

Report of the Physical Oceanography and Climate Committee

The Physical Oceanography and Climate Committee (POC) held two meetings during PICES-2019 in Victoria, Canada, one on Sunday, October 20, 2019 and one on Wednesday, October 23. The meetings were chaired by Dr. Emanuele Di Lorenzo. After welcoming by Dr. Di Lorenzo, and self introductions made, membership was reviewed (*POC Endnote 1*). Dr. Jennifer Jackson was appointed rapporteur by the Chair. The agenda was approved and was adopted without change (*POC Endnote 2*).



POC meeting participants at PICES-2018. Back row, from left: Charles Hannah, Hironmichi Ueno, Shin-ichi Ito, Jennifer Jackson, Elena Ustinova, Steven Bograd, Jim Christian, Masami Nonaka. Front row, from left: Diasuke Hasegawa, Manu Di Lorenzo, SungHyun Nam, Olga Trusenkova. Missing from photo: Jerome Fiechter, Fangli Qiao.

AGENDA ITEM 4

POC sessions at PICES-2019

POC-sponsored Topic Sessions:

- POC Topic Session (S2) on “*Marine heatwaves in the North Pacific: Predictions and impacts in coastal regions*”; Convenors: Jennifer Jackson (Canada), Tetjana Ross (Canada), Toshio Yamagata (Japan), Yun-Wei Dong (China), Emanuele di Lorenzo (USA); Invited Speaker: Simone Alin (PMEL, NOAA, USA), Sonia Batten (CPR Survey, MBA), Eric C.J. Oliver (Dalhousie University, Canada);
- POC/MEQ/BIO Topic Session (S3) on “*Coastal ocean modelling in the North Pacific*”, co-sponsored by ICES; Convenors: Laura Bianucci (Canada), Tarang Khangaonkar (USA), Chan Joo Jang (Korea), Susan Allen (Canada), Fei Chai (China), YouYu Lu (Canada); Invited Speaker: Michael Foreman (IOS, Canada);
- POC/BIO/FIS/FUTURE Topic Session (S5) on “*Trends in ocean and coastal ecosystems and their services and its future*”; Convenors: Shin-ichi Ito (Japan), Angelica Peña (Canada), Kirstin Holsman

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(USA), Xiujuan Shan (China), Igor Yashayaev (Canada); Invited Speaker: Naoki H. Kumagai (NIES, Japan);

- FIS/BIO/POC Topic Session (S8) on “*Creating more effective Integrated Ecosystem Assessments (IEAs) in PICES countries*”, co-sponsored by ICES; Convenors: Alan Haynie (USA), Libby Logerwell (USA), Shigeto Nishino (Japan); Invited Speaker: Phillip Levin (University of Washington, USA);
- FIS/POC/BIO/HD Topic Session (S11) on “*Incorporating ecosystem variability and climate change into fisheries management: Progress and challenges for EBFM in the 21st century*”; Convenors: Barbara Muhling (USA), Carrie Holt (Canada), Kirstin Holsman (USA), Sukyung Kang (Korea); Invited Speaker: Stephani Zador (AFSC, NOAA, USA);
- POC/BIO Topic Session (S12) on “*Impacts of meso-/submeso- scale processes on heat/material transport and on marine ecosystems*”; Convenors: Hiromichi Ueno (Japan), Tetjana Ross (Canada), Olga O. Trusenkova (Russia); Invited Speaker: Jody Klymak (University of Victoria, Canada);
- POC/FUTURE Topic Session (S15) on “*Advances in North Pacific marine ecosystem prediction*”; Convenors: Michael Jacox (USA), Fei Chai (China), Jinqi Du (China), Shoshiro Minobe (Japan); Invited Speakers: Takeshi Doi (JAMSTEC, Japan), Nicole Lovenduski (University of Colorado Boulder, USA), Stephanie Brodie (UC Santa Cruz, USA);
- POC Contributed Paper Session; Convenors: Emanuele Di Lorenzo (USA), Yury I. Zuenko (Russia).

