2021 Report of the Advisory Panel on *Marine Non-indigenous Species*

The Advisory Panel on *Marine Non-indigenous Species* (AP-NIS) met for the fifth time in advance of PICES-2021 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 August, and based on comments and feedback updated the agenda which included presentations from NOWPAP and ICES. It was noted that participants look forward to a time when AP-NIS can meet again in-person, noting that although a useful stopgap measure, the virtual format significantly reduces time available for discussion and time zone differences remain a challenge. AP-NIS met via Zoom videoconference on Monday September 27, 2021 from 16:00-19:00 Pacific Daylight Time (Tuesday September 28, 2021 in Asia; *AP-NIS Endnote 1*).

AGENDA ITEMS 1 AND 2
Welcome, introductions, opening remarks, new members

Dr. Therriault called the meeting to order and acknowledged the challenges around PICES-2021 activities due to the ongoing coronavirus pandemic. Following introductions, members/observers adopted the draft agenda (*AP-NIS Endnote 2*). Since the last meeting at PICES-2020 (virtual) there were some membership changes. Dr. Jongwoo Park, a new member from Korea replaced Dr. Weol-Ae Lim and Dr. Jeanette Davis representing the USA stepped down from AP-NIS. It was noted that the USA does not currently have representation on this PICES expert group and it was agreed that Dr. Therriault would make a request via MEQ and Science Board that the USA Governing Council delegates consider a replacement as soon as possible.

AGENDA ITEM 3
AquaNIS

AP-NIS term of reference 5 states that the AP will work with other international, intergovernmental organizations (*e.g.*, IMO, ICES, NOWPAP and WESTPAC) and/or countries to accomplish these terms of reference, especially those related to data/information exchange and ToR 1 states the AP will continue to share information on marine non-indigenous species (NIS) in the North Pacific via an updated NIS database. At the first AP-NIS business meeting at PICES-2017 in Vladivostok, discussions started on the most appropriate database to exchange such information and at PICES-2018 in Yokohama members agreed that the ICES-sponsored database AquaNIS would be preferred, in part due to the long history of collaboration on marine science issues between PICES and ICES, including on NIS. However, collecting such information has been challenging, in part due to COVID-19 restrictions and membership changes. Thus, Dr. Therriault invited Dr. Sergej Olenin, the AquaNIS database manager to provide AP-NIS members an overview of this database that is capable of housing species records and introduction events from around the world, including the North Pacific. Although it was noted that some data from the PICES region are currently included, there are significant gaps. Further, previous work on a PICES WG 21 (*Non-indigenous Aquatic Species*) database included hundreds of NIS in the North Pacific Ocean while the current AquaNIS holdings for the western Pacific were a scant handful. Thus, AP-NIS members re-committed to collecting NIS records for submission to AquaNIS.

Action: Drs. Therriault, Olenin, and Srebaliene agree to work with Drs. Kawai and Watanabe (Japan) and Drs. Choi and Yu (Korea) to collect NIS records for their respective countries in accordance with AquaNIS data standards.

A template will be used to facilitate a "bulk upload" of NIS records/introduction events. Once records have been uploaded it will be possible for AP-NIS to explore this data to better understand changing NIS distributions and vectors of introduction or spread in the North Pacific.

AGENDA ITEM 4
PICES and its structure

Given the changes in membership and new observers at this year's virtual meeting, Dr. Therriault took the opportunity to provide a quick overview of PICES, its structure, and where AP-NIS is positioned in the Organization, including reporting to MEQ. It was noted that the AP-NIS ToR can be found on the PICES website at https://meetings.pices.int/members/advisory-panels/AP-NIS.

