

REPORT OF PHYSICAL OCEANOGRAPHY AND CLIMATE COMMITTEE

The meeting of the Physical Oceanography and Climate Committee (POC) was held from 16:00–19:30 hours on October 29, 2008. The Chairman, Dr. Michael G. Foreman, called the meeting to order and welcomed members and observers (*POC Endnote 1*). Dr. Ichiro Yasuda served as rapporteur. The Chairman welcomed Drs. Dake Chen and Zangui Wang as new members of the Committee. Several changes were made to the draft agenda in order to accommodate cancellations and additions to the presentations associated with international organizations and programs (Agenda Item 6). The new draft agenda was adopted (*POC Endnote 2*).

AGENDA ITEM 4

Completion of PICES XVI decisions

1. Dr. Foreman gave a presentation at the PICES CFAME Task Team inter-sessional workshop on “*Linking and visualizing climate-forcing mechanisms and marine ecosystem changes: A comparative approach*” and meeting in Honolulu, U.S.A. on April 15–18, 2008, with travel support from PICES.
2. Dr. Foreman co-chaired a session and gave a presentation at the ICES/PICES/IOC Symposium on the “*Effects of climate change on the World’s oceans*”, May 19–23, 2008 in Gijón, Spain.
3. PICES provided partial support for a PICES/CREAMS Summer School on “*Biomass-based management*” at Hokkaido University, Japan in August 23–26, 2008.
4. WG 20 members, Drs. Enrique Curchitser and Foreman, gave presentations at an ESSAS/PICES workshop at the ESSAS Annual Meeting from September 15–19, 2008 in Halifax, Canada.
5. Dr. Angelica Peña gave a presentation in and co-chaired a session on “*Coupled physical and biological models: Parameterization, validation, and applications*” at the ICES Annual Science Meeting in Halifax, September 15–19, 2008.
6. A 1-day CCCC/POC Topic Session on “*Marine system forecast models: Moving forward to the future*” was approved by Science Board for PICES XVII.
7. A 1-day POC Contributed Paper Session was approved by Science Board for PICES XVII.
8. A ¾-day POC Topic Session on “*Coastal upwelling processes and their ecological effects*” proposed for PICES XVII was approved by Science Board
9. A 1½-day CCCC/POC/FIS workshop on “*Climate scenarios for ecosystem modeling (II)*” was approved by Science Board for PICES XVII.
10. Though approval was granted to provide partial financial support for a CC-S member to attend the International Symposium on “*The ocean in a high CO₂ world*” in Monaco from October 6–8, 2008, the attendee did not need it.

AGENDA ITEM 5

Reports of existing subsidiary bodies and plans for new ones

Section on Carbon and Climate

Dr. James Christian, Co-Chairman of the Section on *Carbon and Climate* (CC-S), briefly reported on its annual meeting and requests to be forwarded to Science Board. These included an expansion of the Section to include two new members from Japan, and requests for both a workshop and Topic Session at PICES-2009. A draft Implementation Plan for data synthesis was approved at its annual meeting. The full CC-S annual report, including the full text of the Implementation Plan, is found elsewhere in the PICES 2008 Annual Report.

Advisory Panel on *CREAMS/PICES Program in East Asian Marginal Seas* (CREAMS-AP)

Dr. Yuri Zuenko gave a brief report on the activities of the Advisory Panel in the past year, including its annual meeting at PICES XVII on October 28, an earlier one in Seoul on July 5, a summer school on August 24–25, and plans for the next year including a summer school on “Satellite oceanography”. A full report can be found elsewhere in the PICES 2008 Annual Report.

Working Group on *Evaluation of Climate Change Projections* (WG 20)

Dr. Foreman gave a brief report on the activities of WG 20 over the last year. (The full report is contained in the summary of the WG 20 business meeting found elsewhere in the PICES 2008 Annual Report.) Highlights included: (1) participation at a CFAME Task Team inter-sessional workshop on “*Linking and visualizing climate-forcing mechanisms and marine ecosystem changes: A comparative approach*” in Honolulu in April, (2) participation in the ICES/PICES/IOC Symposium on the “*Effects of global warming on the World’s oceans*” in Gijón, Spain in May, (3) participation in an ESSAS/PICES workshop at the ESSAS Annual Meeting in Halifax, Canada in September, (4) a successful workshop with CFAME and the proposed new ICES/PICES Working Group on *Forecasting Climate Change Impacts of Fish and Shellfish*, (5) a business meeting on October 25 that proposed extending the lifetime of WG 20 for another year, to 2010, proposed a Topic Session for PICES-2009, and discussed the draft implementation plan for FUTURE.

