

Report of the Physical Oceanography and Climate Committee

The Physical Oceanography and Climate Committee (POC) held two meetings during PICES-2016 in San Diego, USA. The first was held on Sunday, November 6, 2016, while the second took place on Wednesday, November 9, 2016. The POC Vice-Chair, Dr. Michael Foreman, presided over both meetings and conveyed regrets from the Chair, Dr. Kyung-Il Chang, who unfortunately was unable to attend. Participants for both meetings are given in *POC Endnote 1* and draft agenda for both meetings was approved on Sunday and is included as *POC Endnote 2*.

AGENDA ITEMS 1 AND 2

Welcome, introductions, remarks and membership

All participants were welcomed and it was noted that the only change to POC membership in 2016 was Dr. Emanuele Di Lorenzo replacing Dr. Enrique Curchitser as a representative of the USA.

AGENDA ITEM 3

Changes to, adoption of, agenda and appointment of rapporteur

The agenda was adopted and Dr. James Christian agreed to act as rapporteur.

AGENDA ITEM 4

Completion of PICES-2015 decisions

1. A list of POC co-sponsored Poster/Topic Sessions and Workshops that were approved for the 2016 PICES annual meeting can be found in item 4 of POC Endnote 2.
2. The following two inter-sessional events were approved:
 - Training Course on “*Coastal vulnerability and freshwater discharge*” (Joji Ishizaka, convenor), November 27–December 10, 2016, Nagoya University, Japan;
 - AP-CREAMS inter-sessional meeting, May 12–13, 2016, Vladivostok, Russia.
3. The following five requests for travel and representation at meetings of other organizations/programs were approved:
 - Travel and local costs for 3 early career scientists (1 Russian, 2 Koreans) to attend the Training Course on “*Coastal vulnerability and freshwater discharge*” at Nagoya University, Japan;
 - Travel costs for Dr. Lisa Miller to attend the 2016 BEPSII (SCOR WG 40) meeting in Paris, France, March 16-18, 2016;
 - Travel costs for 3 early career scientists (2 U.S., 1 Korean) to attend 2016 CLIVAR OSC in Qingdao, China, September 15–23.
 - Co-sponsoring the SCICOM proposal at the ICES ASC 2016 (*Seasonal-to-decadal prediction of marine systems: Opportunities, approaches, and applications*) with Dr. Desiree Tommasi (USA) as the convenor representing PICES.
 - Travel costs for 3 PICES members to act as Scientific Steering Committee members for the 3rd PICES/ICES Early Career Scientist Conference (*Ecosystem response to physical forcing, physical-biological coupling*). Michael Jacox, whom POC had recommended, was not selected as an SSC member.
4. Publications
 - Final Report of WG 27 on *North Pacific Climate Variability and Change*. In Dr. Emanuele Di Lorenzo’s absence, Dr. Foreman reported that Dr. Di Lorenzo submitted the final report to the Secretariat on November 11, 2016. The next step will be to have POC review and approve the report before submitting to Science Board for approval.
 - Final Report of WG 29 on *Regional Climate Modeling*. Dr. Chan Joo Jang reported on the status of this report. Almost all contributors have submitted their chapters, and Dr. Jang plans to have a first draft by December with final submission prior to ISB-2017.

- Dr. Yury Zuenko reported on the status of the AP-CREAMS PICES Scientific Report on “*Oceanography of the Yellow and East China seas*” (EAST-II region) (Editors: J. Ishizaka, T. Matsuno, J. Zhang, J.-H. Lee, S. Kim, D. Xu, Y. Fei, S.-M. Liu, V. Lobanov). A 1-year extension was requested for completion – it should be completed by PICES-2017. The report will have 22 authors, 44 reviewers and be approximately 300 pages long.
- Dr. Zuenko also reported on the Supplementary Chapter of NPESR 2003–2008 (EAST-I area). It has been completed, corrected, and is in preparation for printing.

