

PICES Activities for Conservation of Marine Ecosystems

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PICES

AUG 04, 2011
NOWPAP Expert Meeting



Outline

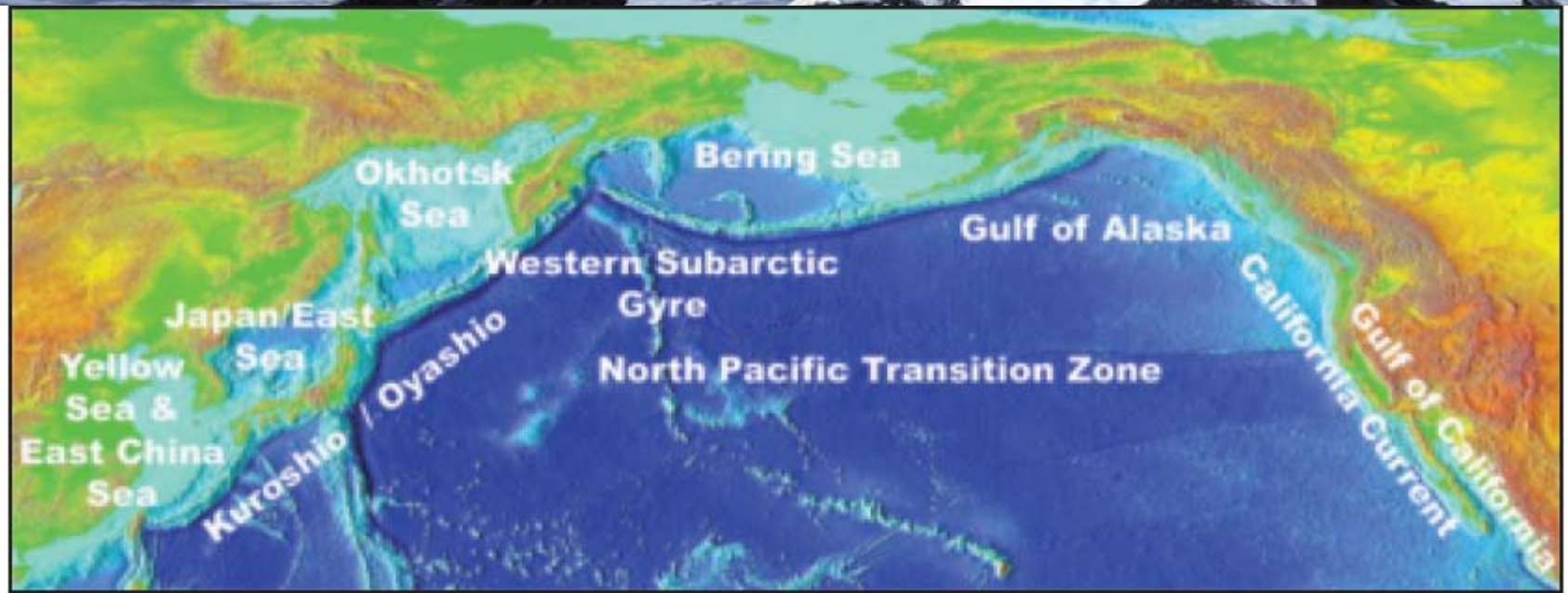
- About PICES
- North Pacific Ecosystem Status Report
- FUTURE -- 2nd Integrative Science Program
- Relevant expert groups in PICES
- A recent workshop on indicators and resilience



- Intergovernmental organization for marine sciences in the North Pacific
- Canada, China, R. of Korea, Japan, Russia, US
- Established in 1992
- Scope:
 - Physical, chemical, biological, carbon cycle, fisheries
 - From environmental quality to climate change, and interactions with human societies



- Purposes (as described in the Convention):
 - Promote and coordinate marine research in the northern North Pacific and adjacent seas especially northward of 30 degrees North
 - Advance scientific knowledge about the ocean environment, global weather and climate change, living resources and their ecosystems, and the impacts of human activities
 - Promote the collection and rapid exchange of scientific information on these issues



General locations of the regional chapters included within the report*



North Pacific Ecosystem Status Reports (NPESR)

- What is the state and trend of North Pacific Ecosystems?
- How do the 10 NP ecosystems respond to climate and anthropogenic forcing? – what are the similarities and dissimilarities?
- Publication date: 1st ed. (2004), 2nd ed. (2010)
- NPESR 2 emphasizes on recent changes (2003-2008)



