CLOSING PLENARY DISCUSSION AND RECOMMENDATIONS

Participants discussed the common themes and gaps identified in the breakout group reports and made recommendations for PICES action on several items.

North Pacific Ecosystem Meta-database

The most common recommendation of the breakout groups dealt with ensuring that the time-series information and scientific contacts identified at the workshop be recorded and updated in the North Pacific Ecosystem Meta-database in which TCODE has already placed the PICES long-term time-series `information. This meta-database, originally titled the "Bering Sea Ecosystem Meta-database", was initiated by two US researchers to provide a means of promoting scientific collaboration and research on the Bering Sea. Direct links to data are only available if the researcher wishes to make it assessable. Otherwise, the meta-database provides information on who to contact about the data.

Participants endorsed the proposal that the existing meta-database be considered as the PICES North Pacific Ecosystem Meta-database. Presently, the database is maintained and updated by U.S. researchers through various funding sources that will be exhausted by the end of 2001. If it is to be considered as a PICES meta-database, then it was recommended that it be shown as a link on the PICES web site, even if it physically resides on a U.S. server at present.

Further discussion about the database involved details on how to ensure that keyword indices for the database are sufficiently detailed to obtain good quality data searches. It was recommended that TCODE examine the existing keyword indices of this database and suggest revisions. It was also recommended that TCODE explore the OBIS database system, which is being developed under funding by the Sloan Foundation's Census of Marine Life. TCODE should then determine whether the North Pacific Ecosystem Meta-database could be considered a contribution to the OBIS system or whether the Meta-database would require revision to be compatible with OBIS. Funds for future enhancements and maintenance of the meta-database might be obtained through written proposals to the Sloan, Packard, or W. Alton Jones Foundations, which might support this activity. The CoML funding announcement will be coming out in early fall 2001, but it was not clear whether the announcement would include this type of work.

Another issue surrounding the database was how to ensure information on all data (meta-data) presented at this workshop could be entered into the database. Sending database forms for participants to fill out and return might get very low response rates. Participants agreed that the optimal solution would be for the meta-data lists compiled at the meeting to be given to the present North Pacific Ecosystem Meta-database administrators. These people would then do follow-ups with individual researchers to ensure that all meta-data sources are entered into the Meta-database, using the keyword list agreed upon by TCODE.

Data gaps and exchange

It was clear from the breakout group presentations that there were data gaps for many groups, particularly for lower trophic level species. As found in data gathering efforts for other world oceans, there was a noticeable lack of long time-series information in both coastal and open ocean areas for benthic invertebrates, primary production, secondary production, micronekton and small pelagic fish biomass and dynamics. It was also obvious that data collection in the margins (continental shelves) was much denser than in the open ocean. Most sampling methodology used in the long time-series tend to be more traditional, low technology approaches such as continuous plankton recorders and net sampling.

As noted before in many PICES gatherings, participants recognized that no individual country could provide a complete sampling coverage of the open ocean. Nations need to pool observational resources in order to provide a complete program in these areas. One possibility would be to enhance or begin sampling temperature, salinity, chlorophyll-*a*, fluorometry, and plankton (through continuous

plankton recorders and/or optical plankton counters) on ships-of-opportunity. It was recommended that MONITOR Task Team examine pilot projects of this nature and also consider projects for putting biological sensors on Argo floats and buoys, and using commercial fishing vessels for data gathering. Some of the technological and practical problems of adding biological sensors to buoys were mentioned. The Marine Mammal and Bird Advisory Panel (MBM) might also want to consider proposals or projects that relate to video monitoring of birds and mammals along CPR cruises and solving species identification and density estimation problems associated with such a program. Coordinated proposals or discussion between MBM and CPR panels and MONITOR Task Team for these projects should be planned. Technological advancements in various fields will also be the theme of the PICES Eleventh Annual Meeting in 2002, so some of these issues could be examined further at that meeting.

It was recommended that PICES make formal connections with programs that are planning coordinated, technologically-advanced observation and communication systems. The NEPTUNE underwater observatory for the northeast Pacific is a program initiated by the University of Washington that will be a contribution to the "Dynamics of Earth and Ocean Systems" planning effort of the US National Science Foundation. There also exists a separately funded Canadian NEPTUNE program led by several Canadian universities. Other nations, such as France, Germany and Japan, have expressed a strong interest in providing contributions to a global NEPTUNE program. The US Consortium of Oceanographic Research and Education (CORE) Task Team on Ocean Observations has prepared a report on an integrated ocean observation system that should be considered by PICES, and by MONITOR Task Team in particular.

