

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 (WGICA) 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) had its sixth meeting on August 24, 2022 (17:00–20:00 Pacific Standard Time, in Sidney, Canada), virtually, at PICES-2022. Co-Chair (PICES), Dr. Sei-Ichi Saitoh, led the meeting.

AGENDA ITEMS 1 AND 2

Welcome and introductions, agenda

Following self-introductions of participants (WG 39 Endnote 1), meeting agenda (*WG 39 Endnote 2*) were reviewed by participants. Dr. Saitoh also introduced the history and time plan of the joint WG.

AGENDA ITEM 3

Review of programs and meetings on the Central Arctic Ocean

Dr. Saitoh reported the overview of spring meeting of WGICA which was held in virtual on May 11–13, 2022. WGICA had a spring meeting to: 1) to discuss Report 2 part 1 (Human activities, pressures and management bodies) and 2) prepare for the October PICES Annual Meeting (Reports, new ToR, IA). The meeting was led by the co-leads: Drs. Lis Lindal Jørgensen, Martine van den Heuvel-Greve and Sei-Ichi Saitoh. In total over 30 scientists and ICES Secretariat members were participated on Day 1 and over 30 participates on Day 3.

AGENDA ITEM 4

Discussion on continuity of Working Group

We discussed the continuity of WG 39 activities in several directions. Finally, we discussed submitting a proposal for a new expert group (*Advisory Panel on the Arctic Ocean and Pacific Gateways*) to develop a strategic plan on how to coordinate and promote the joint scientific activities of PICES to further advance the understanding the Central Arctic Ocean and its interaction and linkage with its Pacific Gateways at PICES-2022.¹

¹ Recommended by Science Board to change to a Study Group on the *Arctic Ocean and Pacific Gateways*, and approved by Governing Council (GC decision 2022/S/7ii).

AGENDA ITEM 5

Publication plans

IEA Report 2, part 1: Human activities, pressures and management bodies (in preparation)

The outline of the report 2, part 1 has been circulated within the WGICA group and PAME and the chapters are currently being written by dedicated author groups from WGICA.

This report will cover the Central Arctic Ocean Large Marine Ecosystem (CAO LME) as geographically defined by WGICA in the opening of this report. The focus is on present and future human activities, the pressures from these human activities, and the impact of these pressures on the living ecosystem. The report will also describe policy, management mechanisms, and existing measures. The report will include a final chapter on what type of analyses and models exist for compiling ecosystem, human activity, pressures and policy metadata. Report 2, part 1 draws from published peer reviewed literature and information in Report 1 and the Ecosystem Overview Report. The six chapters are revised from 6 chapters to new 4 chapters (see *WG 39 Endnote 3*).

AGENDA ITEM 6

WG 39/WG 44 joint workshop at PICES-2022

A one-day WG39/WG44 joint workshop (*WG 39 Endnote 4*; see also [PICES Press article](#), Vol. 31, No. 1, 2023) was held at PICES-2022 to consolidate the WG's findings and advice, connect it to those from ICES and to report to the wider PICES community.

The main objectives for the workshop were to describe and discuss present ecosystem processes (sources, signals, significance) in the CAO and the NBS-CS based on achievements from existing and future research programs such as MOSAiC and SAS, numerous NBS-CS programs, and Indigenous Knowledge. In addition, it is of particular significance to developing future approaches for the United Nations Decade of Ocean Science for Sustainable Development in these oceans, where science for resilience and sustainability is more important than anywhere else and the relevant, regional UN program is yet to be properly initiated. There were about 30 attendants at this one-day in-person workshop on September 25 (Sunday), 9:00–18:00 (Busan, Korea), 2022. Two invited, 8 oral and one poster presentations were made at W2. PICES members from four countries and ICES member from Norway contributed the presentations.

AGENDA ITEM 7

Meetings

Inter-sessionally, we proposed holding the 7th WGICA meeting virtually from October 11–13, 2022. The meeting agenda is found in *WG 39 Endnote 5*. Dr. Lis Lindal Jørgensen, Dr. Martine Heuvel-Greve and Dr. Saitoh led the meeting.

We propose to hold a Spring Meeting of WGICA virtually in April 2023, and inter-sessionally, the 8th WGICA meeting will be held in person in October 2023 during PICES-2023 in Seattle, USA. Drs. Lindal Jørgensen, Heuvel-Greve and Saitoh, will organize the meetings.

AGENDA ITEM 8

Closing

The meeting concurred that further communication would be necessary and should be held on-line. The Co-Chair thanked the attendees and closed the successful meeting of WG 39.