NPESR 1 & NPESR 2

Overall Contents

1st Edition

Synthesis
Ocean and climate changes
Yellow Sea/East China Sea
Japan/East Sea
Okhotsk Sea
Oyashio/Kuroshio
Western Subarctic Gyre
Bering Sea
Gulf of Alaska
California Current
Gulf of California
Transition Zone
Tuna
Pacific Halibut
Pacific Salmon
References

2nd Edition

Synthesis
Oceanic
California Current
Alaska current
Bering Sea
Sea of Okhotsk
Oyashio
Kuroshio
Yellow Sea/East China Sea
References



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North Pacific Synthesis

Citation:

McKinnell, S.M., Batten, S., Bograd, S.J., Boldt, J.L., Bond, N., Chiba, S., Dagg, M.J., Foreman, M.G.G., Hunt Jr., G.L., Irvine, J.R., Katugin, O.N., Lobanov, V., Mackas, D.L., Mundy, P., Radchenko, V., Ro, Y.J., Sugisaki, H., Whitney, F.A., Yatsu, A., Yoo, S. 2010. Status and trends of the North Pacific Ocean, 2003-2008, pp. 1-55 In S.M. McKinnell and M. J. Dagg. [Eds.] Marine Ecosystems of the North Pacific Ocean, 2003-2008. PICES Special Publication 4, 393 p.



Comparison of NPESR 1 & NPESR 2 Synthesis Chapter

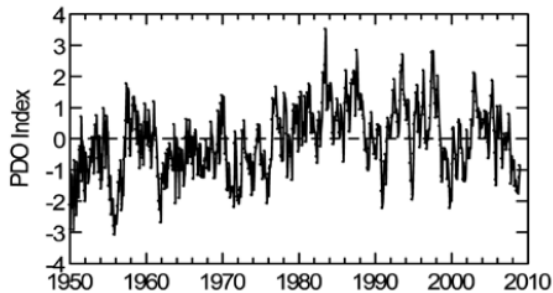
1st Edition

- Key messages
 - Climate
 - Ocean Productivity
 - Living Marine Resources
- Climate
- Productivity
- Living Resources
- The Human Population
- Contaminants & Habitat Modification
- Aquaculture
- Knowledge Gap

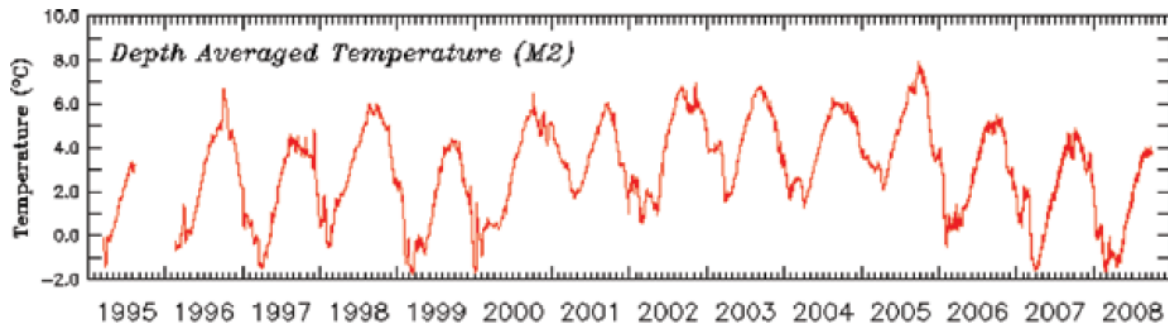
2nd Edition

- Highlights
- Introduction
- Climate
 - Sea level pressure
 - Eastern Pacific
 - Western Pacific
 - Disentangling Climate variability
- Physical Ocean
- Chemical Ocean
- Biological Ocean
- Fish and Invertebrate Fisheries

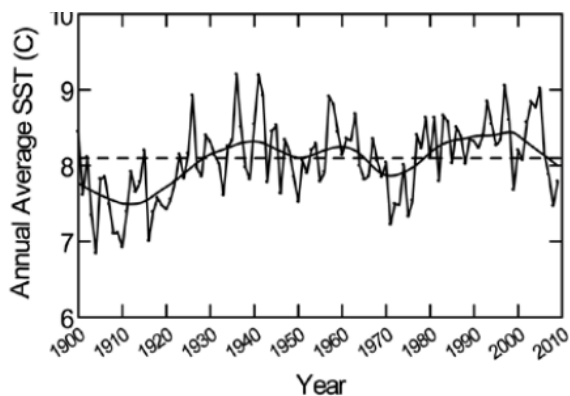
2nd Edition features the changes in the focus period (2003-2008)



