PICES-NOWPAP Framework for Scientific Cooperation in the North Pacific Ocean

September 1, 2015

Executive Summary

The joint PICES-NOWPAP Study Group on *Scientific Cooperation in the North Pacific Ocean* (SG-SCOOP) agreed on the need for a framework to guide and implement joint science and monitoring activities of the North Pacific Marine Science Organization (PICES) and Northwest Pacific Action Plan (NOWPAP). The framework identifies seven topics of joint interest to NOWPAP and PICES, and prioritizes these into three categories. Two topics, related to Harmful Algal Blooms (HABs) and Marine Pollution (MP), had the highest joint ranking (average ranking of the two organizations) and therefore, are the themes that should be of immediate focus for joint activities over the next few years. Three other topics, Non-Indigenous Species (NIS), Ecosystem Status Reporting (ESR), and Biodiversity (BIODIV) were ranked second tier priorities, and should be the subject of opportunistic collaboration between the two organizations in the near-term, and perhaps focused joint activities in 3 to 4 years. Eutrophication (EUT) and Hypoxia (HYPOXIA) were listed as third tier priorities, subject to additional discussion between the two organizations before joint activities are undertaken.

The framework recommends initial activities be accomplished through jointly sponsored workshops and topic sessions to share information. Other approaches to collaborations might involve co-sponsored training activities (workshops, training courses, or summer schools). It should be noted that NOWPAP has *ex-officio* member status on the PICES Section on *Ecology of Harmful Algal Blooms in the North Pacific* (S-HAB), and that the recent PICES Scientific Report (No. 27, 2014) on *Proceedings of the Workshop on Economic Impacts of Harmful Algal Blooms on Fisheries and Aquaculture* was a joint publication of PICES S-HAB and NOWPAP-CEARAC (Special Monitoring and Coastal Environmental Assessment Regional Activity Center). SG-SCOOP views this recent publication as a positive sign for future collaborations between NOWPAP and PICES.

SG-SCOOP recommends that the framework as outlined herein be implemented shortly after approval by both organizations, and that annual updates of collaborative activities be provided to PICES' Science Board and NOWPAP Regional Coordinating Unit (RCU). These bodies will in turn submit the updates to PICES' Governing Council and to NOWPAP's Intergovernmental Meeting.

1 Background

PICES (North Pacific Marine Science Organization) is an inter-governmental organization whose intent is to communicate and foster marine science that will lead to a better understanding of the physical, chemical and ecological functioning of the North Pacific Ocean and its adjacent seas. Six Contracting Parties (Canada, United States of America, Japan, People's Republic of China, Republic of Korea, and the Russian Federation) make up the Organization. The last four countries are also members of the Northwest Pacific Action Plan (NOWPAP). NOWPAP is an organization whose aim is to develop guidelines about indicators, thresholds, monitoring and status reports useful to operational management and monitoring of the marine environment of East Asian seas.

To enhance collaboration between PICES and NOWPAP in developing an improved understanding of North Pacific marine ecosystems, a joint PICES-NOWPAP Study Group on *Scientific Cooperation in the North Pacific Ocean* (SG-SCOOP) was established in July 2014. SG-SCOOP was charged to develop a framework for enhanced collaboration between the two organizations that would serve as the basis for longer-term strategic planning by both organizations. The SG reviewed the scientific goals and approaches of each organization, especially PICES' Strategic Plan and NOWPAP's Medium-Term Strategy, and identified where similar key questions or scientific issues might be explored jointly. Initially there was some disagreement on how rigid or formal the framework needed to be to allow the two organizations to collaborate efficiently. PICES preferred a more formal approach whereas NOWPAP considered an agreement in principle on priorities and activities of joint interest was sufficient, but deferred to a formal framework.

Membership of the SG comprised Chuanlin Huo (Co-Chairman of SG-SCOOP and Chairman of MEQ, PICES), Alexander Tkalin (Co-Chairman of SG-SCOOP, NOWPAP Coordinator), Jennifer Boldt (MONITOR Chairman, PICES), Alexander Bychkov (Executive Secretary, PICES), Toru Suzuki (TCODE Chairman, PICES), Thomas Therriault (Science Board Chairman, PICES), Chunwei Han (NOWPAP DINRAC), Anatoly Kachur (NOWPAP POMRAC), Seong-Gil Kang (NOWPAP MERRAC), and Takafumi Yoshida (NOWPAP CEARAC). The first meeting of SG-SCOOP was held on October 15 (14:00–18:00) and October 16 (9:00–18:00) at PICES-2014 (Yeosu, Korea). PICES and NOWPAP representatives (*Appendix 1*) discussed a working document prepared before the meeting, including topics of joint interest, priorities, and operating procedures for each organization.