POC-sponsored Workshop:

- POC/BIO/FIS Workshop (W4) on “*Circulation, biogeochemistry, ecosystem, and fisheries of the western North Pacific marginal seas: Past and future of CREAMS (Circulation Research of East Asian Marginal Seas)*”; Convenors: SungHyun Nam (Korea), Fei Yu (China), Joji Ishizaka (Japan), Yury I. Zuenko (Russia); Invited Speaker: Kuh Kim (Seoul National University, Korea);

AGENDA ITEM 5

POC Best Presentation and Poster awards

- Best Presentation by an Early Career Scientist for a POC-sponsored Topic Session at PICES-2019
Jiwon Kang (Seoul National University, Korea) for paper on “*Non-seasonal variability of the Kuroshio shelf intrusion and its associated changes in the ocean environment over the East China Sea during 1993-2017*” in POC/BIO/FIS Workshop (W4).
- Best Poster by an Early Career Scientist for a POC-sponsored Topic Session or Workshop at PICES-2019
Hayley V. Dossler (University of British Columbia, Canada) for poster on “*Sharp reduction in nutrient concentrations in deep British Columbian strait linked to marine heatwave*” in Topic Session (S2).

AGENDA ITEM 6

POC Chair election

Dr. Di Lorenzo (USA) was re-elected by proclamation for a second 3-year term as Chair. Dr. Yury Zuenko (Russia) was re-elected as Vice-Chair for a second term of 2 years.

AGENDA ITEM 7

POC Action Plan, Part A

The POC committee held two 1-hour sessions devoted to completing a new 3-year Action Plan. During the first session on Sunday, breakout groups were asked to compile a set of actions and tasks for each of the 6 PICES strategic goals. See Agenda Item 13 for the second session.

AGENDA ITEMS 8 and 9

Expert Group progress reports and requests**S-CCME: Joint PICES/ICES Section on *Climate Change Effects on Marine Ecosystems***

- **Activities in 2019:**
 - New Co-Chair Dr Christian Möllman (ICES/Germany) and Co-Chair TBA [later identified as Dr. Mark Payne (ICES/Denmark)], replacing Drs. Myron Peck (ICES/Germany), and John Pinnegar (ICES/UK) whose terms have ended;
 - Co-Chair Xiujuan Shan (PICES/China), has replaced Shin-Ichi Ito (PICES/Japan) whose term has ended;
 - IPCC Special Report on the Ocean and Cryosphere in a Changing Climate www.ipcc.ch/reports/srocc; S-CCME members Anne Hollowed (PICES/USA) and Manuel Barange (ICES/FAO) contributed to the report as lead author for chapter on “Polar regions” and review editor for chapter on “Changing ocean, marine ecosystems, and dependent communities”, respectively;
 - 5 S-CCME members attended the IPCC AR6 Lead Author 2nd Meeting, July14–19, 2019, Kathmandu, Nepal; POC members are welcome to contribute to this document;
 - Scenarios Forum 2019 – Dr. Pinnegar was a co-convenor for the session on “Scenarios for the Future Ocean” – contributing to fisheries and marine-related scenarios (*e.g.*, fishing pressure, income of fishermen); several scenarios were defined based on different predicted future conditions
 - A Special Issue based on selected papers from the 4th Symposium on “The Effects of Climate Change on the World’s Oceans” was published in *ICES Journal of Marine Science* [Vol. 76, Issue 5](#), with contributed papers by S-CCME members;
 - ICES Annual Science Conference, ASC 2019, Gothenburg, Sweden – Keynotes by Drs. Cisco Werner (PICES) and Manuel Barange (ICES); Theme Session D co-convened by Dr. Kirstin Holsman (PICES);
 - PICES-2019 – Topic Session S5 co-convened by Drs. Shin-ichi Ito, Angelica Peña, and Holsman, and S11 by Dr. Holsman.
- **Future activities:**
 - IPCC WG II AR6 Lead Author’s 3rd Meeting, January 27– February 1, 2020, Faro, Portugal;
 - Climate change and European Aquatic RESources (CERES) Final Meeting in January 20–24, 2020, The Netherlands;
 - Two new projects involving S-CCME members:
 - BiodovERSA – Scenarios of Marine Biodiversity and Evolution under Exploitation and Climate Change project (2019–2021),
 - FutureMARES – decision on funding pending November 2019,
 - MSEAS 2020 Topic Session S2 – Alan Haynie (PICES/USA) co-convenor in May 25–29, 2020, Yokohama, Japan;
 - A 5-year Implementation Plan 2021–2023 will be drafted for Phase 4.
- **S-CCME supports proposals for:**
 - Joint PICES/ICES Working Group on Small Pelagic Fish (WGSPF; see *FIS Endnote 5*);
 - Joint ICES/PICES Working Group on Impacts of Warming on Growth Rates and Fisheries yields (WGGRAFY; see *FIS Endnote 6*).
- **Requests:**
 - An additional Russian member, with biological/chemical background. Currently there is currently only one Russian member (POC) in S-CCME;
 - 1-day meeting following the MSEAS 2020 in May 2020 in Yokohama, Japan;
 - ½-day business meeting during PICES 2020.

