Japan, deduced from the identifications based on molecular markers.*

WG 21 terms of reference (Agenda Item 4)

WG 21 proposes to amend its terms of reference to reflect practical constraints on the work and the two projects funded with the Japanese voluntary contribution (*WG 21 Endnote 3*). These were submitted for approval to the MEQ Committee.

Joint PICES-ICES meeting summary and further co-operation (Agenda Item 5)

Dr. Judith Pederson provided the summary of the joint meeting of PICES WG 21, ICES WG on *Introductions and Transfers of Marine Organisms* (WGITMO) and ICES/IOC/IMO WG on *Ballast and Other Ship Vectors*, (WGBOSBV) held May 25–26, 2007, in Cambridge, U.S.A., with emphasis on the following points:

- Potential projects for “*Development of the prevention systems for harmful organism's expansion in the Pacific Rim*”;

- Lack of taxonomic expertise limiting ICES-PICES exchange;
- Need for the registry of taxonomic experts;
- Adding AIS (Aquatic Invasive Species) data based on NISBase;
- Use bivalve molluscs for database testing;
- Ballast water and biofouling as potential vectors;
- ICES Ballast Water Sampling Guidelines – review of ballast water issues, including early detection, rapid response, impacts, costs, successes, and failures from worldwide examples; role of government and citizens in an EDRR (Early Detection and Rapid Response) system.

Suggestions for future co-operation include:

- ICES Code of Practice for the Introduction and Transfer of Marine Organisms;
- Risk assessments or analysis;
- Guidelines for sampling ballast water;
- Other areas for joint projects, including hull fouling.

Database prototype (Agenda Item 6)

The morning session of the second day opened with a presentation on the WG 21 marine non-indigenous species (MNIS) database prototype that Dr. Henry Lee II and Ms. Deborah Reusser had developed based on the EPA-USGS PCEIS (Pacific Coast Ecosystem Information System) spatial database. Dr. Lee gave an overview of the database that is designed to provide biological, ecological and geo-spatial information. Each attendee received a copy of the manual and a disk with the program. The initial exercise is to enter invasive bivalves of the North Pacific for testing the prototype database. With the database, species information can be entered, edited, and exported. With the input of standardized data across the countries, the data are easily queried. The morning session focused on the details of using the database and issues that arose during the discussion. The major items and action items or conclusions that emerged from the discussion are described below.

The database uses Microsoft Access as the software for developing relationships among the

various components, and this poses a problem for Macintosh users who rely on FileMaker as the database management software.

Action item: Determine how to link File Maker to Access.

The prototype is built so that members from each PICES country can enter and maintain their own database. The main menu offers a variety of options: searching for species, adding/editing species, adding publications, exporting and importing data, documentation, acknowledgements, and exiting. One of the important decisions to be made by the group was the level of biographic detail that would be captured by the program. The Nature Conservancy biogeography regions were used as the basis for making decisions. The bio-geographic hierarchy extends from the North Temperate Pacific Realm > Provinces > Eco-region > Waterbody Eco-region > Sub-component in Waterbody > Site Specific (latitude/longitude).

Consensus decision is to: (1) extend to the Waterbody Eco-region and sub-divisions as this would permit analysis of the data appropriate to the scale for PICES countries; and (2) include latitudes and longitudes as database fields.

Adding a reference with each species, either as a publication or as the name of the person entering the data, is required. The program has several features that make entering the data easier, including options for removing and editing data, accessing publication data, adding relevant ecosystem and MNIS data, and viewing and extracting data. In order to test the database, it was initially suggested that each country would input data on bivalves, however, some countries may add other data, e.g., barnacles. Each country will input data and a training workshop on use of the database will be held to walk through the revised protocols. For several countries, it would take time to identify the individuals who would input the data.

Action item: Each country will input data over the next couple of months and correspond with Ms. Reusser if any problems are encountered.

Ideally the data entry should be completed before December 31, 2007.

Consensus decision is: to hold a workshop to evaluate the protocols and reach final agreement on standards, data elements and data entry templates for the MNIS database on January 30–31, 2008, in Seattle, U.S.A.

Action item: Each country is to submit names of two representatives to be invited to attend the workshop to Ms. Smith by November 30, 2007, especially countries where visas are needed.

Update: Dates and location were changed to March 3–5, 2008 in Busan, Korea.

Planning for PICES XVII (Agenda Item 7)

WG 21 proposed a 1-day Topic Session (including posters) on marine non-indigenous species to be held at PICES XVII (*WG 21 Endnote 4*). This session will focus on ecological and economic impacts of marine non-indigenous species and ballast water technologies. Potential invited speakers are: David Pimentel, Andrew Cohen, James Carlton, Daniel Simberloff (for the Eastern Pacific) and Jiakuan Chen (for the Western Pacific).

