

REPORT OF WORKING GROUP 20 ON EVALUATIONS OF CLIMATE CHANGE PROJECTIONS

The Working Group on *Evaluations of Climate Change Projections* (hereafter WG 20) held its third meeting from 14:00–15:30 hours on October 25, 2008. After introductory formalities to members and observers (*WG 20 Endnote 1*) were conducted by Co-Chairmen, Drs. Michael G. Foreman and Yasuhiro Yamanaka, the draft agenda was reviewed and adopted without changes, and Dr. Enrique Curchitser kindly agreed to serve as rapporteur (*WG 20 Endnote 2*).

AGENDA ITEMS 3 AND 4

Discussion of action items arising from a workshop with CFAME, and update on Terms of Reference

The meeting began with a recap of the WG Terms of Reference (*WG 20 Endnote 3*) and an assessment of what had been achieved thus far. In light of the presentations by Drs. James Overland/Muyin Wang, James Christian, Emanuele Di Lorenzo, and Curchitser, Foreman and Yamanaka, at the workshop on “*Climate scenarios for ecosystem modeling*” (W4), it was felt that with the exception of items 4, 5, and 7, considerable progress had been made in all objectives.

With regard to the collaboration with CFAME (Climate Forcing and Marine Ecosystem Response), whose tenure as a Task Team ended at this PICES meeting, Dr. Foreman briefly described the assignments/homework arising from the CFAME inter-sessional workshop on “*Linking and visualizing climate-forcing mechanisms and marine ecosystem changes: A comparative approach*” held April 15–17, 2008 in Hawaii and the Task Team’s goal of completing their final report by year end. With regard to CFAME’s subproject on the California Current Ecosystem, Dr. Foreman stated that a recent email from CFAME member, Dr. Vera Agostini, requested information on projected changes to the stratification, temperature, river discharge, currents (*e.g.*, undercurrent), eddies/meanders, winds (in relation to turbulence, upwelling, deep mixing), tidal mixing for (if possible), the northern, central, and southern subregions of the system. Though it was generally agreed one or more regional climate models with sufficiently high resolution would be needed to provide these projected changes with some degree of confidence, at present these models do not exist. Nevertheless, an intermediate step that should yield sufficiently accurate estimates for these variables would be the statistical downscaling of global climate model values that has been described in PICES workshops and sessions by Wang/Overland/Bond and Pal/Merryfield/Morrison/Foreman. It was further agreed that the two variables for which it would be most difficult to provide change estimates would be the undercurrent (its underlying dynamics and variability are still not fully understood) and eddies/meanders (though it might be possible to estimate these changes by running existing regional models with higher heat fluxes, this could not be done in the time frame needed by CFAME). It was resolved that Drs. Foreman, Overland, and Wang would do their best to provide the information that Dr. Agostini needed. For the other two CFAME ecosystems, Dr. Yamanaka agreed that he would work with Dr. Sanae Chiba in providing the necessary information for the Kuroshio/Oyashio system while Dr. Young-Shil Kang would work with Dr. Jae-Bong Lee in providing the necessary information for the Yellow and East China Seas system.

AGENDA ITEM 5

FUTURE Implementation Plan

Following a brief summary of the latest draft of the FUTURE Implementation Plan, a lively discussion followed on the roles of WG 20 and a possible follow-up working group. Though WG 20 was scheduled to complete its tenure at the 2009 PICES Annual Meeting, it was felt that the downscaling requirements of the FIS/POC proposed new Working Group on “*Forecasting Climate Change Impacts on Fish and Shellfish*” should justify asking POC and Science Board for a one year extension. After that, it was felt that a new

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working group whose mandate would be to investigate the predictability of interannual to decadal variability might be warranted. Toward that end, it was decided that Dr. Di Lorenzo would work with Drs. Overland and Foreman in developing a proposal for a topic session along those lines for the next PICES Annual Meeting. (See *WG 20 Endnote 4* for the final proposal. Note that at the Science Board meeting on November 1, this proposed Topic Session was switched to a workshop to be scheduled before the main PICES-2009 Annual Meeting.) The success of that session would determine whether or not POC should proceed in creating the new working group.

