Report of Working Group 31 on *Emerging Topics in Marine Pollution*

The Working Group on *Emerging Topics in Marine Pollution* (WG 31) held its second annual meeting from 9:00 to 18:00 h on October 17, 2015, in Qingdao, China, under the chairmanship of Drs. Peter S. Ross (Canada) and Olga Lukyanova (Russia). Ten out of 17 WG members from five member countries participated the meeting (*WG 31 Endnote 1*).

AGENDA ITEM 2
Review of agenda and goals

After review by members, the draft agenda was adopted without revision (*WG 31 Endnote 2*). The main meeting objective was to review data needs and report format for the 3rd PICES North Pacific Ecosystem Status Report.

AGENDA ITEM 3
Review of WG 31 history, activities and deliverables

Background

The Working Group on *Emerging Topics in Marine Pollution* (WG 31) reports through the MEQ Committee. WG 31 was established in 2014 following the recommendations of the Study Group on *Marine Pollutants* (October 2011–December 2013) at PICES-2013 (Nanaimo, Canada). The WG first assembled at PICES-2014 in Yeosu, Korea. Under the approved Terms of Reference, WG 31 has a 3-year mandate (2014–2017). The WG will focus on convening a series of timely topic sessions and workshops, and the organization of Special Issues in international scientific journals. In addition, WG 31 will ensure the continued availability of expertise on marine pollutants within PICES, collaborate with other PICES expert groups and international partners (GESAMP, NOWPAP), and deliver guidance consistent with the expectations of the FUTURE thematic program within PICES. WG 31 will address the question identified in the FUTURE Science Plan "How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?"

In light of the goals of PICES and its member countries, WG 31 recognizes that:
- Pollution can adversely affect the health and abundance of marine biota, especially in densely-populated coastal areas;
- There are socio-economic consequences of coastal pollution, with consumption advisories, fishery closures, trade interdictions and diminished aboriginal access to food resources;
- Regulations, policies and other management actions resulting from marine pollution research in the past have led to declines in the concentrations of a number of harmful pollutants, improving the health of marine biota.

Past WG 31 activities and deliverables

WG 31 had its first meeting at PICES-2014 in Yeosu, Korea, providing an opportunity for members to meet. The first annual business meeting was for WG 31 to confirm the roadmap for its 3-year mandate. During this time, the proposed data sets in support of time series were discussed in light of the planned North Pacific Ecosystem Status Report, and an initial plan was designed to carry out this task. A successful 1-day MEQ Topic Session (S8) on "*Marine debris in the Ocean: Sources, transport, fate and effects of macro- and micro-plastics*" (co-sponsored by GESAMP, ICES and NOWPAP) was held at the Annual Meeting. A Special Issue on "*Microplastics in the ocean*" (Guest Editors: Won Joon Shim (Korea) and Richard Thompson (UK)) in the international journal *Archives of Environmental Contamination and Toxicology* (2015, 69(3): 265–373) resulted from this Topic Session.

A proposal for a Topic Session on "*Source, transport and fate of hydrocarbons in the marine environment*" was supported by WG 31 for PICES-2016 (*WG 31 Endnote 3*).

AGENDA ITEMS 4, 5 and 6
NPESR plans, roundtable presentations, and data collation

WG 31 reviewed the data needs and report format for the 3rd North Pacific Ecosystem Status Report (NPESR3). After consultations with SG-NPESR, WG 31 members produced a matrix for priority contaminants for which time series are likely to be available in some form from each PICES member country.

Applied discussions took place at both the WG 31 business meeting and at the MEQ Topic Session (S4) on "*Indicators of emerging pollution issues in the North Pacific Ocean*" (co-sponsored by NOWPAP), during which issues related to ocean pollution research and monitoring in the North Pacific Ocean were debated. While participants agreed that 'pollution' represents a serious threat to ocean resources, notably in coastal regions, they also acknowledged that the experts assembled through PICES would be unable to adequately speak to all pollution issues. In this context, members felt it important to raise this issue for PICES, and emphasize that WG 31, during its 3-year term, is specifically dealing with the topic of 'chemical pollution', and would not be addressing 'biological', 'noise' or 'light' pollution, all of which represent additional threats to the health of sea life. PICES may wish to consider addressing these topics through additional activities or within another expert group.