AGENDA ITEM 5

Progress reports and future plans of POC active groups

- i. Dr. Christian gave a short report on progress of the Section on *Carbon and Climate* (S-CC). Highlights included the expected publication of a PICES Scientific Report on an ongoing basin-wide assessment of ocean acidification and de-oxygenation in 2017 and a Persian translation of their Best Practices Guide. Some members will be attending the Joint ICES/PICES workshop on understanding the impacts and consequences of ocean ACIDification for commercial species and end-USErs (WKACIDUSE), December 5–8, 2016, in Copenhagen, Denmark. The only financial request was for approximately \$10,000 for a graphic designer to help with the final ocean acidification basin-wide assessment report in the PICES Scientific Report series.
- ii. Dr. Shin-ichi Ito gave a presentation on the Joint PICES/ICES Section on *Climate Change Effects on Marine Ecosystems* (S-CCME). Highlights included a list of membership changes, a summary of recent activities and funding for related projects, and plans for ICES ASC 2017, inter-sessional meetings and the next PICES Annual Meeting. Financial requests included support for: i) an invited speaker for a topic session at PICES-2017, ii) an early career scientist to attend Lowell Wakefield Symposium on “*Impacts of a changing environment on the dynamics of high-latitude fish and fisheries*”, and iii) an early career scientist to attend the ESSAS Open Science Meeting on June 11–15, 2017, in Tromsø, Norway.
- iii. Dr. Zuenko gave a presentation on activities and plans for the Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas*. AP-CREAMS investigators met in May in Vladivostok and will meet again in China in early 2017. The Supplementary Chapter to the second NPESR is now completed and is awaiting publication (Agenda Item 4.4). A PICES Scientific Report on the oceanography of the EAST-II area is expected to be completed this year (Agenda Item 4.4). A training course to be held in Nagoya, Japan, in December (Agenda Item 4.2) will include trainees supported by PICES from Canada, China, Japan, Korea and Russia. Plans for 2017 include an EAST-II survey and a new ferry-based monitoring line. There were no financial requests.

AGENDA ITEM 6

Relationships with other international organizations/programs

- i. Megan Scanderbeg gave an update on the status of the Argo program. Highlights included an array of 3739 floats on October 28, 2016, capabilities in ice-covered regions, many more floats with biogeochemical sensors, floats that can go as deep as 6000 m, enhanced spatial and temporal coverage, and an easily-usable global marine atlas. The atlas includes temperature and salinity data to 2000 m depth, and calculates density and sea surface height. Argo would like to expand coverage in western boundary current regions; the strategy for this is still under development.
- ii. Dr. Nico Caltabiano gave a brief overview of CLIVAR and its recent activities. These included a recent research focus on eastern boundary upwelling systems (in collaboration with IMBER and SOLAS); CLIVAR Open Science Conference (September 18–25, 2016, in Qingdao, China); and a new science plan that is available for comments at <http://www.clivar.org/news/clivar-science-plan-available-comments>. An Early Career Scientists Symposium hosted by China’s First Institute of Oceanography was held the day prior to the OSC and attracted participants from 34 countries; an upcoming conference on “*Regional sea level changes and coastal impacts*” (July 10–14, 2017, New York City; www.sealevel2017.org/).

- iii. Dr. Hee-Dong Jeong gave an overview of NEAR-GOOS (North East Asian Regional Global Ocean Observing System). The last meeting of the IOC/WESTPAC coordinating committee for NEAR-GOOS was December 8–9, 2015 in Tokyo and the next one will be on December 15–16, 2016, in Vladivostok, with the theme “*Developing an operational ocean forecasting system*”. Observations aboard the ferry linking Sakaiminato (Japan), Donghae (Korea), and Vladivostok (Russia) are to begin in early 2017, and will likely be extended to additional ships in the future.
- iv. Dr. Ken Drinkwater gave an overview of ESSAS (Ecosystem Studies of Arctic and Sub-Arctic Seas) goals and future plans (the name was recently revised to include “Arctic”). ESSAS next Open Science Meeting will be held June 11–15, 2017, in Tromsø, Norway, and will include a theme session on ocean acidification. There is a request for PICES to sponsor one person to attend this meeting (see also Agenda Item 5.2).
- v. Dr. Drinkwater also presented a list of theme sessions for the next ICES Annual Science Conference to be held September 16–20, 2017, in Fort Lauderdale, USA. Though some were of marginal interest to POC, it was decided not to offer co-sponsorship to any because there is a considerable overlap in dates with the next PICES Annual Meeting in Vladivostok. Dr. Drinkwater noted that ICES and PICES have cooperated extensively in the area of ocean acidification, including joint topic sessions at the 2015 ICES and 2016 PICES annual meetings and a joint workshop on “*Understanding the impacts and consequences of ocean acidification for commercial species and end-users*” (Tsuneo Ono representing PICES) to be held in December 5–9, 2016.
- vi. Dr. Christian reported that with PICES support, Dr. Lisa Miller attended the last meeting of SCOR WG 140, BEPSII (Biogeochemical Exchange Processes at Sea-Ice Interfaces) March 16–18, 2016, in Paris. BEPSII has now completed its work and ends this year as a SCOR Working Group. It will continue under the same name as a new, indefinite body sponsored by SOLAS and CLiC.

AGENDA ITEM 7

FUTURE

Dr. Steven Bograd (FUTURE SSC liaison to POC provided a brief update on FUTURE activities.

AGENDA ITEM 8

Planning for PICES-2017, Vladivostok, Russia

Two topic sessions were proposed by POC members:

- “*Meso-/submeso-scale processes and their role in marine ecosystems*” by Dr. Hiromichi Ueno;
- “*Interannual variability in marine ecosystems*” by Dr. Zuenko.