AGENDA ITEM 5
PICES collaborations with NOWPAP

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). Thus, Dr. Therriault took the opportunity to invite NOWPAP-CEARAC (Coastal Environmental Assessment Regional Activity Center) member, Dr. Takafumi Yoshida, to present to AP-NIS at and provide an update. In the past, NOWPAP-DINRAC (Data and Information Network Regional Activity Center) produced a list of NIS from the NOWPAP region that was useful for PICES WG 21's work developing an atlas of NIS for the North Pacific and served as a resource for the PICES ADRIFT 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 (delayed due to COVID-19) and has developed an eDNA sampling manual in collaboration with the Japanese eDNA Society. Last year PICES approved a request from AP-NIS to co-sponsor a planned eDNA training course that would include a combination of lectures and hands-on experience in the collection, analysis, and interpretation of eDNA results. This planned activity nicely complements the joint virtual session on eDNA at PICES-2020 and the planned extended version of this session in-person being planned for PICES-2022 (*AP-NIS Endnote 3*). Dr. Yoshida highlighted that NIS were a priority for NOWPAP countries and that their RAP BIO included monitoring the occurrence and sources of NIS, identifying the threats posed by NIS, proposed management and mitigation measures for NIS and capacity building. Due to the ongoing COVID-19 pandemic, NOWPAP plans to produce a video manual for eDNA during the current biennium and host an in-person training course in the next biennium, most likely March 2023, with AP-NIS co-sponsorship (which members were highly supportive of).

AGENDA ITEM 6
Workshops/topic sessions/training courses

AP-NIS had planned to host a follow-up topic session on eDNA at PICES-2021 but since it was not possible to host this session in-person due to the continuing pandemic, the convenors decided to withdraw the session with the intent of submitting for PICES-2022 in Korea (*AP-NIS Endnote 3*). AP-NIS agreed with this strategy seeing a distinct benefit of hosting an in-person session at PICES-2022 (COVID permitting), with co-sponsorship by NOWPAP.

Action: Dr. Therriault to submit this topic session via the online portal following the business meeting.

Given the ongoing interest in eDNA among PICES member countries Dr. Shin and colleagues suggested they would be willing to host a workshop in advance of PICES-2022 at KIOST.

Action: Dr. Therriault to work with Dr. Shin and his team to refine details inter-sessionally.

Finally, Dr. Therriault introduced a joint PICES-ICES proposal to host a workshop and topic session at the 11th International Conference on Marine Bioinvasions (Annapolis, MD, USA – May 2022). AP-NIS agreed this was a high priority and agreed to request 5K in travel support for invited speakers, convenors, or early career scientists.

AGENDA ITEMS 7-11
Terms of Reference (ToR 1, 2, 3)

Agenda Item 8 (Information sharing on NIS within PICES and beyond) is largely focused on AP-NIS's ToR 1; Agenda Item 9 (Changing NIS distributions and pathways) is a critical component of information exchange that directly addresses AP-NIS's ToR 3; and Agenda Item 10 (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/immanent regulatory or policy changes. Due to the virtual format, Dr. Therriault requested that each country report cover these three agenda items in their annual updates. As noted in Agenda Item 3, Canada, Japan and Korea each recommitted to submitting NIS records from their respective waters to AquaNIS. For this past reporting year no new introductions were noted from these three countries. However, each noted that NIS have been observed and in some cases are continuing to spread. Further, of the 33 NIS noted for Korean waters, Dr. Cheol Yu indicated that 10 are considered recent arrivals. This includes a tunicate (*Botrylloides diegensis* – a southern California native) and nine bryozoan species. Many of these species are more tropical species arriving from the south (most likely associated with shipping activities and ocean warming) and are generally appearing first around Jeju Island. Similarly, Dr. Therriault indicated that higher risk species like botryllid tunicates (*Botrylloides violaceus* and *Botryllus schlosseri*) and European Green Crab (*Carcinus maenas*) continue to spread along Canada's west coast. Related to ToR 3, Dr. Therriault introduced a couple of new research projects including one that is looking to characterize natural biogeographic barriers to NIS dispersal and shipping activities that cross these barriers and another that is identifying biofouling NIS with the potential to be moved between global source ecoregions and Canadian sink ecoregions. Once identified, a screening-level risk assessment will be undertaken to identify higher risk species for prevention and monitoring. Also, in relation to Agenda Item 11 (Discussion on Best Practices (ToR 2)), he introduced five projects underway in Canada aimed at improving NIS detections or management and control with results expected at future AP-NIS meetings. Finally, Dr. Young-Dong Moh provided a review of NIS policies, regulations and management in Korea. There were two applicable regulations, one dealing with Organisms Disturbing the Marine Ecosystem and another dealing with the Management of Harmful Marine Organisms. However, at the crux of the issue is that by definition, the NIS must arrive from outside Korean waters thereby creating a gap with respect to potential domestic introductions of NIS among Korea's three oceans. An additional challenge is that these organisms must be demonstrated or expected to disrupt the balance of marine ecosystems, which may be difficult to determine. An area of potential future work for AP-NIS would be to look among PICES member countries to determine if definitions of NIS differ.