S-CC: Section on Carbon and Climate

- **Activities in 2019:**
 - Dr. Alex Kozyr (USA) is new Co-Chair, replacing Dr. James Christian (Canada) who stepped down;
 - [PICES Special Publication 5](#), “Ocean Acidification and Deoxygenation in the North Pacific Ocean” (Christian, J.R. and Ono, T. (eds.), 2019, has been published;
 - A perspective paper on new sensor technology for ocean acidification research (S-CC members J.R. Christian, L.A. Miller, and T. Ono, co-authors) has been accepted in *Frontiers of Marine Science*;
 - High turnover in membership, and non-participation from a number of members.
- **Future activities:**
 - Data synthesis in Asian marginal seas (Korea and China);
 - SOLAS has proposed a Topic Session on “Atmospheric nutrient deposition” for PICES-2020. S-CC expresses strong support for this session.
- **Request:**
 - PICES co-sponsorship of Theme Session on “*Taking stock on ocean acidification research for provision of future efforts*” at ICES ASC 2020 – travel support for 1 member.

WG 38: Working Group on Mesoscale and Submesoscale Processes

- **Activities in 2019:**
 - Synthesis review paper titled “*Oceanic mesoscale processes and their impact in the North Pacific*” will be submitted to *Progress in Oceanography* in December/January;
 - Final report of WG 38 will be submitted after the journal has accepted the paper;
 - Convened a Topic Session S12 on “*Impacts of meso-/submeso- scale processes on heat/material transport and on marine ecosystems*” at PICES-2019; WG 38 has convened a session or workshop at every Annual Meeting since 2016.

Recommendation statement for PICES and POC future work in the area of Mesoscale and Submesoscale Research

In the ocean, forcing acts at planetary scales and dissipation at the microscales. In between are the mesoscales, in a lot of respects akin to nearly two-dimensional, quasi-geostrophically, balanced turbulence. Eddies and fronts, extending from ten to hundred kilometers, represent their best-known dynamical expression. WG-38 has focused on summarizing their role for the PICES areas reviewing observational and modeling studies with the aims of identifying how mesoscale circulations influence the marine ecosystem of the North Pacific. This influence is realized through horizontal advection, often of nutrient-rich coastal waters offshore, and vertical mixing, which is usually stronger at the eddy centers and periphery and may change depending on the eddy age.

Gaps remain in relation to the **role played by climate variability in modulating mesoscale circulations**, possible **impacts of climate change** on mesoscale statistics and seasonality, and on the role of smaller ageostrophic, coherent flow structures that may appear in the form of vorticity filaments, density fronts or coherent vortices, with typical scales of hundreds of meters to few kilometers and a lifespan of few days. These so-called **submesoscale circulations** provide a pathway for energy transfer towards smaller scales, contribute to the global overturning budget, and impact substantially lateral and diapycnal mixing. They develop in presence of density gradients in the turbulent boundary layers, at the ocean surface and near its bottom, and their statistics are not well known in a global sense, but are likely to change in the future due to projected changes in near surface stratification.