WG 39 Endnote 1**WG 39 participation list**Members

Sei-Ichi Saitoh (Japan, Co-Chair/PICES)
 Fujio Ohnishi (Japan/PICES)
 Hyoung Chul Shin (Korea/PICES)
 David Fluharty (USA/PICES)

Observers

Takafumi Hirata (Japan/WG 44)
 others

Members unable to attend

China: Zhongyong Gao, Guangshui Na, Fang Zhang

WG 39 Endnote 2**WG 39 meeting agenda**

1. Welcome and introductions (S.-I. Saitoh and participants)
2. Review of agenda
3. Review of programs and meetings on the Central Arctic Ocean (S.-I. Saitoh)
 - Status of WGICA activities
 - Mid-year Spring Meeting of the ICES/PICES/PAME Working Group on Integrated Ecosystem Assessment for the Central Arctic Ocean (WGICA), May 10 and 12, 2022, on-line
4. Discussion on continuity of Working Group
 - Proposal for PICES Advisory Panel on the Arctic Issues (AP-ARC)
5. Publication plans
 - WGICA IEA Report No.1 (published)
 - WGICA Ecosystem Overview (EO) Report (published)
 - WGICA IEA Report No.2 Part1 (on going)
 - WGICA Annual Report 2022
 - WG 39 is due to submit the Final Report to the Parents Committees and Secretariat by March 31, 2023 (tentative due)
6. WG 39/WG 44 joint workshop at PICES-2022
7. Inter-sessional meetings and workshop (S.-I. Saitoh)
 - 7th Annual Meeting of the ICES/PICES/PAME Working Group on Integrated Ecosystem Assessment for the Central Arctic Ocean (WGICA)
 - Spring Meeting of the ICES/PICES/PAME Working Group on Integrated Ecosystem Assessment for the Central Arctic Ocean (WGICA)
8. Closing of meeting

WG 39 Endnote 3

Outline for IEA report 2, part 1

New chapter 1: Human activities relevant for the CAO

- Global sources (from existing chap 1)
- Shipping (from chap 2 and chap 3)
- Military activities (from chap 2 and chap 3)
- Tourisms (other than cruise ships) (from chap 2 and chap 3)
- Seabed mining, oil- and gas extraction (chap 3)
- Fishery (chap 3)
- Future of human activities in the CAO (chap 3)

New chapter 2: Pressures from human activities relevant for the CAO

- Sea-ice loss and temperature increase (borealisation) (from chap 1)
- Introduction of NiS (chap 1 and chap 2)
- Introduction of contaminant compounds (chap 1) and ship emission (chap 2)
- Marine litter (chap 1 and chap 2 that ships are strictly regulated)
- Noise pollution from ships (chap 2)
- Light pollution from ships (chap 2)
- Ship strikes (chap 2)

New chapter 3: Ecosystem vulnerability (all from last chap 4)

- Microbial processes
- Climate related effects - Trends and thresholds
- Human activities effects - Trends and thresholds
- Potential cumulative/interacting effects
- Foodweb effects
- Primary production
- Climate related effects - Trends and thresholds
- Human activities effects - Trends and thresholds
- Potential cumulative/interacting effects
- Foodweb effects
- Sea ice fauna / zooplankton
- Climate related effects - Trends and thresholds
- Human activities effects - Trends and thresholds
- Potential cumulative/interacting effects
- Foodweb effects
- Benthos
- Climate related effects - Trends and thresholds
- Human activities effects - Trends and thresholds
- Potential cumulative/interacting effects
- Foodweb effects
- Fish
- Climate related effects - Trends and thresholds
- Human activities effects - Trends and thresholds
- Potential cumulative/interacting effects
- Foodweb effects
- Seabirds
- Climate related effects - Trends and thresholds
- Human activities effects - Trends and thresholds

Potential cumulative/interacting effects
Foodweb effects
Marine mammals
Climate related effects - Trends and thresholds

New chapter 4: Management and measures for the CAO (all from last chap 5)

The global framework
Living marine resources
The environment
Military activities
Tourisms
Shipping
Seabed mining
Oil and Gas
Fishery

WG 39 Endnote 4

**Agenda for a joint WG 39/WG 44 Workshop (W2) on
“Integrated Ecosystem Assessment (IEA) to understand the present and future of the Central
Arctic Ocean (CAO) and Northern Bering and Chukchi Seas (NBS-CS)”
at PICES-2022**

Conveners: Sei-Ichi Saitoh (Japan), Hyoung Chul Shin (Korea), Libby Logerwell (USA), Yury Zuenko (Russia)

Morning Session: 09:00-12:30

09:00 Introduction by conveners

09:30 **Lis Lindal Jørgensen (Invited)**

Activities of the ICES-PICES-PAME working group on Integrated Ecosystem Assessment for the Central Arctic Ocean (WGICA)

10:10 **Ferdenant Mkrtchyan (Recorded)**

About remote monitoring of water surface and ice cover of the Arctic

10:50 **Dong-Gyun Han**

Passive acoustic monitoring in the Arctic Ocean for Integrated Ecosystem Assessment

11:10 **Wuju Son**

Vertical behavior of key copepod species subsequent to the midnight sun period in the East Siberian continental margin, Arctic Ocean

11:50 **Irene D. Alabia**

Arctic marine biodiversity and species co-occurrence patterns under recent climate