Work plan for database and taxonomy initiatives (Agenda Item 8)

In April 2007, the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency (JFA) of Japan, provided a voluntary contribution to PICES for a project entitled “*Development of the prevention systems for harmful organisms’ expansion in the Pacific Rim*”. The project is anticipated to run for five years (from April 1, 2007 to March 31, 2012). It has two distinct components, one on MNIS and the other on HABs conducted by WG 21 and Section on *Ecology of Harmful Algal Blooms in the North Pacific* (HAB-S), respectively.

Within the MNIS sub-project, two initiatives have been identified: (1) development of a MNIS database; and (2) development of a

taxonomic system to allow identification and documentation of MNIS establishment outside of their native range. Details for activities under the Database Initiative are outlined in Agenda Item 6. Under the Taxonomic Initiative, WG 21 proposes to conduct a rapid MNIS assessment survey in each PICES member country. These assessments will focus on two port locations within the member country hosting the PICES Annual Meeting and be held immediately prior to the Annual Meeting, using taxonomic experts and students from the host country and Pacific Rim experts as needed. The first rapid assessment survey is scheduled for October 19–23, 2008, in conjunction with PICES XVII. The proposed surveys will be complemented by sub-tidal collectors for biofouling organisms deployed at selected sites in PICES member countries. A revised work plan for 2008–2009 can be found in *WG 21 Endnote 5*.

Sixth International Marine Bioinvasions Conference (Agenda Item 9)

Dr. Gil Rilov presented an overview of the 6th International Conference on “*Marine bioinvasions*” to be held in late August or early September 2009, at Portland State University (PSU), Portland, Oregon, U.S.A. Dr. Sytsma will serve as the local host.

The *Marine bioinvasions* Conference has focused on scientific and management issues related to marine introductions and focused on vectors, distribution, ecological impacts and evolutionary consequences, and related topics. The Conference also continues to identify new topics and emerging issues. As with the 5th Conference, co-sponsorship by the U.S. National Sea Grant Office, the International Council for the Exploration of the Sea (ICES) and PICES is welcome. Planning for the Conference is still in the initial stages. WG 21 is interested in supporting the Conference and requested to have a representative on the Scientific Steering Committee (SSC). Dr. Yoon Lee (Korea) volunteered to serve on the SSC. It was also

suggested to propose that a special session on Pacific Rim invasive species be included in the program. Conference organizers requested the following financial support from PICES:

- 2007–08 Fiscal Year \$10,000
- 2008–09 Fiscal Year \$10,000
- 2009–10 Fiscal Year \$30,000

Aquatic invasive species/climate change connection (Agenda Item 10)

How can WG 21 promote further discussion and/or research regarding the aquatic invasive species/climate change connection in the North Pacific? Dr. Paul Heimowitz raised this as an important upcoming issue and advised that the American Aquatic Nuisance Species Task Force will be discussing this issue at its meeting on November 27, 2007. The state of research on this issue is still in its infancy. The ICES WGITMO has provided some information relating invasions to current and temperature changes to OSPAR Commission. Discussion concluded that researchers will have to focus on this issue in the future and that there will be a need to distinguish between expansion range of non-indigenous species and expansion range of native species.

Next WG 21 meeting (Agenda Item 11)

WG 21 members propose to meet for two days at PICES XVII in Dalian, China. The purpose of this meeting will be to:

- review the draft report due at the end of WG 21’s current mandate;
- review progress of the database project and develop a work plan for Year 3; and
- review progress of the taxonomy project (including the rapid assessment survey) and develop a work plan for Year 3.

The Co-Chairmen closed the meeting by thanking everyone for their full participation, and by giving special thanks to the meeting guests who provided valuable input.

WG 21 Endnote 1

Participation list

Members

Evgenyi I. Barabanshchikov (Russia)
Blake E. Feist (U.S.A.)
Graham E. Gillespie (Canada)
Paul Heimowitz (U.S.A.)
Hiroshi Kawai (Japan)
Henry Lee II (U.S.A.)
Sam-Geon Lee (Korea)
Yoon Lee (Korea)
Vasily Radashevsky (Russia, Co-Chairman)
Darlene L. Smith (Canada, Co-Chairman)

Mark D. Sytsma (U.S.A.)
Thomas W. Therriault (Canada)
Lijun Wang (China)
Li Zheng (China)

Observers

Hak Gyoong Kim (Korea)
Judith Pederson (U.S.A.)
Deborah Reusser (U.S.A.)
Gil Rilov (U.S.A.)
Greg Ruiz (U.S.A)