WG 40: Working Group on Climate and Ecosystem Predictability

- **Activities in 2019:**
 - Inter-session workshop June 2019 in Qingdao, China, to review some of the current ecosystem forecasts in the North Pacific;

- WG 40 convened a Topic Session S15 on “*Advances in North Pacific marine ecosystem prediction*” at PICES-2019;
- Joint meeting of WG 40 and CLIVAR Pacific Panel at PICES-2019 – 6 presentations from CLIVAR and 6 presentations from WG 40.
- **Future activities:**
 - WG 40 is submitting a proposal for a Special Issue, with a tentative title “*North Pacific climate and ecosystem predictability on seasonal to decadal time scales*” in *Frontiers of Marine Science*, based on the outcome of the inter-sessional workshop in Qingdao;
 - Dr. Fangli Qiao, is working to develop a website for hosting forecasts relevant to the PICES community and expects it to be online in the coming months;
 - Collaboration with the ICES Working Group on Seasonal to Decadal Marine Ecosystem Forecasting (WGS2D) to plan contribution to UN Ocean Decade “Predicted Ocean” theme;
 - Joint meeting with WG 36 (*Common Ecosystem Reference Points across PICES Member Countries*) and WG 41 (*Marine Ecosystem Services*) Co-Chairs to develop case studies for the FUTURE SEES approach;
 - Proposal for a 1-day Topic Session on “*Predictions of extreme events in the North Pacific and their incorporation into ecosystem management*” at PICES-2020, with POC and FUTURE co-sponsorship.

AP-CREAMS: Advisory Panel for a CREAMS/PICES Program in East Asian Marginal Seas

- **Activities in 2018/2019:**
 - Three international cruises
 - EAST-I area (Joint Korea-Russia) cruise in December 2018,
 - Ferry-box monitoring between Donghae, Korea, and Vladivostok, Russia,
 - EAST-1 Joint Korea-Russia cruise October–November 2019
 - Climate monitoring sections (CREAMS Line and NEAR-GOOS Line);
 - A paper on continuous bottom water formation under warming climate in *Nature Scientific Reports*, 2018, <https://doi.org/10.1038/s41598-018-19952-4>;
 - Inter-sessional AP-CREAMS meeting May 2019 in Korea;
 - A 1-day workshop (W4) on “*Circulation, biogeochemistry, ecosystem, and fisheries of the western North Pacific marginal seas: Past and future of CREAMS (Circulation Research of East Asian Marginal Seas)*” at PICES-2019.
- **Future activities:**
 - Define the future for AP-CREAMS from ideas generated during W4 at PICES-2019 at an inter-sessional meeting in Russia, May 2020 (develop new TOR for 5-year extension);
 - Completion of EAST-II PICES Scientific Report – anticipated by the end 2019;
 - Development of North Pacific Ecosystem Status Report3, regions 21 and 19;
 - EAST-II cruise, planned for August–September 2020.
- **Requests:**
 - One lecturer and students/ECS to attend a training course on NOWPAP/IOC-WESTPAC on “*Remote sensing data analysis*”, \$7,500;
 - 5-year extension of AP-CREAMS – under POC, MONITOR, maybe FUTURE;
 - Further development of CREAMS program to extend activities into larger geographic area and work with other groups.

AGENDA ITEM 10

FUTURE update

A brief update on FUTURE activities was given by Dr. Steven Bograd.

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NPESR update

Not discussed.

AGENDA ITEM 12

New proposals

- **Working Group on Integrated Ecosystem Assessment of the Northern Bering Sea – Chukchi Sea (IEA-NBS)**

This proposed group would have linkages to ICES, IASC, NOAA IEA, PAME, Bering Sea Elders Group and would be a complement to the Central Arctic group, the joint PICES/ICES/PAME Working Group on *Integrated Ecosystem Assessment for the Central Arctic Ocean* (WG 39). Co-Chairs Yury Zuenko (Russia) and Libby Logerwell (USA) to be confirmed.

The POC Committee is supportive but recommends that HD, POC, BIO, FIS serve as co-parents.

