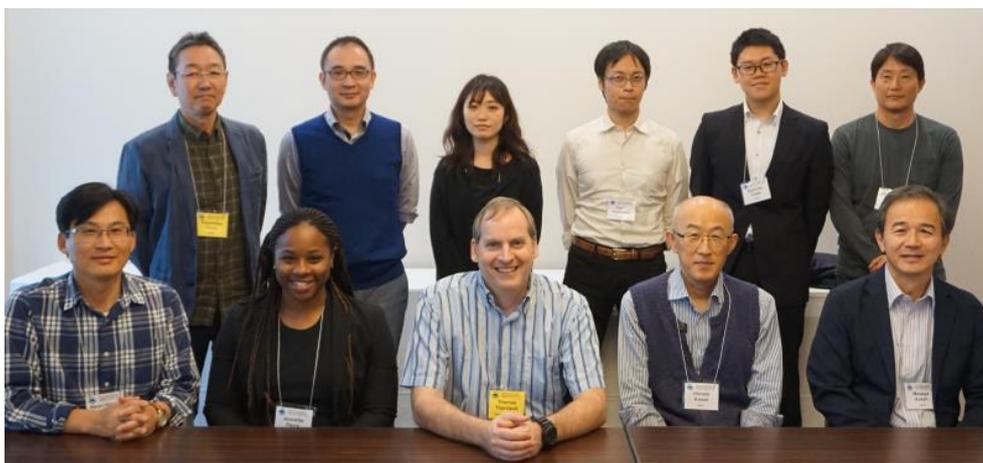


Report of the Advisory Panel on *Marine Non-indigenous Species*

The Advisory Panel on *Marine Non-indigenous Species* (AP-NIS) held its second meeting on Saturday, October 27, 2018 at PICES-2018 in Yokohama, Japan. Since appointment of membership is incomplete, Dr. Therriault (Canada) agreed to act as interim Chair for the Advisory Panel, and circulated a draft agenda to members in August 2018.

Dr. Therriault called the meeting to order and following introductions, members/observers (*AP-NIS Endnote 1*) adopted the draft agenda (*AP-NIS Endnote 2*) with the addition of one item under Agenda Item 13, Other Business, related to the ICES proposed new expert group/activity related to shipping impacts. The Terms of Reference were reviewed and no changes were suggested at this time.



Participants of the AP-NIS meeting at PICES-2018. Back row, from left: Toyomitsu Horii, Takafumi Yoshida, Yumi Okochi, Taichi Yanezawa, Ryosuko Fujita, Tae Gyu Park; front row from left: Keun-Hyung Choi, Jeanette Davis, Thomas Therriault, Hiroshi Kawai, Masaya Katoh. Missing from photo: Weol-Ae Lim

AGENDA ITEM 3

Information sharing on NIS within PICES and beyond

PICES has been very active on NIS issues since the Working Group on *Non-indigenous Aquatic Species* (WG 21) was established at PICES-2005 in Vladivostok, Russia. ToR 1 for AP-NIS is “Continue to share information on marine non-indigenous species (NIS) in the North Pacific via an updated NIS database”. AP-NIS discussed this ToR briefly at PICES-2017 (Vladivostok) recognizing the importance of exchanging information on NIS and how records might be archived/stored in a shared database. Currently, most PICES member countries have some internal domestic capacity related to NIS databases but most/none are publicly available at this time. Further, AP-NIS recognizes it will be (virtually) impossible to revive the WG 21 database and make it fully functional within existing expertise and resources, so the primary goal now is to extract as many records as possible from the WG 21 database to make them available elsewhere. To this end Dr. Therriault has been working with colleagues in ICES, especially Dr. Sergej Olenin, to explore options for using their geospatial database AquaNIS. Dr. Therriault gave a presentation on the structure and features of AquaNIS and AP-NIS endorsed the use of this platform to achieve this ToR. AP members felt this was the most viable solution as it will allow continued exchange of information both among PICES member countries and with the international scientific community also using AquaNIS (*i.e.*, ICES expert groups). AP-NIS recognizes the importance of verifying records prior to entry in any database and so have agreed to act as a review committee for any records that would be uploaded with a PICES designation. AP members agreed to have some records from their country available for upload by PICES-2019 in Victoria,

Canada, and every effort will be made to recover as many NIS records as possible from the old WG 21 database. Any records recovered will be vetted by AP-NIS prior to being deposited in AquaNIS. Dr. Therriault will work with Dr. Olenin and his team to resolve technical issues such as the ability to conduct bulk uploads of NIS records, the spatial resolution of reporting areas for the PICES domain, how to account for historic/ancient introduction events that could pre-date some taxonomic classifications, the ability of the database to account for species that produce cysts/resting stages or display annual/perennial lifecycles (*i.e.*, some phyto-benthos and phytoplankton) that may require an additional category/classification option, *etc.* Also, it appears AquaNIS currently does not support NIS images so Dr. Therriault will explore options to either have images embedded with records or linked (when available). He will also work with Dr. Olenin and the PICES Secretariat to ensure some degree of database redundancy (*i.e.*, backup options), thereby ensuring long-term utility and access.

