

Report of the PICES/ICES/PAME Working Group on an *Integrated Ecosystem Assessment for the Central Arctic Ocean*

PICES joined an existing ICES/PAME (Protection of the Arctic Marine Environment) Working Group on an Integrated Ecosystem Assessment for the Central Arctic Ocean in 2016. Preparing an Integrated Ecosystem Assessment (IEA) for the Central Arctic Ocean (CAO) is a step needed to provide scientific advice on issues such as the prospect for future fisheries in the Arctic Ocean and sensitivity and vulnerability in relation to shipping activities.

The joint PICES/ICES/PAME Working Group on an *Integrated Ecosystem Assessment for the Central Arctic Ocean* (WG 39/WGICA) had its second meeting on October 26, 2018, at PICES-2018 in Yokohama, Japan. Co-Chair (PICES), Dr. Sei-Ichi Saitoh, led the meeting.

AGENDA ITEMS 2 and 3

Review WG 39 terms of reference, history and time plan, and review of meetings

Following participant self-introductions (*WG 39 Endnote 1*), the terms of reference were briefly described by Dr. Saitoh (see *WG 39 Endnote 2*) and reviewed by the members. Dr. Saitoh also introduced the history and time plan of the joint WG and related meetings such as FiSCAO (Fish Stocks in the Central Arctic Ocean). Invited speaker, Dr. Hein Rune Skjoldal, gave an overview of 3rd WGICA meeting which was held on St. John's, Canada on April 24–26, 2018 (see PICES Press, [Vol. 26, No. 2](#)).

AGENDA ITEM 4

Status of WGICA report

Dr. Skjoldal reported the status of WGICA report. He is the lead author and chief editor of the report. The main product from the work of WGICA is a first version of an Integrated Ecosystem Assessment of the Central Arctic Ocean. The meeting agreed on an outline of the IEA report as detailed in *WG 39 Endnote 3*.

A working title for the IEA report is: “*Integrated Ecosystem Assessment of the Central Arctic Ocean: Ecosystem description and vulnerability characterization*”. The subtitle is intended to explain the scope and content of the report, which is to provide an integrated account of the ecosystem of the Central Arctic Ocean, and to consider aspects of vulnerability of this ecosystem and its components to climate-related changes and increasing human activity. This will include spatial information on vulnerability to shipping, in response to the need for such information by shipping experts in their work in PAME. This first version will not be a full-fledged IEA, but will form a basis for further iterations and development towards at end.

Schedule is as follows:

First draft: The end of 2018

Review process: January– March 2019

Final Version: April 2019

AGENDA ITEM 5

Terms of Reference (ToRs) for continuation of WGICA

a. Background

The Working Group for Integrated Ecosystem Assessment of the Central Arctic Ocean – WGICA – was established jointly by ICES and PAME (Protection of the Arctic Marine Environment) in 2016. PICES

joined the group in 2016 (Governing Council Decision 2016/S/5). WGICA met the first time at ICES headquarters in Copenhagen in June 2016 and for its second meeting in Seattle in April 2017. The third meeting was held in St. John's, Newfoundland, Canada. The three WGICA Co-Chairs are John Bengtson (ICES), Sei-Ichi Saitoh (PICES), and Hein Rune Skjoldal (PAME).

WGICA has been working to produce a first version of an Integrated Ecosystem Assessment (IEA) report for the central Arctic Ocean (CAO). At the third meeting, compiled material to be used in the IEA was presented and reviewed, and a plan for the further work to complete the IEA during 2018 was drawn up.

b. Necessity of continuing WG 39

At the third WGICA meeting, held in April 2018 at St John's, Canada, members agreed that the work of WGICA should continue for another 3-year term (2019–2021). It was noted that IEA is a core component of the Ecosystem Approach to management (EA), and that the work of WGICA is contributing to the basis for developing EA for the central Arctic Ocean ecosystem.

At the ICES ASC in late September 2018 and PAME in early October 2018, the continuation of WGICA was proposed and each organization approved its extension for another 3 years, until 2021. WG 39 held its first meeting at PICES-2017 in Vladivostok, Russia. Although very active, the WG was unable to complete the first phase of its assessment report by the end of 2018, and needs to be extended to April 2019 finish this activity.

For PICES, future sustainable monitoring in the Central Arctic Ocean is important issue not only to understand global climate change but also the effects of a changing climate in the Arctic to mid-latitude North Pacific. Therefore, WG 39 requests an extension of 3 years, to align with ICES and PAME, and to complete the first phase of the IEA. PICES' contribution to marine science in CAO is important as all of its member countries are Arctic Council countries (Canada, Russia, USA,) and Arctic Council observer countries (China. Korea. Japan).

c. New TORs

Elements of the new ToRs were identified and discussed at the WG 39 meeting (**WG 39 Endnote 4**).

