

REPORT OF CFAME TASK TEAM

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The Climate Forcing and Marine Ecosystems Task Team (hereafter CFAME) met from 09:00–12:00 hours on October 15, 2006. Attending were 11 Task Team members and 7 observers (*CFAME Endnote 1*). The agenda was reviewed and adopted without modification (*CFAME Endnote 2*).

Inter-sessional activities (Agenda Item 2)

Dr. Akihiko Yatsu gave an overview of the results of the January 2006 CFAME workshop that was convened in Tokyo, Japan. These results were described in greater detail at the April 2006 PICES/GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*” that was held in Honolulu, U.S.A. A manuscript was submitted for the special issue of *Progress in Oceanography* that will follow the symposium. In brief, the manuscript examines species with different life history strategies (opportunistic, periodic, equilibrium, salmonic, intermediate) in the North Pacific and postulates mechanisms whereby climate might affect them. For example, the mechanism for intermediate strategists (*e.g.*, walleye pollock) appears to be ecosystem dependent (*i.e.*, different mechanisms in different ecosystems). This research is being conducted to develop the *Ecosystem Research* component of the CFAME workplan, specifically with regard to linking life-history strategies to ecosystems, and to answer the question “why do species with the same life histories have different abundance trajectories in different ecosystems?”.

Dr. Kerim Y. Aydin reviewed the CFAME discussion of carrying capacity at the January 2006 workshop. Carrying capacity can be defined as productivity (*i.e.*, rates) and not traditionally as production. This concept was also presented at the April 2006 PICES/GLOBEC Symposium. Due to a lack of time for ecosystem comparisons at the January 2006 workshop, this idea was not written up but will

be further developed within the *Ecosystem Research* component of the CFAME workplan.

CFAME workshop at PICES XV (Agenda Item 3)

Dr. Jacquelynne R. King gave an overview of the CFAME workshop held at PICES XV on October 13, 2006 (see *Session Summaries* chapter). It was attended by 21 participants, from all PICES member countries, and included presentations from the United States, Russia, Korea and China. This workshop addressed the first stage of the *Ecosystem Research* component outlined in the CFAME workplan. The objectives of the workshop were to review the three ecosystems identified at the October 2005 CFAME meeting at PICES XIV in Vladivostok, Russia: the California Current system, the Sea of Okhotsk and the Yellow/East China Seas.

For each region, conceptual mechanisms of climate forcing were identified. Workshop participants noted that each ecosystem had different climate forcing mechanisms: boundary current upwelling (California Current), sea ice (Sea of Okhotsk), and freshwater input (East China/Yellow Seas). Discussion also focused on ways to classify and compare ecosystems. Overall, the method employed will depend on the researchers involved and the level of data available for the ecosystems of interest. However, workshop participants agreed on the general themes captured by various ecosystem indicators and methods of comparison: food web structure, life history composition, structural stability, size composition, and change in rates (*e.g.*, PB vs. B, PB diversity pathways, predation load). It was suggested that such a list of specific comparison types could be made, and data could be obtained for these comparisons from each ecosystem. This idea provided strong motivation for an inter-sessional meeting on ecosystem-level carrying capacity and other ecosystem properties in 2007 (see request under Agenda Item 6).

Report of ESSAS activities (Agenda Item 4)

Dr. George L. Hunt presented an overview of the Bering Sea Ecosystem Study (BEST), a research group participating in the GLOBEC regional program on Ecosystem Studies of Sub-Arctic Seas (ESSAS). ESSAS aims to compare, quantify and predict the impact of climate variability and global change on the productivity and sustainability of sub-Arctic marine ecosystems, one of which is the Bering Sea. BEST is a large international and integrated research group. Its first focus will be on the effect of sea ice reduction (or absence). This topic is similar to CFAME's focus on the importance of sea ice in the Sea of Okhotsk. In June 2007, ESSAS will convene two workshops in Hakodate (Japan) on: (1) the role of sea ice in subarctic ecosystems and (2) evaluation of climate change projections for each of the ESSAS regions. These two workshops should be of interest to CFAME, particularly to the *Ecosystem Research* and *Scenario* components of its workplan.

Future Integrative Science Program (FISP) (Agenda Item 5a)

Overall, the FISP outline includes the key scientific issues of interest to CFAME, and to a varying degree, all are relevant to the work of CFAME. Most applicable are:

- marine ecosystem responses on seasonal, annual and decadal time scales;
- climate forcing of physical, biological and biogeochemical processes at scales ranging from the entire North Pacific, to marginal seas and convergence zones, to coastal regions relevant to PICES member countries;
- ecological interactions and linkages between coastal and offshore waters, western and eastern Pacific, northern and equatorial Pacific, and marine, estuarine and freshwater ecosystems;
- the cumulative impacts of multiple ecosystem stresses on biological diversity.

The research conducted by CFAME is applicable to the key activities proposed in FISP. The work of CFAME will provide a basis for

developing integrated models and scenarios of ecosystem change that could be applied to forecasting in a policy environment, although this is currently not a focus of CFAME. Some scientific issues that are missing or not yet highlighted are: (1) identifying levels of uncertainty in ecosystem forecasting, and (2) communication of PICES research to outside of the PICES community. Research on climate forcing needs to include episodic responses (*e.g.*, jellyfish outbreaks) to extreme warming events, affects of episodic climate events (hurricanes) and the changing structure of ecosystems.