AGENDA ITEM 12
AP-NIS special project

Due to time constraints, discussion of a AP-NIS Special Project was deferred and will be discussed at the next in-person meeting of AP-NIS.

Action: AP-NIS requests a 1.5 day meeting at PICES-2022.

AGENDA ITEM 13
Global NIS activities of interest

Dr. Therriault noted that the Second World Ocean Assessment, which included a chapter on Non-indigenous Marine Species (Chapter 22, pp. 343–362, was published this year. There is an opportunity for AP-NIS to contribute to an anticipated Third World Ocean Assessment in the future and by sharing information via AquaNIS, this PICES expert group is well positioned to provide new information on North Pacific NIS.

AGENDA ITEM 14
Update on FUTURE

As the FUTURE SSC liaison with AP-NIS, Dr. Therriault provided a brief update and shared the presentation via email with AP-NIS meeting members.

AGENDA ITEMS 16 AND 17
Other business and adjourn

There was no new business to discuss. Dr. Therriault thanked meeting participants and concluded the second virtual meeting of PICES AP-NIS.

AP-NIS Endnote 1

AP-NIS participation list

Members

Thomas Therriault (Canada, Chair)
Hiroshi Kawai (Japan)
Satoshi Watanabe (Japan)
Keun-Hyung Choi (Korea)
Kyoungsoon Shin (Korea)

Members unable to attend

China: Lijun Wang, Li Zheng
Korea: Jongwoo Park

Observers

Brett Howard (Canada)
Young-Dong Moh (Korea, National Marine Biodiversity Institute)
Sergej Olenin (ICES)
Jae-Yeon Park (Korea, Environment & Resource Convergence Center, Advanced Institute of Convergence Technologies)
Andrew Ross (Canada, MEQ Vice-Chair)
Takafumi Yoshida (NOWPAP-CEARAC)
Cheol Yu (Korea, National Marine Biodiversity Institute)

PICES

Alexander Bychkov (Past Executive Secretary)

AP-NIS Endnote 2

AP-NIS meeting agenda

Monday, September 27, 2021 (NA)/Tues Sept 28, 2021 (Asia)

1. Welcome, introductions, opening remarks
2. Welcome new member(s) of AP-NIS and brief introduction of research area/interests
   a. Discuss possible new members
   b. Discuss possible engagement of ECOPs
3. Introduction and Overview of AquaNIS (Olenin – ICES)
4. Brief overview of PICES and its structure, including AP-NIS reporting, and updates from MEQ (our parent committee)
5. Update on PICES collaborations with NOWPAP (Yoshida)
   a. Update on eDNA training workshops within NOWPAP and potential for new activities
7. Review AP-NIS ToR
8. 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 (ongoing)
9. 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.
10. 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?
11. 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 Virtual Topic Session at PICES-2020 (VS3)
       iii. Discuss possible systematic monitoring among PICES member countries and key partners (e.g., NOWPAP, ICES) such as settlement plates for biofouling
6. Potential for hosting workshops/topic sessions/training courses/etc.
   a. Initially planned to host topic session at PICES-2021 but due to the ongoing COVID-19 pandemic and virtual format the co-convenors requested this be delayed until PICES-2022 (Korea). Continued interest from NOWPAP and ICES. Consider invited speakers, financial support, etc.
   b. Potential to host topic session at ICMB-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. Recent efforts related to eDNA but could be others
12. Discussion of a Special Project to be undertaken by AP-NIS (time permitting)
    a. Possible focus on biofouling issue in the North Pacific

   b. Possible species or vector of common interest
13. Update on Global NIS Activities of Interest to AP-NIS
   a. World Ocean Assessment 2 Chapter 22 (published March 2021)
   b. IPBES Global Assessment (currently seeking peer input)
   c. Others?
14. Update on PICES FUTURE Program, including UN Decade for Ocean Science
15. Finalize info/funding requests for MEQ
16. Other Business
17. Adjourn

AP-NIS Endnote 3

Proposal for a Topic Session on
"*Using eDNA to assess and manage non-indigenous species in the North Pacific*"
resubmitted for PICES-2022

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

Sponsorship: 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.