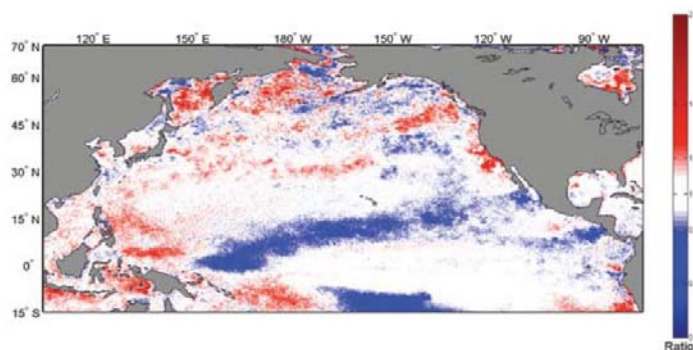
[Figure S-5] Monthly values of the Pacific Decadal Oscillation Index, 1950-2009.



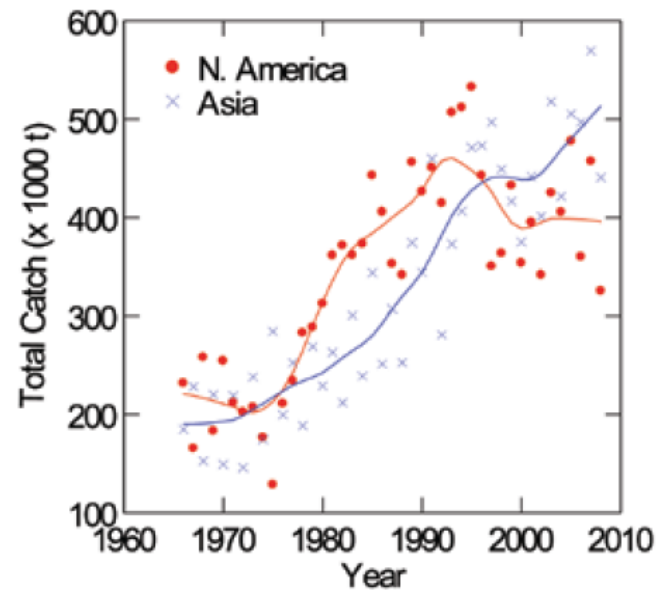
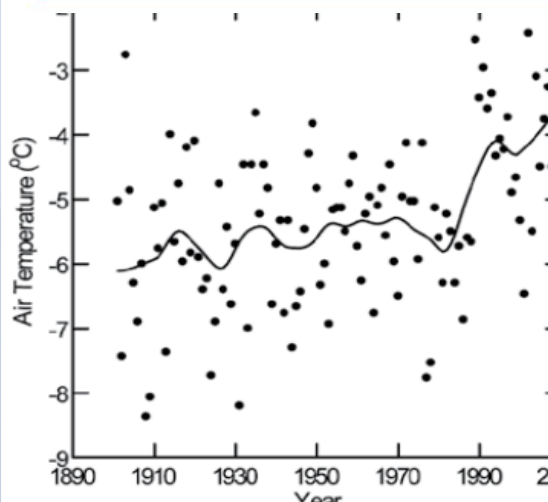
[Figure S-11] Depth averaged temperature at Station M2 (56.9°N 164°W) in the southeastern Bering Sea.



[Figure S-7] Area-weighted annual average SST in the North Pacific north of 50°N and east of 160°W from 1900 to 2009 with a smoother indicating trend. Horizontal dashed line is the mean of the time series (8.1°C). Data source is Smith et al. (2007).



[Figure S-20] Ratio of mean chlorophyll, between 1998-2002 (denominator) and 2003-2007 (numerator) in the North Pacific. Ratios = 0.9-1.1.