The terms of reference for SG-SCOOP were to:

1. Review existing and planned scientific activities of each organization
2. Develop a list potential areas of cooperation
3. Convene a meeting/workshop for the following purposes
    a. improve understanding of the science activities of each organization
    b. review scientific topics from TOR (1) to identify areas of common interest
    c. develop a framework for cooperation between NOWPAP and PICES that lists categories of joint activities and the rationale for each, including the benefits to each organization from the joint activity, and identify priorities for joint activities within categories
    d. recommend processes for implementing TOR (3c)
    e. recommend approaches to develop a strategic plan for cooperation and mechanisms to periodically update that plan
4. Prepare a final Study Group report for distribution by the NOWPAP-PICES Secretariats by fall 2015.

2 Implementation procedures

PICES and NOWPAP have a history of cooperative efforts. Since 2005, there have been significant increases in reciprocal attendance at each other's meetings and workshops, joint sponsorships of scientific sessions/workshops and capacity building activities, and deeper linkages that have developed on a case-by-case basis. The purpose of SG-SCOOP was to build on these prior endeavors by identifying major topics and mechanisms for enhancing scientific cooperation in activities of mutual (shared) interest to both organizations.

2.1 Implementation mechanism of PICES

PICES has developed and supported substantial interdisciplinary research in North Pacific marine science related to oceanography, ocean ecology, marine chemistry, model development and analysis, environment quality, climate variability and change, and fisheries. PICES consists of a Governing Council which is responsible for policy, general direction, decision-making and priority setting. The Secretariat provides support to the science activities that take place under the direction of a Science Board. Science Board directly oversees six Scientific and Technical Committees and, at the time of this report, an integrative science program, four study groups, and one section (Figure 1). Seven active working groups, three sections and three advisory panels report to their respective Committees. The Committees provide overall guidance and direction to the major themes under the PICES Strategic Plan. Study groups (approximately 1-year duration) and working groups (approximately 3-year duration) are established by Science Board, upon approval by Governing Council, to create focused expert groups of scientists, representing all PICES member countries, capable of exploring and contributing new or summarized knowledge products on specific marine science issues. PICES has one active scientific program (approximately 10-year lifespan) that addresses larger-scale questions which require a longer timeline. The first was the Climate Change and Carrying Capacity (CCCC) program which ran for approximately 14 years, ending in 2009. The current integrative science program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of the North Pacific **E**cosystem), is about half way through its anticipated lifetime.

The Marine Environmental Quality Committee (MEQ) encourages, facilitates, and conducts multi-national investigations of the status, conditions, trends, and effects in the environmental characteristics of coastal and marine ecosystems of the North Pacific. PICES' MEQ and NOWPAP have many research areas of common interest, which are reflected in the similar objectives of the FUTURE program and the NOWPAP Medium-Term Strategy (MTS).

