

REPORT OF MONITOR TASK TEAM

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Overview of activities during PICES X

The MONITOR Task Team convened three sessions during PICES X: (1) the *Continuous Plankton Recorder* Advisory Panel meeting (*MONITOR Endnote 1*); (2) a MONITOR Workshop on *Recent progress in monitoring the North Pacific*; and (3) the MONITOR Task Team business meeting. Discussion topics included action items arising from the 2001 PICES/CoML/IPRC Workshop on *Impact of climate variability on observation and prediction of ecosystem and biodiversity changes in the North Pacific*, further discussion of presentations at the MONITOR Workshop, strategies for designing and maintaining long-term ocean monitoring programs, and development of MONITOR's recommendations to PICES.

MONITOR recommendations to the CCCC-IP

MONITOR strongly endorses the concept of a PICES North Pacific Ecosystem Status Report. Such a report will demonstrate to users and national funding agencies the importance of low frequency change in the ocean. It will also provide stimulus and design guidelines for developing regional programs, some of which (e.g. EVOS/GEM) have large, secured funding bases, but are seeking expertise and precedents in monitoring system development.

MONITOR proposes to convene an inter-session workshop on *Voluntary observing systems* in early 2002, in Corvallis, Oregon, or Seattle, Washington, U.S.A., and requests travel support for 3 scientists (out of a probable attendance of 20). Topics include:

- Define/describe a "basic suite" of North Pacific ecosystem monitoring variables and measurement locations; and
- Measurement technologies for platforms of opportunity.

At PICES XI (October 2002, Qingdao, People's Republic of China), MONITOR proposes to convene a full-day workshop (or two half-day workshops) addressing two topics (either or both could be held jointly with the GLOBEC Open Science meeting):

- *Requirements and methods for "early detection of ocean changes"* and
- *Monitoring from moored and drifting buoys*

MONITOR continues to endorse the PICES CPR (Continuous Plankton Recorder) North Pacific Pilot Program (*MONITOR Endnote 1*), and supports addition of value-added measurements such as surface and sub-surface water properties, visual observations of seabirds and mammals, and analytical links to remote-sensed variables such as ocean color and sea surface elevation to the Program.

MONITOR recommends close liaison with Coastal GOOS and NEAR-GOOS, and specifically inviting representatives of these programs to the upcoming MONITOR workshops.

MONITOR supports PICES' cooperation with the Data Buoy Co-operation Panel (DBCP), and the establishment of a *North Pacific Data Buoy* Advisory Panel sponsored collaboratively by PICES and DBCP (see *GC Appendix C* for terms of reference).

Themes for PICES XI and joint activities with GLOBEC

Two workshop themes for next year's MONITOR workshop were proposed and accepted:

Requirements and methods for "early detection of ecosystem change": What variables need to be measured to detect changes to new ocean "regimes"? Are these site-specific or generalizable? In addition to being a CCCC

objective, and a proposed addition to the MONITOR Workplan, this topic is similar to the one proposed as a session in the GLOBEC Open Science Meeting.

Technologies for monitoring from moorings: As time on manned research vessels becomes increasingly scarce and expensive, other monitoring platforms need to be explored. Moored and drifting buoys offer the potential for improved spatial and temporal coverage, especially of open ocean locations. What sensors are available now? What could become available in the near future? What are the options and limitations for data storage and transmission?

Further development of the CPR time-series

MONITOR discussed ways to broaden the suite of measured variables, evolving the CPR Pilot Program toward a diverse “measurements of opportunity along repeated lines”. Suggestions included additional flow-through sensors mounted on the ship, visual observations of birds and mammals, subsurface sampling using XBT and/or XCTD, and coordination/data sharing with other existing North Pacific programs. An inter-session workshop *Voluntary observing systems* was proposed to examine new and existing vessel-based sensor technologies.