- **Study Group on Correlating Habitats using Artificial Intelligence, Numerical Models and Gathered Empirical Data (CHANGE)**

POC noted that the terms of reference (see *SB Endnote 3* in 2019 Science Board report) may need further development.

- **Topic Session on “*Applications of artificial intelligence to advance the understanding of North Pacific ecosystems*”**

This activity falls within the scope of the proposed Study Group on artificial intelligence (CHANGE). If the session is accepted, perhaps the conveners and participant can use this opportunity to develop terms of reference for a working group on this topic.

- **Topic Session on “*Global warming patterns and multiscale climate variability in the North Pacific*”**

POC finds this theme of interest and is supportive of this session.

- **US CLIVAR Workshop Sponsorship request: Prospects for Multi-year Climate Predictability and Societally-relevant Climate Predictions**

This activity is relevant for WG 40. PICES may want co-sponsor of this workshop by supporting the attendance of a few members. One of the members would then be added to the organizing committee to help shape a portion of the workshop towards the goal of developing a platform for multi-year climate and ecosystem predictability.

POC gave highest rankings for the following categories at PICES-2020:

Topic Sessions

- *Predictions of extreme events in the North Pacific and their incorporation into management strategies;*
- *Applications of artificial intelligence to advance the understanding of North Pacific ecosystems;*
- *Global warming patterns and multiscale climate variability in the North Pacific;*
- *Upper ocean energetics from mesoscale, submesoscale to small-scale turbulence in the North Pacific;*
- *Atmospheric nutrient deposition and microbial community responses, and predictions for the future in the North Pacific Ocean.*

Workshops

- *The Social-Ecological-Environmental Dynamics of Climate Extremes in Pacific Coastal Systems*

Inter-sessional workshops:

- *FUTURE SSC inter-sessional meeting*

AGENDA ITEM 13

POC Action Plan, Part B

In the second session, Wednesday, breakout groups synthesized the results from each of the goals. A draft of the POC Action Plan was submitted to Science Board and the Secretariat by Dr. Di Lorenzo on October 26 (*POC Endnote 3*).

AGENDA ITEM 14

POC report sheet to Science Board

A spreadsheet template, provided by the Secretariat in September, was filled out with POC-related information and requests for 2020 and returned to the Secretariat for compilation with the other Committee templates, to be reviewed and decided on by Science Board at its October 26 meeting.

AGENDA ITEM 15

Publication updates

See expert group highlights in Agenda Items 8, 9.

AGENDA ITEM 16

Other business

International organizations:

SOLAS

- Is interested in co-sponsoring Topic Session on “*Atmospheric nutrient deposition and microbial community responses, and predictions for the future in the North Pacific Ocean*” at PICES-2020.

CLIVAR

- The future of CLIVAR is unclear;
- Research foci for 2020 are: Eastern Boundary Upwelling Systems and Tropical Basin Interaction (starting spring 2020);
- Overarching goal is building a society resilient to environmental changes;
- Need for multi-scale approach and fundamental science;
- Will hold a meeting in Spring 2021 – towards a sustainable global ocean observing system to contribute to UN decade for the ocean; what is needed at the global level for observations;
- Can S-CC fit into CLIVAR? Is carbon well-integrated into other major international projects and programs?

Argo

- Core array remains healthy though deployment numbers are decreasing
- Deployments in the next 20 years
 - Deep
 - Equatorial
 - WBC
 - Polar

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- BGC
- Marginal seas
- Requests POC to continue supporting Argo.