Proposed new ICES/PICES (FIS/POC) Working Group on *Forecasting Climate Change Impacts on Fish and Shellfish*

Dr. Foreman presented the background and Terms of Reference (see *POC Endnote 3*) for a proposed new ICES/PICES Working Group on *Forecasting Climate Change Impacts on Fish and Shellfish*. It was resolved that POC would support the creation of this group.

AGENDA ITEM 6

Relations with other international organizations

The following six brief presentations were given.

1. Dr. Dake Chen reviewed the Argo program and requested that PICES take responsibility to construct and supply (*i.e.*, print and mail) a volume of abstracts for the Third Argo Science Workshop to be held in Hangzhou, China, March 25–26, 2009. In return, Argo will ensure that PICES assistance is given full exposure and credit in all advertisements for this meeting, at the meeting itself and on any subsequent reports that emerge.
2. Dr. Dongxiao Wang, member of the Pacific CLIVAR panel, gave a brief summary of WCRP/CLIVAR activities, and described two programs that may be relevant to PICES: i) SPICE (Southwest Pacific Ocean Circulation and Climate Experiment; mainly Australia and New Zealand) and ii) PACSWIN (Pacific Source Water Investigation). Initial investigation will focus on Indonesian seas.
3. Dr. Ken Drinkwater, Co-Chairman of the ESSAS Steering Committee, gave a brief summary of activities for the past year and those planned for 2009/10. He requested travel support for one WG 20/POC member to attend the next ESSAS workshop in Seattle, U.S.A. in June 2009.
4. Ms. Sandy Shan, Secretary of the Pacific Arctic Group (PAG), gave a brief description of her organization and expressed the possibility of future cooperation with PICES. PAG is an independent discussion/information sharing forum for border nations around the Pacific Arctic region whose membership comprises many of the same countries as PICES. Regions of interest overlap in Bering Sea.

AGENDA ITEM 7
POC Action Plan

The Chairman reported that he made minor updates to the POC Action Plan and anticipated more when the FUTURE Implementation Plan was ratified. The Committee agreed that this issue will be reviewed at PICES-2009.

AGENDA ITEM 8
Discussion of the draft FUTURE Implementation Plan

This item was moved to the end of the meeting as it was expected to consume as much time as was available. The Chairman gave a brief summary of the latest draft that was posted on the PICES web page and reviewed issues that he felt were relevant to POC and WG 20. After considerable discussion, the following Committee comments were presented at the FUTURE Open Forum the following evening.

1. There is too much emphasis on forecasting with uncertainties. The Committee is more comfortable with “outlooks” than “forecasts”, though the former term needs to be defined. It was agreed that it is more than a scenario, *i.e.*, it has some reasonable probability of happening.
2. The Plan needs to identify opportunities for forecasting; not just what clients want but what is predictable. First, it should be determined what can be done now (the low hanging fruit), and then what needs more work (understanding) before it could be forecast.
3. We do not want to interfere with existing operational activities in PICES member countries, such as the forecasts given by Japanese and American fisheries agencies.
4. Many forecasts could be quite site-specific and not international. In such cases, what is the role of PICES?
5. The Plan needs more emphasis on “Understanding”. This has to come before the outlook/forecasts. Even though the acronym is FUTURE, we should really think of it as UFTURE.
6. The IPCC AR5 can be considered as a client for the long time scale outlooks/forecasts.
7. We will learn by issuing outlooks/forecasts.
8. The links to the Committees needs to be more explicit. It was suggested that the Committee Vice-Chairs should be members of the FUTURE Steering Committee.

AGENDA ITEM 9
Planning for PICES-2009

Including a POC Paper Session, four Topic Sessions were proposed. See *POC Endnote 4 and WG 20 Endnote 4*. The Committee also approved the request for a CC-S workshop (with invited speaker Dr. Robert Key) and a combined WG 20 workshop and business meeting with no invited speakers.

