

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

The Advisory Panel on *Marine Non-indigenous Species* (AP-NIS) held its fourth meeting virtually due to the ongoing COVID-19 global pandemic. Dr. Thomas Therriault (Canada), Chair of this expert group, circulated a draft agenda to members in September, recognizing recognizing significant time constraints compared to other AP-NIS annual meetings. AP-NIS met via Zoom videoconference on Friday September 25, 2020 from 16:00–19:00 Pacific Daylight Time (Saturday, September 26, 2020 in Asia).

AGENDA ITEMS 1, 2, 3,

Welcome, introductions, opening remarks, PICES and its structure, and new members

Dr. Therriault called the meeting to order and acknowledged the challenges around PICES-2020 activities due to the novel coronavirus pandemic. Following introductions, members adopted the draft agenda (*AP-NIS Endnotes 1 and 2*). Since the last meeting at PICES-2019 in Victoria, Canada, there were membership changes within the Japanese delegation. Thus, Dr. Satoshi Watanabe, a new member from Japan replacing Dr. Tatsuya Yurimoto, provided an overview of his research interests that included the effects of eutrophication and Integrated Multitrophic Aquaculture (Agenda Item 3). Given these changes in membership, Dr. Therriault took the opportunity to provide all participants with an overview of PICES, its structure, and where AP-NIS is positioned in the organization, including reporting to MEQ (Agenda Item 2).

AGENDA ITEM 4

Review AP-NIS Terms of Reference

No changes were suggested at this time although the AP recognizes that an updated ToR around the new PICES Data Policy and data management requested at PICES-2019 will need to be delayed until AP-NIS is able to meet again face-to-face, hopefully for PICES-2021 in China.

PICES has a long history of collaborations with NOWPAP, especially on topics related to MEQ including non-indigenous species (NIS) and harmful algal blooms (HABs). For PICES-2021, NOWPAP agreed to co-sponsor a virtual session on eDNA with AP-NIS. Thus, Dr. Therriault took the opportunity to invite NOWPAP-CEARAC member Dr. Takafumi to present to AP-NIS at this business meeting and to discuss potential areas of mutual interest and mechanisms to advance these, including but not limited to eDNA. In the past, NOWPAP-DINRAC produced a list of NIS from the NOWPAP region that was useful for PICES WG 21's (Working Group on *Non-indigenous Aquatic Species*) work developing an atlas of NIS for the North Pacific and served as a resource for the PICES ADRIFT (Assessing the Debris Related Impact From Tsunami) project. More recently NOWPAP-CEARAC has made significant commitments to the development of eDNA tools for monitoring with potential application to a number of biodiversity and conservation issues, including potential NIS. Currently there are no standardized methods for eDNA collection or analyses so NOWPAP-CEARAC had been planning training courses for late fall 2020 (pre-COVID) and has developed an eDNA sampling manual in collaboration with the Japanese eDNA Society. Postponed training courses are being planned for early 2021 with tentative dates of March 8–12, 2021 in Kobe, provided COVID allows. Thus, there is an opportunity for PICES via AP-NIS to sponsor this important activity (see *AP-NIS Endnote 3*). The training would include a combination of lectures and hands-on experience in the collection, analysis, and interpretation of eDNA results. This planned activity will nicely complement the joint virtual session on eDNA at PICES-2020 and the planned extended version of this session in-person being planned for PICES-2021. There are many benefits from this type of collaboration that would allow technical exchanges between NOWPAP and PICES members including use of this emerging tool, species to target, and interpretation of results for

NIS management. From an operational perspective it may be possible to better refine applications for both single species (*i.e.*, targeted) detection or metabarcoding (*i.e.*, community patterns). AP-NIS was highly supportive of furthering our collaborations with NOWPAP-CEARAC on eDNA and discussions highlighted the need for reliable DNA databases of reference sequences with sufficient depth and coverage to be useful for NIS management. It was also noted that sequences needed to be tied to vouchers confirmed by recognized taxonomists to ensure errors that are common in some global databases are not perpetuated. It is possible that the new SCOR WG 157 (Toward a New Global View of Marine Zooplankton Biodiversity based on DNA Metabarcoding and Reference DNA Sequence Databases (MetaZooGene)), chaired by Dr. Anne Buckland, may provide an additional means of collaboration.