AGENDA ITEMS 6, 7, 8

Final report, future workshops/meetings, items with financial implications

Other issues discussed are as follows:

1. Though extending WG 20 for another year forestalls planning the final report, it was agreed that we should be thinking of how that report should be structured. It is hoped that all WG 20 members could provide summaries of their work relevant to the terms of reference.
2. Even with an extension of WG 20's lifetime, the development, testing, and evaluation of regional climate models will go beyond the tenure of WG 20. So a new home needs to be found for this activity – perhaps within one of the new FUTURE Task Teams.
3. An informal WG 20 progress report meeting will be scheduled for those members attending the GLOBEC Open Science Meeting in Victoria, Canada in June 2009.
4. A new zooplankton working group (Working Group (WG 23) on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim*) might also be asking for climate change estimates relevant to their research. In order to respond to this request and perhaps others like it in the future, it might be possible to create an archive of downscaled results on some web server.
5. It was agreed that WG 20/POC would support Dr. Anne Hollowed's proposal for the creation of a new Working Group on "*Forecasting Climate Change Impacts on Fish and Shellfish*". See *WG 20 Endnote 5* for the background and Terms of Reference.
6. It was also agreed that WG20/POC needs to continue emphasizing the fact that the physics cannot be assumed done in FUTURE activities. Work needs to continue in better understanding the physical dynamics (*e.g.*, interannual to decadal variability) relevant to ecosystems.

AGENDA ITEM 9

Other business

No other business was discussed and the meeting was adjourned.

WG 20 Endnote 1

WG 20 participation list

Members

James Christian (Canada)
Enrique Curshitser (U.S.A.)
Emanuele Di Lorenzo (U.S.A.)
Michael G. Foreman (Canada, Co-Chairman)
Elena Ustinova (Russia)
Muyin Wang (U.S.A.)
Yasuhiro Yamanaka (Japan, Co-Chairman)
Sang-Wook Yeh (Korea)

Observers

Guoqi Han (Canada)
Albert J. Hermann (U.S.A.)
Masahide Kaeriyama (Japan)
Oleg Katugin (Russia)
David L. Mackas (Canada)
James E. Overland (U.S.A.)
Jake Schweigert (Canada)
John E. Stein (PICES)
Akihiko Yatsu (Japan)

WG 20 Endnote 2**WG 20 meeting agenda**

1. Welcome, introductions, opening remarks
2. Changes to, adoption of, agenda and appointment of rapporteur
3. Discussion of, and action items arising from, workshop with CFAME and new fisheries WG
4. Updates on work related to WG Terms of Reference
 - a. Shopping list for CFAME
 - b. Additional presentations to those in W4
 - c. Other
5. Discussion of FUTURE Implementation Plan: Roles for WG 20, its successor (?), and respective member countries
6. WG 20 final report: discussion, publications, work assignments
7. Future WG 20 workshops/meetings
 - a. Before or after GLOBEC Open Science Meeting in Victoria, June 22–26, 2009?
 - b. Final meeting and/or workshop/session at PICES-2009, Jeju, Korea, October 2009
 - c. Other?
8. Items with financial implications
 - a. Travel support requests:
 - (i) Invited speaker for June 2009 meeting?
 - b. Other items
9. Other business
10. Adoption of report for presentation at POC committee meeting

WG 20 Endnote 3**Terms of Reference**

1. To analyze and evaluate climate change projections for the North Pacific and its marginal seas based on predictions from the latest global and regional models submitted to the Inter-governmental Panel on Climate Change (IPCC) for their 4th assessment report;
2. To facilitate analyses of climate effects on marine ecosystems and ecosystem feedbacks to climate by, for example computing an ensemble of the IPCC model projections for the North Pacific and making these projections available to other PICES groups such as CFAME;
3. To facilitate the development of higher-resolution regional ocean and coupled atmosphere-ocean models that are forced by, and take their boundary conditions from, IPCC global or regional models;
4. To facilitate the development of local and regional data sets (*e.g.*, SST, river flow, sea ice cover) incorporating information from climate model projections as well as observations and historical re-analyses;
5. To ensure effective two-way communication with CLIVAR;
6. To convene workshops/sessions to evaluate and compare results;
7. To publish a final report summarizing results.

