# REPORT OF BASS TASK TEAM

The Basin Scale Studies (BASS) Task Team met from 8:30 - 9:45 hours on October 17, 2004, to review the accomplishments since its establishment, and activities for the new Task Team, CFAME (**C**limate **F**orcing **a**nd **M**arine **E**cosystems), created to replace the BASS and REX Task Teams during the synthesis phase of the CCCC Program. The Co-Chairmen, Drs. Kerim Y. Aydin and Akihiko Yatsu, welcomed participants (*BASS Endnote 1*) and outlined the objectives of the meeting. The agenda was approved as presented (*BASS Endnote 2*).

**Activities and accomplishments in 2004 (Agenda Item 2)**

Publication from BASS Workshop at PICES XII

A 1-day BASS Workshop on "Linkages between open and coastal systems" was convened on October 15, 2003, in Seoul, Korea, during the PICES Twelfth Annual Meeting. A total of 11 selected papers from the workshop were accepted for a special issue of *Deep-Sea Research II* (Elsevier) to be published in the spring of 2005.

CCCC Workshop at PICES XIII

Following the successful completion of the BASS/MODEL workshop series on data synthesis and trophic modeling of the subarctic Pacific basin ecosystems, the MODEL/REX, workshop series to develop NEMURO and NEMURO.FISH, and the 2003 BASS Workshop on "Linkages between open and coastal systems", the BASS Task Team proposed convening a workshop to explore specific food web modeling approaches for linking climate with coastal and oceanic biological production, as a recommended continuation of these Pacific-wide collaborative research efforts.

A 2-day CCCC Workshop on "Linking open ocean and coastal systems II" was held October 15-16, 2004, at PICES XIII. This workshop aimed to develop approaches for synthesis of the CCCC Program on the basis of reviewing ongoing Task Team activities on modeling of lower trophic levels (NEMURO), forage species (NEMURO.FISH) and upper trophic levels (ECOSIM) for multiple regions of the North Pacific. The summary of the workshop is included elsewhere in this Annual Report.

Report of IFEP Advisory Panel

Dr. Hiroaki Saito presented a brief report on past and future activities of the Advisory Panel on *Iron fertilization experiment in the subarctic Pacific Ocean* (IFEP-AP). Differences in biogeochemical responses between two *in situ* iron enrichment experiments carried out in the western subarctic gyre of the North Pacific, SEEDS-I (2001) and SEEDS-II (2004), were discussed.

The IFEP-AP meeting was held later during PICES XIII (from 17:00-19:30 hours on October 19 and 19:00-21:00 hours on October 20, 2004), and the report of this meeting is included elsewhere in this Annual Report.

**Review accomplishments of the BASS Task Team since its inception (Agenda Item 3)**

Activities and accomplishments of the BASS Task Team since its inception in 1995 were summarized and appended as *BASS Endnote 3*.

**Recommendation for CFAME Co-Chairmen (Agenda Item 4)**

The Task Team recommends that the current BASS Co-Chairmen, Drs. Kerim Aydin (U.S.A.) and Akihiko Yatsu (Japan), become Co-Chairmen of the newly established CFAME Task Team. The nomination is to be discussed by the Executive Committee of the Climate Change and Carrying Capacity Program Implementation Panel (CCCC-IP/EC), and should be finally approved by Science Board.

**Other business (Agenda item 5)**

Proposal for CFAME Workshop/Symposium

The following ideas were suggested for a CFAME Workshop or Symposium in 2005 and 2006:

- Using recommendations of the Study Group on *Fisheries and ecosystem responses to recent regime shifts* (FERRRS), and WG 16 on *Climate change, shifts in fish production, and fisheries management* to develop a CFAME work plan (final reports of FERRRS and WG 16 will be published in the PICES Scientific Report Series in early and late 2005, respectively);
- Euphausiid studies in relation to WG 14 on *Effective sampling of micronekton* (final report of WG 14 will be published in the PICES Scientific Report Series in early 2005).

Status of NPAFC/PICES Symposium on salmon

A joint NPAFC/PICES Symposium on "The status of Pacific salmon and their role in North Pacific marine ecosystems" will be held in conjunction with the 2005 NPAFC Annual Meeting. A Steering Committee has been formed and will discuss the symposium objectives and key questions to be addressed soon after the completion of this year's PICES and NPAFC Annual Meetings. It was agreed that BASS would present the proposal for the symposium at the upcoming CCCC-IP Executive Committee meeting.