AGENDA ITEM 5

Information sharing on NIS within PICES and beyond (ToR 1)

Agenda Item 5 is largely focused on AP-NIS's ToR 1. Canada noted that it has made progress in collecting NIS information for AquaNIS and the first batch of species is expected to be ready by end of FY 2020–21 (but this timeline could be disrupted by COVID-related restrictions currently in place). It was noted that preliminary data for the Gulf of Alaska were made available for an ICES WG manuscript "Trends in the detection of aquatic non-indigenous species across global marine, estuarine and freshwater ecosystems: a 50-year perspective" to be published in *Diversity and Distributions* later 2020/early 2021. Korea indicated they are currently focused on gathering data for 18 NIS of interest including 5 plants, 5 jellyfish, 6 invertebrates, and 2 plants. The USA indicated that no data had been compiled yet but they are planning on extracting information from the US Geological Survey database that now allows eDNA records to be uploaded. Both the USA and Japan indicated some additional guidance was necessary and that a bulk upload feature would be most useful. Dr. Therriault will pursue options prior to PICES-2021 with his contact at ICES.

AGENDA ITEM 6

Changing NIS distributions and pathways (ToR 3)

Changing NIS distributions and pathways is a critical component of information exchange that directly addresses AP-NIS's ToR 3. Canada indicated that although no new NIS introductions to Canada had been observed/reported over the past year, a high-risk invader in the Pacific, European green crab, continues to spread in British Columbia with a major new incursion to Haida Gwaii (a remote archipelago off British Columbia's north coast). It is premature to determine if this incursion represents an established population or not but it does put green crab closer to Alaska. Dr. Therriault reported on Early Detection and Rapid Response activities that are now underway although these have proven challenging due to COVID-19 and funding restrictions. Canada also noted that DFO Science has provided Transport Canada updated advice on Ballast Water Exchange plus Treatment, is advancing a national biofouling risk assessment, and has ongoing projects with the Department of National Defence on biofouling risks. Korea introduced a new 5-year project on biofouling that is planned to get underway in 2021. This project would be looking at biofouling in niche areas, exploring removal/cleaning technologies, identifying biosecurity threats with new risk assessments and eDNA technologies, and developing mitigation methods. Japan noted the spread of *Spartina alterniflora* Loisel. This cordgrass species is native to the eastern USA and was unintentionally introduced to Aichi and Kumamoto Prefectures, Japan most likely via China at around 2010. The USA also noted no new introductions of NIS in the past year and introduced expanded NIS-related activities in Alaska, including the use of eDNA for monitoring high risk species like European green crab and *Didemnum vexillum* (a colonial tunicate) – work that is being carried out with the support of NOAA Sea Grant.

AGENDA ITEM 7

Changing NIS distributions and pathways (ToR 3)

Policy, regulation and management of NIS in the North Pacific directly addresses AP-NIS's ToR 2 and provides an opportunity for members to better understand NIS management and to increase awareness around planned/imminent regulatory or policy changes. Canada noted that in DFO Fisheries and Aquaculture Management is currently in the process of reviewing Conditions of Licence for the shellfish industry that may include increased restrictions to manage/control NIS. Once finalized these may be of use to other countries trying to limit the spread of NIS via this pathway. It was also noted that NIS Managers had asked for advice developing AIS Watch Lists (in a way that is more scientifically defensible) and a review of the effectiveness of Clean, Drain, Dry (and Decontaminate) as a means to limit the movement of NIS. From a regulatory perspective Canada noted that work continues on a process to add additional species to existing schedules in the AIS Regulations in the Canadian Fisheries Act. The USA provided an update on their Vessel Incident Discharge Act (VIDA). This regulation is aimed at replacing an existing patchwork of NIS regulations at federal, state, and local levels of government. The US EPA has been tasked with developing national standards by December 2020 and the US Coast Guard would then have to develop regulations within two years. It was also noted that the USA has developed an interagency Memorandum of Understanding to deal with zebra and quagga mussels in the western US.