POC Endnote 1

POC participation list

Members

Emanuele Di Lorenzo (USA, Chair)
Steven Bograd (USA)
James Christian (Canada)
Jerome Fiechter (USA)
Daisuke Hasegawa (Japan)
Shin-ichi Ito (Japan)
Jennifer Jackson (Canada)
SungHyun Nam (Korea)
Fangli Qiao (China)
Hiromichi Ueno (Japan)
Elena Ustinova (Russia)

Members unable to attend

Canada: Michael Foreman
China: Fan Wang, Lei Zhou
Korea: Chan Joo Jang, Hee-Dong Jeong
Russia: Vyacheslav Lobanov, Yury Zuenko (Vice-Chair)

Observers

Charles Hannah (Canada)
Masami Nonoaka (Japan)
Olga Trusenkova (Russia)

POC Endnote 2

POC meeting agenda

Sunday, October 20, 6:00pm–8:00pm

1. Welcome and introductions
2. Membership updates
3. Changes to, adoption of, agenda and appointment of rapporteur
4. POC Chair election
5. POC Action Plan, Part A – Discussion
6. POC Sessions at PICES-2019
7. POC Best Presentation and Poster Awards, Early Career judgment for POC
- 8.

Wednesday, October 23, 2:00pm–6:00pm

9. ExGs Progress Reports and future plans of POC active groups
10. Requests from and to existing ExGs
11. FUTURE updates
12. NPESR update
13. New proposals for ExGs, meetings, workshops, symposia, conferences
14. POC Action Plan, Part B – Synthesis
15. POC report sheet to Science Board
16. Publication updates
17. Other business
18. Adjourn

POC Endnote 3**POC Action Plan****POC Mission Statement**

To promote and coordinate research and facilitates exchange of information and data on the impacts of ocean climate variability and change on living marine resources and human societies, on scales ranging from sub-seasonal to millennial and sub-mesoscale to basin-scale.

Goal 1: Foster collaboration among scientists within PICES and with other multinational organizations

Coordinate research and communication among international organizations and programs focusing on climate-ecosystem interactions, including CLIVAR, PACON, WESTPAC, and IOC through implementation of the UN Decade of Ocean Science.

Facilitate partnerships with organizations and programs, within and outside of PICES, with interests in understanding North Pacific climate processes and impacts.

Participate in and contribute to organization of scientific fora to promote North Pacific climate research.

Goal 2: Understand the status and trends, vulnerability and resilience, of marine ecosystems

Promote coordinated activities dedicated to understanding physical and chemical processes in the North Pacific, their impacts on ecosystems, and their current status and trends.

Facilitate the development of modeling frameworks to improve climate and ecosystem predictability, and guide research and communication about the drivers and impacts of extreme events.

Communicate the status and trends of North Pacific climate conditions to the PICES and broader scientific communities.

Goal 3: Understand and quantify how marine ecosystems respond to natural forcing and human activities

Lead PICES efforts for improving understanding and advancing predictability of North Pacific climate variability and change, through guidance of collaborative research projects, parenting of Expert Groups, and organizing sessions and workshops.

In the near term, a research focus is on understanding the drivers, impacts and predictability of extreme events, and diagnosing the links between coastal ecosystems and large-scale climate with a focus on multi-scale processes.

Goal 4: Advance methods and tools

Advance the development of regional to basin-scale models of North Pacific physics and biogeochemistry, including seasonal forecasts and multi-decadal projections.

Develop modeling toolkit to facilitate research and operational forecasts throughout the North Pacific.

Contribute to the training of early career scientists on the development and use of models.

Promote advanced observational technologies and the rapid dissemination of data to the PICES community and other stakeholders.

Goal 5: Provide relevant scientific information pertinent to North Pacific ecosystems that is timely and broadly accessible

Provide data, products and information on North Pacific oceanographic conditions and climate variability and change to the PICES and broader scientific community through peer-reviewed publications and other PICES communication outlets.

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Contribute to a publication of a special journal issue on North Pacific climate and ecosystem predictability, the North Pacific Ecosystem Status Reports, and contribute to other special issues on emerging issues of interest to PICES.

Goal 6: Engage with early career scientists to sustain a vibrant and cutting edge PICES scientific community

Promote the engagement of early career scientists in the work and leadership of POC and PICES, including the organization of Summer Schools on ocean processes, climate variability and change, methods of ocean modeling and observing, data analysis and management, and impacts of extreme events.

Work through NEAR-GOOS, SOLAS and other PICES partners to support the participation and involvement of young scientists in PICES meetings and projects.

Support and participate in the creation of a professional development program for early career scientists within PICES.