Yellow and East China Seas

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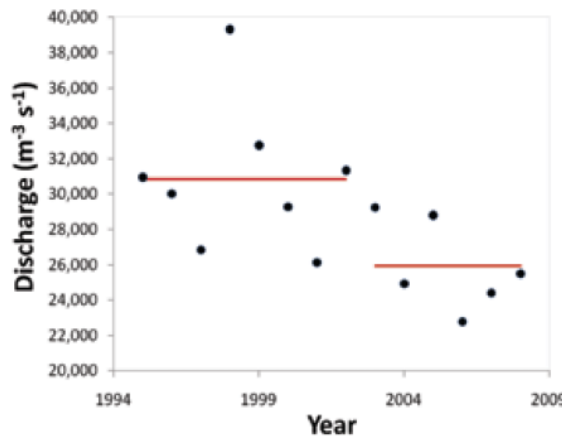
Citation:

Yoo, S., An, Y.-R., Bae, S., Choi, S., Ishizaka, J., Kang, Y.-S., Kim, Z.G., Lee, C., Lee, J.B., Li, R., Park, J., Wang, Z., Wen, Q., Yang, E. J., Yeh, S.-W., Yeon, I., Yoon, W.-D., Zhang, C.-I., Zhang, X., Zhu, M. 2010. Status and trends in the Yellow Sea and East China Sea region, pp. 360-393 In S.M. McKinnell and M.J. Dagg [Eds.] Marine Ecosystems of the North Pacific Ocean, 2003-2008. PICES Special Publication 4, 393 p.

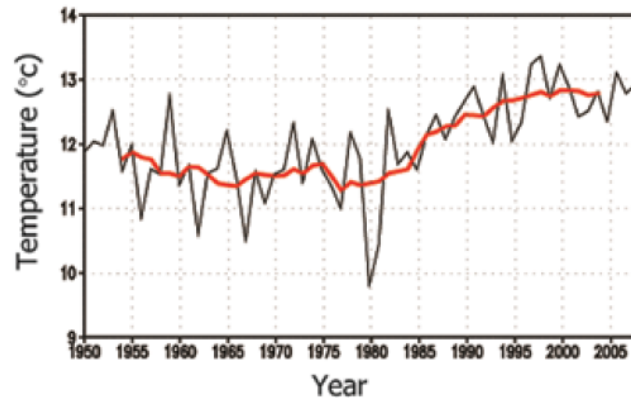
Yellow and East China Sea

Highlights

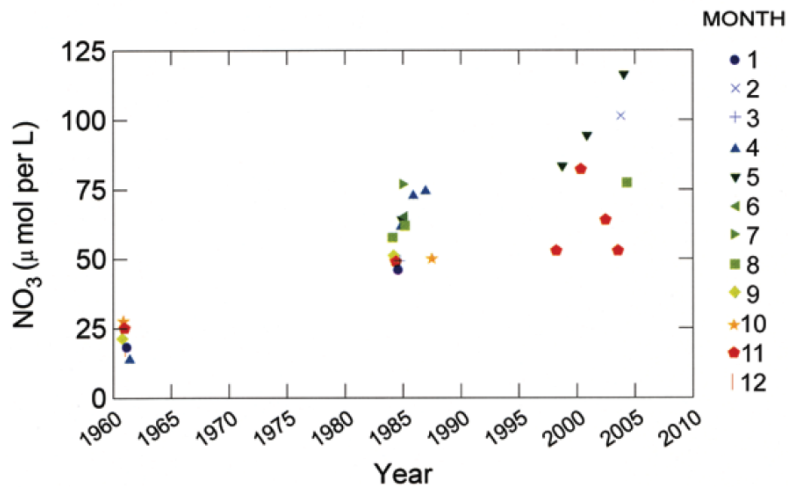
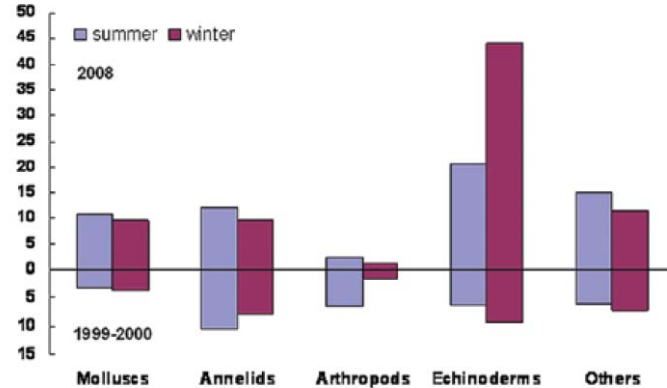
- Drastic changes in the past decades (species shifts, outbreaks of HABs, jellyfish blooms, macroalgal blooms, eutrophication, appearance of an hypoxic area).
- Ongoing eutrophication (organic deposition in sediments, increases in biomass and abundance of the benthos during the past decade, and the appearance of an hypoxic area)
- Warming of the ocean surface waters since the mid- to late 1980s with a parallel increasing trend in mesozooplankton abundance and a reduction in the volume of the Yellow Sea Bottom Cold Water
- Operation of Three-Gorges Dam: impact on ecosystem productivity and structure in the vicinity of the river mouth.