No possible invited speakers for the Science Board Symposium were put forward.

AGENDA ITEM 10
PICES-2010 theme

The theme suggested by the U.S.A. for PICES-2010 was not available for the Committee meeting and thus was not discussed.

POC-2008

AGENDA ITEM 11

Items with financial implications

Inter-sessional travel requests

After considerable discussions, the Committee agreed to forward the following list of ranked requests for financial support to Science Board:

1. One foreign guest lecturer and 5 non-Korean students for a CREAMS/PICES Summer School on “*Satellite oceanography*”, August 2009, in Seoul, Korea;
2. The PICES Secretariat to prepare and supply (*i.e.*, print and mail) books of abstracts for the third Argo Science Workshop (ASW-3) March 25–26, 2009 in Hangzhou, China;
3. One WG 20 member to attend the ESSAS Annual Meeting June 15–21, 2009 in Seattle, U.S.A.;
4. Some travel support for a CREAM/PICES workshop for the Asian marginal seas contribution to NPESR, February 18–20, 2009 in Seoul, Korea.

Proposed publications for 2009 and beyond

1. CC-S has a special section in the *Journal of Oceanography* scheduled for publication in 2009 with papers arising from their Topic Session on “*Decadal changes in carbon biogeochemistry in the North Pacific*” at PICES XVI in Victoria, Canada.
2. At the inter-sessional Science Board meeting in Seattle, U.S.A., PICES agreed to co-sponsor a special issue on “*Tides in marginal seas – A volume in memory of Prof. Alexei Nekrasov*” in *Progress in Oceanography*. Editors will be Drs. Alexander Rabinovich, Boris Kagan, Michael Foreman, and Josef Cherniawsky. Since that time, the journal has switched to *Continental Shelf Research*. Manuscripts are to be submitted by December 15.

PICES-2009 travel support requests

For PICES-2009, travel support will be requested for 1 invited speaker for each of the four Topic Sessions that POC has agreed to co-sponsor. (At the Science Board meeting, two of those Topic Sessions (*WG 20 Endnote 4* and proposal 3 in *POC Endnote 4*) were switched to workshops and another (proposal 1) was merged with one proposed by CCCC.)

AGENDA ITEM 12

POC Best Presentation and Poster awards

Drs. Ichiro Yasuda, Steven Bograd, and Elena Ustinova acted as judges for the best early career presentation and best poster in the POC Paper Session and POC Topic Session (S6) on “*Coastal upwelling processes and their ecological effects*”. The Best Presentation award was given to Chuanyu Liu (Institute of Oceanology, China) for his presentation (co-authored by Fan Wang) on “*An N-shape thermal front in the western South Yellow Sea in winter*”. The Best Poster award was given to Masatoshi Sato (Tokai University, Japan) for his poster (co-authored by Tokihiro Kono) on “*The 1000 km-scale variability of the dynamic height revealed by Argo CTD data at 40°N in the North Pacific*”.

AGENDA ITEM 13

Other business

No other business was raised.

AGENDA ITEM 14

Adoption of report and recommendations to Science Board

The preceding report has been circulated and approved by all Committee members. All recommendations were brought forward by Dr. Foreman at the Science Board meeting on November 1, 2008.

POC Endnote 1**POC participation list**Members

Steven Bograd (U.S.A.)
 Kyung-Il Chang (Korea)
 Dake Chen (China)
 James Christian (Canada)
 Michael Foreman (Canada, Chairman)
 Shin-ichi Ito (Japan)
 Hee-Dong Jeong (Korea)
 James Overland (U.S.A.)
 Elena Ustinova (Russia)
 Ichiro Yasuda (Japan, Vice-Chairman)
 Yury I. Zuenko (Russia)

Observers

Kenneth Drinkwater (ESSAS)
 Vadim Navrotsky (Russia)
 Hiroaki Saito (Japan)
 Sandy Shan (PAG)
 Dongxiao Wang (CLIVAR)

