REPORT OF THE IMPLEMENTATION PANEL ON THE CCCC PROGRAM

The CCCC-IP Panel met on Thursday, October 22, 1998. The meeting was opened by the two CCCC-IP Co-Chairmen and the agenda was reviewed. An agenda item to discuss a CCCC web representative was added and the agenda item on national GLOBEC reports was omitted because GLOBEC representatives had previously provided their reports at the FIS/CCCC Topic Session. The Co-Chairmen discussed their activities of the previous year, including attendance at the GLOBEC International Open Science Meeting, design of the CCCC web pages, and regular provision of newsletter articles to the PICES Press, and the GLOBEC International newsletter. The Panel then heard reports of each of the Task Team accomplishments for 1998, and planned activities for 1999. The panel accepted the proposal by C.S. Wong to add an advisory group under BASS to assist in the development and implementation of an iron fertilization experiment in the subarctic. The proposals developed by REX, MODEL, MONITOR, and BASS for workshops were discussed, revised, and accepted. It was noted that the first two weeks of April are not good for Japanese scientists to attend meetings or workshops due to the nature of the fiscal year and the school year. A recommendation was made to forward the Working Group 11 (Birds and Mammals) report to the MODEL Task Team for consideration and further action in deciding how to incorporate these data into upper trophic level models. The Panel received information about the current status of cooperation with other programs such as JGOFS, GLOBEC International, and the GOOS-LMR module. A recommendation was made and adopted that CCCC will nominate a representative from REX who will be the contact point to receive cruise information of CREAMS and other programs doing research in the Japan/East Sea region. Once received, this information will be posted on the PICES web site. Mr. Robin M. Brown presented a report on data management issues based on his attendance earlier in the year of a JGOFS data management meeting. The Panel discussed the responses received from the letter sent earlier in the year from TCODE and CCCC to national GLOBEC committees about data management issues. Mr. Brown made the suggestion that the CCCC-IP wait for the results from JGOFS in their trial of a structured inventory system before making suggestions to national GLOBEC committees about a standard format for the inventory system. Mr. Brown agreed to notify the CCCC upon completion of the JGOFS trial whereupon TCODE and CCCC would consult and jointly recommend a strategy to the national GLOBEC programs in PICES nations. The CCCC/IP agreed to nominate one CCCC representative as a web representative of the program, who would oversee and coordinate the provision of scientific information for the PICES web site. Dr. David Welch accepted this responsibility.

The PICES CCCC/IP recommended:

Publications

1. Publication of the 1998 MODEL, REX, and MONITOR workshops' proceedings in a single volume of the PICES Scientific Report Series.

Travel support

2. PICES travel support for one outside expert to attend the MONITOR Workshop in Hakodate, Japan, just prior to the PICES VIII Annual Meeting.
3. PICES travel support for one outside expert to attend the BASS Workshop.
4. PICES travel support for two scientists to attend the REX Workshop.

Approval of members

5. Drs. David W. Welch (Canada) and Suam Kim (Korea) as the new CCCC/IP Co-Chairmen; Dr. William T. Peterson (U.S.A)

as REX Co-Chairman to replace Dr. Anne B. Hollowed; Drs. Gordon A. McFarlane (Canada) and Andrei S. Krovnin (Russia) as the new BASS Co-Chairmen; and Drs. Michio Kishi (Japan) and Dan Ware (Canada) as the new MODEL Co-Chairmen. Drs. C.S. Wong, Paul J. Harrison, N. Price (Canada), M. Wells, K. Coale, R. Bidigare (U.S.A.), S. Takeda, M. Kiyono, H. Obata (Japan) as members of the BASS Advisory Committee on an Iron Fertilization Experiment.

Proposed workshops and symposia for 1999

6. a. BASS should hold a 2-day workshop to identify key research questions and opportunities for coordinated research on climate change in the subarctic North Pacific.
   b. MONITOR should hold a 2-day workshop in Hakodate, Japan, just prior to the PICES VIII Annual Meeting to design an improved monitoring system based on the findings of the BASS Workshop.
   c. REX should hold a 2-day workshop just prior to the Annual Meeting in Vladivostok, Russia, to compare vital rates of herring and examine food web interactions with euphausiids.
   d. A 2-day workshop on Regime Shifts and their Identification to be held on the west coast of North America in early September.
   e. A half-day topic session on Recent Findings of GLOBEC and GLOBEC-like programs in the North Pacific, to be convened at PICES VIII.