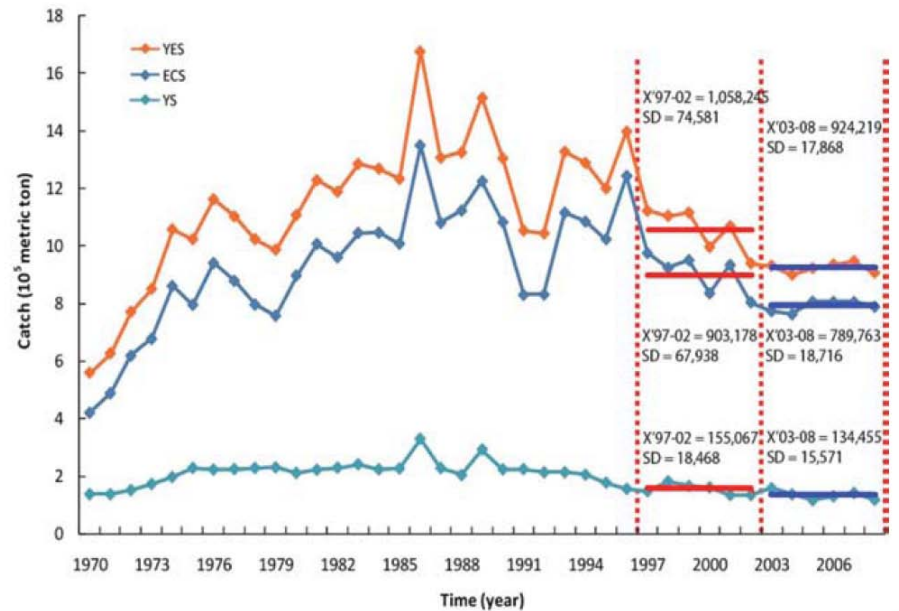
[Figure YS-6] Annual average discharge of the Changjiang River measured at Datong station. The discharge decreased after the impoundment of water began by TGD in June 2003.



[Figure YS-7] The trend of SST (Hadley Center) in Dec-Jan-Feb from 1950 to 2008 in the Yellow Sea and East China Sea region (25°N-40°N, 118°E-127°E). A warming trend is evident after the mid-1980s. The thick line indicates a nine-year moving average.



[Figure YS-13] Long-term variation of nitrate concentration at the mouth of the Changjiang River, by month and year when a sample was collected. Data collected during the 1960s are courtesy of Dr. Hongkan Gu.



[Figure YS-27] Long-term trend in the catch by Korean fisheries in the Yellow Sea (YS), East China Sea (ECS) and the sum of the two seas (YES).



PICES

North Pacific Marine Science Organization

The 2nd Integrative Science Program of PICES FUTURE

Forecasting and **U**nderstanding **T**rends,
Uncertainty and **R**esponses of North
Pacific Marine **E**cosystems
(2009-2019)

*To understand and **forecast** responses of North Pacific marine ecosystems to climate change **and human activities** at basin and regional scales, and to broadly **communicate** this scientific information to members, governments, resource managers, stakeholders and the public.*



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North Pacific Marine Science Organization

FUTURE Objectives

Objective 1 (scientific understanding)

- Answer the three key scientific questions

Objective 2. Status Reports, Outlooks, Forecasts and Engagement

- The production of *Status Reports, Outlooks and Forecasts*.
- *Engagement:*
 - *Establish Dialogs with Recipients of Potential FUTURE Products*
 - *Communicate with clients*



Working Group 21: Non-indigenous Aquatic Species

Assess the status of non-indigenous aquatic species in the PICES area

- Assemble an inventory of expertise and programs related to non-indigenous aquatic species in PICES member countries
- Develop recommendations for best practices for prevention and mitigation.
- Promote collaboration between ICES and PICES Working Groups on non-indigenous species by:
 - ✓ Develop a comprehensive Non-Indigenous Aquatic Database.
 - ✓ Establish a North Pacific Marine Non-Indigenous Aquatic Species taxonomy initiative.



Working Group 24: Environmental Interactions of Marine Aquaculture

Develop standard methods and tools to assess and compare the environmental interactions and characteristics of existing and planned marine aquaculture activities in PICES member countries.