POC Endnote 2**POC meeting agenda (revised)**

1. Welcome, introductions, opening remarks
2. Changes to, adoption of, agenda and appointment of rapporteur.
3. Welcome new representatives, Drs. Dake Chen and Zhanggui Wang from China
4. Completion of PICES XVI decisions:
 - i) CFAME inter-sessional meeting, Honolulu, April 15–18, 2008
 - ii) ICES/PICES/IOC Symposium on “*Effects of Climate Change on the World’s Oceans*”, May 19-23 2008, Gijón (Spain)
 - iii) PICES/CREAMS summer school “*Biomass-based management*”, August 23–26, Hokkaido University, Hakodate
 - iv) ESSAS annual science meeting, September 15–19, 2008, Halifax, Canada
 - v) ICES annual science meeting September 22–26, 2008, Halifax: co-convener for theme session on coupled modeling
 - vi) Monaco symposium, “*The ocean in a high CO₂ world*”, October 2008
 - vii) CCCC/POC Topic Session “*Marine system forecast models: Moving forward to the FUTURE*” at PICES XVII
 - viii) POC Topic Session “*Coastal upwelling processes and their ecological effects*” at PICES XVII
 - ix) POC Contributed Paper Session at PICES XVII
 - x) POC/CCCC/FIS workshop “*Climate scenarios for ecosystem modeling (II)*” at PICES XVII
5. Reports of existing and plans for new subsidiary bodies
 - i) Progress report of the Section on Carbon and Climate (Christian/Saino)
 - ii) Progress report of the Advisory Panel on CREAMS/PICES Program in East Asian Marginal Seas (Sakurai/Kim)
 - iii) Progress report of WG 20 on Evaluation of Climate Change Projections (Foreman/Yamanaka)
 - iv) Proposed new ICES/PICES WG on Forecasting Climate Change Impacts on Fish and Shellfish
6. Relations with other international organizations/programs:
 - Argo (Dake Chen)
 - WCRP/CLIVAR (Dongxiao Wang)
 - ESSAS (Ken Drinkwater)
 - PAG (Sandy Shan)
7. Discussion of the POC Action Plan
8. Discussion of FUTURE Implementation Plan: Roles for POC and respective member countries

POC-2008

9. Planning for PICES-2009 (“*Understanding ecosystem dynamics, and pursuing ecosystem approaches to management*”) in Jeju Island, Korea
 - Topic/Paper Sessions
 - Workshops for WG 20, CC-S
 - Invited speakers for the Science Board Symposium
10. Theme for PICES-2010 in USA (TBA)
11. Items with financial implications
 - Proposed inter-sessional meetings for 2009 and beyond
 - Proposed publications for 2009 and beyond
 - Travel support requests
 - Other items
12. 2008 POC Best Presentation and Poster award (Judges will be appointed early in week and give their recommendation at the Closing Session)
13. Other business
14. Adoption of POC report and recommendations to Science Board

POC Endnote 3

Proposal for a new PICES/ICES Working Group on *Forecasting Climate Change Impacts on Fish and Shellfish (WG-FCCIFS)*

Proposed Parent Committees

ICES approved the formation of WG-FCCIFS as a permanent working group. FIS will serve as the parent committee for WG-FCCIFS with support from POC. The activities of WG-FCCIFS may be integrated into the PICES FUTURE program as a task team. WG-FCCIFS will report to the ICES Climate Change Steering Group, ICES Oceanography Committee, and the PICES FIS and POC Committees.

Suggested Co-Chairmen

Anne Hollowed (U.S.A.), Manuel Barange (United Kingdom), Suam Kim (Korea), Harald Loeng (Norway). [Suggested Working Group members: James Overland – U.S.A. (ESSAS, PICES POC) , Shin-ichi Ito – Japan (ESSAS, PICES POC), Michael Foreman – Canada (PICES POC), Sang-Wook Yeh – Korea, Thomas Okey – Canada (PEW Trust), Richard Beamish – Canada (NPAFC, PICES FIS), Daniel Duplisea – Canada (ICES), Jason Holt – United Kingdom (QUESTFISH, ICES), Keith Brander – Denmark (ICES, IPCC ecosystem writing team), Jürgen Alheit – Germany (ICES, GLOBEC SPACC)]

Rationale

The work of the FCCIFS Working Group is essential to ensure that ICES and PICES will be able to provide guidance on the potential impacts of climate change on marine ecosystems and the response of commercial fish and shellfish resources to these changes.

