

## A Proposal for a new Integrative Scientific Program built upon the foundations of CCCC

Few can doubt that climate change due to global warming is beginning to show its effects on our planet. Significant events that many ignored because they were not expected for tens or hundreds of years in the future are now happening all around us today. Among these events are increased incidence of powerful typhoons and hurricanes, acceleration of the melting of glaciers in Alaska, an ice-free southeastern Bering Sea, and an Arctic system that is changing so rapidly that Overpeck et al. (EOS, 86(34):310, 2005) stated that at the present rate, an ice-free Arctic during summer months is a real possibility within this century. Also, the PICES Special Publication, "Marine Ecosystems of the North Pacific", concluded that "during the past five years profound changes have occurred in the North Pacific climate system, in the composition, abundance and distribution of its living marine resources, and in the human societies that depend on the North Pacific Ocean and its resources".

PICES has made great advances toward understanding better some of the potential impacts of climate change on the North Pacific through the first major interdisciplinary initiative, the Climate Change and Carrying Capacity (CCCC) Program. The ultimate goal of CCCC was to forecast the consequences of climate variability on the ecosystems of the subarctic Pacific. Recently CCCC consolidated around two efforts: (1) modeling, and (2) climate forcing of marine ecosystems. Modeling will advance the development of conceptual, theoretical and modeling studies needed for both regional and basin-scale components of CCCC; the climate forcing group will synthesize regional and basin-wide studies and provide a forum for the integration of CCCC-related hypotheses and data.

Here we propose that existing CCCC efforts should continue but that we move from a goal of "gaining a better understanding" to a program with more distinct and measurable products and progress. That is, we must move to a program with these foci: (1) clear exposition and testing of **mechanisms** whereby physical forcing is translated into a biological response, including development and testing of **ecosystem indicators**, (2) development of regional climate change **scenarios** with quantitative estimates of uncertainty, and (3) increased **outreach** whereby CCCC establishes a new human dimensions program that would facilitate translation of our understanding of mechanisms, ecosystem indicators and scenarios into a language understandable to those setting policy, to the media, and to the general public.

PICES has clearly articulated the need for a mechanistic understanding of global change given that this is the theme for PICES 14. Modeling will need to be expanded especially with regards to involvement of PICES scientists in global climate models. Examples would be the Community Climate System Model (CCSM) developed in the US, the HadCM3 developed in the UK, and the CCSR/NIES/FRSGC developed in Japan. Due to increased computer power, such models can now provide useful information on the potential impacts of climate changes and the policy consequences that they imply.

An emphasis on mechanisms, indicators and scenarios coupled with a stronger human dimensions and outreach program would allow PICES to better predict and communicate the outcome of various climate change/ecosystem response scenarios and their uncertainties so that we can better explain the options and consequences of various policy choices to society.

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