Descriptions are given in **POC Endnote 3** and each was ranked 3 out of 3. A POC Paper Session was also requested and given the same ranking. Among the topic sessions proposed by other expert groups, the two listed below were assigned a ranking of 2 by the POC members. All other proposed topic sessions were assigned the ranking of 1.

- “*Adverse impacts on coastal ocean ecosystems: How do we best measure, monitor, understand and predict?*” (proposed by Akash Sastri (Canada, BIO, AP-NPCOOS));
- “*Emerging issues in understanding, forecasting and communicating climate impacts on North Pacific marine ecosystems*” (proposed by Steven Bograd).

AGENDA ITEM 9

North Pacific Ecosystem Status Report

Mr. Peter Chandler gave a short overview on the status of this report which included the recommendations of the SG-NPESR3 that were accepted at ISB-2016, outcomes from an inter-sessional workshop in Victoria on June 28–30, 2016, a summary of proposed ETSOs (environmental time series observations) indexed by data type (e.g., physical, chemical, plankton, mammals) and geographic region, a new data management system, a sample of the steps to be followed in submitting material, and proposed next steps. A new Working Group on *North Pacific Ecosystem Status Report* (WG 35) was established at ISB-2016, but membership, as of PICES-2016, has not been finalized. Dr. Zuenko was proposed as a member of WG 35, representing POC, with Peter Chandler and Nicholas Bond supporting him as POC “associates”.

AGENDA ITEM 10

Elect new POC Chair and Vice-Chair

At the Sunday meeting, Dr. Di Lorenzo was nominated for the new POC Chair position and Dr. Zuenko was nominated as the new Vice-Chair. No other nominations were received by the Wednesday meeting so both were elected by acclamation. Dr. Harold (Hal) Batchelder was present to conduct the election. POC members offered hearty congratulations and best wishes to both!!

AGENDA ITEM 11

Proposals for publication in 2017 and beyond

- S-CC plans to publish a basin-wide ocean acidification and de-oxygenation assessment as a PICES Scientific Report or Special Publication before the 2017 Annual Meeting. A shorter version will also be submitted to a peer-reviewed journal.
- AP-CREAMS PICES Scientific Report on “*Oceanography of the Yellow and East China seas*” is planned for completion by the PICES-2017 .
- The final report of WG 27 on *North Pacific Climate Variability and Change* was submitted to the PICES Secretariat shortly before PICES-2016.
- The final report of WG 29 on *Regional Climate Modeling* is nearing completion and is planned for submission to the PICES Secretariat before ISB-2017.

AGENDA ITEM 12

Proposals for new working groups, study groups, and special projects

Two new working groups were proposed and submitted to Science Board for approval. Their motivation, terms of reference, and proposed membership are given in **POC Endnote 4**.

- Working Group on *Mesoscale and Sub-mesoscale Processes*, proposed by Hiromichi Ueno;
- Working Group on *Climate and Ecosystem Predictability*, proposed by Emanuele Di Lorenzo and Nicholas Bond.

AGENDA ITEM 13

Requests from and to existing expert groups

Dr. Christian requested funding to complete the acidification assessment report (*e.g.*, hire a graphic designer) arising from W1 on “Acidification of the North Pacific Ocean: A basin-wide assessment” (held November 3). See Agenda Items 5(1) and 11.

AGENDA ITEM 14

Proposals for new meetings, workshops, symposia, conferences with PICES as organizer or co-sponsor

POC members reviewed several meetings planned for later in 2016 and 2017 that have PICES as organizer or co-sponsor, including PICES/ICES 3rd Early Career Scientists Conference from May 30–June 2, 2017 in Busan, Korea. The Fourth International Symposium on the “*Effects of climate change on the world’s oceans*” is scheduled for Washington, DC, in June 2018 and presumably, has already made its request to PICES for co-sponsorship. NEAR-GOOS will hold a meeting in Vladivostok in December 2016 and ESSAS will hold an Open Science Meeting in Tromsø in June 2017 (see Agenda Item 16). No other new meetings were raised.

AGENDA ITEM 15

Upcoming meetings relevant to POC

The following do not require POC or PICES support but were drawn to our attention by Dr. Shin-ichi Ito:

- Scoping Meeting for the IPCC Special Report on Climate Change, the Oceans, and the Cryosphere, December 6–9, 2016, Monaco;
- JpGU-AGU Joint Meeting on Marine ecosystem and biogeochemical cycles: theory, observation and modeling, May 20–25, 2017, Makuhari, Japan.

AGENDA ITEM 16

Priority of items with funding implications

Inter-sessional meetings/workshops/symposia for 2017 and beyond:

- Travel support for an early career scientist from a PICES member country to attend the ESSAS Open Science Meeting, June 11–15, 2017, Tromsø, Norway.
- S-CCME request for travel support for an early career scientist from a PICES member country to attend the Lowell Wakefield Symposium on “Impacts of a changing environment on the dynamics of high-latitude fish and fisheries”, May 9–12, 2017, Anchorage, USA.