The work done within ICES and PICES on climate change and fisheries has been diverse and has included: a) guidance on methods for selection of IPCC scenarios for use in projections; b) techniques for downscaling IPCC scenarios to local regions, c) development of coupled ecosystem models for use in evaluating climate-induced shifts in environmental conditions, d) literature documenting relationships between climate forcing and marine fish and shellfish distribution and production, and e) stock assessment techniques for evaluating management strategies to mitigate the impacts of change. A challenge facing ICES and PICES is the need to integrate all of this research to provide stakeholders with quantitative estimates of the potential impact of climate change on marine life throughout the world. This challenge calls for the establishment of an interdisciplinary research team composed of experts from around the world who will focus attention on the development of common and standardized frameworks for forecasting climate change impacts on marine life

with particular emphasis on commercially important fish and shellfish. ICES and PICES should act now to ensure that our research communities develop the capabilities to provide quantitative contributions to the next IPCC reports and to provide guidance for management under climate change scenarios.

Several case studies will be identified by the Steering Group based on their potential for contributing to methodological development and the opportunity for comparison of marine species and community responses to climate forcing in different ecosystems. Members of the Working Group will be responsible for encouraging the development of regional interdisciplinary teams responsible for the production of forecasts. Members of the working group will provide guidance to the regional teams by providing a framework for the development of the forecasts and communication of new advances in analytical tools. The culmination of the Working Group's effort will be presentation and discussion of results at an inter-sessional meeting and publication of results in a peer reviewed journal by 2011. The timing for the publication is critical because the future IPCC AR5 report is slated for release in 2013 and the IPCC only allows references to published papers.

Proposed Terms of Reference

We recommend that WG-FCCIFS be established to promote and coordinate research on the potential impacts of climate change on marine fish and shellfish around the world.

The working group will:

1. Promote research on climate change impacts on fish and shellfish by scientists in ICES and PICES member nations through coordinated communication, exchange of methodology, and organization of meetings to provide a venue for discussion and publication of results.
2. Develop frameworks and methodologies for forecasting the impacts of climate change on the growth, distribution and abundance of marine life with particular emphasis on commercial fish and shellfish;
3. Review the results of designated case studies to test methods;
4. Hold an inter-sessional symposium in early 2010 where scientists can present, discuss and publish forecasts of climate change impacts on the world's commercial fish and shellfish resources;
5. Establish techniques for estimating and communicating uncertainty in forecasts;
6. Evaluate strategies for research and management under climate change scenarios, given the limitations of our forecasts;
7. Produce publications that could be considered for the Fifth Assessment Report of the Intergovernmental Panel on Climate Change in 2013;
8. Publish a final report summarizing work.

The Working Group will utilize web technology to hold several virtual working group meetings. They will hold an inter-sessional Working Group meeting on June 21, 2009, one day prior to the GLOBEC Open Science meeting in Victoria, Canada. At that meeting members will review the results of designated case studies and discuss the symposium for 2010. The WG-FCCIFS will report by September 2009 for the attention of the ICES Climate Change Steering Group, ICES Oceanography Committee, and the PICES FIS and POC Committees. The WG-FCCIFS will provide the several case studies that will contribute to the PICES FUTURE program.

Working Group members will seek widened participation for this group, including contact with relevant academic and intergovernmental organizations such as fisheries managers, the North Pacific Anadromous Fish Commission, the Intergovernmental Oceanographic Commission, and FAO for the inter-symposium in 2010.

POC Endnote 4

(1.) Proposal for a 1-day POC Paper Session

Papers are invited on all aspects of physical oceanography and climate in the North Pacific and its marginal seas.

Co-convenors: Michael Foreman (Canada) and Ichiro Yasuda (U.S.A.)

No invited speakers.