AGENDA ITEMS 4 AND 5

Changing NIS distributions and pathways and Policy, regulation and management of NIS

Databases are not the only way to exchange information related to NIS in the North Pacific and other mechanisms would be more appropriate in some situations (*i.e.*, urgent needs) or for other purposes (*i.e.*, program/management/policy updates). In order to advance the exchange of information among AP-NIS members on changing NIS distributions and pathways (ToR 3) or regulations/policy and management of NIS in the North Pacific (ToR 2), it was agreed that a Standardized Reporting Template would be more appropriate. AP-NIS was concerned such a report might be misinterpreted as an official “National Report” but the AP agreed that a report for exchange of information was useful and any report represents the best attempt to exchange relevant information and should not be interpreted as an official country report. Specifically, the AP agreed to consider reporting on four major elements pertaining to their ToR:

- 1) New introductions of marine NIS,
- 2) Spread of existing/known marine NIS,
- 3) Vectors and pathways,
- 4) Management and policy.

Although this will be discussed in more detail at the next meeting during PICES-2019, the goal is to keep each PICES member country updated with respect to NIS incursions, spread, changes in vectors/pathways and the development or implementation of any new domestic or international NIS management or policy measures. Of primary concern is anything “new” and the AP agreed that this would be communicated rapidly (via email); the AP will discuss potential options for a Species Alert template that would provide critical information for possible management or control. AP-NIS also discussed how NIS distributions are changing, noting that some of these changes are exacerbated by climate change (as with other marine species). Several PICES member countries indicated ongoing work to apply species distribution models (SDMs) or other environmental niche modeling approaches to better understand not only potential distributions/spread under current conditions but also under climate change scenarios. AP-NIS is well positioned to provide current/accurate NIS sightings and environmental layers that will improve model outputs. It is possible that this could form the basis for a joint AP activity in the future and has links to some of the Working Group on *Biodiversity of Biogenic Habitats* (WG 32)’s ToRs. Dr. Keun-Hyung Choi gave an interesting presentation about efforts in Korea to better understand the changing distributions of some marine NIS and the monitoring programs that are in place to track these changes.

AGENDA ITEM 6

Best practices

AP-NIS ToR 2 also states the need to exchange information on “best practices for monitoring, early detection, rapid response, and control/containment options”. The AP had a general discussion about each of these

and not surprisingly many different approaches have been taken in PICES member countries. As part of the AP-NIS work plan, members agreed that the initial focus would be on monitoring and early detection and that rapid response and control would be the focus in the second phase (likely post-2020). A workshop was proposed for PICES-2019 (*AP-NIS Endnote 3*) to better understand the types of NIS monitoring taking place in member countries. This includes traditional surveys for mobile species, the use of settling plates for sessile fouling species, and emerging tools and techniques using eDNA and other molecular methods. At PICES-2019 the AP will consider the strengths/weaknesses of different approaches and be able to provide some guidance on optimizing monitoring for NIS.

AGENDA ITEM 7

Workshops/topic sessions/training courses

NIS activities within PICES have been featured at previous topic sessions/workshops hosted at PICES Annual Meetings (2005, Russia; 2008, China; 2016, USA), ICES ASCs (including 2017, USA), and several International Conferences on Marine Bioinvasions (including 2009, USA; 2011, Spain; 2013, Canada; 2016, Australia; 2018, Argentina). Several options/opportunities for hosting PICES-sponsored/co-sponsored sessions/workshops at upcoming meetings were discussed (see also *AP-NIS Endnote 3*). Dr. Therriault also noted that the ICES International Symposium on “*Shellfish – Resources and invaders of the North*”, November 2019, Tromsø, Norway was highly relevant to AP-NIS and recommended requesting partial funding for a member to participate.

Action: AP-NIS requests partial travel support for AP-NIS participation at the ICES symposium related to invaders in the North (2k).

AGENDA ITEM 8

NIS special project

AP-NIS discussed the potential options for a research project. Previous PICES NIS activities have benefitted from directed outside funding but there is currently no such fund for new NIS work. Thus, the AP considered possible options for low-cost activities that could be undertaken within existing domestic resources/programs. Once member countries update their NIS records in AquaNIS (see Agenda Item 3) there is the possibility to conduct novel research on North Pacific marine invasions. AP-NIS also recognizes that shipping and biofouling are major issues, including at the IMO (International Maritime Organization). Members discussed the possibility of sampling biofouling (or applying fouling panels) on vessels making trans-Pacific voyages to better understand the species transported, survival probabilities, likelihood of release and establishment in receiving environments, *etc.* It was noted that this work, if undertaken, could be complementary with planned GloFouling work and AP-NIS might be able to collaborate on this international project. Based on a suggestion from Dr. Choi, Dr. Therriault will contact Dr. Greg Ruiz to explore potential options for collaboration.

