

## REPORT OF BASS TASK TEAM



The Basin Scale Studies (BASS) Task Team met on the afternoon of October 19, 2002, to review the past year's activity and plan activities for 2003. The Co-Chairmen, Drs. Andrei S. Krovnin and Gordon A. McFarlane, 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 2002

A 2-day BASS/MODEL Workshop on *Using models to test hypothesis on effects of climate change on the North Pacific subarctic gyre system* was convened April 21-22, 2002, in La Paz, Mexico, in conjunction with the International Symposium on *North Pacific transitional areas*. The purpose of the workshop was to provide a "picture" of the two subarctic gyres, and to facilitate our understanding of how these systems respond to natural and anthropogenic change. A number of hypotheses were discussed as appropriate proxies to test the response of the two gyres to various trophic level changes and climate change scenarios. These were further refined into "Perturbation analyses" and "Function fitting and forcing". The results of these analyses will be published as a PICES Scientific Report. It is hoped that the workshop will form the basis of future work, which will attempt to link the subarctic gyres system to coastal systems.

The results from a 1-day BASS/MODEL Workshop on *Ecosystem models for the subarctic Pacific gyres* (held October 5, 2001, immediately preceding Tenth Annual Meeting in Victoria) were published in PICES Scientific Report No. 20.

The Iron Fertilization Experiment Panel (IFFP) met on October 19, 2002, and the report of their meeting is appended as *BASS Endnote 3*. The Panel focused their discussion on the results of the successful Canadian SOLAS iron enrichment

experiment in the eastern subarctic, in July-August 2002.

### Proposed inter-sessional activities

Participants agreed to complete and publish the results of the successful BASS/MODEL gyre modelling work as a separate volume in the PICES Scientific Report Series. In addition, the model and selected results will be published in primary scientific literature.

### Proposed activities at PICES XII

With the successful completion of the gyre modelling work, participants discussed linking open ocean and coastal ecosystems. A 1-day workshop on *Linkages between open ocean and coastal systems* to be held just prior to PICES XII (Seoul, Republic of Korea) was proposed.

This workshop will examine the oceanographic and biological linkages between open ocean and coastal systems in the North Pacific Ocean. Papers will be prepared by "teams" of investigators to review existing information on linkages for various physical and biological components. Suggested papers would include reviews of physical oceanography, phytoplankton, zooplankton, migratory pelagics, mesopelagics, marine birds and marine mammals. In addition there will be an open session for contributed papers. Selected papers will be published. Drs. Vladimir Belyaev (Russia), Gordon A. McFarlane (Canada) and Akihiko Yatsu (Japan) were recommended as convenors.

### Proposed activities at PICES XIII

The Task Team also proposed a 2-day joint BASS/NPAFC workshop for 2004, immediately prior to PICES XIII (Honolulu, U.S.A.). A focus of the workshop would be on the role of salmon and associated species in linking open

ocean and coastal systems. Development of the workshop objectives and key questions to be addressed will take place in early 2003, and final organization will occur at NPAFC and PICES Annual Meetings in 2003. Drs. Richard J. Beamish (Canada) and Yukimasa Ishida (Japan) were recommended as PICES convenors.

### **Requests for travel**

BASS requests support for 1 scientist to attend the BASS workshop on *Linkages between open ocean and coastal systems* at PICES XII.

### **BASS Task Team White Paper**

Participants discussed the BASS Task Team White Paper submitted to the CCCC Implementation Panel (CCCC-IP). The main components of this discussion were presented to the CCCC Integration Workshop held October

20, 2002, and are included in the CCCC-IP report. The lack of participation by some countries and members in BASS activities was noted, and BASS recommends that the current membership be reviewed to ensure the Task Team was comprised of appropriate members from each country.

### **Election of Co-Chairmen**

The terms of both Co-Chairmen, Drs. Krovnin (Russia) and McFarlane (Canada), had expired. BASS nominated Dr. Akihiko Yatsu (Japan) to replace Dr. Krovnin. BASS participants noted that the successful cooperative BASS/MODEL gyre modelling work was nearing completion and a new phase of integrated work was about to begin. The need for continuity in this transition phase was strongly suggested, and BASS recommends that Dr. McFarlane remain as Co-Chairman until this was completed.