**(2.) Proposal for a 1-day POC/FUTURE Topic Session at PICES-2009 on
“Future marine ecosystem predictions from an earth system science perspective”**

[later renamed to “Outlooks and forecasts of marine ecosystems from an earth system science perspective:
Challenges and opportunities”]

The prediction of marine ecosystem responses to future climate scenarios is one of the most urgent themes to be conducted in FUTURE. However, the marine ecosystem is part of the earth system and its prediction needs integrated knowledge from physical, chemical, and biological perspectives. Earth system science (ESS) is an interdisciplinary approach that integrates anthropology, atmospheric science, biology, oceanography, geophysics, policy to provide predictions of ecosystem response to climate change. The earth system is complex with nonlinear feedbacks, thresholds responses, and, in some cases, irreversible change. Understanding the mechanisms controlling these system properties is critical to correctly forecast future states of nature in a changing climate. Moreover, conducting large-scale experiments on the earth system is impossible. Therefore, regional marine ecosystem models should include earth system science links that are essential for producing better predictions of marine ecosystem response to future climate scenarios. This session will focus on multidisciplinary coupled models designed to forecast marine ecosystems. Presentations that focus on both long-term and short-term predictions, and that link two or more disciplines (such as physical oceanography, climate, ecosystem dynamics, marine resource management, or socio-economic systems) are welcome.

Co-sponsors: POC/FUTURE

Co-Convenors: Shin-ichi Ito (Japan), Anne B. Hollowed (U.S.A.), Michael G. Foreman (Canada)

Invited speaker: Manuel Barange (GLOBEC IPO, UK)

**(3.) Proposal for a 1-day POC/BIO Topic Session at PICES-2009 on
“Anthropogenic perturbations of the carbon cycle and their impacts in the North Pacific”**

Accumulation of anthropogenic carbon and associated changes in ocean chemistry ("ocean acidification") affect all of the world's oceans. Anthropogenic CO₂ has multiple feedbacks to ocean chemistry and biology, such as reduction of calcification, shifts in phytoplankton species composition, and dissolution of particulate or sedimentary carbonates. The carbon system can also be affected by other anthropogenic factors such as changes in river flow and aeolian dust deposition. Carbon and nutrient biogeochemistry will be affected both directly and indirectly by ocean acidification. This session invites papers that address the biogeochemistry of anthropogenic carbon (processes controlling its distribution, processes by which it alters ocean chemistry), other anthropogenic impacts on carbon and nutrient cycles, acidification impacts on marine biota, and feedbacks among these.

Co-sponsors: POC/BIO

Co-Convenors: Toshiro Saino and James Christian

Possible invited speakers: Richard Zeebe (U.S.A.), Yoshihisa Shirayama (Japan) Ken Caldeira (U.S.A.)

**(4.) Proposal for a 1-day POC/BIO Topic Session at PICES-2009 on
“Mesoscale eddies and their roles in North Pacific ecosystems”
[later changed to a workshop]**

Mesoscale eddies move through the ocean carrying physical, biological, and chemical anomalies. They translate over space scales of hundreds to thousands of kilometers and exist for periods lasting from months to years. Eddies found throughout the North Pacific Ocean in association with strong boundary currents like the Kuroshio and Oyashio, and also with North Pacific eastern boundary currents like the California Current and Alaskan Stream. They are also prevalent in marginal seas. Generation and evolution of eddies are thought to be related to the shear instability of jets and boundary currents like the Kuroshio and the Alaskan Gyre, and topographic features in the California Current System.

Mesoscale eddies affect the structure of marine plankton in various ways. Horizontal advection and vertical mixing by eddies contribute to the generation of high chlorophyll concentration off the coast. They draw shelf water containing nutrients and planktons into the deep offshore waters. Mesoscale eddies are also important for survival of larvae. Eddy pumping also plays a role in episodic nutrient injections into the photic zone resulting in enhanced primary production inside the eddy for cyclonic eddies. For anticyclonic eddies, ageostrophic upwelling and divergent Ekman pumping due to winds over the eddies yield upwelling within the eddy.

This session will address:

- Dynamical characteristics of mesoscale eddies in different parts of PICES domain, focusing on their similarity and difference;
- Influences of eddies in constituting the dominant physical forcing on the ecosystems;
- Expected future eddy activities and their possible impacts on North Pacific ecosystems.

Co-sponsors: POC/BIO

Co-Convenors: Kyung-Il Chang (Korea), Shin-ichi Ito (Japan), Vyacheslav Lobanov (Russia), William Crawford (Canada), Michael Dagg (U.S.A.)