Proposed workshops and symposia for 2000

7. a. A 3-day workshop on prototype lower trophic level ecosystem model for comparison of different ecosystems in the North Pacific to be held in Nemuro in February.
   b. A 2-day ICES/PICES Zooplankton Production Ecology Workshop to be convened in Hawaii in March.

BASS Task Team Report

Co-Chairmen: Dr. Richard J. Beamish and Prof. Makoto Terazaki

1998 Accomplishments

- Publication of 1997 Symposium Proceedings

  - The symposium proceedings will be published in a special issue of *Progress in Oceanography* at no cost to PICES (for publishing).

  - All papers have been received except for one. This paper will be submitted by mid-December.

  - We have also received a paper by Banse and English on phytoplankton seasonality in the eastern and western subarctic Pacific and the western Bering Sea. This paper was not part of the symposium but will be included in the proceedings.

1999 Planned Activities

- the Co-Chairmen of BASS, R. Beamish and M. Terazaki, have both asked to be replaced. BASS nominates Gordon A. McFarlane (Canada) and Andrei S. Krovnin (Russia) as the new Co-Chairmen.

- In 1999, we propose to (1) identify new BASS members to assist in the development of a long-term work plan for BASS and (2) hold a special workshop to develop a conceptual model of how subarctic gyres work and how they change with regime shifts.

- Assign BASS representative to coordinate provision of a list of annual cruises to PICES, through contacts in each member country and through other organizations such as NPAFC, GLOBEC, etc.

- BASS received a proposal on an iron fertilization experiment from C.S. Wong.

- BASS recognizes iron limitation as an important unanswered question in the North Pacific and at last year's meeting identified this as an area requiring further research

- BASS recommends that CCCC-IP brings this proposed experiment into the CCCC Program and provides support to meet the goals of the experiment by identifying national expertise from PICES nations that could assist in carrying out the experiment.

BASS Workshop: *Development of a Conceptual Model of the Subarctic North Pacific Gyres*

Objective: Determine how the ecosystems of the subarctic North Pacific gyres function and how they respond to regime shifts.

Outline:
- Workshop format will be similar to the 1997 REX Workshop.
- We will use the information brought together in the BASS Symposium volume to identify research questions and opportunities.
- A conceptual model comparing the two gyres will be developed.
- The initial focus will be on three areas of research:
  - physical structure of the gyres in relation to climate change;
  - long-term changes in plankton abundance and species composition;
  - trophic relationships; fish, birds, mammals.

Participants:
- Representatives from each country
- Invited participants with expertise in these areas of research

Venue: TBA
Duration: 2 days
Organizers: Gordon A. McFarlane and Andrei S. Krovnin

MODEL Task Team Report
Co-Chairmen: Drs. Sinjae Yoo and Ian Perry.

1998 Accomplishments
- Home page
  Directory of existing circulation models and outputs for embedding ecological models has been contructed. Information includes the contact point, area, resolution, related publication, etc. Currently 5 basin models and 3 regional models are listed.

  Web site address:
  http://pices.ios.bc.ca/new/newf.htm

- Lower trophic level model workshop
  A small workshop was held during October 14-15, 1998, to deal with model-comparison issues and to gather information for nutrient data bases.

- Model-comparison
  - The participants discussed about related JGOFS/GLOBEC activities after reviews were presented. They agreed that: i) Models with too diverse structures might be difficult to compare, and ii) comparison protocols are necessary to tackle the problem.

  - Model behavior with different combination of formulations were presented by Dr. Michio Kishi. A lower trophic model of the Equitorial Pacific was presented by Dr. Dick Dugdale.

  - The participants recommended development of a prototype model and comparison protocols as a long-term activity.

- Availability of nutrient data bases
  Presentations were made on nutrient data availability of NODC holdings, ship-of-opportunity program, Station "P" , PROBES, and Japanese national data base.

1999 Planned Activities

- A prototype model (with 12 compartments as was recommended in Nemuro Workshop) executable on web will be made available by June 1999, by Dr. Kishi.
- The model will be applied to more than two sites, including Station P and Sanriku area and will be compared with the Bering sea ecosystem model.
- Directory home page will be continuously expanded to include more regional models.
- Directory of nutrient data base will also be added to the home page.