Progress on CFAME Terms of Reference and Workplan (Agenda Item 5b)

The January 2006 workshop was shortened from 3 to 2 days to accommodate members' schedules. As a result, the preliminary *Ecosystem Research* component was postponed until October 2006. CFAME is therefore approximately 6 months behind in its workplan and proposes an inter-sessional workshop in the spring of 2007 to finalize its work on ecosystem mechanisms of climate forcing. This workshop will focus on formalizing the conceptual mechanisms of climate forcing; and applying the comparative approach to the selected focus ecosystems: the California Current system, the Sea of Okhotsk and the Yellow/East China Seas. Additionally, the Kuroshio/Oyashio Current system will be included since many of the species-mechanism work conducted by CFAME is applicable to this system, and it represents a second boundary current-dominated ecosystem which could simplify the comparisons between ecosystems by selecting two with similar dominant characteristics (*i.e.*, compared to the California Current system).

It was noted that there is potential overlap of CFAME Terms of Reference with the objectives of the PICES XV FIS workshop (W2) on "*Linking climate to trends in productivity of key commercial species in the subarctic Pacific*" (see the *Session Summaries* chapter of this Annual Report), so it was suggested that if this workshop was to lead to future work by the FIS Committee, collaboration between the two groups should be encouraged.

Interaction with WG 20 on *Evaluations of climate change projections* (Agenda Item 5c)

Several CFAME members attended all or part of the PICES XV POC workshop on “*Evaluations of climate change projections*” (W5) and were encouraged that climate modeling results would be available for CFAME’s modeling efforts. It was suggested that the period for greater interaction between CFAME and POC WG 20 on *Evaluations of climate change projections* would follow the proposed 2007 inter-sessional CFAME workshop. A joint workshop of the two groups in conjunction with PICES XVI would be timely.

Workshops and Topic Sessions for 2007 (Agenda Item 6)

CFAME placed their highest priority on a series of workshops. The sequence is as follows:

1. A CFAME workshop in the spring of 2007 (*CFAME Endnote 3*) to complete the comparisons of ecosystem forcing, structuring, and controlling mechanisms, in preparation for a collaboration with WG 20 in predicting future ecosystem states and controlling mechanisms. It was suggested that this workshop should be held in North America, possibly in conjunction with a workshop that was proposed as a follow-up from the PICES XV FIS workshop. The workshop could also be held in conjunction with the June ESSAS workshops in Hakodate, but it was felt that interactions between CFAME and ESSAS would be more focused if CFAME had completed this component of its workplan earlier in the spring, before discussing their results with ESSAS. It was also noted that attendance of North American members to an inter-sessional meeting in Japan might be difficult after three successive CFAME meetings in Asia (two annual and one inter-sessional).
2. A joint WG 20/CFAME workshop at PICES XVI where CFAME members would present the results of their inter-sessional meeting, and the feasibility and schedule for providing climate scenarios for CFAME models would be discussed (*CFAME Endnote 4*).

3. A WG 20/CFAME series of workshops and/or Topic Sessions beginning in 2008, possibly under the auspices of the new PICES integrated program (FUTURE).

MODEL presented a proposal for a joint CCCC/FIS Topic Session at PICES XVI to compare different model structures with climate forcing mechanisms to determine what advantages different components of a modeling “suite” might have for making biological projections (*MODEL Endnote 3*). CFAME agreed that this is a priority for a Topic Session and for CCCC in general. Dr. Vera Agostini was nominated as a co-convenor.

Drs. Aydin and Elizabeth Logerwell described a potential FIS/CCCC/BIO Topic Session on the importance and methods of measuring local interactions (*e.g.*, between predators on prey) and links to modeling (*FIS Endnote 4*). There is a potential for collaboration with ICES on this proposal. While CFAME felt that this topic was interesting, they suggested that FIS should take the lead in proposing this session, with CCCC (CFAME) acting as an interested collaborator. Several suggestions were made on the wording of the session description to broaden its interest to member nations, although these comments have not been included in the proposal.

Travel requests/priorities for 2007 (Agenda Item 7)

CFAME requests support (in the order of priority) for:

1. 2 scientists to attend the proposed spring 2007 inter-sessional CFAME workshop (*CFAME Endnote 3*). One of the two invitees will be a Russian scientist to provide data for the Sea of Okhotsk. The other invitee would depend on the workshop location, and participation of experts on the Yellow/East China Seas is especially encouraged;
2. A modeling expert from outside (*e.g.*, from Europe) of the PICES community for the proposed CCCC/FIS Topic Session at PICES XVI (*MODEL Endnote 3*);
3. A CFAME member to attend the June 2007 ESSAS workshops in Hakodate (see Agenda

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Item 4). While the Task Team felt that collaboration with ESSAS should be encouraged, it was noted that at least one CFAME member and perhaps others are planning to go to Hakodate in their roles as ESSAS participants/members.