WG 21 Endnote 2

WG 21 meeting agenda

October 26, 2008

1. Opening remarks and introductions
2. Country/Agency reports (15 minutes presentation + 5 minutes discussion each)
3. Science presentations (15 minutes presentation + 5 minutes discussion each)
4. WG 21 terms of reference: Discussion on progress and plans for completion
5. Joint PICES-ICES meeting summary and further co-operation (J. Pederson)

October 27, 2007

6. Database prototype: presentation (H. Lee II and D. Reusser) and discussion (All)

7. Topic Session on non-indigenous aquatic species at PICES XVII (Dalian, China)
8. Development of detailed work plan for database and taxonomy initiatives (including planning of the 2008 workshop) funded by a voluntary contribution from Japan
9. Sixth International Conference on “*Marine bioinvasions*” (2009): Discussion of PICES WG 21 support/involvement
10. How can WG 21 promote further discussion/research on the aquatic invasive species/climate change connection in the North Pacific? (P. Heimowitz)
11. Next WG 21 meeting and closing remarks

WG 21 Endnote 3

Proposed revisions to WG 21 terms of reference

1. Initiate compilation of an inventory of marine non-indigenous species in PICES member countries together with a compilation of definitions of terms and recommendations on use of these terms. Summarize the situation on bioinvasions in PICES member countries;
2. Increase taxonomic capacity of PICES member countries through rapid assessment surveys and possibly through creation of a web-based taxonomy tool;

3. Initiate compilation of an inventory of scientific experts on marine non-indigenous species subject areas and of the relevant national research programs and projects underway in PICES member countries;
4. Summarize existing requirements for ballast water management (e.g., discharge and monitoring requirements) in PICES member countries;
5. Summarize research related to impacts of ballast water and best practices for ballast

- water management in PICES member countries;
6. Coordinate activities of the PICES WG 21 with related Working Groups in ICES through joint meetings of these groups;

7. Develop and recommend an approach for formal linkages between PICES and ICES on aquatic non-indigenous species;
8. Publish final report summarizing results and recommendations.

WG 21 Endnote 4

Proposal for a 1- day Topic Session at PICES XVII on “Consequences of non-indigenous species introductions”

Non-indigenous species (NIS) are ubiquitous throughout the World's marine, coastal and estuarine waters. There is little doubt that human mediated dispersal of NIS and subsequent establishment of NIS has altered biodiversity, species assemblages, food web dynamics, and trophic structure and interactions in marine ecosystems. These alterations have ecological, biological, evolutionary and economic consequences, especially in coastal and estuarine systems. It is ironic that mariculture and the global shipping trade have been identified as the most affected economically, given that these two

activities are often identified as the primary vectors of marine NIS introductions. This session will address the impacts of marine NIS on the ecosystems in which they have invaded. Examples of impacts include, but are not limited to, biological, ecological, evolutionary, and economic. While abstracts addressing any type of economic impact will be considered, preference will be given to research projects focusing on ballast water and bio-fouling diagnostic and treatment technologies.

Convenors: Blake Feist (U.S.A.) and TBD

WG 21 Endnote 5

A 2008/2009 work plan for database and taxonomy initiatives of a marine non-indigenous species (MNIS) project funded by a voluntary contribution from Japan

DEVELOPMENT OF A COMPREHENSIVE MNIS DATABASE

Principal Investigator

Dr. Henry Lee II (Environment and Protection Agency, U.S.A.)

Database development

A template for standards and elements of relevant scientific data (scientific and common names, native range distribution and invasion range distribution(s), life histories, habitat requirements, ecological roles, impacts of invasions, and management and mitigation measures undertaken in invaded countries) will be developed and documented, based on the United States Environmental Protection Agency (EPA) and the United States Geological Survey (USGS) “Pacific Coast Ecosystem Information System” (PCEIS) spatial database.

Beta testing of the database

Focus will be on entry of data for a pilot NIS taxon (bivalves) by all PICES member countries. In situations where limited NIS bivalve data exist, another NIS taxa or native data will be used for testing purposes. Potential limitations identified through this exercise will be discussed at the proposed inter-sessional meeting.

Meeting to obtain consensus on database format, standards and elements

An inter-sessional meeting of WG 21 will be held after beta testing is completed (mid-winter 2008, in either Seattle, U.S.A. or Korea) to evaluate the database protocol and to reach final agreement on standards, data elements and data entry templates.