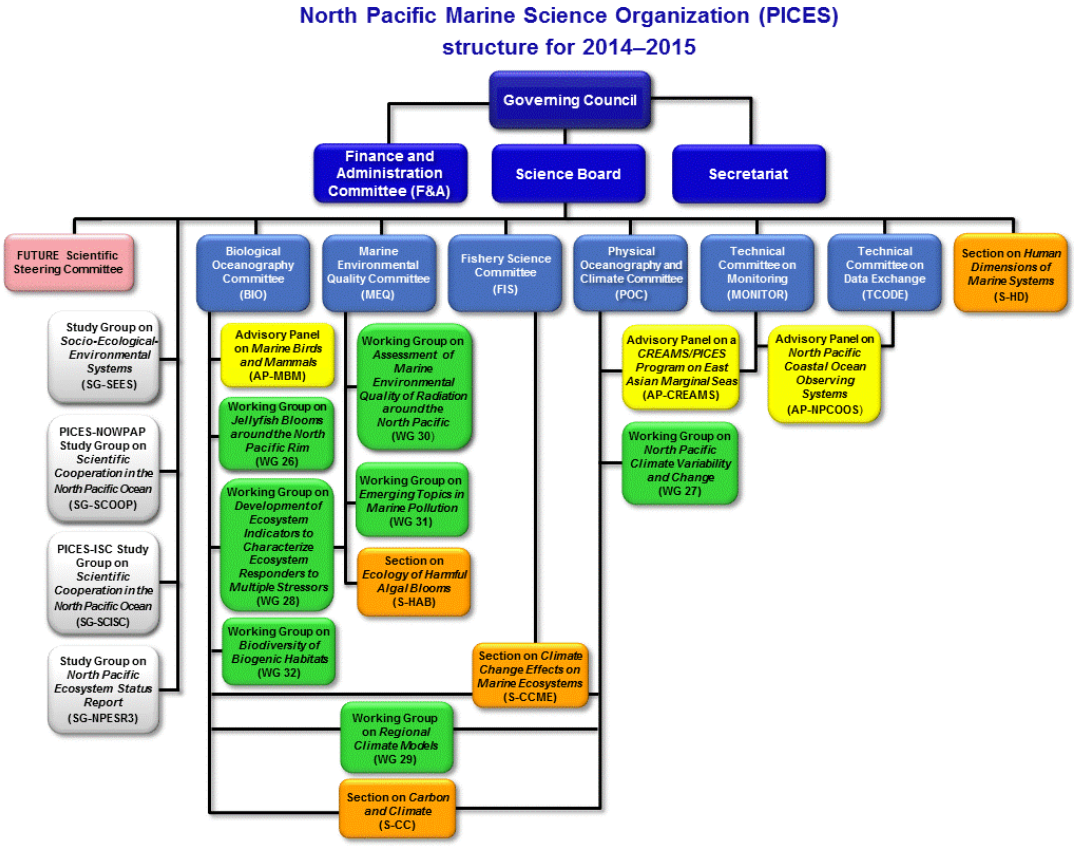

Figure 1 Organizational structure of PICES in 2014–2015. The uppermost rows are the executive and standing committees. Expert groups under them are generally ephemeral, with their lifespan determined by the nature of their duties

2.2 Implementation mechanism of NOWPAP

NOWPAP was adopted as a component of the Regional Seas Program of the United Nations Environment Program (UNEP) in September 1994. NOWPAP contributes to the Global Program of Action for the Protection of the Marine Environment from land-based activities by providing information from the Northwest Pacific region which contains coastal and island ecosystems with spectacular marine life and commercially important fishing resources. The coastal regions adjacent to the Northwest Pacific are also one of the most densely populated parts of the world, resulting in enormous pressures, stresses and demands on the environment. The overall goal of NOWPAP is "*the wise use, development and management of the coastal and marine environment so as to obtain the utmost long-term benefits for the human populations of the region, while protecting human health, ecological integrity and the region's sustainability for future generations*". To achieve this goal, NOWPAP is organized with the following elements: Intergovernmental Meeting (IGM), a Regional Coordination Unit (RCU), and four regional activity centers composed of the Data and Information Network Regional Activity Center (DINRAC), Marine Environmental Emergency Preparedness and Response Regional Activity Center (MERRAC), Special Monitoring and Coastal Environmental Assessment Regional Activity Center (CEARAC) and Pollution Monitoring Regional Activity Center (POMRAC) (Figure 2).