**BASS Endnote 1**

**Participation List**

Members

Kerim Aydin (U.S.A., Co-Chairman)
Masahide Kaeriyama (Japan)
Gordon A. McFarlane (Canada)
Rolf Ream (U.S.A.; for Thomas R. Loughlin)
Patricia A. Wheeler (U.S.A.)
Akihiko Yatsu (Japan, Co-Chairman)

Observers

Richard J. Beamish (Canada)
Hiroaki Saito (Japan)

**BASS Endnote 2**

**BASS Meeting Agenda**

1. Welcome and introduction
2. Review accomplishments in 2004
   a) Publication from BASS Workshop on "Linking open ocean and coastal systems " at PICES XII
   b) CCCC Workshop on "Linking open ocean and coastal systems II" at PICES XIII
   c) Report of IFEP Advisory Panel
3. Review accomplishments of the BASS Task Team since its inception
4. Recommendation for CFAME Co-Chairmen
5. Other business
   a) CFAME Workshop/Symposium in 2005 and 2006
   b) NPAFC/PICES Symposium on "The status of Pacific salmon and their role in North Pacific marine ecosystems"

**BASS Endnote 3**

## BASS Task Team Final Report

Background

The Basin Scale Studies (BASS) Task Team was established in 1995, following the first meeting of the Executive Committee of the Climate Change and Carrying Capacity Program Implementation Panel (CCCC-IP/EC). The Task Team was created to facilitate the exchange of scientific data and encourage scientific research in the eastern and western basins of the subarctic Pacific Ocean.

In general, the oceanography and ecology of the eastern and western basins of the subarctic Pacific are poorly understood relative to the coastal areas. It is known that the central subarctic Pacific is productive, as indicated by the large abundance of Pacific salmon, squid and other important fishes. Recent studies also suggest that the oceanography of the gyres is closely linked to the decadal scale changes in climate. It is important, therefore, that there is a coordinated effort to focus on the priority research issues and to exchange scientific information on a timely basis.

At the PICES Sixth Annual Meeting (October 1997, Pusan, Korea), the BASS Task Team sponsored a symposium on "Ecosystem dynamics of the eastern and western subarctic gyres". The purpose was to bring together available information on the two gyres in a comparative framework. Topics included: 1) ocean responses to climate forcing, 2) nutrients and primary production, 3) structure of the lower trophic levels, the mesozooplankton communities, and the epipelagic nekton, 4) the role of mid-water fishes, and 5) the importance of these areas to marine birds and mammals. Papers presented at the symposium were published in 1999, in a *Progress in Oceanography* special issue entitled "Ecosystem Dynamics in the Eastern and Western gyres of the Subarctic Pacific" (Guest Editors: R.J. Beamish, S. Kim, M. Terazaki and W.S. Wooster).

A 2-day follow-up workshop on "The development of a conceptual model of the subarctic Pacific basin ecosystems" was convened in conjunction with the PICES Ninth Annual Meeting (October 20-21, 2000, Hakodate, Japan), to identify potential models which might have utility for examining gyre systems. Trophodynamic linkages that were likely to be common, as well as those that were model-specific, were identified, and shortfalls were highlighted. Discussions included identifying data groups and potential data sources, incorporating climate and oceanographic change in models, and linking gyre models to coastal area models. Extended abstracts of papers given at the workshop are published in *PICES Scientific Report* No. 17 (2001).

The workshop participants recognized that as the CCCC Program enters its synthesis phase, modeling would play an increasingly prominent role in examining the dynamics of the gyres, and recommended that the BASS and MODEL Task Teams examine the feasibility of using the ECOPATH/ECOCIM modeling approach as a means to organize our understanding of the ecosystem of the subarctic gyres. Specific objectives were: (a) synthesize all trophic level data in a common format; (b) examine trophic relations in both the eastern and western subarctic gyres using ECOPATH/ECOSIM; and (c) examine methods of incorporating the PICES NEMURO lower trophic level models into the analysis.

Three joint BASS/MODEL workshops followed: a 2-day workshop on "Quantification of a food web model for the subarctic Pacific gyre systems" (March 5-6, 2001, in conjunction with the PICES/CoML/IRC workshop on "Honolulu, U.S.A.); a 1-day workshop "Ecosystem models for the subarctic Pacific gyres" (October 5, 2001, in conjunction with the PICES Tenth Annual Meeting in Victoria, Canada); and a 2-day workshop on "Perturbation analysis on subarctic Pacific gyre ecosystem models using ECOPATH/ECOSIM" (April 21-22, 2002, in conjunction with the PICES co-sponsored symposium on "North Pacific transitional areas" in La Paz, Mexico). At these workshops, ECOPATH/ECOSIM baseline models were developed, linked to the NEMURO model, and a number of hypotheses were tested.