AGENDA ITEM 6

Relevant national research programs

Relevant national research programs were introduced, and key aspects were described. Dr. Shigeto Nishino presented Japan's "Country Report: Results from 2018 season and future planning", including cruise report of the T/S *Oshoro-Maru* cruise (June 25–July 15, 2018 (Dutch Harbor, USA) and the R/V *Mirai* cruise (October 25 (Hachinohe) to December 7, 2018 (Shimizu) in the Arctic Ocean. Dr. Zhongyong Gao presented "China's National Report on Carbon Cycle and Ocean Acidification in Bering Sea and the Western Arctic Ocean", including cruise reports of the last two decades in the Arctic Ocean.

AGENDA ITEM 7

Meetings and workshops

The attendees were in general agreement that it is important and necessary to have significant Pacific input in CAO activities. Rather broad findings of previous reports will need to be supplemented with details and more information. This will form the basis of PICES input and advice to the IEA envisioned.

As a follow-up to WG 39's workshop ([W2](#)) on “*PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (Second)*” at PICES-2018 as well as a wrap-up, a ½-day workshop (WG 39 Endnote 5) was proposed for PICES-2019 to consolidate the WG's findings and advice, connect it to those from ICES and to report to the wider PICES community. It will be desirable to engage other PICES committees, at least MONITOR and FIS. WG 39 requests travel support for an expert outside of PICES to attend the workshop at PICES-2019.

WG 39 proposed holding an inter-sessional activity, the 4th WGICA meeting in Sapporo, Hokkaido, Japan. The planned meeting period would be the middle of April or middle May 2019 (avoiding golden week of Japan). Dr. Saitoh and Dr. Ohnishi, Hokkaido University, will promote the meeting as one of local organizers.

AGENDA ITEM 8

Closing

The meeting concurred that further communication would be necessary and should be made by remote communication. The Co-Chair thanked the attendees and closed a successful meeting of WG 39.

WG 39 Endnote 1

WG 39 participation list

Members

Zhongyong Gao (China/PICES)
Guangshui Na (China/PICES)
Fujio Ohnishi (Japan/PICES)
Sei-Ichi Saitoh (Japan, Co-Chair/PICES)
Hein Rune Skjoldal (Norway/Co-Chair/PAME)

Members unable to attend

China: Fang Zhang
Korea: Hyoung Chul Shin

Observers

Ayumi Kanaya (Japan)
Kirill Kivva (Russia)
Xiuoyang Li (Japan)
Banryo Murakami (Japan)
Shigeto Nishino (Japan)
Shohei Sasabe (Japan)
Naoki Tojo (Japan)

WG 39 Endnote 2

WG 39 meeting agenda

1. Welcome, introductions, opening remarks
2. Review WG 39 terms of reference
3. Review on programs and meetings on the Central Arctic Ocean
4. Status of WGICA report
5. Terms of Reference (ToRs) for continuation of WGICA
6. Relevant national research programs
7. Meetings and workshops
8. Closing

WG 39 Endnote 3

Outline of the IEA report

*Integrated Ecosystem Assessment of the Central Arctic Ocean:
Ecosystem Description and Vulnerability Characterization*

Executive summary

1. Introduction [aim for 2-3 pages?]
 - a. Purpose of this IEA of the CAO
 - b. Define CAO: bathymetrically, ecologically, politically
 - c. Map of the area and LMEs
2. Overview of the CAO
 - a. CAO key features (perhaps expand Skjoldal draft, with food web graphics, maps, include physical oceanography) [aim for 8-10 pages]
 - b. Pacific Gateway (Grebmeier et al., describe gateways and how far into the CAO various components extend) [aim for 8-10 pages?]
 - c. Atlantic Gateway (Randi et al., describe gateways and how far into the CAO various components extend) [aim for 8-10 pages?]

3. Description of CAO ecosystems [aim for 15 pages per species group/section]

Questions to ask and answer for each group/section (emphasize physical and trophic linkages, status and trends, ecological features such as feeding, life history, and briefly point to potential vulnerabilities)

- How has this component changed during the past 20-30 years?
- What changes to this component, if any, are anticipated over the next 20-30 years?
- How does primary production link to benthos and other trophic levels?
- How are CAO animals **connected** to other geographic areas?
- To what potential impacts, if any, might this component be vulnerable? Why?