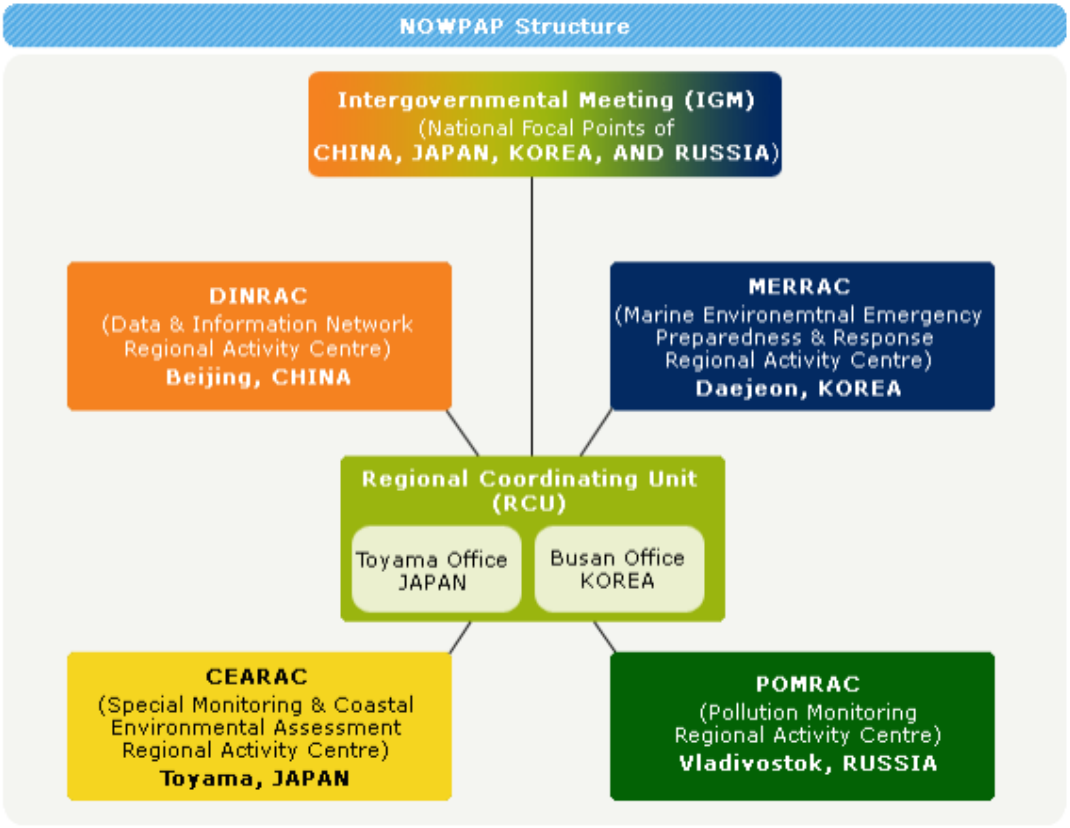

Figure 2 The structure of NOWPAP as a part of the Regional Seas Program of the United Nations Environment Program (UNEP).

The NOWPAP MTS, which was approved in 2012, serves as guidance for its member countries, RACs and the RCU to implement NOWPAP activities during 2012–2017 in order to achieve its overall goal. The MTS includes thematic elements relating to: (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 alien invasive species), (5) climate change impacts, (6) information management, and (7) enhancing public awareness.

For 2018–2021 (and probably beyond), NOWPAP activities, as part of the UNEP Regional Seas Program, will concentrate on four major issues: a) ecosystem services, with focus on extraction of living and non-living resources, b) pollution, c) governance, and d) climate change impacts, including ocean acidification.

2.3 Cooperation mechanism

Based on the structure and operating processes of PICES and NOWPAP, discussions in SG-SCOOP began with generating a better understanding of the key groups in each organization and their scientific responsibilities. Thus, substantial time was spent early in the meeting on clarifying who is doing what within each organization, and attempting to match of each organization's subgroups that already have shared interests. For instance, MEQ has a broad mandate to (1) promote and coordinate interdisciplinary scientific research on marine environmental quality, with an ultimate goal to improve understanding of the ecological effects of marine pollution on valued resources with emphasis on the sources and fates of environmental contaminants (including radionuclides), (2) understand harmful algal bloom science, marine aquaculture issues, including eutrophication, and introduction/expansion/transport of non-indigenous species, and (3) increase societal awareness about human uses and impacts of coastal and oceanic ecosystems of the North Pacific. Figure 1 shows WG 26, WG 30, WG 31 and S-HAB which have been established to better understand some of these problems. With these missions, for instance, PICES' WG 30 is responsible for the assessment of marine environmental quality of radiation around the North Pacific, whereas NOWPAP CEARAC is responsible for special monitoring and coastal environmental assessment; PICES' WG 31 is focusing on emerging topics in marine pollution, whereas NOWPAP POMRAC is dealing with pollution monitoring issues, NOWPAP DINRAC is compiling data on marine environment quality and NOWPAP MERRAC is tasked to examine and improve marine environmental emergency preparedness and response. As will be shown later in prioritizing the science activities of the two organizations, knowledge about harmful algal blooms is a priority for both organizations. Section 3 identifies several scientific issues of concern in the North Pacific and of interest to one or both organizations. At PICES-2014, Science Board recommended the establishment of a new Working Group on *Biodiversity of Biogenic Habitats* (WG 32) which nicely complements the biodiversity interests of NOWPAP CEARAC.

