PICES FUTURE

Report from COVE AP

18 August 2010, Seoul, Korea
This is a report from COVE AP members who spend a couple of long days in Seoul.....
COVE will be associated initially with the CC-S, WG-20, WG-22, WG-23.

**COVE priorities** might recommend consideration of whether different species, or regional ecosystems as a whole, respond in phase or with time lags to changes in the ocean environment, and whether there are matches/mismatches between forcing and responses based on interannual versus multi-decadal environmental changes.

**AICE and COVE APs will recommend priority tasks** to PICES SB and relevant Scientific and Technical Committees that **establish new PICES expert groups** of build on and extend existing activities in PICES

Three APs provide continuing direction, leadership, coordination and synthesis within PICES toward attaining the FUTURE goal.
Mainly the key questions (2) & (1):

(2) How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?

(1) What determines an ecosystem’s intrinsic resilience and vulnerability to natural and anthropogenic forcing?
WORK PLAN FOR THE 1ST TRIENNIAL

- Review the current and proposed activities of related ExGs to COVE-AP (WG20, 22, 23, CC-S) and evaluate them in terms of FUTURE.
  
  October 2010 (PICES 19), ongoing

- Work with Committee chairs and ExGs to identify priority topics and activities for COVE with consideration on the issues of 1) organisms and processes sensitive to perturbations, 2) intrinsic resiliency of ecosystem to pressure and perturbations.
  
  October 2010 (PICES 19), ongoing

- Work with Committee chairs to develop new ExGs to address the COVE-AP related FUTURE priorities.
  
  October 2010 (PICES 19), ongoing

- Based on the identified priorities, advice on revising the ToR for the ExGs with the term beyond 2010 (i.e., WG23) as needed. Advice on rebuilding the ToR of CC-S for the next term.
  
  October 2010 (PICES 19), ongoing
WORK PLAN FOR THE 1ST TRIENNNIUM (2)

- Review the progress of work plans and update as needed. 2011-2012
- Initiate reviews and synthesis of information to address FUTURE goals. 2010-2012
- Review briefly on another ExGs related to AICE and SOFE October 2010 (PICES 19), ongoing
Strategy to implement FUTURE sciences of COVE subject:

**ExGs carry out FUTURE Science** and APs provide continuing direction, leadership, coordination and synthesis within PICES toward attaining the FUTURE goal.

We should keep in mind that PICES capacity establishing new ExGs is limited. FUTURE is a 10-years project, meaning 3 scrup&build processes are possible using 1-slot of the funding for a WG. During 10-years FUTURE life, we can expect to establish at least 6x3 WGs. We may find several (many) important topics/issues for FUTURE sciences but the “prioritization” is essential duty of the COVE AP.

We also need to consider that collaboration with AICE on the issues of coastal-oceanic Interaction, anthropogenic forcing influencing whole North Pacific “Section” is a semi-permanent body. The ToR of CC-S was revised in 2007. We can advice on the “products” from the sections.
RELATED EXPERT GROUPS OF COVE

Section on Carbon and Climate (CC-S)
Working Group on Evaluation of Climate Change Projections (WG-20)
Working Group on Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean (WG-22)
Working Group on Comparative Ecology of Krill in Continental Shelf and Oceanic Waters around the Pacific Rim (WG-23)

We selected priority topics from the report of the related ExGs of COVE
Reports from COVE related ExGs

WG-20 (Emanuele Di Lorenzo)

- Developing higher resolution RCMs and regional data sets
- Need to continue evaluating IPCC GCM and RCM results
- Need to analyze and evaluate seasonal and/or decadal projections variability
- Request WG20 to provide a list of RCM in the North Pacific so that there is a summary of activities that are ongoing. One of the request from WG20 is preparing live-access servers for results of RCMs and ROMs results

Report of the results of RCM from National University of Seoul (Prof. Kim)

Collaboration with CFAME did highlight that there is a mismatch between what the climate and ocean models can currently produce, and what biologists suggest are important physical forcing factors required for predicting species and ecosystem responses to climate change
Linkages between WG22 and FUTURE program/COVE

- Data sets of iron and related parameters in the North Pacific would contribute to improvement of marine ecosystem models that will be used for understanding how do ecosystems respond to natural and anthropogenic forcing.