AGENDA ITEM 17

POC Best Presentation and Poster Awards

Drs. Ueno, Elena Ustinova, and Christian agreed to be judges for these awards for POC-sponsored topic sessions/workshops. There were many deserving candidates but after a difficult decision, the awards were given to Hannah Na for her presentation on “*Mesoscale-eddy-induced variability of flow through the Kerama Gap between the East China Sea and the western North Pacific*” in POC Topic Session (S11) on *Advances in understanding and modeling of physical processes in the North Pacific in the past 25 years of PICES and future directions*” and Kirill Kivva for his poster on “*Seasonal dynamics of dissolved inorganic nutrient in the Bering Sea*” in POC Workshop (W9) on “*The role of the northern Bering Sea in modulating Arctic environments: Towards international interdisciplinary efforts*”.

AGENDA ITEM 18

Documenting business meetings, topic sessions and workshops

The Chairs of AP-CREAMS, S-CC, and S-CCME are asked to submit their business meeting reports to Secretariat within 1 month after the Annual Meeting, and the Conveners of Topic and Poster Sessions are requested to submit their summaries to the Secretariat as soon as possible: POC Poster Session – Dr. Foreman, S7 – Tsuneo, and S11 – Dr. Ito or Dr. Bograd. The short summaries should include what was presented, (not necessarily paper by paper), general impressions, and opinions on the future direction of the research.

AGENDA ITEM 19

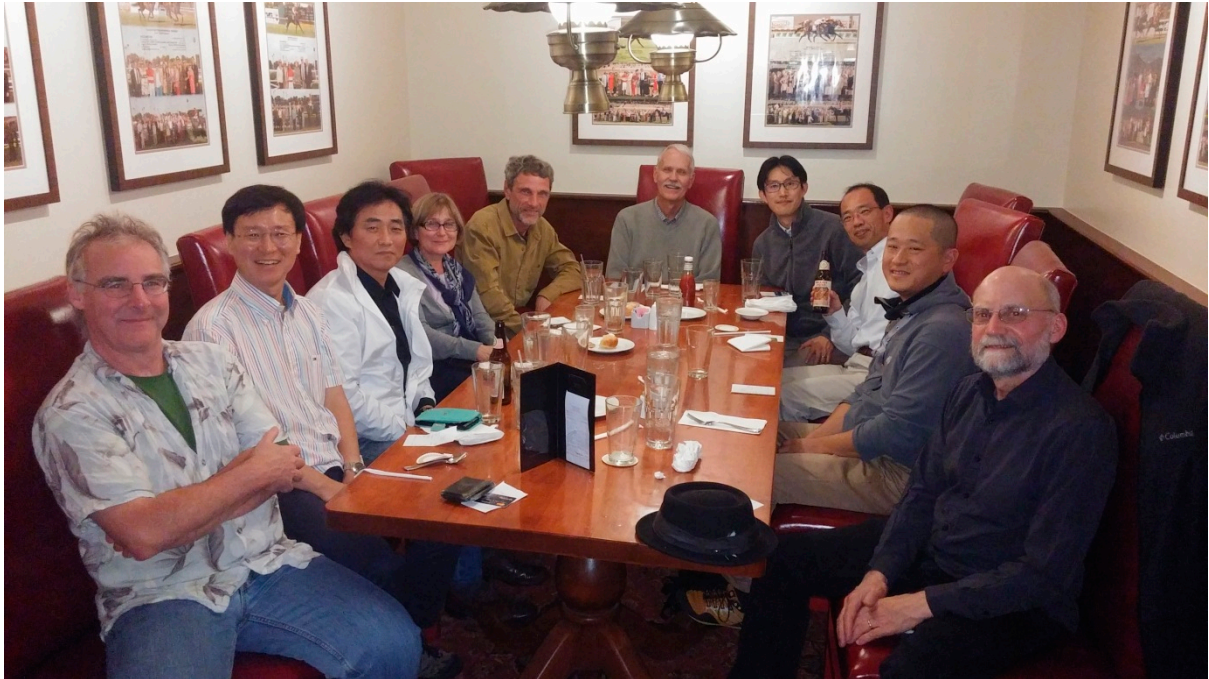
Other business

No other business was raised.

AGENDA ITEM 20

Adoption of POC report and recommendations to Science Board

A summary spreadsheet of requests to Science Board was prepared by Dr. Foreman and presented at the Science Board meeting by Dr. Bograd.



Dinner after the Sunday (November 6) POC business meeting. From left: James Christian, Chan Joo Jang, Hee-Dong Jeong, Elena Ustinova, Yury Zuenko, Michael Foreman, Hiromichi Ueno, Shin-ichi Ito, Daisuke Hasegawa, Albert Hermann.