WG 20 Endnote 4

Proposal for a 1-day Topic Session for PICES-2009 on
“Exploring the predictability and mechanisms of Pacific low frequency variability beyond interannual timescales” [later changed to a workshop]

Introductory lecture

M. Foreman (POC) – *“Overview of current understanding of Pacific Ocean climate variability”*

Understanding the dynamics that control climate variability in the Pacific basin is essential for exploring the degree of predictability of the ocean–atmosphere and sea–ice climate systems of the North Pacific. The goal of this session is to improve the conceptual and quantitative frameworks used by the PICES community to interpret low-frequency climate variability in the Pacific basin, ranging from interannual to multi-decadal timescales. We invite contributions on a broad range of topics including (1) studies that link regional to basin scale dynamics, (2) investigations of “regime shift”, specifically the extent to which sharp transitions in the climate system are predictable and connected with low-frequency variations in the ocean–atmosphere and sea–ice systems, (3) studies that separate the stochastic and deterministic components of low-frequency climate fluctuations, (4) analysis of long-term observations collected in regional environments across the Pacific, specifically their relationship to large-scale climate processes as opposed to local scale dynamics, (5) climate change and how it may impact the statistics of Pacific climate (*e.g.*, frequency of “regime shifts”) and (6) more generally, studies that propose new mechanisms underlying low-frequency Pacific climate variability.

Sponsor: POC

Convenors: Emanuele Di Lorenzo (U.S.A.), Shoshiro Minobe (Japan)

Recommended Invited Speakers

John Fyfe, William Merryfield or Kenneth Denman (Canada) – climate modelling;
Tim Barnett or David Pierce (U.S.A.) – Pacific decadal variability and climate change;
Nicolas Gruber (Switzerland) – mechanism of global biogeochemical cycles;
other speakers from Japan, U.S.A. or Korea TBD.

Session Organization

1. Dr. Minobe and Di Lorenzo have agreed to convene the session.
2. The session will open with a 40-minute overview of the current theories and understandings of Pacific climate variability. The overview will be given by Dr. Foreman (POC) with contributions from several authors.
3. The session will last for no longer than one day.
4. We plan to have four invited speakers representing the countries involved in PICES. The goal is to use the invited speaker slots to invite and attract scientists who are currently not involved in PICES but who can bring new insights to the PICES community in terms of Pacific climate variability and climate change.

WG 20 Endnote 5

**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 (UK)
Suam Kim (Korea)
Harald Loeng (Norway)

Suggested Working Group members

Richard Beamish – Canada (NPAFC, PICES FIS)
Daniel Duplisea – Canada (ICES)
Thomas Okey – Canada (PEW Trust)
Michael Foreman – Canada (PICES POC)
Keith Brander – Denmark (ICES, IPCC ecosystem writing team)
Jürgen Alheit – Germany (ICES, GLOBEC SPACC)
Shin-ichi Ito – Japan (ESSAS, PICES POC)
Sang-Wook Yeh - Korea
Jason Holt - UK (QUESTFISH, ICES),
James Overland – U.S.A. (ESSAS, PICES POC)

Rationale

The work of WG-FCCIFS 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 models under different emission scenarios for use in projections; b) techniques for downscaling IPCC model outputs 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 WGFCCIFS is 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 a symposium for 2010. 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. WG-FCCIFS will provide 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 inter-governmental organizations such as fisheries managers, the North Pacific Anadromous Fish Commission, the Intergovernmental Oceanographic Commission, and FAO for the symposium in 2010.