Recommendations to Science Board

- Approve new Co-Chairmen: Drs. Dan Ware and Michio Kishi.
- Publish the workshop report as a part of PICES Scientific Report Series.
- Facilitate model activities using the MODEL home page, which will include directory of circulation models and nutrient data base, and prototype lower trophic level model.
- Facilitate interactions with JGOFS/GLOBEC modeling activities.
- Convene a workshop on the development of prototype model and comparison protocols.

PICES-GLOBEC/Lower Trophic Level Model-ling Workshop: *International Workshop on Prototype Lower Trophic Level Ecosystem Model for Comparison of Different Marine Ecosystems in the North Pacific*

Objectives :

- To develop a prototype lower trophic level ecosystem model for comparative study on marine ecosystems in the North Pacific;
- To develop model comparison protocols.

Outline of planned activities:

- Pre-workshop collaboration in Kushiro
- Presentation of prototype model
- Demonstrate applicability of the prototype model by comparing lower trophic ecosystem dynamics among different study sites of CCCC Program
- Comparison of the prototype model with other models
- Identification of necessary process study and monitoring
- Planning of application to higher trophic models, regional circulation models, and JGOFS models

Venue: Nemuro, Hokkaido, Japan
Time & Duration: Early 2000 (Feb.?), 3 days
Funding Sources: PICES, Nemuro, JSTA
Organizing Committee (tentative): Drs. Sinjae Yoo, Michio Kishi, Dan Ware, Makoto Kashiwai, Bernard A. Megrey, Richard Dugdale, Jeffrey M. Napp

MONITOR Task Team Report

Co-Chairmen: Drs. Yasunori Sakurai and Bruce A. Taft

1998 Accomplishments

The MONITOR Task Team was formed during 1998. A workshop was held just prior to PICES VII to outline the present monitoring activities in PICES nations and to identify future monitoring needs and intercalibration experiments that might need to be conducted. Task Team members and others contributed to the workshop. The workshop was successful with 15 papers presented including GLOBEC monitoring plans. A workshop report will be prepared and published in the PICES Scientific Report Series. Based on the presentations and discussions at the workshop and during the Task Team meeting the following monitoring activities were outlined for the upcoming years.

Geographic coverage of monitoring in the subarctic N. Pacific

Sampling in NW Pacific is more dense than in the NE Pacific. The first priority is to increase coverage in the east and maintain present monitoring in the west.

ACTION (inter-sessional): Construct time (monthly)/space break-out of present monitoring shipboard observations to clearly reveal gaps. This document will be used to guide the Task

Team in designing an improved monitoring system.

RECOMMENDATION: The present time series in PICES area must be maintained. For example, Central Pacific sampling lines now occupied by research ships *Oshoru Maru* and *Hokusei Maru* must be continued with replacement ships, if these ships are pulled out of program.

Continuous plankton recorder

There are few large-scale zooplankton data sets collected in the NE Pacific. Ship-of-opportunity (SOP) continuous plankton recorder (CPR) observations provide an attractive method to obtain these data. The SOP/CPR is capable of sampling a long track in both winter and summer (sample annual cycle) and it efficiently samples a part of the zooplankton community that does respond to climate variability.

ACTION (inter-sessional): Prepare a white paper on the use of CPR in PICES region.

PALACE float array

The US has plans (ARGO) to deploy PALACE floats (measure temperature and salinity profiles and velocity at 1,000 m) in the North Pacific as part of a global measurement program. Sampling resolution is 300 km in space and 10 days in time. The North Pacific array will be deployed late in 2000. The ARGO temperature and salinity data between the surface and 1,000 m in the PICES region will provide a vital climatic data set. For example, at the present time we do not have a large-scale description of the depth and strength of the halocline in the subarctic.

RECOMMENDATION: PICES support the ARGO plan to begin subarctic North Pacific PALACE float deployment in 2000.

Zooplankton time series

Many types of sampling gear have been used to collect zooplankton abundance data in the open ocean and coastal regions of the North Pacific. Adequate intercalibration data for many of these sampling systems do not exist and the time series are flawed by systematic errors.

ACTION (inter-sessional): Prepare a report on the sampling gear used in the North Pacific and the status of the calibration data. Based on the report, we will develop a plan for obtaining needed calibration data.