Participants at the Wednesday (November 9) POC business meeting. From left: Hiromichi Ueno, Chan Joo Jang, Hee-Dong Jeong, Yury Zuenko, Elena Ustinova (partially hidden), James Christian, Steven Bograd, Peter Chandler, Megan Scanderbeg, Ken Drinkwater, Nicholas Bond, Michael Foreman.

POC Endnote 1**POC participation list**Members

Steven Bograd (USA)
 James Christian (Canada)
 Jerome Fiechter (USA)
 Michael Foreman (Canada, Vice-Chair)
 Charles Hannah (Canada, Nov. 6)
 Daisuke Hasegawa (Japan, Nov. 6)
 Shin-ichi Ito (Japan, Nov. 6)
 Chan Joo Jang (Korea)
 Hee-Dong Jeong (Korea)
 Fangli Qiao (China)
 Hiromichi Ueno (Japan)
 Elena Ustinova (Russia)
 Yury Zuenko (Russia)

Members unable to attend

China: Fan Wang, Lei Zhou
 Korea: Kyung-Il Chang
 Russia: Vyacheslav Lobanov
 USA: Emanuele Di Lorenzo

PICES

Harold (Hal) Batchelder

Observers

Nicholas Bond (USA, Nov. 9)
 Nico Caltabiano (CLIVAR, Nov. 6)
 Peter Chandler (Canada, Co-Chair, WG 35)
 Ken Drinkwater (ESSAS, Nov. 9)
 Megan Scanderbeg (Argo, Nov.9)

POC Endnote 2**POC meeting agenda**

1. Welcome, introductions, opening remarks
2. Membership status
3. Changes to, adoption of, agenda and appointment of rapporteur
4. Completion of 2015 PICES decisions
 - (1) 2016 PICES POC co-sponsored Poster/Topic Sessions and Workshops

| ID | Title | Convenors | Date | Committee Sponsors | Invited Speakers |
|-----------|---|--|--------------|-----------------------------|---|
| | POC Poster | Kyung Il Chang Michael Foreman | Nov. 8 | POC | |
| S6 | What factors make or break trophic linkages? | Elliott L. Hazen Jameal Samhouri Shin-ichi Ito Jennifer Boldt | Nov. 8 | POC/MEQ/ MONITOR/ BIO | Masashi Kiyota (Japan) Kenneth Rose (USA) |
| S7 | New stage of ocean acidification studies: Responses of oceanic ecosystem including fisheries resources | Tsuneo Ono Jun Kita Debby Ianson John Pinnegar | Nov. 8 | POC/TCODE/ MEQ | John Pinnegar_(UK) George Waldbusser_(USA) Steven Widdicombe_(UK) |
| S11 | Advances in understanding and modeling of physical processes in the North Pacific in the past 25 years of PICES and future directions | Shin-ichi Ito Kyung-Il Chang Steven Bograd | Nov. 8 and 9 | POC | Michael Foreman (Canada) Jerome Fiechter (USA) Vyacheslav Lobanov (Russia) Ichiro Yasuda (Japan) |
| W1 | Acidification of the North Pacific Ocean: A basin-wide assessment | James Christian Tsuneo Ono | Nov. 3 | POC | Karen Kohfeld (Canada) |

| | | | | | |
|----|--|---|--------|-----------|---|
| W8 | Mesoscale and submesoscale processes in the North Pacific: history and new challenges | Kyung-Il Chang Hiromichi Ueno Annalisa Bracco | Nov. 4 | POC | Sachihiko Itoh (Japan) Naomi M. Levine (USA) |
| W9 | The role of the northern Bering Sea in modulating Arctic environments: Towards international interdisciplinary efforts | Lisa Eisner Matthew Baker Kirill Kivva | Nov. 3 | POC, NPRB | Seth Danielson (USA) Kirill Kivva (Russia) Alexander Zavolokin (NPFC) |