3 Potential NOWPAP-PICES Priority Activities

Joint activities of NOWPAP and PICES should benefit both organizations. A framework for collaboration must start with ideas that are of interest to and will benefit both organizations. Discussion about potential topics of cooperation began in July 2014 with emails circulated by the SG-SCOOP Co-Chairs to SG members. At PICES-2014, the SG Co-Chairs led a broad and wide-ranging discussion of topics that are of interest to both organizations. The topics for proposed potential cooperation, included the following:

1) **Harmful algal blooms** (HAB) strongly influence water quality in East Asian regional seas. Thus, there is a need for monitoring harmful algae, or their toxins, identifying HAB outbreaks, conducting research to understand the mechanisms of toxin transport to marine organisms, and identifying leading indicators of HAB events. PICES' S-HAB is active in documenting and reporting outbreaks of HABs, and species occurrences in the North Pacific. NOWPAP monitors HABs in order to protect human health. PICES Scientific Report No. 47 on *Proceedings of the Workshop on Economic Impacts of Harmful Algal Blooms on Fisheries and Aquaculture* was jointly published with NOWPAP in 2014. CEARAC focuses on HABs, among other topics, and collaborates with S-HAB through a NOWPAP *ex-officio* member.

2) **Monitoring of Non-Indigenous (Invasive) Species** (NIS) introductions in coastal regions of Northeast Asia, including NOWPAP member countries is important because of heavy shipping traffic and extensive aquaculture operations in the region. Ballast water and aquaculture trade and seeding are known to be vectors of introduced species. There is potential for the two organizations to collaborate to identify ways to more effectively prevent invasive introductions.

3) **Eutrophication** (EUT) of coastal waters is a global issue that must be managed regionally or locally. Human activities in watersheds (*e.g.*, excessive agricultural fertilization) allow nitrates, phosphates, and perhaps micronutrients to enter coastal waters in freshwater runoff. These can cause phytoplankton blooms in coastal waters, with negative consequences to water quality. While this is a world-wide issue, it is especially of concern in East Asia where many nearshore regions are developed for marine food production (aquaculture), and where eutrophication can lead to hypoxia.

4) PICES produces periodic **North Pacific Ecosystem Status Reports** (ESR) which indicate the directions of change in marine ecosystems—ranging from ocean climate/physics to biological population abundances and spatial extent, and more generally, marine environmental quality. NOWPAP produces periodic "State of Marine Environment" reports and is interested in developing Ecological Quality Objectives (EcoQOs), which are specific objectives used to translate an unmeasured qualitative goal of a healthy and sustainable ecosystem into a quantitative set of metrics that can be used operationally (*e.g.*, with indicators, limits and/or targets) to trigger interventions/actions when environmental quality conditions are not acceptable. PICES, to date, has not developed specific quantitative thresholds, targets or limits that could be used to trigger management actions (interventions). Instead, PICES provides quantitative descriptions of present conditions and relative change to its member countries, and relies on their taking appropriate actions. It is unclear whether PICES will take a prescriptive approach in the future, as it is not within the mandate of the Organization to prescribe national actions. However, a joint PICES-NOWPAP workshop or working group might be a venue to explore this aspect more broadly with a group (NOWPAP) that has experience with this approach.

5) PICES, at the bequest of the Ministry of the Environment (MoE) of Japan is undertaking a new **Debris** initiative to track and identify the types of debris and potential risk of invasive species movement from East Asia to North America and Hawaii that may result from the March 2011 tsunami. Debris or marine litter is also a topic of interest to NOWPAP.