AGENDA ITEM 8

Best practices (ToR 2)

AP-NIS had a brief discussion on best practices for NIS monitoring, including the potential application of new technologies like eDNA, and collaborations with NOWPAP. To this end AP-NIS members reiterated the desire to host an in-person session at PICES-2021 in Qingdao, China (COVID permitting) co-sponsored by NOWPAP to further explore eDNA for NIS applications (*AP-NIS Endnote 3*). This is a rapidly growing field that many PICES member countries are already engaged in. With respect to best practices, Canada reported on the systematic NIS monitoring that is being conducted by DFO. The focus has been on the deployment of settlement plates mainly in ports/marinas to characterize the distribution of biofouling species like tunicates and bryozoans and targeted trapping surveys for European green crab. Canada has also been developing eDNA tools for Early Detection of new NIS by focusing on methods that can be used by community groups or First Nations throughout the remote coastline of British Columbia. The USA reported on the use of large-scale trapping efforts for lionfish in the Gulf of Mexico and how this has benefited tremendously from citizen science engagement and collaborations across the Caribbean. As noted above, Alaska has extended its monitoring efforts and are using eDNA for Early Detection. This aligns well with NOAA's new "Omics Strategy" of which Goal 2 deals with the Blue Economy and biosurveillance is an essential element. It was also noted that in Washington State eDNA is being used for green crab and walleye (a freshwater fish invader). Finally, the National Invasive Species Committee has developed a white paper for using eDNA in NIS management – a nice complement to NOWPAP activities. In Korea monitoring efforts have focused on HABs and jellyfish. DNA detections have been used in Korea since 2014, especially when identifying species who threaten aquaculture or fisheries. Japan noted that there is a number of NIS monitoring programs throughout the country but that they lack centralized coordination. Again, it was noted how much interest there was on eDNA among all PICES member countries and how this technology had many potential applications for NIS.

AGENDA ITEM 9

Workshops/topic sessions/training courses

AP-NIS discussed the potential options for hosting workshops/topic sessions/training courses, *etc.* despite COVID-19 concerns. Once again the discussion focused on how eDNA might be used within PICES member countries for NIS. Building on discussions throughout the AP meeting, it was agreed that AP-NIS would like PICES to support the NOWPAP eDNA training course, especially through the involvement of Early Career Scientists and participants from North America (outside the NOWPAP region). This would contribute to capacity building by providing new training opportunities. Specifically, **AP-NIS would like to request PICES support and provide travel support for up to 2 ECS from the eastern Pacific to participate in the NOWPAP-led training course on eDNA (Japan, exact date TBD due to COVID) – 6K.** This request also was discussed and supported in principal by MEQ. In addition to this workshop, PICES has been a strong supporter of several iterations of the International Conference on Marine Bioinvasions. Due to COVID-19 this conference, initially being planned for May 2021, has been pushed back to May 2022. Further, colleagues in ICES are suggesting a joint PICES-ICES session or workshop on eDNA to be held at/in conjunction with this conference. Thus, **AP-NIS would like to request PICES provide travel support for either an Early Career Scientist or session/workshop convenor at ICMB-XI (Washington, DC, USA – May 2022 – delayed due to COVID) – 3K.**

Previous PICES NIS activities have benefitted from directed outside funding (*i.e.*, MAFF (Ministry of Agriculture, Forestry and Fisheries) of Japan or ADRIFT via MOE (Ministry of the Environment) of Japan) but there is currently no such fund for new NIS work. However, there is some scope for low-cost activities building on work already underway by AP-NIS members. For example, there is work around biofouling and several PICES member countries have some domestic capacity for NIS detection in ports or other high risk marine environments. These could be discussed in more detail if **AP-NIS were given a 1.5 day business meeting at PICES-2021.**

AGENDA ITEM 10

AP-NIS Special Project

Not discussed due to lack of time.