5. Progress reports and future plans of POC active groups
 - i. Section on *Carbon and Climate* (Jim Christian). [NB. POC will be the parent committee responsible for giving short report on progress at the SB meeting.]
 - ii. Joint PICES/ICES Section on *Climate Change Effects on Marine Ecosystems* (Shin-ichi Ito). [NB. FIS will be the parent committee responsible for giving short report on progress at the SB meeting.]
 - iii. Advisory Panel on CREAMS/PICES Program in East Asian Marginal Seas (Y. Zuenko). [NB. POC will be the parent committee responsible for giving short report on progress at the SB meeting.]
6. Relationships with other international organizations/programs
 - i. Argo (Megan Scanderbeg, msscanderbeg@ucsd.edu)
 - ii. CLIVAR: Nico Caltabiano (Mike to present)
 - iii. NEAR-GOOS: Hee-Dong Jeong or Vyacheslav Lobanov
 - iv. ESSAS: Ken Drinkwater
 - v. ICES: Ken Drinkwater
 - vi. SCOR
7. FUTURE
8. Planning for PICES-2017, Vladivostok, Russia;
9. North Pacific Ecosystem Status Report (Phil Mundy or Peter Chandler)
10. Elect new POC Chair and Vice-Chair
11. Proposals for publication in 2017 and beyond
12. Proposals for new working groups, study groups, and special projects:
13. Requests from and to existing expert groups
14. Proposals for new meetings, workshops, symposia, conferences with PICES as organizer or co-sponsor
15. Upcoming meetings requesting POC input (Shin-ichi Ito)
16. Priority of items with funding implications
17. 2015 POC Best Presentation and Poster Award
18. Documenting business meetings, topic sessions and workshops
19. Other business
20. Adoption of POC report and recommendations to Science Board

POC Endnote 3**POC Topic Session proposals for PICES-2016****Topic Session on “*Meso-/submeso-scale processes and their role in marine ecosystems*”**

Duration: 1 day

Convenors: Hiromichi Ueno (Japan), M. Debora Iglesias-Rodriguez (USA) Sachihiko Itoh (Japan), Elena Ustinova (Russia)

Invited speaker: Yevgeny Samko (Russia)

Mesoscale and submesoscale (~1 to 100 km) currents and fronts such as eddies, streamers, filaments and streaks are ubiquitous features of the ocean. These complex but coherent patterns in the sea surface are often captured by satellite imagery and partially reproduced by high-resolution numerical ocean-circulation/biogeochemical models. While the interior structure of these fine-scale features and its dynamics are still in exploration, it has been well-known that there are tight linkages between physics and distribution of marine organisms at these scales, which includes dispersion, patchiness and aggregations of plankton, nekton, birds and mammals. Understanding the structure and physics of these horizontal fine-scale features, their effects on distribution and production of marine organisms, and how they influence the functioning of the marine ecosystem and its services such as fisheries yield and efficiency is necessary in order to assess likely system changes and shifts under a changing climate. This topic session aims to discuss the interaction between physics, chemistry, biology and fisheries of the ocean at the meso- and submesoscale based on observations and modeling. Presentations will include various levels of organization (physics, biogeochemistry, fish/fisheries and other marine predators) from different areas in the PICES region, and participants will be invited to compare differences and discuss the underlying mechanisms.

Topic Session on “*Interannual variability in marine ecosystems*”

Convenors: Yury Zuenko (Russia), Hee-Dong Jeong (Korea), TBD from the East Pacific

Co-sponsors: POC, S-CCME, AP-CREAMS

Duration: 1 day

In practice of environmental maintenance of fisheries and other human activities in the World Ocean, year-to-year variability is more important than the changes of longer scale. However, its mechanisms are poorly known yet, the cyclic processes in the scale from 2 to 20 years are usually considered and forecasted without real understanding of their nature. The ideas on the year-to-year variability mechanisms and results of their revealing and practical using are welcome.

The session will be held concurrently with the ICES/PICES topic session on “predictability in interannual scale, some on-line and post-session communications between them are considered.

Convenors: Yury Zuenko (Russia), Hee-Dong Jeong (Korea), TBD from the east Pacific

Potential invited speakers: Elena Ustinova (Russia), TBD from the fisheries science community.

POC Endnote 4

New Working Group proposals from POC

Mesoscale and Sub-mesoscale Processes

Mission

Oceanic mesoscale flow fields like eddies, upwelling, and fronts at spatial scales of 10 – 100 km have been extensively studied for their dynamics and various contributions to marine ecosystems. Motions on the submesoscale (~1 km) and their impacts on the marine ecosystem, however, are less well known. Submesoscale features are often found along the periphery of mesoscale eddies and involve larger vertical fluxes than those associated with mesoscale eddies which then have substantial effects on the biological production. Submesoscale processes also interact with mesoscale processes. Understanding the structure and physics of these processes, their effects on distribution and production of marine organisms, and how they influence the functioning of the marine ecosystem and its services is necessary in order to assess likely system changes and shifts under a changing climate. Faced with these important issues, however, observational skills, theoretical understandings, and modeling techniques are still immature. This working group elucidate the meso-/submeso-scales processes, their spacio-temporal variations and impacts on heat/material transport and marine ecosystem.

Terms of Reference

1. Review and document the current understanding of meso-/submeso-scale processes and their impact in the North Pacific.
2. Summarize the detection, observation and modeling methods of meso-/submeso-scale processes.
3. Classify meso-/submeso-scale features, and identify their spatio-temporal variations.
4. Compare the impacts of meso-/submeso-scale processes on heat/material transport and marine ecosystems between areas in the PICES region.
5. Convene a session or workshop on meso-/submeso-scale processes at PICES Annual Meetings.
6. Publish a final report summarizing results.
7. This working group contributes to FUTURE by understanding how meso-/submeso-scale processes affect ecosystems.