6) Quantitative metrics of **Marine Pollution (nutrients, organics, toxins, *etc*.)** (MP) in nearshore or coastal systems were largely ignored and poorly represented in the first two PICES North Pacific Ecosystem Status Reports. Future reports would benefit greatly from a more focused effort in obtaining marine pollution data from all its member countries. NOWPAP, with its stronger connections to coastal monitoring programs in East Asian seas, might be able to assist with this effort. Although PICES is research focused and NOWPAP is operationally focused, both organizations will benefit from better collaboration and exchange of information. Research activities of PICES may be able to identify more cost effective and accurate monitoring methods or better locations for NOWPAP monitoring, and provide better justification for the types, frequency and number of monitoring sites implemented by NOWPAP.

7) The PICES/ICES Section on *Climate Change Effects on Marine Ecosystems* (S-CCME) is examining the influence of climate change on both current and future marine ecosystems generally, but with a strong emphasis on the **fisheries resources that are important to the livelihoods and economies of coastal ocean communities**. The extent to which this is of interest within NOWPAP is not clear from the priority objectives provided by their MTS. However, if it is of interest to NOWPAP, the activities of S-CCME, which is examining future climate projections on fish communities, fisheries, and the communities that depend on fish harvests, might be valuable.

8) **Jellyfish blooms** are becoming increasingly common as nuisance species within East Asian seas. PICES Working Group on *Jellyfish Blooms around the North Pacific: Causes and Consequences* (WG 26) will conclude and deliver their final report to Science Board in 2015. While this Working Group is concluding,

there are still opportunities for ongoing joint NOWPAP-PICES activities on jellyfish through new expert groups. Three specific terms of reference of WG 26 that might be of interest to NOWPAP now or in the future are (1) encouraging joint research surveys on jellyfish among the member countries, (b) developing jellyfish metrics as indicators of ecosystem change and resiliency, and (c) providing recommendations to policy makers for reducing potential negative impacts of jellyfish blooms.

Considering the science interests and the feasibility of joint implementation within the next 5 years for both organizations, seven topics emerged as being of highest priority during SG-SCOOP discussions at PICES-2014. Five of these are from the list above. Hypoxia emerged as a concern of both organizations, and was grouped together with eutrophication (EUT) below, since both are processes caused by excess nutrification of coastal seas. A topic on biodiversity (BIODiversity) was introduced during the discussions that is not in the above list because it was developed just prior to the SG-SCOOP meeting. Table 1 summarizes these seven topics.

Table 1 NOWPAP-PICES priority topics for joint collaboration.

Category	PICES	NOWPAP	PICES Interests	NOWPAP Interests	Potential Activities	Priority within the next 5 yr
1-HAB	2	2	Regular information update through regional report; understanding the dynamic mechanism for future potential forecasting	Regular information update through regional report every 5 years	NOWPAP plans to actively participate in S-HAB meetings; develop mechanisms for sharing info on HABs from the regions of overlap; continue organization of joint sessions, workshops, and reports.	Green
6-MP/Oil/Chem	2	3	Compiling data on pollution indicators describing spatial and temporal status, trends and impacts in the North Pacific Ocean	Facilitating regional activities on marine pollution preparedness and response; implementing a joint response operation in case of major spill accidents under Regional Contingency Plan	Develop mechanisms for sharing information on environmental pollutants from the regions of overlap; potentially hold a joint NOWPAP-PICES session/workshop in 2015 (17); explore potential use of MP indicators for NPESRs.	Green
2-NIS	3	3	Looking for NIS with tsunami debris; exploring ways to update NIS distribution data and make it available	Nothing until 2016; might support PICES NIS database	Explore potential mechanisms of sharing NIS data.	LtGreen
4-ESR	3	3	Production of ecosystem status report, including indicators (*ca*. 2017)	Development of EcoQOs (in 2015); indicators and targets to be developed in 2016–17	Develop mechanisms for sharing information on environmental status from the regions of overlap; work on potential common indicators; potentially hold a joint NOWPAP-PICES workshop.	LtGreen
9-BIODiversity	2.75	3	Increasing concerns about changing biodiversity in the North Pacific – needs concerted (expanded) monitoring efforts	Regional report on endangered species; regional report on biodiversity threats; support regional MPA network	Hold a joint session/workshop in 2015 (17) with possible joint publication; other activities can be determined following 2014 GC decisions.	LtGreen
3a-EUT	2.5	3	Potential activities – regional mechanism to be developed	Regional report on eutrophication in 2015	Apply and evaluate NOWPAP-developed methodology for eutrophication assessment to both sides of the North Pacific; conduct a potential training workshop.	Yellow
3b-HYPOXIA	2.5	2	Potential activities – regional mechanism to be developed	2015 regional reports on eutrophication will include hypoxia	TBD	Yellow