Biophysical moorings

In September 1998, an ATLAS mooring, modified for the subarctic N. Pacific, was deployed at station PAPA to test the system for survivability. It will be replaced in September 1999. The test mooring has only meteorological and subsurface physical sensors.

RECOMMENDATION: At the completion of the engineering studies, moorings with a complete suite of meteorological, biological, and physical sensors should be designed and installed near the centers of the Alaska Gyre and the Western Pacific Gyre.

ACTION (inter-sessional): Task Team will prepare for a discussion of the optimum set of biological sensors to be installed on the mooring.

Zooplankton production

There is very little monitoring data on the variability of zooplankton production in the subarctic.

ACTION (inter-sessional): The Task Team will prepare for a discussion of the need for an expanded monitoring of zooplankton production in the subarctic. Specific suggestions for the design of a monitoring system will be addressed.

Regime-shift description

There was a substantial delay between timing of 1976-77 regime shift and its recognition by scientists and assessment of its impact. An interesting question is whether there were precursors that were overlooked. Analysis of data at the time of the transition will provide insight into what type of monitoring will improve our description of the shift.

RECOMMENDATION: PICES should sponsor a workshop to review physical and biological characteristics of regime shifts and the extent to which various elements of the ecosystem were affected.

Next meeting
The 1999 meeting of the Task Team will address the above items as well as others that will be suggested during the year.

REX Task Team Report
Co-Chairmen: Drs. Anne B. Hollowed, Vladimir I. Radchenko and Tokio Wada

1998 Accomplishments
- The PICES Climate Change and Carrying Capacity Workshop on the Development of Cooperative Research in Coastal Regions of the North Pacific was published as PICES Scientific Report No. 9.
- A 2-day workshop on climate effects on small pelagic species was convened prior to the PICES VII Annual Meeting, in Fairbanks, Alaska (see attached report).
- A scientific session highlighting research findings of GLOBEC and GLOBEC-like programs was convened in the PICES VII Annual Meeting.

Short-term recommendations for future work
- REX recommends that William Peterson replace Anne Hollowed as REX Co-Chairman.
- Collate and synthesize small pelagic species data for comparative studies. Initially, this could involve the exchange of scientists **(or a workshop)**, data assembly, and development and application of analysis tools. The purpose of exchanging scientists is to:

  - Facilitate a comparative analysis of larval and juvenile vital rates of **Pacific herring** from different regions of the North Pacific and its adjacent seas.
  - Facilitate comparative studies of the life pattern of dominant zooplankton species **(especially euphausiids and calanoids (*Calanus, Neocalanus*))** .

  REX will conduct a two day workshop for these purposes just prior to PICES VIII in Vladivostok, Russia. We anticipate that 12-15 scientists would participate in the workshop and request that PICES provide some funds (for 2 scientists) to attend this meeting and facilitate this exchange.

- REX recommends that the report of the REX Workshop on "Small Pelagic Species and Climate Change" be published in the PICES Scientific Report Series.

- Compile a summary of the sampling strategies and methods used to assess the stocks of small pelagic species.

- Continue to encourage discussions of small pelagic species through REX Task Team. Conduct a CCCC symposium on small pelagic species for the year 2000.

- REX endorses the proposal for a meeting to review the 1976/77, and 1988/89 regime shifts and will assist in preparing for this symposium.

- REX encourages a review of the relationship between El Niño events and regime shifts.

Long-term activities
- PICES Scientfic Report No. 9 provides long-term research questions and activities.

- REX highlights the recommendation for compiling a catalogue of historical samples and data sets which are not yet analyzed or readily available as a high priority activity. **Initially, this could be done for egg and ichthyo-plankton samples and catch data by research vessels.**

REX Workshop in 1999: *Herring and Euphausiids*

Background

Herring and euphausiids are key species of coastal ecosystems in the sub-arctic region in the North Pacific. Juvenile herring is a predator of euphausiids, but it is a competitor with euphausiids for copepods such as *Calanus* and *Neocalanus* as common prey. The biomass fluctuations of euphausiids usually correspond well with changes in primary production, and it is suggested that biomass fluctuations are strongly affected by climate variability. Changes in euphausiid biomass affect the growth of juvenile herring, and eventually determine the degree of winter mortality. At the same time, predation mortality of juveniles by hake or pollock, etc. is also changed because these predators also feed on euphausiids. Therefore, to examine the ecosystem response, we must know the dynamics of the herring - euphausiids inter-action through the comparative studies among areas in the sub-arctic region in the North Pacific.