Expected outcomes

1. A review article published as a PICES Scientific Report;
2. A synthesis paper on the detection, observation and modeling methods of meso-/submeso-scale processes;
3. A synthesis paper on classifying meso-/submeso-scale features and identifying their spatio-temporal variations;
4. A synthesis paper on comparing the impacts of meso-/submeso-scale processes on heat/material transport and marine ecosystems between areas in the PICES region.

Notes:

A more detailed understanding of meso-/submeso-scale processes would be helpful to other committees, e.g., BIO/FIS, because they have a significant impact on e.g. larvae production.

Parent Committee: POC

Proposed Co-Chairs: Hiromichi Ueno (Japan), Annalisa Bracco (USA)

Proposed members:

- Canada: Tetjana Ross, TBD
- China: Bin Xiao, Xiaspei Lin, Dongfeng Xu
- Japan: Sachihiko Itoh, Daisuke Hasegawa
- Korea: Young-Gyu Park, TBD
- Russia: Elena Ustinova, Maxim Budyansky, Orga Trusenkova
- USA: Carol Ladd, TBD

Climate and Ecosystem Predictability

Background

PICES Working Groups 27 (*North Pacific Climate Variability and Change*), 28 (*Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors*), and 29 (*Regional Climate Modeling*) ended in 2015. While WG 27 has identified and described a series of climate and ecosystem mechanisms that have forecast potentials ranging from 3 months to 10 years, WG 29 has developed a set of modeling strategies to simulate these mechanisms at both the basin and regional-scale over the North Pacific. Complementary to WG 27 and WG 29, the outcomes of WG28 provide us with a series of key ecosystem indicators that can be connected to climate processes identified by WG 27 and modeled by WG29. Furthermore, the activities of WG 27 and WG 29 strongly leveraged collaborations with CLIVAR by conducting joint sessions and by entraining CLIVAR expertise. Building on the outcomes of WGs 27, 28, and 29, and the CLIVAR collaborations, we propose a new PICES Working Group on Climate and Ecosystem Predictability (WG-CEP) with parent committees being FUTURE and POC. The WG-CEP will interact with CLIVAR towards integrating the knowledge gained on the mechanisms of Pacific climate, regional modeling, and ecosystem indicators to identify and quantify the sources of climate and ecosystem predictability in the North Pacific.

Motivation and Goals

To identify, diagnose and quantify predictable response in North Pacific marine ecosystems that arise from regional- and large-scale climate processes

The North Pacific marine ecosystems are primary sources of ecosystem services for Russia, Canada, Japan, China, Korea and the US (*e.g.*, fishing, shipping, and recreation). Long-term historical observations of physical and biological variables been collected around the North Pacific rim since the 1950s, leading to an excellent foundation for understanding the ecosystem impacts of dominant climate processes such as the Pacific Decadal Oscillation, North Pacific Gyre Oscillation, and the El Niño-Southern Oscillation (ENSO). In the North Pacific, regional- and large-scale climate forcing impacts a wide range of physical and biotic processes including temperature, stratification, winds, upwelling, and primary and secondary production. Moreover, there is some predictability in the physical system on seasonal (Stock *et al.*, 2015) and even longer (*e.g.*, Qiu *et al.*, 2014) times scales. Nevertheless, there has been no systematic and synergistic attempt to use this knowledge to forecast marine ecosystem responses to climate forcing, which is a primary goal of the PICES FUTURE science plan and CLIVAR. The new PICES working group will leverage the international expertise within PICES and foster more active interactions with CLIVAR to “identify, diagnose and quantify predictable response in North Pacific marine ecosystems that arise from regional- and large-scale climate processes.”

Terms of Reference

1. *Identify a set of North Pacific ecological indicators and/or marine ecosystem functional responses of fish and shellfish, which show predictable responses to large- and regional-scale climate forcing at timescales from months to 1-2 decades.*

The WG will (1) identify a finite number of ecological indicators and/or marine ecosystem functional responses that are prime for making ecosystem predictions, and (2) diagnose the regional mechanism and drivers controlling these ecosystem responses (see diagram 1). The selected mechanisms can act on any of the following timescales: intra-seasonal, seasonal, interannual, decadal and climate change. To identify this set of mechanisms, the WG will (a) use findings from WG28 on the ecosystem indicators and WG 27/29 on regional climate mechanisms, and (b) coordinate with the ongoing section S-CCME, to align some of the prediction efforts to complement the gaps in S-CCME.