Notes: Numbers in the PICES and NOWPAP columns indicate the priority given to the category : 1 equals highest priority and 5 lowest priority. The Interests columns are brief summaries of the two organizations' specific interests for each category listed. Potential Activities describe possible joint activities that could be undertaken within the next 5 years. Those marked Green represent the highest priority, LtGreen slightly lower priority, and Yellow lowest priority. Note that all topics are of interest, which is why most of the priority rankings for both organizations are within the fairly narrow range of 2–3 on a scale of 1(highest) to 5 (lowest) priority.

4 Joint NOWPAP-PICES Activities and Next Steps

After SG-SCOOP recommendations and priorities are approved by PICES and NOWPAP, relevant expert groups within the two organizations will collaborate with each other. Some of the priority topics have been discussed extensively in workshops and topic sessions, especially MP (marine pollution), HAB (harmful algal blooms), the two highest priority joint activities, at PICES Annual Meetings. In the next 5 years, these priority collaborations should be carried out regardless of whether they are led by NOWPAP or PICES. At PICES-2015, it was clear that NOWPAP was keen on co-sponsoring a number of workshops and a topic session with PICES.

- S4: *Indicators of emerging pollution issues in the North Pacific Ocean* (three invited speakers were sponsored by NOWPAP);
- W1: *Contrasting conditions for success of fish-killing flagellates in the western and eastern Pacific – A comparative ecosystem approach*;
- W2: *Identifying major threats to marine biodiversity and ecosystems in the North Pacific* (one convenor and one invited speaker were sponsored by NOWPAP);
- W4: *Marine Environment Emergencies: Detection, monitoring, response and impacts* (one convenor was sponsored by NOWPAP).

This is a great first step, and was achieved in advance of the formal framework being in place.

In addition:

- Sessions/workshops at annual meetings or at inter-sessional meetings of NOWPAP and PICES should be on a focused (*e.g.*, narrowly targeted) topic;
- Each workshop or sustained activity should result in a report to each organization, or be published in an appropriate publication series or in peer reviewed literature in the next 5 years;
- Joint PICES and NOWPAP capacity building activities such as training courses and summer schools should take place every 2 years.

Below is a roadmap showing the proposed timeline for NOWPAP-PICES collaborative activities in the next 5 years.

		2015	2016	2017	2018	2019
Meeting	Session	S_X	S_X	S_X	S_X	S_X
	Workshop	W_X,W_X,W_X		W_X,W_X,W_X		
Product	Publication		Special issue 1		Special issue 2	
	Report	SCOOP reports		Joint NOWPAP-PICES expert group reports		Joint NOWPAP-PICES expert group reports
Capacity building activities	Training course	Training course 1		Training course 2		Training course 3
	Summer school		Summer school 1		Summer School 2	

Appendix 1 SG-SCOOP meeting participants at PICES-2014.

Members	Organization	Affiliation
Dr. Chuanlin Huo	PICES (MEQ)	NMEMC, SOA, P.R. China
Dr. Alexander V. Tkalin	NOWPAP	NOWPAP Regional Coordinating Unit
Dr. Thomas W. Therriault	PICES (SB)	Fisheries and Oceans Canada
Dr. Jennifer L. Boldt	PICES (MONITOR)	Fisheries and Oceans Canada
Dr. Toru Suzuki	PICES (TCODE)	Marine Information Research Center, Japan
Mr. Xiaodong Zhong	NOWPAP	NOWPAP Regional Coordinating Unit
Dr. Seong-Gil Kang	NOWPAP	NOWPAP-MERRAC
Dr. Takafumi Yoshida	NOWPAP	NOWPAP CEARAC
Dr. Alexander S. Bychkov	PICES	PICES Secretariat
Dr. Harold (Hal) Batchelder	PICES	PICES Secretariat
Mr. Robin M. Brown	PICES	Fisheries and Oceans Canada