Proposal

In the workshop, for the major herring populations in the Pacific Rim, we will compare the population dynamics, then identify the fluctuation pattern and changes in life history parameters with climate variability. We also analyze the food web by area, and try to compare the ecosystem response to climate change by developing a simple trophodynamic model.

Venue: Vladivostok, Russia
Time: 2 days just prior PICES VIII
Tentative Co-Conveners: William Peterson (U.S.A.), Vladimir I. Radchenko (Russia) and Tokio Wada (Japan)

Summary of REX Task Team Workshop "Small Pelagic Species and Climate Change" Oct.16-17, 1998, Fairbanks, Alaska, U.S.A.

Participants: K. Asano, Richard D. Brodeur, E. Brown, I. Hara, Douglas E. Hay (Co-Convener), Anne B. Hollowed, B. Holladay, Makoto Kashiwai, T. Kishida, H. Lee, Bernard A. Megrey, Michael M. Mullin, H. Nshida, Brenda Norcross, S. Ohshimo, Vladimir I. Radchenko (Co-Convener), Yasunori Sakurai, S. Thornton, Ling Tong, H. Yamada, Orio Yamamura, Tokio Wada (Co-Convener), Chang-Ik Zhang

Objectives

The REX Task Team convened a workshop October 16 - 17, 1998. The objectives of the workshop were:

- to compare the present findings on the response of small pelagic species to ocean climate changes in the PICES areas, and
- to encourage the research collaboration among member countries through identifying key hypotheses and research methods suitable for testing the hypotheses.

Workshop schedule

1st day:
- Present findings on the response of small pelagics to ocean climate changes

2nd day:
- Present situation in GLOBEC and GLOBEC like programs related to small pelagics in each country
- Discussion on key questions, key hypotheses, and recommendations

Present findings on the response of small pelagics to ocean climate changes

Nine papers were presented from seven areas of the PICES region.

Tokio Wada. A Population dynamics model for Japanese sardine - Why the sardine shows such a large population fluctuation?

Larry Jacobson. Biological production, variability, and standards for sustainable yield in the great sardine and anchovy stocks (presented by T.Wada)

Makoto Kashiwai. Carrying capacity change of Oyashio shelf ecosystem with disappearance of Japanese sardine

Seiji Ohshimo. Acoustic estimation of biomass of the small pelagic fishes in the East China Sea

Douglas Hay. Changes in the timing and distribution of herring spawn in British Columbia: An impact of climate change?

Vladimir I. Radchenko. Scale and causes of growth of the Pacific herring abundance in the western Bering Sea in 1990s

Richard D. Brodeur. Forage fishes in the Bering Sea: distribution, species associations, and biomass trends

Hiroshi Nishida. Effect of short-term fluctuation of water temperature on fish-catch by set-net fishing around Awa-shima Island, the Sea of Japan

Yasunori Sakurai. Which is responsible for fluctuating squid catch rates - fishing or climate change?

Brenda Norcross kindly presented her work on herring recruitment model in the Prince William Sound. E. Brown also talked about her work on biomass assessment for small pelagic fishes using aerial observation and acoustic survey in their area. Their formal title will be listed later.

Present situation in GLOBEC and GLOBEC like programs related to small Pelagics in each country

Present situation of the on going and planed programs were reported from Canada, Japan, Russia, and U.S.A. by participants.

Key questions and hypotheses discussion points

Participant addressed the following as the discussion points to identify key questions:

- Recruitment prediction
- Spatial studies: Nursery / spawning areas
- Size at age / somatic growth
- Species alternation
- Assessment / sampling methods

Key questions

Participants considered the following key questions which were related to higher trophic levels and addressed in CCCC Implementation plan as the basic key questions.