Include figures, species tables, key area maps, diagrams for each component Consider implications of NOT having information on this component for the CAO

- a. Climate, oceanography, and sea ice (Ingvaldsen, Ivanov, Nishino, Overland, Saitoh)
 - b. Primary production (Skjoldal draft review—completed)
 - c. Sea ice biota (Bluhm, Gradinger, Hop, Melnikov, von Quillfeldt.), zooplankton (Skjoldal draft), benthos (Bluhm, Grebmeier)
 - d. Fish and fish stocks (Gjøsæter, Hedges, Hop, Leijonmalm, Logerwell, Lunford, Skjoldal)
 - e. Seabirds (good start by Gavriilo and Kuletz, plus Skjoldal; keep focus on CAO, refer out to surrounding areas as needed)
 - f. Marine mammals (Bengtson, Frie, Skjoldal, Regehr, Gavriilo, Burkanov to compile)
4. Vulnerabilities (threats, spatial and temporal aspects, potential consequences, pathways to effect, define/clarify sensitivities/vulnerabilities, perhaps include “heat maps” or matrix) [about 20 pages]
 - a. Behavioral disturbance (e.g., visual, acoustic, physical) – ships, shipping, seismic exploration
 - b. Food web disruption (e.g., fisheries reducing food supply) – commercial fisheries
 - c. Pollution (e.g., oil spill, chemical discharges, emissions) – accidents, oil and gas production
 - d. Climate change (e.g., primary production changes) – food consumption estimates?

5. Monitoring and research gaps

Annexes

- a. Any accounts that are too detailed for main report could be attached as an annex
- b. Consider drafting a special product on shipping for PAME

WG 39 Endnote 4**WG 39 new Terms of Reference**

1. Consider approach and methodology for doing IEA of the CAO ecosystem;
2. Review and report on ongoing and recent changes and events in the CAO ecosystem associated e.g. with changes in sea ice, circulation, and hydrographic properties;
3. Continue to examine the effects of climate change on the CAO ecosystem by compiling and reviewing information on changes in response to the ‘Great melt’ with substantial loss of sea ice up to now and assess likely consequences to the CAO ecosystem of projected future changes associated with further loss of sea ice and other climate-related changes (Climate Impact Assessment);
4. Assess the consequences of recent and ongoing climatic and oceanographic changes on transport pathways (physical and biological) and potential effects of contaminants in the CAO ecosystem;
5. Review and report on new studies on fish as well as other biological components of the CAO ecosystem;
6. Continue to identify priority research issues and monitor how identified knowledge gaps (needed to improve IEA and management effectiveness) are being addressed and filled.

These (and any additional) ToR elements will be elaborated over the next months and presented to ICES, PICES and PAME at their meetings.

WG 39 Endnote 5

**Proposal for a Workshop on
“PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (Third)”
at PICES-2019**

Duration: ½ day

Convenors: Sei-Ichi Saitoh (Japan), Hyoung Chul Shin (Korea), Guangshui Na (China), Lisa Eisner (USA), Gordon Kruse (USA)

Suggested invited speaker: Mette Skern-Mauritzen, Institute of Marine Research, Norway (Chair of ICES SC for IEA WGs)

The Central Arctic Ocean (CAO) is in rapid transition, largely driven by North Pacific change, has become accessible to a range of activities. Rapid loss of sea ice cover has opened the Central Arctic Ocean (CAO) for potential fishing opportunities. Debate and policy initiatives have already been launched for regulating fisheries in the CAO that has not yet begun. Scientific research in the CAO, however, remains too scarce in contrast to a dearth of research in neighboring North Pacific, to inform and support policy decisions. With substantial science and policy challenge presented, its integrated ecosystem assessment is the foremost task. PICES joined forces with ICES and PAME for such an assessment by forming WG 39 with its mission period ending 2018. WG 39, despite its late start, intends to provide significant Pacific input for the assessment at the 3rd meeting of the Joint Group in May 2018, and also to the final report expected toward the end of 2018. We propose workshops in 2019. As a follow-up to this as well as a wrap-up, a half day workshop is proposed to take place at PICES 2019 to consolidate our findings and advice, connect it to those from ICES and to report to wider PICES community. The major theses of the third workshop at PICES 2019 will be: key locations in the Pacific Arctic and the critical processes to determine biological production; characterization of major changes for recent decades; ramifications for the ecosystem monitoring and management in the region: sustainable monitoring by ice breakers and research ships in CAO with coordination among PICES countries, both Arctic and non-Arctic countries. One of the tasks for the WG 39 in doing this will be to explore for and make use of a pool of databases, aided by the general findings of previous reports and literature survey.