S4 featured talks on:
- Microplastics as a monitoring tool for contaminants,
- Spatial variation in metal concentrations in Northwest Pacific mussels,
- Level and trends of persistent pollutants in small cetaceans from Japan,
- Levels of legacy and emerging contaminants from wildlife in Korea,
- Microplastics in coastal environments in the Russian Far East,
- Microplastic risk to Cassin's auklets in coastal British Columbia,
- Spatial and temporal trends in mercury in seabird eggs from Pacific Canada,
- Mercury and methyl mercury cycling in coastal China,
- Persistent pollutants in the marine food web in the Northwest Pacific Ocean,
- Biodindicators of marine pollution in the Sea of Okhotsk, and
- Emerging pollution issues as identified in different matrices in the Northeast Pacific Ocean.

A Special Issue in a peer-reviewed journal was proposed for the results of Topic Session S4. Dr. Hideshige Takada agreed to serve as one co-Guest Editor (the second remains to be secured). The proposal was reviewed by WG 31 and has been submitted to *Archives of Environmental Contamination and Toxicology*. A proposed deadline for manuscript submissions is May 1, 2016.

The Workshop (W4) on "*Marine environment emergencies: Detection, monitoring, response, and impacts*" (co-sponsored by NOWPAP) featured 10 oral presentations, including two invited speakers, as well as several posters. NOWPAP was well represented, and provided very practical overviews of progress made among and within its member countries (China, Korea, Russia and Japan) on spill response and monitoring. An applied roundtable discussion was held after the presentations to review several 'hot topics', data needs, and environmental assessment and monitoring questions.

A Special Issue in a peer-reviewed journal was proposed for the results of the W4. Dr. Un Hyuk Yim and Dr. Jeffrey Short (NOAA) agreed to serve as co-Guest Editors. The proposal was reviewed by WG 31 and has been submitted to *Archives of Environmental Contamination and Toxicology*. A proposed deadline for manuscript submissions is March 31, 2016.

Pollutants of concern within the PICES realm of the North Pacific Ocean were discussed, and a priority list was proposed for consideration for inclusion in the NPESR time series submissions. These pollutants included

six general categories, followed by specific constituents for which data are most likely to be available from all six member countries and for comparative purposes. These included:

- Metals (Mercury (Hg), Lead (Pb);
- Hydrocarbons (Polycyclic Aromatic Hydrocarbons (PAHs), Benzo-a-Pyrene (BaP));
- Persistent, Bioaccumulative and Toxic substances (PBTs; PCBs, PBDEs, PFOS);
- Plastics (macrodebris shoreline surveys; microplastics);
- Pharmaceuticals (triclosan);
- Antifoulants (organotins, Irgarol).

Members agreed to identify data (published, unpublished) in support of NPESR reports, and to provide at least one report for each general category of contaminants (above) from each member country. These reports will be used in the NPSER effort, and 'pollutants' will be included for the first time in this important North Pacific compendium.

Contaminant data are available for multiple matrices, using different study designs and different analytical methods. In order to guide report drafting in support of the NPESR, members agreed that the provision of time series from a suitable ocean 'indicator' would be most informative. Deadline for the first draft report from each member country is January 15, 2016. This single report (× 6 member countries) will be circulated, shared, and reviewed to ensure that all authors agree on format, content and style after which each member country will be expected to produce reports on as many of the identified contaminants as possible. It is hoped that each country will produce at least one report for each of the six categories of pollutants (*e.g.*, metals), but members are encouraged to produce more, drawing from the proposed list of specific pollutants (*e.g.*, Hg). The deadline for these reports is May 15, 2016.

A working definition was shared to ensure that different individual draft reports ended up being comparable:
Ocean pollution indicator: "A regular sampling of a species or matrix that provides insight into the state of contamination of the marine environment".

Factors to consider when selecting, tabulating, comparing and reporting on a selected contaminant or contaminant class included:

- The indicator could be abiotic (air, water or sediments) or biotic (shellfish, fish, birds or marine mammals);
- The matrix selected should be well understood so as to ensure good 'real world' understanding of habitat;
- Confounding factors should be considered so as to maximize comparability (*e.g.*, stable isotopes for trophic position, lipid for condition, organic carbon in sediments);
- Availability of time series and/or spatial trends;
- QA/QC issues in the laboratories (detection limits, certified reference materials, inter-lab comparisons);
- Links to regulations, source control, species of concern, habitat, and human health.

AGENDA ITEM 7
Relations with other groups/organizations

The relationship between WG 31 activities and other groups within and outside of PICES was discussed. Of note is the ongoing support of GESAMP and NOWPAP, with these two organizations providing expert participation or travel support for speakers.