12:10 **Jee-Hoon Kim**

Inter-annual changes of the mesozooplankton community structure in the Central Arctic Ocean (CAO) and Northern Bering and Chukchi Seas (NBS-CS) during summers of 2016-2020

Afternoon Session: 14:00 – 18:00

14:00 **Lisa B. Eisner (Invited)**

Recent ecosystem research in the Chukchi and north Bering seas

WG 39 – 2022

14:40 **Kirill Kivva (ECS)**

Spatio-temporal **variability of ice retreat in the Pacific Arctic**

15:00 **Kirill Kivva (ECS)**

Distribution of water masses in the Chukchi Sea in August 2019 and their chemical characteristics

15:20 **Yury Zuenko (Cancelled)**

Utilization of nutrients intruded to the Chukchi Sea through Bering Strait

15:20 **Fujio Ohnishi**

The development of Japan's Arctic Policy and the citizens' awareness

16:10 Discussion

17:45 Summary and Next Steps

18:00 W2 Ends

WG 39 Endnote 5

7th WGICA Annual Meeting agenda October 11–13, 2022 ICES headquarters, Copenhagen, Denmark

Goal: discussion of Report 2-part 1

Meeting times are in CEST

October 10 – travel

06 pm CET - meet up at restaurant Wagamama in TIVOLI 5 minutes' walk from the ICES HQ - <https://www.wagamama.dk/en/restauranter>

October 11

Morning (09 am–01 pm CET)

- Welcome and introduction round (name, affiliation, role in WGICA, no-conflicts-of-interests)
- Approving the agenda, the situation with Russian colleagues.
- What have we done (ToR, Report 1, Report 2) and how to move forward toward the IEA next year
- Moving from old to new outline of Report 2 and the preliminary results (Lis go through the Report)
- Presentations and discussion:
 - CAO Global sources: presence and pressures in space and time (Randi Ingvaldsen)
 - CAO Local shipping: presence and pressures in space and time (Lis Jørgensen)
 - CAO Local tourism: presence and pressures in space and time (Hauke Flores)

Break and work: 1–5pm

Evening (05–08 pm CET)

- Introduction round (name, affiliation, role in WGICA, no-conflicts-of-interests)
- Short update of the morning session
 - CAO pressures: litter in space and time (Jessica Nilsson)
 - CAO pressures: NIS in space and time (Martine van den Heuvel-Greve)
 - CAO pressures: pollution in time and space (Bjørn Einar Grøsvik)
 - CAO Local military: presence and pressures in space and time (Paul Arthur Berkman)
- Summary – Human activities/pressures - What do we still need to work on? (WG1) (Lis LJ and Sei-Ichi Saitoh)

October 12

Morning (09 am–01 pm CET)

- Bacteria: distribution in space and time, sensitivity to pressures (Pauline Snoeijs-Leijonmalm)
- Zooplankton and ice-fauna: distribution in space and time, sensitivity to pressures (Hauke Flores)
- Benthos: distribution in space and time, sensitivity to pressures (Bodil Bluhm)
- Sea mammals: distribution in space and time, sensitivity to pressures (Mario Acquarone)

Break and work: 1–5pm

Evening (05–08 pm CET)

- Algae and ice-fauna: distribution in space and time, sensitivity to pressures (Cecilie v Q)
- Fish (ice, pelagic, meso, deep): distribution in space and time (Pauline Snoeijs-Leijonmalm)
- Fish: sensitivity to pressures (Kevin Hedges)
- Seabirds: distribution in space and time (Kathy Kuletz)
- Seabirds: sensitivity to pressures (Tom Christensen)
- Summary - Ecosystem sensitivity toward human pressures - What do we still need to work on? (WG2) (Lisa Speer and Martine S-L)

October 13

Morning (09 am–01 pm CET)

- WP 1: WG1 Human activities and pressures - What do we still need to work on? (lead by Lis and Sei-Ichi) in meeting room Atlantic
 - Ongoing work of identifying spatial, temporal distribution of human sectors and defining its pressures
- WP 2: WG2 Ecosystem sensitivity toward human pressures - What do we still need to work on? (led by Lisa Speer and Martine S-L) in meeting room Baltic
 - Ongoing work of dividing the ecosystem components into relevant groups, identifying spatial, temporal distribution, and defining vulnerability to defined pressures from WP1.

Evening (05–08 pm CET)

- WP 1: WG1 Human activities and pressures - What do we still need to work on? (lead by Lis and Sei-Ichi)
 - Wrapping up and finalized tables and text (seeking high confidence level) for spatial, temporal distribution of human sectors and its pressures.
- WP 2: WG2 Ecosystem sensitivity toward human pressures - What do we still need to work on? (led by Lisa Speer and Martine S-L)
 - Wrapping up and finalized tables and text (seeking high confidence level) for spatial, temporal distribution of biological groupings and its vulnerability toward pressures.
- Plenum meeting with working-plan for Report 2 to finish all text before 2023
- Summing up and plans for 2023

October 14 – travel