Time-series at risk

Participants noted the following programs that were either likely to be canceled or were about to undergo substantial change:

- PMEL mid-shelf mooring in the Bering Sea;
- Japanese time-series station KNOT in the western gyre;
- Japanese summer cruises in the North Pacific are experiencing cutbacks in the number of ships and number of sea-days. Lines along 170°E and 175°30'E are already being dropped; and
- Mexican IMECOCAL has only 3 more years of funding, and is limited by the size of its present vessel.

Liaison with Data Buoy Cooperation Panel

MONITOR endorsed a PICES linkage with the WMO-IOC Data Buoy Cooperation Panel, via the POC Committee.

Liaison with GOOS

The Living Marine Resources Panel of international GOOS has merged with Coastal GOOS. Planning for monitoring in continental margin regions is developing well. The prospects for active ecosystem monitoring of the open ocean are less clear. Representatives of an expanding regional program (GEM) stressed the important present and future role of PICES in providing expert advice and example in the design of ocean monitoring programs. MONITOR recommends close liaison with Coastal GOOS and NEAR-GOOS, and specifically inviting representatives of these programs to future meetings.

Interactions with the PICES Advisory Panel on Marine birds and mammals

This group of scientists is very interested in placing observers on ship-of-opportunity platforms, including those used by the CPR Pilot Program. Drs. Hidehiro Kato and Sei-ichi Saitoh presented results of a feasibility study on video censoring of marine mammals. Detection rates from video replays are at present much lower than those by experienced live observers.

North Pacific Ecosystem Status Report

Creation of such a report was a major recommendation from the PICES/CoML/IPRC Workshop on *Impact of climate variability on observation and prediction of ecosystem and biodiversity changes in the North Pacific*, and continues to be broadly endorsed by MONITOR attendees. Major discussion points were:

- The report should be updated regularly (not just a one-time assessment), should include analysis and interpretation as well as data, and should attempt to cover “physics-through-fish”.

- Several regional precedents and prototypes were noted, including the annual CalCOFI report, the annual Canadian PSARC “State of the Ocean” report (<http://www.pac.dfo-mpo.gc.ca/sci/psarc/OSRs/Ocean%20Status%20Reports.htm>), and reports by the European Oslo and Paris Commission (OSPAR) on the North Atlantic (<http://www.ospar.org>). Data from Japanese time-series off Hokkaido (Line A) and in the oceanic North Pacific (Hokkaido University summer cruises) are being made available in electronic format.
- Some of the PICES TCODE website links need to be updated.
- On the possible form and function of PICES Regional Analysis Centres (RACs), participants noted that data-producers are more likely to contribute to a RAC if they are able to use it, and the need for search and visualization tools was indicated. One good example is the combination of web-based data and tools being developed by the Human Genome Project.

Scientific and funding strategies for starting and maintaining long-term observation programs in the North Pacific

This was a broad and open-ended concluding discussion touching on several of the above topics. Issues included:

- Risks and benefits of programs dependent on multilateral “partnerships”;
- Attention spans of funding agencies versus time scales of ocean variability;
- Standardization issues: spatial and temporal variations in sampling and analysis methodologies; and

- Linkages to shorter-term process and modelling studies.

MONITOR “Report Card” - progress toward our objectives

Identify existing coastal and open ocean observations: Good progress (see PICES Scientific Report 18), but need closer links to TCODE and regional programs on data availability.

Develop and promote long-term observation programs inside or outside GOOS: Good progress within the PICES community, but need outreach to users. Should PICES take a lead for basin scale efforts?

Inter-calibration and standardization: Fair progress, but need to decide the “basic suite” of measurements before putting major effort into protocols. Changes in methodology run a risk of orphaning existing time-series.

Report from SAHFOS

Dr. P. Christopher Reid, Director of SAHFOS, gave a brief report on changes observed in North Atlantic zooplankton by CPR results. The principle observation is that recent decades, particularly the 1990’s, show a northward displacement of the boundary between cold temperate species (e.g., *Calanus finmarchicus*) and warm temperate species (e.g., *Calanus helgolandicus*). The extent and intensity of this change are impressive and consonant with expected effects of global warming.