### **BASS Endnote 1**

#### **Participation List**

##### Members

Gordon A. McFarlane (Canada, Co-Chairman)  
Masahide Kaeriyama (Japan)  
Andrei S. Krovnin (Russia, Co-Chairman)  
Patricia A. Wheeler (U.S.A.)  
Akihiko Yatsu (Japan)

##### Observers

Kerim Y. Aydin (U.S.A.)  
Richard J. Beamish (Canada)  
Yukimasa Ishida (Japan)  
Jacquelynne R. King (Canada)  
Shigenobu Takeda (Japan)

### **BASS Endnote 2**

#### **BASS Meeting Agenda**

1. Welcome and opening remarks
2. Review accomplishments in 2002
  - a. BASS/MODEL Workshop on *Using models to test hypothesis on effects of climate change on the North Pacific subarctic gyre system*
  - b. Review of joint sessions of CCCC Task Teams and GLOBEC Working Groups
  - c. Report of Iron Fertilization Experiment Panel
3. Discuss plans for 2003 and beyond
  - a. Publication of BASS/MODEL gyre modelling work
  - b. Joint workshop with REX/MODEL
  - c. Theme for a workshop at PICES XII
  - d. Joint BASS/NPAFC Workshop in 2004
4. Request for travel to future meetings
5. BASS Task Team White Paper submitted for CCCC integration
6. Election of new Co-Chairmen

## BASS Endnote 3

### Report of Iron Fertilization Experiment Advisory Panel

The meeting was held from 08:30-17:30 hours on October 19, 2002. Co-Chairman Dr. Shigenobu Takeda called the meeting to order and welcomed the participants (*IFEP Endnote 1*). The Advisory Panel reviewed the draft agenda and it was adopted (*IFEP Endnote 2*). The meeting focused mainly on the preliminary results of the successful iron enrichment experiment in the eastern subarctic Pacific in July-August 2002.

#### Activities in 2002

##### *Eastern subarctic Pacific*

An *in situ* iron enrichment experiment in the eastern subarctic Pacific, SERIES (Subarctic Ecosystem Response to Iron Enrichment Study), was conducted in July-August 2002, as a part of the Canadian-SOLAS project.

##### SERIES scientific objectives

- Community response to iron addition (comparison with other HNLC regions such as Eq Pac, S Ocean, NW Pacific);
- Natural longitudinal dust/Fe gradient from Western Subarctic Gyre to Alaska Gyre;
- Fe chemistry and complexing agents;
- Carbon export – needs > 30 days to see;
- Trace gas production *e.g.* DMS & organic halides.

##### SERIES implementation - three ships

- CSS *John P. Tully* (Canada): pre-injection survey, patch mapping, buoy handling, underway sampling, nutrients, sediment traps;
- M/V *El Puma* (Mexico, chartered by Canada): atmospheric and ocean process studies (gas production, DMS, DMSP, grazing, BP, PP, Chl, zooplankton, etc.);
- M/V *Kaiyo Maru* (Japan): mapping, pCO<sub>2</sub>, sediment traps, nutrients, BP, PP, Chl, foodwebs, taxonomy.

##### Experiment and preliminary results

An *in situ* iron enrichment experiment was conducted in the northeast subarctic Pacific near

station P26 - Ocean Station Papa (50°N, 145°W). Site selection was based on the location of waters with low density, uniform physical characteristics, the predominant direction of the drogued drifter buoys, and matching the HNLC condition. There were evidence of two eddy-like features, the southwest and northeast of P26, that was taken into consideration.

The first iron release was performed from 01:05-18:45 hours on July 7, 2002. The SF<sub>6</sub> and iron solutions were mixed and pumped over the side at rate of 5 and 20 liters/min to a depth of about 7 m as maintained by attachment of the outlet to a Hi-Fin fish. The release track was an expanding square covering 4.75 x 4.74 n miles, with a distance between transects of 0.4 n miles. Some of the initial values for reactive and unfiltered iron were in the 4 nM range, while dissolved iron concentration was as high as 2.5 nM. Values declined very quickly over the first few days in the surface mixed layer of 10 m. Winds and rough seas mixed the iron down uniformly to about 30 m on July 13 to 14.

Re-infusion of iron was performed from 14:45 hour on July 16 to 08:00 hour on July 17, 2002. An expanding rectangle was used for the re-infusion with the SF<sub>6</sub> mapping system used to monitor the release. The second smaller injection brought levels up to 0.6-0.7 nM for dissolved Fe in the 3-10 m depth on July 17. By July 22, dissolved iron concentrations were very close to background.

Rapid and small initial response was observed in phytoplankton. As the experiment progressed, the biological response, such as increases in Fv/Fm, primary productivity and Chl-*a* concentration and decreases in macronutrient concentrations, became apparent. This was also augmented by underway pCO<sub>2</sub>.

The phytoplankton bloom peaked physiologically around July 21, primary production peaked on July 24, and Chl-*a* peaked on July 24-26 and reached 8 mg m<sup>-3</sup>.

Concentration of Chl-*a* then decreased gradually to 1.5 mg m<sup>-3</sup> on August 4. Most dominant phytoplankton at the Chl-*a* peak was centric diatoms, and many pennate diatoms were also observed. Exhaustion of iron and macronutrient seems to be one of the reasons for the termination of the bloom. Sinking particles gradually increased after July 31.