It was also suggested that PICES further exploit scientific platforms-of-opportunity for filling data gaps. This would require more communication among PICES scientists about national cruise plans, particularly in international and transboundary waters, in order to provide more scientific exchange.

To address the technological difficulties in assessing small pelagic fish, it was recommended that FIS Committee consider a new working group to examine this problem and make recommendations on how to improve sampling of these important links in marine food chains.

There was mention of the idea that physical models could be used to fill historical gaps in the data record. Some examples were given of how this is being done by US researchers. Simulation models that include biology could be used to identify important ecosystem components that would warrant increased sampling effort. Other data gaps might be clearer once PICES completes one or two Ecosystem Status Reports and more recommendations might be made at that time with regard to filling identified gaps.

Data exchange was discussed as an issue to bring forward to Governing Council. MONITOR and TCODE, in particular, should consider specific data exchange issues and develop recommendations for Science Board and Governing Council to consider. There was also data exchange issues discussed in relation to the WMO Data Buoy Cooperation Panel. Presently, there are separate web sites and access for buoy data from various PICES nations. It would be of great value to those making ocean predictions to have these data sources joined and linked, through the work of a North Pacific Data Buoy Cooperation Panel, and then linked to the PICES web site.

North Pacific Ecosystem Status Report and Regional Analysis Centers

There was general recognition that the initial North Pacific Ecosystem Status Report would take the form of a "quick" report that might omit substantial interpretation of the observed trends. Some components of the report, such as physical oceanography and atmospheric information, might be updated more frequently (e.g., quarterly) than other components such as fish stock assessments that might be carried out on an annual time frame. Thus, one possibility would be that the report might be updated quarterly on the PICES web site for some components but less frequently for other components. There would also need to be further work on future reports to decide how to provide

objective interpretation and expert opinion of the trends to decision-makers. This is an area that is actively being worked on in some PICES countries and by ICES. We may need to have future workshops to refine a set of quantitative ecosystem change indicators and methods for synthesizing and interpreting results of these change indicators for a target audience that might consist of the interested public and policy- and decision-makers in PICES countries.

Details regarding actual production of the report were discussed. One suggestion was that the analyses should be done and the report prepared by PICES. Another idea was that report sections would be prepared by co-lead authors, one from each side of the North Pacific. Some thought that what we would be doing was similar to what the Intergovernmental Panel on Climate Change (IPCC) is doing. This group bases its assessment mainly on published and peer-reviewed scientific technical literature and individuals contribute ideas. IPCC working group group reports are prepared by co-leaders, with many experts that represent a balance of geographic areas. There is an effort to achieve consensus in the reports and then a set of procedures is followed to accept and approve the report, first by the working group and then by the IPCC. Reports are reviewed by experts and by governments before a final draft is prepared for approval by the IPCC. A summary for policymakers is also prepared and approved. A recommendation was made to contact ICES to look at their structure and procedures for stock and environmental assessments and also how they are proceeding with providing ecosystem advice.

There was a suggestion that the procedure should be to get PICES and other international organizations and their experts together to agree on an assessment. The assessment would then adopt the practice used in stock assessment reviews, where a draft document is provided about 6 months before the meeting for review. A final, revised draft would then be prepared for approval at the annual meeting. The PICES-GLOBEC Climate Change and Carrying Capacity (CCCC) Program was mentioned as the primary PICES group that should be performing these assessments, though it should also be recognized that PICES Working Groups and Advisory Panels would also provide important scientific input to these reports.

The concept of Regional Analysis Centers (RACs) was discussed as a way for PICES to have a central focus for supporting the work involved in producing an Ecosystem Status Report. Participants mentioned two different ways of viewing these centers. One type of RAC would be an actual geographic location and building with staff assigned to it. The other view was that it could be thought of as a virtual entity, such as the Human Genome Project, where a variety of organizations and individuals contribute to the work even though they may not be housed in a common center. (It should be noted that post-workshop review of this revealed that this Project is actually operated in the U.S. through a research institute whose function is to coordinate the research, which may be performed either internally or by other institutions.)

Similarly, the Space Environment Database and Analysis Tools project was mentioned as another model. This project is carried out by the Central Laboratory of the Research Councils of the United Kingdom, which provides the building space for outside researchers, plus its own technical experts to work on joining and interpreting data. Funding for this Central Laboratory is provided mainly by the other Research Councils of the U.K.

Finally, participants thought that although the RAC concept would draw heavily upon a distributed network of scientists to contribute to the work, some central support would still be required to accomplish the work. Initially, one person in the PICES Secretariat might be sufficient to organize and coordinate the work involved in producing an Ecosystem Status Report.