MONITOR Endnote 1

Report of Continuous Plankton Recorder Advisory Panel

The meeting convened from 13:30-17:30 hours on October 5, 2001. The participation list appears as *CPR Endnote 1*.

Meeting summary

Dr. Sonia D. Batten reported on completion of the second year of CPR sampling on the Valdez to Los Angeles line (5 transects from April through September this year) and on a Vancouver to Japan line (1 transect in June). Sampling was successful and the results are scientifically informative. Continued funding for 2003 appears likely from the EVOS Trust Council, but is not definitely promised as yet. The Panel recommends that PICES approve addition of one or two bird-mammal observers on the Vancouver to Japan run for 2003. The Point Reyes Bird Observatory will undertake to provide trained observers for one trip on a trial basis. The principal investigators will approach the shipping company for cooperation. Success will lead to proposals for funding to extend this project to later years. Discussion of techniques for enhancing instrumentation for volunteer observing ships (VOS) guides the Panel to recommend that PICES sponsor a small workshop on VOS instrumentation. A brief report on recent evaluations of Atlantic CPR results was offered by Dr. P. Christopher Reid of SAHFOS.

Report on current CPR work

A clear and sophisticated report was received from Dr. Batten on the second year of CPR results, principally from the north-south line from Valdez to Los Angeles. Towing was largely successful (~95% of planned samples) on six roughly monthly transits in 2001. Every fourth sample has been counted for dominant species and species groups of zooplankton and larger phytoplankton, together with color evaluation for chlorophyll. Results again show a north-south trend in timing of development in interzonal migrating copepods (*Neocalanus* and *Eucalanus* species), given stages in the annual life cycle being reached earlier to the south than

to the north. There appear to have been differences in abundance and timing of seasonal events between 2000 and 2001. However, evaluation of the interaction between timing of sampling, timing of events and actual interannual differences will require further analysis. Evaluation of the east-west line is in progress. As planned by the CPR Panel at its 2000 meeting, sample collection was extended into the Asian coastal zone in 2001.

One north-south sample series was analyzed entirely, all samples were counted. This spatial data series was examined for auto-correlation and none was found. In the terminology used in the report, the "decorrelation length scales" were very short. This is somewhat surprising, since the recorder sampling process should produce a mechanical running average among adjacent samples and, thus, some auto-correlation regardless of abundance patterns along the ship track. Consideration of this data set will continue. Dr. Batten reported that a paper on the North Pacific CPR results has been submitted to *Fisheries Oceanography*.

Funding

The Panel discussed plans for continued funding of the CPR survey in 2002 and beyond. A proposal is under review by the EVOS Gulf of Alaska Ecosystem Monitoring and Research Program (GEM). Discussion from EVOS representatives indicates that funding is reasonably likely, although not assured. It is hoped that the 2002 funding will provide a bridge to longer-term funding under the GEM. Funding from the same source is anticipated by Dr. Thomas C. Royer to support a thermosalinograph and fluorometer system on the tankers that are towing the CPR.

The Panel also recognized the desirability of incorporating more agencies and nations to support the CPR program. Some support is already coming to the east-west line from sources directed by Prof. Takashige Sugimoto of Japan. The Panel will seek to continue that.

Submission of proposals to Fisheries and Oceans Canada and NOAA-U.S.A. was discussed and may proceed.

There was discussion of the importance of changes in the operation of the tanker fleet. Tankers owned by ARCO have been sold to Polar Tankers, and are now used by ARCO-BP on a lease basis. This change requires some re-negotiation of the agreement to tow CPRs on the Valdez-Los Angeles line in 2002 and beyond. The importance of undertaking negotiations through the standardized SAHFOS process was emphasized. The work is done by Captain Peter Pritchard who has extensive experience with shipping companies and with shipboard personnel.