AGENDA ITEM 9

Report template

Not discussed.

AGENDA ITEM 10

AP-NIS Workplan

Not discussed.

AGENDA ITEM 11

Funding requests

See Agenda Item 7.

AGENDA ITEM 13

Other business

AP-NIS reviewed and discussed an ICES proposal for an ICES-PICES expert group the “Impact of Shipping” (*AP-NIS Endnote 4*). The context and rationale for this were not clear but the AP recognizes the role shipping plays in the re-distribution of marine species. Although the IMO ballast water management convention is in force, hull fouling continues to be an important issue in marine systems. The AP discussed the limitations of in-water cleaning and the potential to exacerbate spread. Further, the facilities, experience and regulations to do this type of work vary around the North Pacific. One emerging topic that deserves more consideration is the likely change in shipping routes due to climate change. With the opening of the Arctic Ocean it is probable that the number of Pacific–Atlantic introduction events will increase. Although possibly planned by IMO, the AP recognizes the importance of evaluating the effectiveness of the ballast water management convention. PICES member countries could provide insights this. Other shipping impacts include noise and microplastics but specifics were not discussed.

A new global survey of emerging issues around marine invasive species has been developed. This survey is available in all PICES member languages and Dr. Therriault will circulate a link for AP-NIS members to complete and distribute within their existing networks. The goal is to survey not only researchers but managers, industry, and communities that could be impacted by NIS.

Action: AP-NIS requests the chairmanship be finalized as soon as possible.

AP-NIS Endnote 1

AP-NIS participation list

Members

Keun-Hyung Choi (Korea)
Jeanette Davis (USA)
Masaya Katoh (Japan)
Hiroshi Kawai (Japan)
Weol-Ae Lim (Korea)
Thomas Therriault (Canada, acting Co-Chair)

Observers

Ryosuko Fujita (JANUS)
Toyomitsu Horii (Japan)
Yumi Okochi (JANUS)
Tae Gyu Park (Korea)
Taichi Yanezaea (JANUS)
Takafumi Yoshida (NOWPAP-CEARAC)

Members unable to attend

China: Lijun Wang, Li Zheng
Korea: Kyoungsoon Shin

*AP-NIS Endnote 2***AP-NIS meeting agenda**

1. Welcome, introductions, opening remarks
2. Review AP-NIS ToR
3. Information sharing on NIS within PICES and beyond (ToR 1)
 - a. WG-21 database
 - b. Other global databases
 - c. AquaNIS (supports ICES NIS ExGs) as preferred solution
 - i. Spatial scale
 - ii. Frequency of updates
 - iii. Other details
4. Changing NIS distributions and pathways (ToR 3)
 - a. How to communicate/report changing distributions
 - i. Only AquaNIS (or other database)?
 - ii. Country reports/updates
 - iii. Species alerts
 - b. How to communicate/report changing invasion vectors/pathways
 - i. Country reports/updates
 - ii. Others?
 - c. Modeling or predictions related to a) or b)
 - i. Efforts related to environmental niche modeling, etc.
5. Policy, regulation and management of NIS in the North Pacific (ToR 2)
 - a. Country updates
 - b. Gap identification and potential steps AP-NIS could take to inform member nations
6. Discussion on best practices (ToR 2)
 - a. Risk assessments
 - i. Rapid/screening/detailed
 - ii. Potential implications for trade (*i.e.*, EU proposed ban on NA lobster)
 - b. For monitoring/early detection
 - i. Traditional surveys, eDNA, *etc.*
 - ii. National programs vs. citizen science
 - c. For rapid response
 - i. Past experiences with NIS incursions
 - ii. Use/support for Incident Command Systems
 - iii. Lessons learned/new approaches
 - d. For management/control
 - i. Existing or planned control of NIS in the North Pacific
 - ii. Lessons learned/new approaches
7. Potential for hosting workshops/topic sessions/training courses/*etc.*
 - a. Debrief from MFIS-2018 in Beijing (several AP members attending)
 - b. Potential to host workshop/topic session at PICES-2019 (Canada) or PICES-2020 (China)
 - c. Potential capacity building activities (WG 21 did some of this)
 - d. Potential to collaborate with other groups (*i.e.*, ICES/NOWPAP/*etc.*)
8. Discussion of a special project to be undertaken by AP-NIS
 - a. Potential funding opportunity from Korea
 - b. Possible focus on biofouling issue in the North Pacific
 - c. Possible species or vector of common interest
9. Discussion of draft reporting template
 - a. Action from PICES-2017 (Therriault to circulate prior to PICES-2018)