The purpose of this approach was to provide a "picture" of the two subarctic Pacific gyres, and to facilitate our understanding of how these systems respond to natural and anthropogenic change. It was hoped that it will form the basis of future work which will attempt to link the subarctic system to coastal system. The results of these workshops have been presented in several issues of *PICES Press* and in *PICES Scientific Reports* No. 20 (2002) and No. 25 (2003). The latter report summarized our current understanding of the dynamics of these systems, and also data availability and gaps in upper trophic level biological data for understanding the function and variation in the subarctic gyres' food webs.

Following a direction suggested by the participants of the BASS/MODEL workshops, a 1-day BASS Workshop (with the involvement of the MODEL and REX Task Teams) on "Linkages between open and coastal systems" was convened at the PICES Twelfth Annual Meeting (October 15, 2003, Seoul, Korea). A total of 15 talks and 5 posters covering all trophic levels from both gyres and coastal areas were presented. Invited speakers from North America and Asia provided current information on physics, plankton, fish, birds and mammals, and speculated on mechanisms for energy transfer between areas. Selected papers from the workshop constitute a special issue of *Deep-Sea Research II* (Guest Editors: G.A. McFarlane and S.M. McKinnell) to be published in the spring of 2005.

This subject was further explored at a 2-day CCCC Workshop on "Linking open ocean and coastal systems II" held October 15-16, 2004, in conjunction with the PICES Thirteenth Annual Meeting in Honolulu, U.S.A. This workshop aimed to develop approaches for synthesis of the CCCC Program on the basis of reviewing ongoing Task Team activities on modeling of lower trophic levels (NEMURO), forage species (NEMURO.FISH) and upper trophic levels (ECOSIM) for multiple regions of the North Pacific. A total of 9 talks and 3 posters were presented. The summary of the workshop is included in the 2004 PICES Annual Report. Recommendations of the workshop will be useful for future activities of the CFAME (Climate Forcing and Marine Ecosystems) Task Team.

Objectives of BASS

In 1996, the BASS Task Team developed a 5-year work plan with 5 objectives:

1. retrospective comparison of lower trophic level dynamics in the eastern and western subarctic Pacific gyres: a link between climate change and higher trophic levels
2. zooplankton standardization
3. time-series measurements of primary productivity and zooplankton stocks
4. inventory of higher trophic level species
5. acquire and collate the work or science plans of all agencies carrying out research in the eastern and western subarctic Pacific gyres.

Substantial progress has been made towards objectives 1, 4 and 5. Linkages between NEMURO lower trophic model outputs and a higher trophic mass balance model (ECOPATH) have been established. This represents progress to linking climate change to the subarctic Pacific gyre systems. Included in this exercise is the compilation of an inventory of higher trophic level species. This also required the collation of scientific work and data of all agencies carrying out research in the gyres.

The results of this BASS/MODEL collaboration were published in *PICES Scientific Report* Nos. 17 (2001), 20 (2002) and 25 (2003). These are the major products of the successful east-west comparison of ecosystem structure and responses to turbulences such as climate variations, primary production variations and removals of key elements (fishery) using ECOPATH and ECOSIM. One conclusion of this exercise is that improved understanding of factors that control species abundance will require directed research by PICES member nations.

Future work

Among the five objectives of BASS, considerable progress was made in comparisons of structure and dynamics between two gyres on the basis of inventory of higher trophic level species. However, zooplankton standardization and time-series measurements of primary productivity and zooplankton stocks remain insufficient. These tasks will be taken over by the new CFAME Task Team in colaboration with MONITOR.

Advisory Panel on *Iron fertilization experiment*

Considering the questions and potential significance relating to the role of iron on productivity processes in the subarctic North Pacific, an Advisory Panel on *Iron fertilization experiment in the subarctic Pacific Ocean* (IFEP-AP) was formed in 1999, under the BASS Task Team. The objective of this Panel is to design, coordinate and oversee *in situ* iron enrichment experiments in the subarctic North Pacific, in order to examine the details of the responses of the lower trophic levels to the addition of iron. The Panel plans to identify similarities and differences in the biogeochemical responses of the planktonic ecosystems in the eastern and western subarctic Pacific gyres obtained from various *in situ* experiments (*e.g.*, differences in species composition, export flux rates, etc.), and to develop new experimental strategies and hypotheses to explain these differences. There are strong linkages of IFEP-AP activities with the emerging IGBP SOLAS (Surface Ocean Lower Atmosphere Study) Program.