AGENDA ITEM 8
Next steps for WG 31 in 2016

WG 31 expects to publish two Special Issues in a scientific journal (one on 'Indicators of ocean pollution' and one on 'oil spills and environmental emergencies') reflecting the MEQ Topic Session S4 on "*Indicators of emerging pollution issues in the North Pacific Ocean*" and Workshop W4 on "*Marine environment*

emergencies: Detection, monitoring, response, and impacts", respectively, held PICES-2015. Another Special Issue is anticipated to come from the Topic Session on "*Hydrocarbon source, transport and fate in the marine environment*" at PICES-2016, and a series of NPES reports from WG 31 efforts.

The meeting adjourned at 18:00 h.

WG 31 Endnote 1

WG 31 participation list

Members	Observers
John Elliott (Canada)	Karin Baba (Japan)
Dong-Woon Hwang (Korea)	Seong-Gil Kang (NOWPAP MERRAC)
Olga Lukyanova (Russia, Co-Chair)	Peter John Kershaw (GESAMP)
Hideaki Maki (Japan)	Cathryn Clarke Murray (PICES)
Kazuhiko Mochida (Japan)	Vasiliy Yu. Tsygankov (Russia)
Hyo-Bang-Moon (Korea)	Xiaodong Zhong (NOWPAP RCU)
Guangshui Na (China)	
Peter S. Ross (Canada, Co-Chair)	
Hideshige Takada (Japan)	
Un Hyuk Yim (Korea)	

WG 31 Endnote 2

WG 31 meeting agenda

1. Introductions
2. Review of agenda and goals for the day
3. Review of WG 31 history, activities and deliverables
   - 2014 (Korea): Microplastics (Topic Session and Special Issue in *Archives of Environmental Contamination and Toxicology*)
   - 2015 (China): Indicators (Topic Session and proposed Special Issue in a journal) and workshop on "*Marine environmental emergencies*"
   - Discussion on proposal for Topic Session at PICES-2016 (San Diego, USA; co-sponsored by GESAMP) and Special Issue in a journal: Hydrocarbon transport, fate and effects in the marine environment
4. WG 31 and FUTURE opportunities and tasks; PICES Status report plans for WG 31:
   - Persistent, bioaccumulative substances;
   - Metals or elements of concern;
   - Marine debris and microplastics.
5. Roundtable presentations on 'What is an Indicator of ocean pollution?'
6. Breakout groups to discuss data collation in support of NPESR and four selected contaminant categories:
   - Review papers and original research;
   - Assessment leads and teams;
   - Finalise framework/conceptual approach for each category;
   - Deadline for report submission;
   - Draft manuscripts for journal submission?
7. Relationship of WG 31 to PICES groups and international organizations (*e.g.*, NOWPAP, GESAMP)
8. 2016 as the final year for WG 31: roundtable on next steps

WG 31 Endnote 3

Proposal for a 1-day MEQ Topic Session on "*Source, transport and fate of hydrocarbons in the marine environment*" at PICES-2016

Co-sponsor: GESAMP

Co-Convenors: Hideaki Maki (Japan), Staci Simonich (USA), Geraldo Gold-Bouchot (GESAMP) Peter S. Ross (Canada)

Suggested Invited Speakers: Ken Lee (Australia Oceans Program, CSIRO, Australia), John Stein (NOAA, USA)

This session will focus on the behavior, fate and effects of hydrocarbons in the marine environment. While it is expected that some examples of oil spills (catastrophic release of hydrocarbons) will be examined, most discussions will focus on chronic, low level releases from multiple sources that are far more evasive and widespread (*e.g.*, ballast discharges, fuel release, harbor contamination). Following two successful sets of activities at PICES-2014 and PICES-2015 ('Microplastics' and 'Indicators of ocean pollution'), the WG-31 (Emerging Topics Marine Pollution; ETMP) proposes to organize, convene and facilitate the third in its planned series of Special Sessions. The topic for 2016 is to comprehensively address the science of 'Source, transport and fate of hydrocarbons in the marine environment'. This is timely for PICES as it follows up on the 2015 workshop on short-term response workshop ("*Marine Environment Emergencies: Detection, monitoring and response*"). This topic is also timely since oil and gas exploration, development and transport is taking place to varying degrees around the North Pacific Ocean. Thousands of different hydrocarbon compounds are found in fuels, each with different physical and chemical properties. The resulting complex interactions between these compounds and components of the marine environment highlight the importance of a multidisciplinary and up-to-date sharing of knowledge. This knowledge will provide insight into the consequent risks to biota, the design of monitoring programs, the choice of analytical methods, and management responses following leaks or spills. This Topic Session will feature invited speakers from several national organizations. A Special Issue in a scientific journal will arise from the presentations on "*Source, transport and fate of hydrocarbons in the North Pacific Ocean*". Presenters and others will be invited to submit a manuscript on the topic, with the goal of the resulting compendium being to become a useful reference work for scientists and managers.