AGENDA ITEM 11

Info/funding requests

See Agenda Item 9 on funding request for a NOWPAP-led eDNA training course.

AGENDA ITEM 12

Global NIS activities of interest to AP-NIS

Dr. Therriault updated participants on Chapter 25 of the World Ocean Assessment 2 Report in which he was the lead on marine non-indigenous species. The chapter was finalized and has undergone two review processes. The UN has not yet met to approve the chapter due to COVID-related circumstances. If not meeting face to face, Dr. Therriault expects there will be approval by correspondence in the very near future. Previous work done by WG 21 was instrumental in informing the element of the chapter dealing with the North Pacific. Presumably there will be a World Ocean Assessment 3, so AP-NIS should continue to exchange information, improve the records for some parts of the North Pacific, publish in scientific literature so that we can then use it as a citation for WOA 3.

Dr. Therriault encouraged members to look at the IPBES Global Assessment on Biodiversity and Ecosystem Services draft document and register at <https://www.ipbes.net/global-assessment> if they would like to review and provide comments on the marine aspects of the work.

AGENDA ITEM 13

FUTURE

As the FUTURE SSC liaison with AP-NIS, Dr. Therriault provided an update which included the program's transition from Phase II into its next phase (Phase III, 2021–2025). Integral to FUTURE was that the momentum developed during Phase II should be maintained, rather than starting a new program.

AGENDA ITEM 14

MEQ meeting update

Dr. Therriault provided an update from the MEQ business meeting that took place before the AP-NIS meeting due to the virtual format of PICES-2020. However, Dr. Therriault reassured members that MEQ would still receive any requests, including for funding, from the AP prior to the Science Board meeting.

AGENDA ITEM 14

Other business

At the recommendation of the Secretariat, it was noted that AP-NIS should have a Co-Chair. Interested members can forward their names to the chair. At the end of the business meeting the USA delegate, Jeanette Davis, indicated that this would be her last meeting as she would need to step down from the AP as she had recently agreed to start a new position within NOAA. All the best Jeanette!

This concluded the first ever virtual meeting of PICES AP-NIS. The Chair thanked all participants for their contributions to the discussions and decisions recognizing that some members had to stay up late and others had to get up early in order to participate.

AP-NIS Endnote 1

AP-NIS participation list

Members

Thomas Therriault (Canada, Chair)
Hiroshi Kawai (Japan)
Satoshi Watanabe (Japan)
Weol-Ae Lim (Korea)
Kyoungsoon Shin (Korea)
Jeanette Davis (USA)

Observers

Takafumi Yoshida (NOWPAP-CEARAC)

PICES

Sonia Batten (Executive Secretary)
Harold (Hal) Batchelder (Deputy Executive Secretary)

Members unable to attend

China: Lijun Wang, Li Zheng
Korea: Keun-Hyung Choi

AP-NIS Endnote 2

AP-NIS meeting agenda

Friday, September 25, 2020 (PST)