- How do life history patterns, distributions, vital rates, and population dynamics of small pelagic species respond directly and indirectly to climate variability? (PICES Scientific Report No. 4)
- Do small pelagic species respond to climate variability solely as a consequence of bottom-up forcing? Are there significant intra-trophic level and top-down effects on small pelagic species? (PICES Scientific Report No. 4)

Participants addressed the following as the questions specific for small pelagic species:

- Do small pelagic species respond in the same way between high and low latitude and longitude?
- Can we distinguish between changes induced by climate change and those changes related to fishing other anthropogenic, or intrinsic biological variation?
- How does small pelagic fish community structure vary with oceanographic conditions?
- Do small pelagic species in the eastern and western Pacific exhibit similar patterns of year-class strength?
- Does spawning time (duration) and spatial range change with stock abundance and size structure?
- Does size at age change with stock size?

Key hypotheses

In the last REX Workshop, the mid-water and demersal fish group considered the principal mechanisms underlying the fish species response to climate variability, then they addressed key hypotheses that correspond to each mechanism. Participants in the present workshop adopted that approach, and identified starvation, transport, concentration, prey suitability, prey type, competition, and predation mortality as the mechanisms that determine survival in the early life stages. Participants also considered that changes in distribution and growth rate resultant of climate change in adult stage affect to the survival of early life stages. Hypotheses linking climate variability and small pelagic species response can be stated as follows:

1. STARVATION:
   a. Survival of small pelagic fish larvae depends on matching hatch dates with the peak zooplankton production (i.e. the match mis-match theory).
      Factors that alter the timing of the spring bloom can influence "the match mis-match" between first feeding larvae and prey availability.
   b. Survival of small pelagic fish larvae and juveniles depends on sustained secondary production through out the spring and summer months.

2. TRANSPORT:
   a. Survival of small pelagic fish larvae depends on advection to favorable nursery grounds. Atmospherically driven shifts in large scale circulation patterns can impact recruitment success by changing larval distributions.
   b. Survival of small pelagic fish larvae depends on advection to favorable nursery grounds. Density dependent or climatically induced changes in spawning grounds can impact recruitment success by changing transport conditions in time and space.

3. CONCENTRATION:
   Survival of small pelagic fish larvae depends on mesoscale advection patterns that concentrate larvae and their prey. Mesoscale features such as eddies or frontal systems concentrate prey and enhance larval survival.

4. PREY SUITABILITY / COMPETITION:
   Survival of small pelagic fish larvae depends on the availability of the appropriate prey species at suitable size for consumption. Existence of other small pelagic species affect the survival through the competition for common food resources.

5. PREDATION MORTALITY:
   a. ADVECTION: Survival of small pelagic fish depends on advection processes that separate larvae and juveniles from their predators.
   b. SIZE DEPENDENT MORTALITY: Processes that enhance larval and juvenile growth rates will reduce predation mortality by reducing the time when larval or juvenile fish are vulnerable to predation.
   c. PREDATOR / PREY OVERLAP: Processes that separate predators from larvae and juveniles of small pelagic species influences the amount of predation mortality.

6. MATERNAL FACTOR:
   Survival of small pelagic fish larvae depends on maternal factors, such as fecundity, egg quality, mature age, and others, which are dependent on the physiological condition of adult and that is influenced by climate variability.

Recommendations

To facilitate the research cooperation for testing hypotheses, participants made following recommendations:

- Conduct comparative analysis of larval and juvenile vital rates of small pelagic species from different regions of the North Pacific and its adjacent seas.

- Collate and synthesize small pelagic species data for comparative studies. Initially, this could involve the exchange of scientists, data assembly, and development and application of analysis tools. Hopefully, this could be accomplished in 1999.

- Choice of scale should be carefully chosen to detect mesoscale response.

- Conduct comparative studies of stock structure of small pelagic species in the North Pacific. Specifically, we recommend analysis of genetics of small pelagic fish stocks to evaluate the potential for climate influence on marginal populations and stock separation.

- Define a suitable sampling protocol for use in assessing the distribution and ecology of small pelagic species.

- Examine sampling characteristics of gear: e.g. availability, selectivity, catchability.

- Choose sampling methods and technologies that are suitable for the temporal and spatial scales of the question.

- Continue to encourage discussions of small pelagic species through REX Task Team. Conduct a CCCC symposium on small pelagic species for the year 2000.

- Maintain an inventory of scientists active in small pelagic species research (perhaps activity for TCODE)

- Consider hake, pollock, and non-commercial species (e.g. sandlance, eulachon) in the small pelagic species discussions.