Co-Chairman of CFAME (Agenda Item 8)

The Task Team unanimously thanked Dr. Akihiko Yatsu for several years of his leadership and excellent work as the CFAME Co-Chairman (and previously as the BASS Co-Chairman). The Task Team recommended Dr. Young-Shil Kang as a new Co-Chairman of CFAME.

CFAME Endnote 1

Participation list

Members

Vera Agostini (U.S.A.)
Kerim Y. Aydin (U.S.A., Co-Chairman)
Sanae Chiba (Japan)
George L. Hunt (U.S.A.)
Masahide Kaeriyama (Japan)
Hyung-Ku Kang (Korea)
Young-Shil Kang (Korea)
Jacquelynn R. King (Canada)
Gordon A. (Sandy) McFarlane (Canada)
Yoshiro Watanabe (Japan)
Akihiko Yatsu (Japan, Co-Chairman)

Observers

Michael G. Foreman (Canada)
Shin-ichi Ito (Japan)
Yoshioki Oozeki (Japan)
Kenneth Rose (U.S.A.)
Jacob Schweigert (Canada)
Thomas C. Wainwright (U.S.A.)
Yury I. Zuenko (Russia)

CFAME Endnote 2

CFAME Task Team meeting agenda

1. Introductions and adoption of agenda
2. Follow-up of the January 2006 CFAME workshop and the April 2006 CCCC Symposium:
 - a. Comparisons between life-history strategists
 - b. Carrying capacity concept
3. Follow-up of the October 2006 CFAME workshop:
 - a. Comparisons between ecosystems
 - b. Approach to carrying capacity at ecosystem level
4. Report of ESSAS activities
5. Discussion of CFAME next steps:
 - a. Future Integrative Science Program
 - b. CFAME Terms of Reference and Workplan
 - c. Interaction with WG 20 on *Evaluations of climate change projections*
6. Workshops and Topic Sessions for 2007
7. Travel requests/priorities for 2007
8. Co-Chairman of CFAME
9. Other business

CFAME Endnote 3**Proposal for a 3-day CFAME inter-sessional workshop on “*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: A comparative approach*”**

At various meetings in 2006, CFAME outlined the dominant species representing five life-history types in ecosystems across the North Pacific: opportunistic, periodic, equilibrium, salmonic, and intermediate. Intermediate forcing mechanisms were identified that vary by ecosystem within the North Pacific; distinguishing ice-driven processes, freshwater-driven processes, and boundary current-driven processes. Four contrasting ecosystems were selected to be examined: the California Current system (boundary current with upwelling), the Oyashio/Kuroshio Current system (boundary currents), the Sea of Okhotsk (sea ice cover), and the Yellow/East China Sea region (freshwater input). At this workshop, CFAME members will finalize their working hypotheses about mechanisms that link climate to key species in these ecosystems, and that link climate to changes in indices of ecosystem productivity, structure and function. The ecosystem indicators will be viewed through a

set of “lenses” that are either activating or constraining factors on growth and recruitment. For example, participants will examine how climate affects demographic, trophodynamic, and spatial transitions in size-spectra, food web structure, life-history strategies, turnover rates, and usage of physical habitat. The goal of finalizing these mechanisms is in anticipation of climate scenarios from POC WG 20 on *Evaluations of climate change projections* in order to develop ecosystem-level forecasts as part of FUTURE.

Recommended convenors: Kerim Y. Aydin (U.S.A.), Young-Shil Kang (Korea) and Akihiko Yatsu (Japan).

Date and Location: 3-day workshop to be held in May 2007, in Seattle, U.S.A. (possibly immediately preceding or following a proposed inter-sessional FIS workshop in the same location).

CFAME Endnote 4**Proposal for a POC/CCCC (WG 20/CFAME) workshop at PICES XVI on “*Climate scenarios for ecosystem modeling*”**

This workshop will include invited papers from members of the Climate Forcing and Marine Ecosystem Task Team (CFAME) and the POC Committee Working Group on *Evaluations of climate change projections* (WG 20) on research activities related to applying output from WG 20 regional climate models, or IPCC (Intergovernmental Panel for Climate Change) global models, to CFAME ecosystem models. CFAME is developing conceptual and empirical models of the mechanisms relating climate forcing to the population dynamics of species and to ecosystem processes. CFAME has focused on four North Pacific ecosystems that represent different dominant physical processes: (1) California Current system (boundary current with upwelling); (2) Kuroshio/Oyashio Current system (boundary currents); (3) Sea of Okhotsk

(sea ice cover); and (4) Yellow Sea/East China Sea region (freshwater input). WG 20 is developing higher resolution regional coupled atmosphere–ocean models forced by IPCC global or regional models. These regional models could provide forecasts of regional parameters (such as SST, sea ice cover, and river discharge) relevant to ecosystem processes. This workshop will facilitate discussion between CFAME and WG 20 members for future collaborative research on forecasting the impacts of climate change (as represented by IPCC projection scenarios) on regional ecosystems and species of the North Pacific.

Proposed convenors: Michael G. Foreman (Canada), Jacquelynne R. King (Canada) and an Asian colleague (TBD).