During 2001-2004, three *in situ* iron enrichment experiments were conducted in both gyres under the **S**ubarctic Pacific Iron **E**xperiment for **E**cosystem **D**ynamic **S**tudy (SEEDS) and the **S**ubarctic **E**cosystem **R**esponse to **I**ron **E**nrichment **S**tudy (SERIES): SEEDS-I (Japan/Canada, summer of 2001) and SEEDS-II (Japan/U.S.A., summer of 2004) in the western subarctic Pacific, and SERIES-I (Canada/Japan, summer of 2002) in the eastern subarctic Pacific.

The Panel convened several workshops and meetings to design/plan the experiments, and to evaluate and synthesize the data: a workshop on "Designing the iron fertilization experiment in the Subarctic Pacific (October 19-20, 2000, in Tsukuba, Japan); a workshop on "*In situ* iron enrichment experiments in the eastern and western subarctic Pacific" (February 11-13, 2004, in Victoria, Canada); and a joint Canadian SOLAS/PICES-IFEP session on "Response of the upper ocean to meso-scale iron enrichment" (February 17-18, during the ASLO/TOS 2004 Ocean Research Conference held in Honolulu, U.S.A.).

The proceedings of the two IFEP-AP workshops will be published as a *PICES Scientific Report* in 2004 or early 2005. A synthesis paper on SEEDS-I was published in *Science* (Tsuda et *al*. "A meso-scale iron enrichment in the western subarctic Pacific induced a large centric diatom bloom", Vol. 300: 958-961, 2003), and a synthesis paper on SERIES was published in *Nature* (Boyd et *al*. "Evolution, decline and fate of an iron-induced subarctic phytoplankton bloom", Vol. 428: 549-553, 2004). Selected papers resulted from the SEEDS-I experiment will be published as a special issue of *Progress in Oceanography*, and selected papers from the SERIES experiment will be published as a special issue of *Deep-Sea Research II*. Both volumes will appear in 2005. It is expected that a second volume of *Deep-Sea Research II* on SERIES would be proposed for 2006.

**Historical List of BASS Task Team members**

Canada
- Richard J. Beamish (1996-98; Co-Chairman 1996-98)
- David L. Mackas(1996-2000)
- Gordon A. McFarlane (1999-2004; Co-Chairman 1999-2003)

Japan
- Masahide Kaeriyama (2001-04)
- Makoto Kashiwai (1996-2000)
- Hidehiro Kato (2000-2004)
- Kazuya Nagasawa (1996-1998)
- Makoto Terazaki (1996-2000; Co-Chairman 1996-1998)
- Akihiko Yatsu (1999-2004; Co-Chairman 2003-04)

Korea
- Suam Kim (1996-2000)
- Jang-Uk Lee (1999-2004)

Russia
- Alexander Boltnev (1996-2000)
- Andrei S. Krovnin (1999-2004; Co-Chairman 1999-2002)
- Vadim F. Savinykh (2001-04)

U.S.A.
- Kerim Y. Aydin (2002-04; Co-Chairman 2003-04)
- Michael L. Dahlberg (1996-1999)
- Bruce W. Frost (1996-2000)
- Thomas R. Loughlin (2000-04)
- Bruce A. Taft (1996-2000)
- Patricia A. Wheeler (1996-2004)

**List of Presenters and Convenors**
**BASS Symposium on "Ecosystem dynamics of the eastern and western subarctic gyres"**
(October 24, 1997, Pusan, Korea)

Canada
- Richard J. Beamish (convenor)
- Paul J. Harrison
- David L. Mackas

Japan
- Michio J. Kishi
- Moriyuki Kotori (poster)
- Shosiro Minobe
- Yoshihiko Sekine
- Akira Taniguchi
- Makoto Terazaki (convenor)

Korea
- Suam Kim (convenor)

U.S.A.
- Richard D. Brodeur
- Gretchen Ann Harrington (poster)
- James E. Overland (poster)
- Alan M. Springer
- Warren S. Wooster (convenor)