1. Welcome, introductions, opening remarks
2. Brief overview of PICES and its structure, including AP-NIS reporting
3. Welcome new member(s) of AP-NIS and brief introduction of research area/interests
4. Review AP-NIS ToR
5. Information sharing on NIS within PICES and beyond (ToR 1)
 - a. **Action Item** from PICES-2018: Members to have some records for review and upload to AquaNIS
 - b. Discuss any challenges related to record gathering/reporting for AquaNIS
 - c. Discuss current situation for each member country and develop revised timeline for submissions to AquaNIS (likely ongoing)
6. Changing NIS distributions and pathways (ToR 3)
 - a. **Action Item** from PICES-2018: Members to report:
 - i. New introductions of marine NIS
 - ii. Spread of existing/known marine NIS
 - iii. Vectors and pathways updates
 - b. Each member country should prepare a brief summary that can be shared. A specific template for reporting needs to be discussed and finalized before PICES 2021 in China.
7. Policy, Regulation and Management of NIS in the North Pacific (ToR 2)
 - a. **Action Item** from PICES-2018: Members to report:
 - i. Management and policy updates
 - b. Updates from IMO activities
 - i. Ballast water
 - ii. Biofouling Correspondence Group
 - iii. Others?
8. Discussion on Best Practices (ToR 2) (Action Item from PICES-2018 was to focus on Monitoring but can discuss other topics if of interest)
 - a. For Monitoring/Early Detection (Current Focus)
 - i. Current efforts in each member country (*e.g.*, traditional surveys, eDNA, *etc.*)
 - ii. Outcomes from Workshop at PICES-2019 (W9)
 - iii. Virtual Topic Session at PICES-2020 (VS3)
 - iv. Discuss possible systematic monitoring among PICES member countries and key partners (*e.g.*, NOWPAP, ICES)
9. Potential for hosting workshops/topic sessions/training courses, *etc.*
 - a. Plan to host topic session at PICES-2021 (China) – this element was deferred from PICES-2020 due to COVID but increased interest from NOWPAP and others. Consider invited speakers, financial support, *etc.*
 - b. Potential to host topic session at MBIC-2022 (USA)
 - c. Potential capacity building activities (WG-21 did some of this)
 - d. Potential to collaborate with other groups (*i.e.*, ICES/NOWPAP/*etc.*)
 - i. ICES is thinking of hosting an eDNA workshop for NIS monitoring in 2021 or 2022
 - ii. NOWPAP also has activities underway on eDNA
 - iii. Others?
10. Discussion of a Special Project to be undertaken by AP-NIS
 - a. Possible focus on biofouling issue in the North Pacific
 - b. Possible species or vector of common interest
11. Discuss potential info/funding requests for MEQ

12. Update on global NIS Activities of interest to AP-NIS
 - a. World Ocean Assessment 2 Chapter 25 (final stages of approval)
 - b. IPBES Global Assessment (currently seeking peer input)
 - c. Others?
13. Update on PICES FUTURE Program
14. Update from MEQ business meeting, including possible collaboration with NOWPAP
 - a. Update on eDNA training within NOWPAP and potential for new activities
15. Other business
16. Adjourn

AP-NIS Endnote 3

Proposal for a Topic Session on “Using eDNA to assess and manage Non-indigenous species in the North Pacific” at PICES-2021

Co-conveners: Thomas Therriault (Canada); Keun-Hyung Choi (Korea); Satoshi Nagai (Japan)

Co-sponsor: NOWPAP

Duration: 1 day

Non-indigenous species (NIS) cause ecological and/or economic harm and are a threat to biodiversity. The spread of aquatic NIS has increased in the last decade due to globalization and other related human activities and preventing all introductions is not possible. Thus, early detection is the most valuable cost-effective control and eradication option, yet many species are difficult to detect using traditional survey techniques, especially over large spatial areas. The use of environmental DNA (eDNA) as a new and rapidly growing tool to detect, monitor, and quantify species for biodiversity and conservation management is of considerable interest. In comparison to traditional methods, eDNA sampling is more sensitive, less harmful to the environment, cost-effective, safer for both species and field staff, and more targeted for identifying species of interest. Therefore, eDNA is a promising tool for early detection of NIS. However, the effectiveness for this technique across many NIS taxonomic groups and habitat types is unexplored and could have important management implications. This topic session will explore the use of eDNA to detect and assess NIS status in the North Pacific. The goal is to evaluate the landscape of how eDNA monitoring is being applied in the NIS community globally and to share information relevant to management and policy. Since different environments and species will require different sampling standards, there are potential opportunities for lessons learned and shared methodologies for data collection, analyses, and comparison.