RAPID ASSESSMENT SURVEYS IN PICES MEMBER COUNTRIES

Principal Investigator

Dr. Thomas Therriault (Fisheries and Oceans Canada)

Purpose

Non-indigenous species (NIS) have the potential to alter habitats and biological diversity and can have economic and ecological impacts. There is a need for good taxonomy and consistency for sampling approaches in PICES member countries and other Pacific Rim countries. To better understand MNIS in PICES member countries, rapid assessment surveys will be carried out to gather and compare species information among countries. We have a unique opportunity at the 2008 PICES Annual Meeting in Dalian, China, to conduct the first rapid assessment survey and include taxonomic experts and students from each member country. If successful, this would be repeated in subsequent years in each PICES country the year they host the PICES Annual Meeting. All data collected would be entered into the PICES MNIS database being developed by WG 21.

Rapid assessment survey scope

Two separate locations in each country will be selected. Locations will be determined by the host country and could include areas near international shipping ports and aquaculture facilities as these are two major vectors for the introduction of marine non-indigenous species. Within each of the two locations, three different habitats will be selected for rapid assessment:

- intertidal habitat;
- floating docks/structures (*e.g.*, aquaculture facilities) that support subtidal biofouling organisms; and
- pilings/piers associated with commercial shipping activities that support biofouling organisms.

A total of six sampling sites will be assessed during the survey characterizing both the native and non-native species using available taxonomic experts. All species encountered

during the survey (or found on collectors or in traps) will be identified to the lowest taxonomic level possible. For 2008, it is suggested to focus the survey on Dalian Port (Yellow Sea) and Ba Yu Quan (Bohai Sea) as both are close to the Annual Meeting site and represent two different marine environments. The proposed locations have to be confirmed by the State Oceanic Administration.

Methods

The proposed project will examine community assemblages in both intertidal and subtidal habitats through two components:

The first component is sampling native and non-native species in various marine habitats such as:

- intertidal shoreline;
- commercial shipping piers or docks;
- floating structures such as aquaculture facilities; and
- baited traps to sample mobile fauna such as decopods (*e.g.*, crabs).

The second component will capture settlement of biofouling organisms over a period of 6 months. To do this we will:

- deploy settlement plates and collectors 6 months prior to the rapid assessment survey to sample subtidal biofouling communities;
- other PICES member countries wishing to do so, may also deploy settlement plates and collectors at the same time to provide additional information for comparison.

Previous rapid assessment surveys in the United States have used standardized methods and they may be referred to for establishing a protocol for PICES member countries. Two examples can be found in the following papers:

- Cohen, A.N. *et al.* (2000) Report of the Washington State Exotics Expedition 2000: A rapid assessment survey of exotic species in Elliot Bay, Totten/Eld Inlets and Willapa Bay. In: Washington State Department of Natural Resources, Olympia WA, pp. 46.

- Cohen, A.N. *et al.* (2005) Rapid assessment survey for exotic organisms in southern California bays and harbors, and abundance in port and non-port areas. *Biological Invasions* 7: 995–1002.

Required resources

Each rapid assessment survey will require the participation of the PICES host country's taxonomic experts representing the variety of non-indigenous marine taxa that have had significant negative ecological or economic consequences. These may include taxonomists specializing in ascidians (tunicates), crustaceans (crabs, barnacles, amphipods), mollusks (gastropods, bivalves), worms (polychaetes), cnidarians (hydroids, anemones) and algae. Taxonomic experts and students (primarily from the host country) who are familiar with these groups will form the bulk of the assessment team. The rest of the team could include experts from PICES member countries and other Pacific Rim countries. Representatives from other PICES member countries who will be involved in future rapid assessments should also participate. This approach ensures that highly qualified individuals confirm species identification while allowing training for students and taxonomic generalists. The list of experts from the host country should be provided 6 months in advance of the rapid assessment survey to permit sufficient time to identify additional required experts from other countries. Judith Pederson, Chairman of the

ICES Working Group on *Introductions and Transfers of Marine Organisms*, will serve as a resource person for this project.

Vehicles will be needed to transport the rapid assessment survey team to sampling sites. A small boat will be required to access potential floating/pier sites. The following sampling gears will be needed: (1) standard plankton nets for sampling phytoplankton and zooplankton; (2) standard traps (Fukui folding traps?) and groundlines for sampling decapods; and (3) tools (rakes, shovels, screens) to sample intertidal infaunal organisms. SCUBA divers, if available, could be used to sample subtidal species, but this is optional. Laboratory facilities with compound light microscopes and stereoscopes (dissecting scopes) will be required. Specimens will be photographed. Preliminary identifications are made in the field. However, all samples are taken back to a laboratory for verification and archiving. Some effort should be made to identify in advance and provide taxonomic reference books for each country (some may have to be purchased).

Funding

Travel and accommodation expenses for taxonomic experts and students will be covered under the taxonomy initiative of the MNIS project funded by a voluntary contribution from the Japanese government.