Bird-mammal observers

Drs. William Sydeman and David Hyrenbach of Point Reyes Bird Observatory (PRBO) presented the possibility of adding observers to the CPR Program to make standard bird abundance estimates along the ship tracks. The census technique is standardized, following guidelines established some years ago by Mark Tasker for the North Sea. Drs. Sydeman and Hyrenbach felt that PRBO could provide observers for initial work in 2002 without additional funding. The Panel is enthusiastic about this. The feasible scale of trial observations appears to be placement of an observer or two just on the east-west run from Vancouver to Japan. The Panel agreed to attempt this. Dr. Batten will approach the ship operators, seeking an agreement in principle, to include seabird observers on the 2002 east-west run. If this is successful, funds will be sought for more extensive seabird counting in 2003 and beyond.

Improved instrumentation

There was an extended discussion of the possibilities for generating enhanced data series from ships of opportunity (SOOPs), also known in the meteorological community as volunteer observing ships (VOS). VOS seems the preferable acronym and is adopted here. There is now an extensive suite of equipment for making along track observations from either

towed, sea-chest or masthead instrumentation. The following partial list shows how extensive the possibilities are:

- Thermosalinographs
- Periodically self-activating XBT's and XBCT's (WOCE system, D. Cutchin)
- Fast repetition rate fluorometry (phytoplankton production potential)
- Simple fluorometry (chlorophyll)
- Bridge wing LIDAR fluorometry (upper ocean pigment profiles)
- Continuous Plankton Recorders (CPR, in use, modernized versions including multiple depth samplers available)
- Optical plankton counting (zooplankton counted by size category)
- Acoustic zooplankton abundance (problematic, especially at 17 to 20 kts)
- Video Plankton Recorder (VPR, C. Davis)
- Continuous underway Fish Egg sampler (CUBES, D. Checkley)
- Automated, repetitive nutrient analysis (nitrate, phosphate, others)
- Solar isolation
- Water column spectral irradiance
- Total light attenuation and absorbance at multiple wavelengths (e.g., Wetlabs AC9)
- Partial Pressure of dissolved CO₂
- And others!

After extended discussion, the Panel recommended that PICES sponsor a small workshop on VOS instrumentation. This recommendation has the following stipulations:

The focus of the workshop will be on existing state-of-the-art instrumentation. Participants should involve manufacturers and users already deploying suitable instruments, including those with current VOS packages. Concerns include the potential of instruments to produce stable data (unchanging for given instrument types at identical field values over intervals up to a century). Data collection schemes (computerized data assimilation), instrument integration, and untended reliability are key issues. The second of these points led to a suggestion that participants be invited from some or all of the following groups (subject to revision):

- Paul Allen - sea chest instrumentation for cruising yachts
- Otis Brown, Miami - cruise ship program
- Nancy Wheatley, Royal Caribbean Cruises, Inc.- instrumentation of Alaska Inside Passage cruise ships
- Tom Rossby, URI - instrumentation of *Oleander* on New York-Bermuda run
- Tom Hayward and Greg Mitchell, SIO - enhanced CalCOFI instrumentation
- MBARI - instrumenting AUV's

Since current interest is centered along the North American coast, the workshop would probably best be held there, but Asian participation would be desirable. A total of about 25 participants are expected at a workshop to be held in spring of 2002. If the PICES Governing Council approves this recommendation, the Panel will seek funding from American and Canadian sources. The Panel will be looking to establish a basis at the same time for funding of an actual advanced instrumentation package for VOSs.

CPR Endnote 1

Participation List

Members:

Sonia D. Batten (UK)
 David L. Mackas (Canada)
 Charles B. Miller (U.S.A., Chairman)
 Jeffery M. Napp (U.S.A.)
 David W. Welch (Canada)

Observers:

Robin Brown (Canada, TCODE Chairman)
 George L. Hunt (U.S.A.)
 David Hyrenbach (U.S.A.)
 Patricia Livingston (U.S.A., Science Board Chairman)
 Phillip Mundy (U.S.A., GEM)
 P. Christopher Reid (UK)
 Thomas C. Royer (U.S.A.)
 Sei-ichi Saitoh (Japan)
 Robert Spies (U.S.A., EVOS Trust Council)
 William Sydeman (U.S.A.)

(A few more people attending only toward the end of the session were not recorded.)