**List of Participants**
**BASS Workshop on "The development of a conceptual model of the subarctic Pacific basin ecosystems"** (October 20-21, 2000, Hakodate, Japan)

Canada
- Richard J. Beamish (convenor)
- James Irvine
- Jacquelynne R. King
- Steven J.D Martell
- Gordon A. McFarlane (convenor)

China
- Ling Tong

Japan
- Yukimasa Ishida
- Masahide Kaeriyama
- Takashige Sugimoto
- Akihiko Yatsu (convenor)

Russia
Andrei S. Krovnin (convenor)
Victor Tsiger

U.S.A.
Kerim Y. Aydin
Albert J. Hermann
Dale B. Haidvogel
Jeffrey J. Polovina

**List of Participants**
**BASS/MODEL Workshop on "Quantification of a food web model for the subarctic Pacific gyre systems"** (March 5-6, 2001, Honolulu, U.S.A.)

Canada
Richard J. Beamish
Jacquelynne R. King
Gordon A. McFarlane (convenor)
Daniel M. Ware

China
Qi-Sheng Tang

Japan
Makoto Kashiwai
Michio J. Kishi
Hiroyuki Sakano
Lan Smith
Akihiko Yatsu (convenor)

Russia
Andrei S. Krovnin (convenor)

U.S.A.
Kerim Y. Aydin
Bernard A. Megrey (convenor)
Jeffrey J. Polovina

**List of Participants**
**BASS/MODEL Workshop on "Ecosystem models for the subarctic Pacific gyres"**
(October 5, 2001, Victoria, Canada)

Canada
Jacquelynne R. King
Gordon A. McFarlane (convenor)
R. Ian Perry
Marc Trudel

Japan
Makoto Kashiwai
Toshio Katsukawa
Michio J. Kishi (convenor)
Takahiro Iida
Kohei Mizobata
Sei-ichi Saitoh
Hiroaki Saito
S. Lan Smith
Akihiko Yatsu
Hiroshi Yoshinari

Russia
Natalia Klovatch
Andrei S. Krovnin (convenor)
Alexei Orlov

U.S.A.
Kerim Y. Aydin
Patricia Livingston
Thomas R. Loughlin
Bernard A. Megrey (convenor)
Thomas C. Wainright
Francisco E. Werner

**List of Participants**
**BASS/MODEL Workshop on "Perturbation analysis on subarctic Pacific gyre ecosystem models using ECOPATH/ECOSIM"** (April 21-22, 2002, La Paz, Mexico)

Canada
- Gordon A. McFarlane (convenor)
- Jacquelynne R. King
- R. Ian Perry

Japan
- Takashige Sugimoto
- Michio J. Kishi
- Ichiro Yasuda
- Sachihiko Itoh

Mexico
- Salvador E. Lluch-Cota

U.S.A.
- Kerim Y. Aydin
- Bernard A. Megrey (convenor)
- Francisco E. Werner
- Jeffrey J. Polovina

**List of Presenters and Convenors**
**CCCC Workshop on "Linkages between open and coastal systems"**
(October 15, 2003, Seoul, Korea)

Canada
- Richard J. Beamish
- Jacquelynne R. King
- David L. Mackas
- Gordon A. McFarlane (convenor)
- Frank A. Whitney

Japan
- Atsushi Kaneda (poster)
- Sachi Ohki
- Takashige Sugimoto
- Kazuaki Tadokoro
- Tomowo Watanabe
- Orio Yamamura
- Akihiko Yatsu (convenor)

Korea
- Hyo Choi
- Kyung-Hoon Shin (poster)

Russia
- Vladimir A. Belyaev (convenor)
- Larissa A. Gayko (poster)
- Svetlana V. Naydenko

U.S.A.
- Keith L. Boslev (poster)
- George L. Hunt, Jr
- Carol Ladd
- Rolf Ream

**List of Presenters and Convenors**
**CCCC Workshop on "Linking open ocean and coastal systems II"**
(October 15-16, 2004, Honolulu, U.S.A.)

Canada
- Gordon A. McFarlane (convenor)
- Jacob Schweigert

Japan
- Shin-ichi Ito (convenor, poster)
- Kosei Komatsu
- Motomitsu Takahashi
- Akihiko Yatsu (convenor)

Korea
- Jin-Yeong Kim (convenor, poster)

Russia
- Yury I. Zuenko (poster)

U.S.A.
- Kerim Y. Aydin (convenor)
- Vera N. Agostini
- Alec D. MacCall