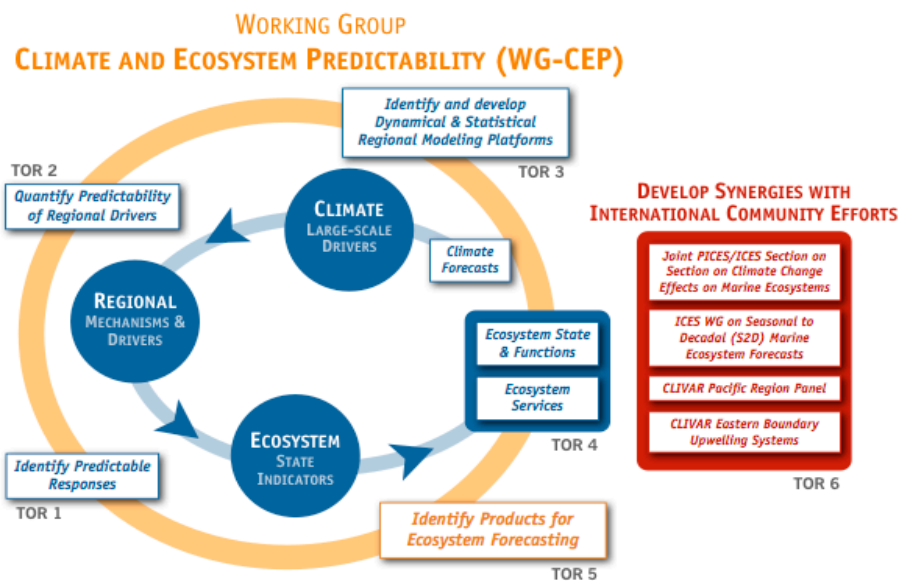


Diagram 1: Schematic of WG-CEP Terms of Reference.

2. *Quantify the predictability of the regional ecosystem drivers that are controlled by large-scale climate variability and change.*

The WG will diagnose the large-scale climate processes that relate to the regional physical-biological mechanisms associated with predictable ecosystem responses (e.g. the ones identified in TOR 1). The WG will also quantify the predictability and uncertainties from large-scale climate forcing to regional ecosystem drivers to ecosystem responses (e.g., blue path in diagram 1). To accomplish this TOR the WG will make use of output of IPCC-class climate models as well as regional ocean model simulations and reanalyses. This effort will require examination of a great amount of data from a number of model simulations of extended durations. The WG will collaborate with representatives from CLIVAR to devise feasible strategies for data analysis and archival.

3. *Identify dynamical and statistical modeling frameworks for climate and ecosystem predictability.*

The WG will identify a set of modeling frameworks and existing model outputs (e.g., IPCC-class climate models) that can be used to evaluate the predictability dynamics identified in TOR 1 and 2. To do so, the WG will leverage outcomes and products from WG 29.

4. *Identify how and which ecosystem predictions can be integrated in the management of ecosystem services.*

The WG will engage with the section on human dimensions and other stakeholders to identify what type of ecosystem prediction can be (1) potentially integrated in managing ecosystem services and (2) used to characterize the ecosystem state and function in selected regions of the North Pacific. This effort will also consider the issues that arise in operational maintenance of prediction systems.

5. *Identify climate and ocean products that can be used to begin making predictions of North Pacific marine ecosystems.*

The WG will identify sets of variables that are presently available, or expected to be available soon, for experimental predictions. Initially, there may be a focus on regions and predictands for ecosystem predictions on timescales of months to a year. The WG would collaborate with CLIVAR towards making the data available for prediction experiments.

6. *Outcomes and synergies with international efforts.*

The WG will engage in synergistic activities with other efforts and groups that work on climate and ecosystem predictability. These include the ICES WG on Seasonal to Decadal (ICES-S2D) Marine Ecosystem Forecasts, Joint PICES/ICES Section on Section on *Climate Change Effects on Marine Ecosystems* (S-CCME), the CLIVAR Pacific Region Panel, and CLIVAR Eastern Boundary Upwelling Systems Research Focus. Specifically, WG will plan joint theme sessions and workshops at the ICES

and PICES annual meeting and a session at the 4th International Symposium on “*Effects of climate change on the world’s ocean*”.

Proposed PICES Co-Chairs: Michael Jacox (USA) and Masami Nonaka (Japan)

Proposed CLIVAR Co-Chairs: Ryan Rykaczewski (USA) and Antonietta Capotondi (USA)

Proposed members : Sam Siedlecki (USA), Emanuele Di Lorenzo (USA), Shoshiro Minobe (Japan), Sanae Chiba (Japan), Fei Chai (China), Vladimir Kulik (Russia), Desiree Tommasi (USA, CLIVAR).

Other potential members as suggested by POC: Jim Christian (Canada), Jacquelynne King (Canada), Ying Bao (China), Yajuan Song (China), Chan Joo Jang (Korea), TBD (Korea).