Working Group on *Non-indigenous Aquatic Species*

The Working Group on *Non-indigenous Aquatic Species* (hereafter WG 21) held its eight meeting October 12, 2013 under the chairmanship of Ms. Darlene Smith who presented opening remarks and welcomed participants. WG 21 members from three PICES member countries (Canada, China and Korea) and observers from the Northwest Pacific Action Plan (NOWPAP) attended (*WG 21 Endnote 1*). The agenda for the meeting can be found in *WG 21 Endnote 2*.

Participants at the final meeting of WG 21 at PICES-2013 in Nanaimo, Canada. (Back, left to right) Hao Guo, Kyoungsoon Shin, Sangjin Lee, Graham Gillespie, Thomas Therriault, Keun-Hyung Choi, Anya Dunham. (Front) Jung-Hoon Kang, Darlene Smith.

AGENDA ITEM 2
Report on WG 21 related ICES activities

The International Council for the Exploration of the Sea (ICES) has launched the Strategic Initiative on Biodiversity Advice and Science (SIBAS) which has a key focus on aquatic invasive species, but also deals with ecological and biologically sensitive areas and marine protected areas. Information on SIBAS can be found on the ICES website: http://ices.dk/community/groups/Pages/SIBAS.aspx.

There will be a joint ICES/PICES theme session on marine biofouling at the ICES Annual Science Conference in A Coruña, Spain (September 15–19, 2014). WG 21 member, Dr. Thomas Therriault, will chair the session.

AGENDA ITEM 3
International Conference on Marine Bioinvasions

The 8th International Conference on Marine Bioinvasions was held in Vancouver, British Columbia, from August 20–22, 2013, and was co-sponsored by PICES. The conference's theme was "*Biological invasions in changing waters: Envelopes, estuaries, and evolution*". Approximately 125 researchers, policy makers, and managers from 13 countries in North America, South America, Europe, Australia/New Zealand, and Asia exchanged ideas and discussed the latest findings and progress in the global effort to understand and reduce the delivery, establishment, and spread of marine invasive species. Additional information on the Conference can be found in the PICES Press article (Vol. 22, No. 1): http://pices.int/publications/pices_press/volume22/v22-n1/pp_20-21_2013-MBIC.pdf.

Planning has begun for the 9th International Marine Bioinvasions Conference tentatively scheduled for January 2016 in Sydney, Australia, and the 10th International Marine Bioinvasions Conference tentatively scheduled for 2018 in Argentina.

AGENDA ITEM 4
NOWPAP Medium-Term Strategy

The Northwest Pacific Action Plan (NOWPAP) has adopted a Medium-Term Strategy for 2012–2017. Under this Strategy NOWPAP activities will focus on five priority areas:
1. Integrated coastal and river basin management;
2. Regular assessments of the state of the marine environment;
3. Pollution prevention and reduction, including harmful substances, hazardous waste and marine litter;
4. Biodiversity conservation (including marine invasive species); and
5. Climate change impacts.

NOWPAP will publish an Atlas of Marine Invasive Species in 2014.

Given the overlap of interests and membership, WG 21 members recognized the benefits of cooperation on marine non-indigenous species between PICES and NOWPAP.

AGENDA ITEM 5
Review of final WG 21 report

A draft of the final report was reviewed and suggestions made for completion.

AGENDA ITEM 6
Discussion and recommendations for future NIS activities in PICES

Having completed its original mandate, WG 21 concluded that non-indigenous species (NIS) will continue to be an issue of significant concern for PICES member countries. Discussion considered various options for continuing work on NIS. Briefly, WG 21 recommends two options for continuing NIS activities:
1. Create a section focused entirely on marine non-indigenous species; or
2. Create a Section on Conservation Focused on Drivers of Change in Biodiversity.

Proposed terms of reference for the two recommended options can be found in *WG 21 Endnote 3*.

WG 21 also recommends that PICES organize and support the following workshop/special sessions:
- Support a joint PICES/ICES theme session on "*The Increasing importance of biofouling for marine invasions: an ecosystem altering mechanism*" at the 2014 ICES Annual Science Conference in Spain;

- Mitigation and control measures to reduce the impacts of NIS on biodiversity;
- Range expansion of indigenous and non-indigenous species *vs*. human-mediated introductions;
- FAO workshop on identification of VMEs in the North Pacific Ocean;
- NPFC SWG meetings on identification of VMEs and development of encounter protocols.