- Basic questions and hypothesis that will be summarized in the final report of WG22 would give useful suggestions to narrow the target of COVE activities concerning the role of iron in regulating ecosystem responses to natural and anthropogenic forcing.

- WG-22 TOR-5 “Elucidate the role of iron as a potential regulator of harmful algal bloom (HAB) in coastal ecosystems of the North Pacific” has not been fully taken up for discussion in WG-22. This topic could be incorporated in the activity plans of FUTURE.
WG-23 CONTRIBUTIONS

WG-23 ends in 2011. WG23 are well-prepared to contribute ideas, data and new research to FUTURE on the following topics:

- **Population Dynamics.** How might climate change affect distribution, population dynamics and production of euphausiids (and other zooplankton)?

- **Modeling:** Krill (and copepods) in models is well developed.

- **Trends:** trends in abundance of copepod and krill eggs, larval and/or adult abundance based on long term monitoring of eggs, larvae and adults as a function of changes in temperature, oxygen, pH, and transport pathways.

- **Response:** Experiments on the effects of reduced pH and Oxygen on development, growth and survival of krill eggs, larvae and adults.
Research focused on hypoxia & ocean acidification

Synergistic effects (Hypoxia + Acidification) in the California current region (Oregon coast) as considered as Natural laboratory (upwelling regions are more acidified and the OMZ (oxygen minimum layer is expanding)

Depth scale: where pH<7.75 (or Ωarg <1)

taken from Science 320 (Freely et al., 2008)
A double problem: during the summer upwelling season, upwelled waters have very low oxygen (often < 2 ml L⁻¹) and upwelled waters can have a pH of 7.8 units. Thus upwelling has a “dark side” (waters are hypoxic and relatively acidic). How will the ecosystem respond?
**Emerged (unexpected) forcing**

Hypoxia and acidification off Oregon by upwelling

Hypoxia in the Peter the Great Bay is induced by eutrophication, due to excess fertilizer/increased agriculture

Japanese new projects indicates the increasing in SST will impact fisheries (pelagic fish, migrating fish, seaweed bed, etc).

Increase in SST in the northern Bering Sea and Arctic Sea is faster than other marginal seas and oceanic N.Pac, changing ecosystem structure and productivity.

Volcanic eruption and increase in wild fire, natural and anthropogenic dust flux (change in land use, urbanization, fossil fuel) are potentially change the ecosystem structure of HNLC. Ocean acidification is estimated to influence iron chemistry in sea water and influence the ecosystem dynamics

Emerged forcing and the impact to the ecosystem are variable by regions
Based on the identified priorities, advice on revising the ToR for the ExGs with the term beyond 2010 (i.e., WG23) as needed. Advice on rebuilding the ToR of CC-S for the next term.

*October 2010 (PICES 19), ongoing*
CC-S objectives for 2010-2015

• complete and publish scientific analyses arising from PACIFICA data synthesis (as noted above these contain temporal information not available in earlier synthesis projects)

• proceed with data synthesis and intercalibration efforts for marginal seas (PACIFICA-MarginalSeas) and scientific analyses of these data

• conduct analyses of the SOCAT pCO₂ data base for the North Pacific region and coordinate synthesis and archiving of pCO₂ data from ongoing programs in PICES member countries

• document and archive historical pH data and conduct retrospective analyses of ocean acidification

• coordinate and encourage research into ocean acidification and its biological impacts

These data are quite useful for developing Ecosystem and BGC models for RCM.
Identify potential for new ExGs to address COVE-AP priorities

"Mechanism of North Pacific Climate Variability".

This WG would provide the physical basis and conceptual frameworks for other working groups that are focused more on ecosystem dynamics.