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Joint **PICES / ICES** Working Group on Forecasting Climate Change Impacts on Fish and Shellfish

- Promote research on climate change impacts on marine ecosystems
- Develop frameworks and methodologies for forecasting the impacts of climate change on marine ecosystems, with particular emphasis on the distribution, abundance and production of commercial fish and shellfish;
- Review the results of designated case studies to test methods;
- Explore techniques for estimating and communicating uncertainty in forecasts;
- Explore strategies for research and management under climate change scenarios, given the limitations of our forecasts;



Working Group 26: Jellyfish Blooms around the North Pacific Rim: Causes and Consequences

PICES•

Review past and ongoing studies on the reproductive biology of jellyfish species that cause problematic blooms.

- Compile existing data on temporal variations in jellyfish abundance in the North Pacific and its marginal seas, and analyze them in relation to regional environmental and climate changes in order to identify causes of increasingly recurrent jellyfish blooms.
- Elucidate the role of jellyfish in coastal and oceanic marine food webs and assess the impacts of jellyfish blooms on marine ecosystems and socio-economies such as fisheries and aquaculture.
- Evaluate methodologies for predicting blooms and for diminishing their impact on marine and human systems, including bloom forecast modeling and the modification of fishing gears.
- Promote international collaboration among PICES member countries for exchanging available information on jellyfish, and encourage joint research surveys on jellyfish among PICES member countries.
- Provide jellyfish metrics as indicator of ecosystem change and resiliency in cooperation with FUTURE AICE-AP and SOFE-AP and FUTURE related expert groups.



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Proposed Section: Human Dimension

- To promote, coordinate, integrate and synthesize the research activities related to the contribution of the social sciences to FUTURE and to PICES as an organization.
- To develop an inventory of potential recipients, and their communication requirements for FUTURE and other PICES products
- To explore scientifically the consequences to and responses of human social systems to climate-induced changes in marine ecosystems
- To facilitate academic cooperation with other international research activities such as ICES, IMBER, LOICZ, etc.



Workshop on “Indicators of status and change within North Pacific marine ecosystems”

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- Held at the East-West Center, Honolulu, Hawaii, USA
April 26-28, 2011
- To identify:
 - ✓ means of determining ecosystem resilience or vulnerability;
 - ✓ ecosystem-level indicators of status and change, including but not limited to fisheries-based indicators;
 - ✓ methods to characterize uncertainty in these indicators;
 - ✓ common ecosystem indicators to be used for regional comparisons by the PICES’ community;



Scientific questions of FUTURE

Objective 1: Understanding Critical Processes in the North Pacific

- (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?

Objective 2: Status Reports, Outlooks, Forecasts, and Engagement



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Topics for discussion

- Ecosystem-level Indicators and Assessments
 - Purposes
 - Key criteria
 - Performance test
- Ecosystem resilience
 - Concepts
 - Measurability
- Indicator Uncertainty
 - Types of uncertainty
 - Communicating indicator status and uncertainty



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Workshop Outcomes

- Selecting common indicators for regional comparisons was deemed premature
- Rather, a framework for selecting indicators was developed, including methods to identify and calculate indicator uncertainty.
- Finally, the Terms of Reference (ToR) for a new PICES WG 28 were developed



Working Group 28: Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors

- Identify and characterize the spatial (and temporal) extent of critical stressors in North Pacific ecosystems both coastal and offshore and identify locations where multiple stressors interact. Identify trends in these stressors if possible.
- Review and identify categories of indicators needed to document status and trends of ecosystem change at the most appropriate spatial scale (e.g., coastal, regional, basin).
- Determine the most appropriate weighting for indicators used for:
 - a. documenting status and trends
 - b. documenting extent of critical stressors
 - c. assessing ecosystem impacts/change
- Review existing frameworks to link stressors to impacts/change, assessing their applicability to North Pacific ecosystems and identify the most appropriate for application to North Pacific ecosystems.
- Determine if ecosystem indicators provide a mechanistic understanding of how ecosystems respond to multiple stressors and evaluate the potential to identify vulnerable ecosystem components.



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PICES will continue to

- Provide leadership on scientific issues and identify research priorities and appropriate approaches for their solution;
- Plan, coordinate and implement integrated, inter-disciplinary research programs and related activities to be undertaken through the national efforts of the participating partners;
- Promote the collection and exchange of data and information related to marine scientific research;
- Assess ecosystem status and trends and project future changes;
- Synthesize scientific information and make it available to a broader user community and the public.
- Respond to requests from the Contracting Parties and other organizations to provide advice on scientific issues;
- Develop capacity within the scientific communities of the Contracting Parties;
- Foster partnerships with other organizations and programs that share a common interest