### ***Western subarctic Pacific***

The Panel reviewed the results of the Japanese iron enrichment experiment in the western subarctic Pacific - SEEDS 2001 (Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study). These results will be published as a special issue of *Progress in Oceanography*. The Panel discussed the plans for the second longer-term (>30 days) experiment in this area in July-August, 2004.

### Scientific objectives for SEEDS 2004

- Observe the decline of diatom bloom and elucidate the fate of fixed carbon;
- Measure additional parameters to see the overall biogeochemical responses to iron enrichment;
- Determine the influence of Fe on trace gas production and aerosol formation;
- Measure gas fluxes from ocean surface to atmosphere.

Scientists from U.S.A. are planning to take part in the longer-term experiment in the western gyre, and the proposal submitted to NSF was presented.

### **Proposed activities in 2003**

IFEP proposes a 3-day workshop on *In situ iron enrichment experiments in the eastern and*

*western subarctic Pacific*, to be held December 4-6, 2003, at the Institute of Ocean Sciences in Sidney, British Columbia, Canada.

Specific objectives of the workshop are:

- Synthesize results from two *in situ* iron enrichment experiments performed in the eastern and western subarctic Pacific (SEEDS-2001 and SERIES);
- Discuss responses in lower and higher trophic levels, carbon cycles, trace-gas production and ocean-atmosphere flux, and models;
- Determine similarity and differences in biogeochemical and ecosystem responses to iron addition between eastern and western subarctic Pacific;
- Identify specific scientific questions for the longer-term experiment in the western subarctic Pacific (SEEDS-2004).

The results of the Workshop will be published as a special issue of *Deep Sea Research II*.

IFEP requests support for three invited speakers (two from New Zealand and one from Mexico) to attend the IFEP Workshop in December 2003 in Sidney, Canada.

It was suggested that IFEP need to work more closely with MODEL Task Team for the improvement of NEMURO model by adding iron limitation to phytoplankton production using the data from two successful iron enrichment experiments performed in the eastern and western subarctic Pacific. Such a model would be useful to see the long-term ecosystem responses as well as the experimental design of SEEDS 2004.

## IFEP Endnote 1

### Participation List

#### Members

William Cochlan (U.S.A.)  
Paul J. Harrison (Canada)  
Isao Kudo (Japan)  
Shigenobu Takeda (Japan, Co-Chairman)  
Atsushi Tsuda (Japan)  
C.S. Wong (Canada, Co-Chairman)

#### Observers

Fei Chai (U.S.A.)  
William R. Crawford (Canada)  
John F. Dower (Canada)

Liu Hui (China)  
Maurice Levasseur (Canada)  
Xiuren Ning (China)  
Jun Nishioka (Japan)  
Yukihiro Nojiri (Japan)  
Sachiko Oguma (Japan)  
Kelvin Richards (U.S.A.)  
Hiroaki Saito (Japan)  
Daniela Turk (Canada)  
Nelson D. Sherry (Canada)  
Masahide Wakita (Japan)  
Shuichi Watanabe (Japan)  
Emmy Wong (Canada)

## IFEP Endnote 2

### IFEP Meeting Agenda

1. Round-table introduction of attendees
2. Adoption of agenda
3. Adoption of the report of the IFEP Panel meeting held at PICES X (Victoria, Canada)
4. Review of time-table of international iron enhancement experiments in the North Pacific
5. Progress report of the Japanese iron enhancement experiment (SEEDS-2001) activities in the western subarctic Pacific
6. Summary of the Canadian iron enhancement experiment (SERIES) in the eastern subarctic Pacific
  - 6.1 Introduction of SOLAS/SERIES
  - 6.2 Overview of logistics and biological responses
  - 6.3 CSS *J.P. Tully* measurements  
Cruise report, SF<sub>6</sub> mapping, iron, DMS, climate gases, pCO<sub>2</sub>, carbon, nutrients, sediment trap, and physics
  - 6.4 M/V *El Puma* measurements  
Cruise report, primary production, Chl-*a*, incubation; DMS(P) biology, and aerosol/atmospheric studies
- 6.5 M/V *Kaiyo-maru* measurements  
Cruise report, mapping, Chl-*a*, FRRF, iron, incubation experiments, pCO<sub>2</sub>, nutrients, sediment trap
7. IFEP related activity in other areas
  - 7.1 Overview of SOFeX
  - 7.2 Modeling results of iron enrichment experiments (IronEx-II)
8. Future IFEP related activity plans in the North Pacific
  - 8.1 SERIES/SOLAS
  - 8.2 SEEDS
  - 8.3 US-NSF proposal for post-fertilization long-term study
9. Discuss plans for 2003
  - 9.1 Discuss need for special Symposium /Workshop(s) of SERIES and SEEDS
  - 9.2 Discuss need for PICES Scientific Report(s) of SERIES and SEEDS
  - 9.3 Requests for travel to future meetings
10. Other new business