10. Develop draft Workplan for AP-NIS
11. Discuss potential info/funding requests for MEQ
12. Update on World Ocean Assessment 2
 - a. Chapter specifically devoted to Marine Invasive Species (Chapter 25)
13. Other business
 - a. ICES brainstorming on impacts of shipping
14. Adjourn

AP-NIS Endnote 3

Proposal for a Workshop on “Monitoring non-indigenous species in PICES member countries: Towards best practices” at PICES-2019

Convenors: Thomas Therriault (Canada), Hiroshi Kawai (Japan), and Jeanette Davis (USA)

Duration: 1 day

Globally, marine non-indigenous species (NIS) introductions continue due to an increasing number of human-mediated vectors (*e.g.*, shipping, recreational boating, aquaculture-related movements) and pathways that are connecting previously discrete marine ecosystems. Once introduced outside their native range, NIS can significantly reduce native biodiversity and ecosystem goods and services thereby negatively affecting coastal communities and economies. Management of new incursions is often most effective when NIS are detected early when populations are small and spatially constrained. One approach to early detection of new invaders or tracking the spread of existing invaders relies on the establishment of effective monitoring programs that consider the type of species/taxa most likely to be introduced and the areas they are most likely to be introduced to (such as ports and marinas) or vulnerable/sensitive areas (such as Marine Protected Areas). There is a long history of marine invasions in the North Pacific and among PICES member countries early detection monitoring programs for NIS are likely to vary. In this workshop we will explore the types of NIS monitoring programs that are in place (or are being planned) with a focus on the North Pacific. This workshop will include both traditional monitoring techniques (*i.e.*, settlement plates, trapping or beach surveys) and more recent molecular approaches (*i.e.*, high-throughput sequencing, qPCR). By reviewing the strengths and weaknesses of these various NIS monitoring approaches/programs we aim to identify best practices for NIS monitoring in the North Pacific thereby informing one of AP-NIS’s Terms of Reference.

AP-NIS Endnote 4

Potential for an ICES-PICES expert group on “Impact of Shipping”

(one of the items discussed between ICES and PICES at the ICES 2018 ASC in Hamburg, Germany)

ICES has identified a need to address impacts of shipping on the marine environment more widely and pro-actively. The desire is to assemble a group that can answer broad questions related to the distribution and intensity of shipping on the coastal environment, considering impacts such as noise, mammal strikes, and pollution. There is also a desire to have broad geographic coverage of the ICES area, including the Arctic, and also beyond the ICES area into the Mediterranean and perhaps also the Pacific. Although the work will be relevant to invasive species as well, this will not be the core focus since there are other expert groups in ICES already focused on AIS.

As incoming Chair of the Steering Group that this new working group will belong to, I am looking to assemble a core group of experts to brainstorm and develop terms of reference for this new expert group. At this stage, I have contacted multiple experts asking for input through the attached survey

(see Appendix). Based on the responses, I will work with ICES HQ to draft potential terms of reference.

Please let me know if need any additional information to determine where this may fit into PICES activities. It would be great if any interested PICES experts could respond to the survey asap, as we will start drafting the terms of reference in the next month or two. Our hope is to finalize the terms of reference and establish the working group in 2019. Once the WG is formed, we will seek nominations more broadly for participation in the WG.

It would be great if this can go forward as a joint group.

Sarah A. Bailey, Ph.D.

Research Scientist, Great Lakes Laboratory for Fisheries and Aquatic Sciences
Fisheries and Oceans Canada / Government of Canada

(Sarah Bailey is Chair of ICES WGBOSV (Ballast and Other Ship Vectors) and incoming Chair (as of January 2019) of ICES Scientific Steering Group on Human Activities and Pressures and Impacts (HAPISG))

Appendix **New Shipping WG Brainstorm Questions**

Question	Response
1. WGMABS focused on oil spills, while WGBOSV focuses on the introduction of invasive species by shipping activities. List all shipping activity impacts that you think could be considered by the new WG because there is a knowledge gap or need for science advice?	
2. Are there any geographic regions that you think are poorly studied in terms of the impact of shipping activities?	
3. Are you conducting, or are aware of, any existing science activities related to shipping impacts which could benefit from interaction with a new WG? If yes, please describe the project and how a WG could help.	
4. Can you identify a shipping impact activity that you think would be a good topic for a literature review?	
5. Can you identify any gaps in methods that you think could be developed by the WG?	
6. What is the most pressing research question related to the impacts of shipping activities?	
7. Do you have any additional suggestions for activities that could be undertaken by a new shipping impacts WG?	