The task of this working group would be to develop simplified understanding of North Pacific climate variability and change, which could be used to better guide the formulation of process-based hypotheses of the links between ecosystem dynamics and physical climate.

1) developing “simplified” understanding (or developing conceptual frameworks) of North Pacific Climate variability that can be readily used by the ecosystem scientist to guide them in formulating process-based hypotheses of the links between ecosystem dynamics and physical climate.

2) providing metrics to test the dynamics of the IPCC models. Could request included focus on RCM development

3) filling the gap between what the climate and ocean models can currently produce and what biologists suggest are important physical forcing factors required for predicting species and ecosystem responses to climate change
• providing metrics to test the dynamics of the IPCC models
  • could request included focus on RCM development
Mechanism of North Pacific Climate Variability

National/International projects such as
POBEX
US CAMEO project
Japanese Climate-Ocean Interaction
CREAMS EAST-I
etc

are potential projects to implement the new WG sciences.
Ecosystem responses to multiple stressors: Process and modeling studies.

Marine ecosystems of the North Pacific are impacted by recently emerged stressors, such as increase in temperature, change in iron supply (and chemistry under decreasing pH), hypoxia/eutrophication, ocean acidification, and are changing their structure and dynamics. The emerged stressor are variable by regions. The topic is a comparative study of the North Pacific ecosystem responses to natural or anthropogenic forcing, and available to answer the key themes of (1) and (2)

This topic can include emerging issues from WG22 (iron chemistry in low pH ocean, anthropogenic dust flux) and WG23 (hypoxia impact on euphausiids). CC-S products of PACIFICA, PACIFICA-MarginalSeas, and the data set of pH are useful to carry out the sciences related to the topic.
Sensitivity of HNLC regions to Fe-dust deposition in a low pH ocean: a case for a multiple-stressor approach

Maurice Levasseur

With the intellectual contributions of Martine Lizotte (U. Laval, Canada), Shigenobu Takeda (U. of Tokyo, Japan), Philippe Tortell (UBC, Canada), Gui-Peng Yang (Ocean University of China, China), Guangyu Shi (Institute of Atmospheric Physics, China), Hui-Wang Gao (Ocean Institute of China, China), Nadja Steiner (Institute of Ocean Sciences, Canada), Lisa Miller (Institute of Ocean Sciences, Canada), Michael Scarratt (Maurice Lamontagne Institute, Canada)

Objectives

1. To determine how the predicted decrease in ocean pH will impact the response of the HNLC ecosystems to dust (Fe) deposition in the Subarctic Pacific.

2. To develop standardized protocols to test the co-effect of Fe and pH (onboard or in situ mesocosms) to be applied in the different HNLC regions as part of a SOLAS coordinated effort.
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“**identify priority topics and activities**” includes not only for the advice to establish new ExGs but also for **advise to identify the topics for session, workshops, publications, educating activities, etc.** COVE AP advices the priority topics for PICES scientists and Committees by means of, such as posing them in the web site.
The fruits obtained in WG22 activities are quite useful to understand present status of the North Pacific ecosystems and to forecast the future under anthropogenic forcing. One concern for me on the present PICES structure is limited activities on biogeochemistry. CC-S is an only BGC expert group after the termination of WG22 but most of CC-S members are carbon specialist and not familiar with the dynamics of other biogenic elements. I guess CC-S, HAB-S, and model related expert group potentially establish in near future are candidate of the users of WG22. My questions are:

> Do you have any ideas how to make the WG22 results more useful and easier for other expert groups?
> Do you have any plan or idea to establish BGC/iron/model related expert group?

I think the products from the WG 22 (iron data and models) will be very useful for the future expert groups (CC-S and HAB-S, Modeling) if some of the current WG22 members will join other expert groups. I don't think that we are going to propose a new working group just for iron. But if there are interests similar to GEOTRACER or SOLAS for the North Pacific, then we can incorporate iron cycling into these working groups.