FUTURE – A milestone reached but our task is not done

by John Stein

At this year's Annual Meeting, PICEanS took a major step forward when Governing Council approved the FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems) science plan. Congratulations to all because it was a collective effort that got us to this important milestone. To be more precise, Governing Council gave approval-in-principle to our next integrative science plan, with final approval to come once the final draft is completed: now a top priority. So there is more to do: we have to finish the science plan and then immediately start developing an implementation plan for FUTURE.

The need for a new scientific program in PICES was identified by Science Board at the Thirteenth Annual Meeting in October 2004, in Honolulu, U.S.A. FUTURE was then one of six candidate programs discussed at the Fourteenth Annual Meeting in 2005, in Vladivostok, Russia. It emerged as the preferred option during the course of various meetings in 2006, including the Fifteenth Annual Meeting Open Forum, and culminating in a second Open Forum and a Workshop at the Sixteenth Annual Meeting in 2007, in Victoria, Canada.

Many colleagues have to be acknowledged for their commitment to developing this new, 10-year integrative science plan; however, listing each is not practical. So let me start by thanking everyone in PICES who contributed oral or written comments at Committee meetings or at the Open Fora. Special thanks go to the Writing Team of our Study Group on Future Integrative Scientific Program(s) (SG-FISP): their very active participation led to our new Science Plan. Although it took many months to reach consensus, it was very important to ensure that everyone had an opportunity to express their views in order to produce a plan that most scientists in PICES could support. While some had, and may still have, concerns on various aspects of the objectives or approaches described in FUTURE – that is the nature of science. Finally, my thanks to Science Board and Governing Council for their sustained interest, support and participation at key times as we worked (and occasionally struggled) to arrive at a plan that resonates with PICES goals, is scientifically relevant, and is compelling to the constituents who support our scientific activities. I think we have accomplished these objectives with this science plan.

What is the FUTURE?

FUTURE is a science program to be undertaken by PICES member countries to *understand* the responses of marine ecosystems in the North Pacific to climate change and human activities at basin-wide and regional scales, to *provide forecasts* of what might be expected based on current understanding, and to *communicate* this information effectively to their members and to society in general.

Why is PICES taking this direction?

FUTURE was motivated by a growing societal concern for the future of marine ecosystems, given an increasing awareness of the potential threats to the diverse benefits that are derived from them. The threats include:

- Diminished resiliency and productivity of marine ecosystems and their components;
- Irreparable damage to non-renewable resources;
- Loss (or change) of socioeconomic opportunities;
- Increasing risks and uncertainty.

The combined pressures of climate change and a growing human population, with the associated human activities in and around the oceans, are a major impetus for the central scientific issues. These pressures affect the composition, structure, and function of North Pacific ecosystems in ways that are not completely understood. The rapidity of recent changes is unprecedented in the human experience.

To increase our understanding there is a need to examine closely the mechanisms for an ecological response to change. To be policy-relevant it is a necessary to develop forecasting capabilities of known reliability to quantify both the risks and uncertainties of the consequences of the major pressures. Finally, a strategy is required to communicate those forecasts effectively for their implications to be known and useful in a policy context.

What are the challenges?

FUTURE addresses a large and complex set of problems, to which our member countries must respond. While the trajectory of some of the major effects is known generally, there is great uncertainty about the magnitude of the changes and the consequences of interactions among them. This uncertainty is caused by an inadequate understanding of the mechanisms by which the pressures affect ecosystem composition, structure and function, and the linkages among oceanic, coastal and terrestrial ecosystems. These uncertainties hamper the ability of science to provide reliable estimates of known precision of the future status of the ecosystems of a region. Hence, the goals of FUTURE are to improve these abilities and to communicate expectations effectively. By so doing, science will be more policy-relevant by providing a better appreciation of the consequences of change and variability in the North Pacific.

What are the major questions?

> *"Given current and expected pressures, what is the future of the North Pacific?"*

This overarching question will guide FUTURE's activities for the next decade. Three themes will organize the research to address this question:

1. What determines an ecosystem's intrinsic resilience and vulnerability to natural and anthropogenic forcing?
2. How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?
3. How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?

Expected outcomes

- Better understanding of the processes that link climate, physics, chemistry, biology, and humans to provide a better understanding of how anthropogenic and climate pressures have and will affect ecosystems;
- Better quantitative and qualitative forecasts of ecosystem change, with uncertainty measures;
- Improved scientific basis for managing coastal ecosystems to sustain ecosystem services and to mitigate environmental problems;
- Quantification of the benefits and risks associated with different management strategies;
- IPCC-like reports (*e.g.*, IPCC Part 2) on marine ecosystem responses to climate change;
- Regional assessments of emerging topics (*e.g.*, HABs, eutrophication, ocean acidification);
- Coordinated monitoring and nowcasts of the current state of ecosystems;
- Increased data sharing, access and dissemination, with a focus on coordination and metadata;
- Increased capabilities in PICES member countries.

> *"The challenge is not only to improve our understanding of the North Pacific Ocean, including its climate, biological processes and human activities, but to communicate this information effectively to governments and society at large so they can establish policies and directions that anticipate change."*

With FUTURE, PICES is setting goals that are challenging but can be achieved if we are effective in communicating the value and benefits of FUTURE to agencies and organizations in our member countries. I am convinced that we will be successful if we address the challenges described below. A key ingredient of scientific success is an improved, effective communication of the program's value and benefits to society.

Where do we go from here?

Our first job is to finalize the science plan for final approval by Governing Council. Thereafter, an inter-sessional Science Board meeting and workshop will be held April 23–25, 2008, to begin the implementation phase of FUTURE. A key task is appointing the Implementation Plan Writing Team. The agenda of the workshop will include: discussing the organizational structure for FUTURE, developing a detailed outline for the Implementation Plan, determining the composition of the Writing Team and establishing the timeline.

Once the Implementation Plan Writing Team is in place, PICES will establish dates shortly after the inter-sessional Science Board meeting, with the initial objective of developing a first draft. This approach worked well to develop the implementation plan for the CCCC Program, so I recommend the same approach be used to develop the implementation plan for FUTURE. I expect that a full draft of this plan would be available by September 2008, for review by Science Board, Governing Council and the PICES community. The draft plan could be presented at an Open Forum during the Seventeenth Annual Meeting in Dalian, China, with the intent to seek approval-in-principle from Governing Council at this meeting. If we can meet this timeline, FUTURE would likely begin in early 2009.

In closing, we took a significant step at the last Annual Meeting towards making the next integrative science plan of PICES a reality. While that accomplishment is worth celebrating, there is much to be done in implementing the plan so that it is effective in answering the questions posed in FUTURE. To be effective we must have a structure that builds on the "lessons learned" in the CCCC Program and that can be sustained by the Organization. Finally, the latest IPCC reports have highlighted the value and continued need for multi-national science programs that address key societal questions at multiple scales and devote focused effort on how to communicate the science so that it has clear and tangible benefits to difficult decisions that confront societies. Improved forecasts and understanding of ecosystem responses to human activities and environmental variability will be essential to meet societal needs for establishing sound policies and directions that anticipate change and either adapt to the change or mitigate the impacts where possible. Through FUTURE, PICES can do its part in meeting this challenge, and now it is up to us to deliver, as I know we can.