WG 21 Endnote 1

WG 21 participation list

Members	Observers
Keun-Hyung Choi (Korea)	Anya Dunham (Canada, FIS, AP-AICE)
Graham Gillespie (Canada)	Sangjin Lee (NOWPAP of UNEP)
Hao Guo (China)	
Jung-Hoon Kang (Korea)	
Kyoungsoon Shin (Korea)	
Darlene Smith (Canada, Co-Chairman)	
Thomas Therriault (Canada)	

WG 21 Endnote 2

WG 21 meeting agenda

1. Opening remarks and introductions (Darlene Smith)
2. Report on WG 21 related ICES activities (Thomas Therriault)
3. International Conference on Marine Bioinvasions (Thomas Therriault)
4. NOWPAP Medium-Term Strategy (Sangjin Lee)
5. Review of WG 21 final report (All)
6. Recommendations for future PICES activities on marine NIS (All)

WG 21 Endnote 3

Recommendations for future PICES activities on NIS

WG 21 makes the recommendations to Science Board on the following two options for continuing activities related to marine non-indigenous species:

Option 1 – Create a section focused entirely on marine non-indigenous species

Terms of reference

1. Continue to share information and taxonomic expertise and update the database and atlas on new introductions to ecoregions.
2. Evaluate how changes in patterns of trade affect pathways and vectors, and provide new species pools from donor regions (*e.g*., in the potential opening of a north polar sea route, it is possible that NIS could spread between the North Atlantic and North Pacific).
3. Develop a protocol for sampling non-indigenous aquatic species in PICES member countries, including a method for sampling on polar sea route ships.
4. Develop a better understanding of changing distributions of NIS and vectors in the context of global climate change and its impacts on temperature, salinity, ocean acidification and deoxygenation.

5. Develop capacity for predicting changes in the distribution patterns of selected marine NIS among PICES member country ports over the next 100 years as global climate change leads to the opening of new pathways (*e.g.*, shipping in the Arctic).
6. Evaluate the risk of biofouling (hull fouling and tsunami debris) as a vector for the introduction of NIS. Additionally, evaluate the individual risks presented by species commonly encountered in biofouling vectors.
7. Investigate why some species establish over broad areas while some only establish restricted distributions. Compare widely distributed species (*e.g.*, green crab) with those of the same phyla with a narrow distribution. This information could be used in future risk assessments.
8. Changing vectors (*e.g.*, biofouling ships + tsunami debris (a novel vector) and understanding the risk of these species).
9. Plan workshops/special sessions, for example:
   - Support a joint PICES/ICES theme session on "*The increasing importance of biofouling for marine invasions: an ecosystem altering mechanism*" at the 2014 ICES Annual Science Conference in Spain;
   - Propose a workshop/session on mitigation and control measures to reduce the impacts on NIS on the marine environment;
   - Propose a workshop session on the role of global climate change in species' range expansion and human-mediated introductions.
10. Work with NOWPAP and ICES to accomplish the terms of reference.
11. Work with other PICES expert groups to accomplish the terms of reference.
12. Prepare a final report on accomplishments.

Option 2 – Create a Section on Conservation Focused on Drivers of Change in Biodiversity

Terms of reference

1. Partnerships:
   - Establish linkages with other intergovernmental organizations dealing with biodiversity issues (*e.g.*, ICES, NOWPAP, WESTPAC, NPFC, CBD, FAO);
   - Document and predict patterns in biodiversity:
     - Identify potential mechanisms to store and share information/data on biodiversity issues in the North Pacific (and beyond), *e.g.*, PICES atlas on NIS, NPFC SWG to build and update databases of the past and current distributions of key commercial and non-commercial species, including database of NIS, at the scale of ecoregions;
     - Identify areas that support high, rare, or unique biodiversity, including VMEs and EBSAs in collaboration with international organizations including CBD, FAO, NPFC, NOWPAP using international criteria (*e.g.*, CBD criteria for EBSA identification; FAO criteria for VME identification).

2. Understanding drivers of change in biodiversity:
   - Identify major drivers of change in biodiversity in the North Pacific Ocean, including non-indigenous marine species, climate change, fishing, and eutrophication, and develop pathways of effects models for related activities that describe the mechanisms of change, including interactions among multiple stressors;
   - Develop indicators to assess how drivers and biodiversity are changing over time and space (*e.g.*, ecosystem status index);
   - Develop models that relate changes in environmental (*e.g.*, climate-related changes in temperature, salinity, pH and O_2, human (*e.g.*, changes in the distribution of fishing effort, discharge of effluents), and ecological variables (*e.g.*, change in community structure) to changes in species distribution patterns, including changes in NIS distributions;
   - Develop models and predictions of change in biodiversity under alternative scenarios of climate change, NIS introductions, fishing patterns, eutrophication, or other key threats;

- Investigate impacts of NIS, fishing, climate change, contaminants (and other key threats) in areas that support high, rare, unique or endangered biodiversity;
- Identify how human societies around the North Pacific value marine biodiversity and how they benefit from naturally diverse marine ecosystems.

3. Provision of science advice:
   - Develop risk assessments for areas that support high, rare, unique or endangered biodiversity;
   - Review mechanisms to conserve biodiversity in the North Pacific, including development/implementation of Ecologically and Biologically Significant Areas (EBSAs), identification of Vulnerable Marine Ecosystems (VMEs), Marine Protected Areas (MPAs), *etc*. and identify mechanisms to preserve endangered and threatened species in the North Pacific;
   - Respond to emerging issues related to biodiversity;
   - Prepare science advisory reports on key biodiversity issues;
   - Work with other PICES expert groups to accomplish the terms of reference.

4. Prepare a final report on accomplishments.