

PICES Press



Newsletter of the North Pacific Marine Science Organization (Published semi-annually)



Beyond El Niño Conference

Since the creation of PICES, scientists from member countries have actively debated the influence of climate variability on the productivity of the North Pacific. Following the extraordinary 1998 El Niño, it was first resolved to review the physical and ecosystem consequences of that event. A broader perspective soon led to the planning of a meeting which would go beyond the concern with El Niño to encompass a broad spectrum of changes over longer time scales (decadal oscillations, regime shifts...), both in the physical environment and within the biological realm. Given the wide interest in these issues among other organizations, PICES sought partners in planning and organizing the meeting. The support and participation of the Inter-American Tropical Tuna Commission, the International Pacific Halibut Commission, the Interim Scientific Committee for Tuna and Tuna-like Species, the North Pacific Anadromous Fish Commission and the Scientific Committee for Oceanic Research, was a significant contribution to the flavour and success of the conference.

While the meeting, convened on the campus of the University of California at San Diego, attempted in vain to restrict itself to the North Pacific, it acknowledged few other constraints. The discussions progressed through four themes, starting with presentations on the *Evidence for Variability* (convenors: Richard J. Beamish, Richard D. Brodeur and Kimio Hanawa), following with papers on *Ecosystem Consequences of Variability* (convenors: Anne B. Hollowed, Daniel Lluch-Belda and Yasunori Sakurai), continuing with discussions of

Mechanisms of Interaction with Ecosystems (convened by Ann Gargett, Michio J. Kishi, Jeffrey J. Polovina), and concluding with the more practical *Implications for Fisheries Management* (convenors: Steven R. Hare, David W. Welch and Chang-Ik Zhang). A total of 142 presentations were scheduled, 79 as posters. It is impossible to do justice to each paper in this short review but I have tried to capture the essence of the oral presentations, although generally not in the order in which they were presented. For brevity, only the name of the presenter is given in multi-author papers. Full abstracts are to be found on the PICES web site: <http://pices.ios.bc.ca>.

The Chairman of PICES, Dr. Hyung-Tack Huh, opened the conference, followed by brief opening remarks by the Co-Chairmen of the Scientific Steering Committee, Paul H. LeBlond and Warren S. Wooster. L. Scott Parsons, President of the International Council for the Exploration of the Sea, presented a summary of ocean climate change from an Atlantic perspective.

The evidence for interannual and decadal scale variability in all aspects of the North Pacific ecosystem is overwhelming. Presentations first focused on El Niño. Todd Mitchell's review of the instrumental record of ENSO over the past 150 years revealed the surprising variability of the equatorial characteristics of the phenomenon. El Niño's impact on the local physical environment off Alaska (Thomas C. Royer) and Oregon (Robert L. Smith) brought up the question of the

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propagation of the influence by Kelvin waves from the equator, which P. Ted Strub examined through tantalizing TOPEX altimetry data. Richard A. Feely explained the important role played by El Niño in modulating the global air-sea flux of CO₂, while Takashige Sugimoto (invited speaker) addressed the influence of El Niño and the Asian monsoon on ocean conditions and living marine resources in the western Pacific. On a broader time scale, Kimio Hanawa presented an analysis of variability of sea-surface temperatures based on the 100-year Kobe Collection of ship observations, identifying modes of variability and regime shifts as transitions between them, each shift endowed with its own individual characteristics. Steven R. Hare gathered together 100 time series of physical and biological variables to re-examine the 1976 shift and a somewhat similar event in 1989. George L. Hunt (invited speaker) presented a comprehensive regional overview of changes in the Bering Sea over the past three decades, ranging from physical variables to the highest trophic levels (birds and sea mammals). In the same area, Grace E. Abromaitis reported on a stable-isotope analysis of bird tissues as an indication of a possible decline in marine productivity. Daniel Lluch-Belda discussed variability in the California current, while Atsamon Limsakul described links between atmospheric forcing and primary productivity south of Japan. Tim R. Baumgartner (invited speaker) documented very long-term variability using 1,500 years of sedimentary record of sardine scales off Southern California and British Columbia, finding a significant spectral peak at a period of 65 years. Gordon A. McFarlane reviewed the history of the BC sardine, from its disappearance in 1947, attributed at the time to overfishing, to its spontaneous recovery after 1992. Finally, Jürgen Alheit and Andrey S. Krovnin presented results on the variability of North Atlantic fish stocks which they held as examples of similar variations in the North Pacific, encouraging a more global perspective in relating environmental change to fish fluctuations.

The second day, focusing on ecosystem consequences of variability, started with an invited review by Jake Rice of the practical impact of the presence of ecosystem variability at a multiplicity of time scales. He advocated a re-examination of classical ecological principles, discarding ideas based on equilibrium systems, stressing the need for basic understanding of transition periods and for extreme caution in managing resources through times of change. Starting at the bottom of the productivity ladder, Joaquim I. Goes described a method of estimating primary production from satellite measurements of temperature and chlorophyll-*a*, finding that in contrast to what happens in the eastern North Pacific, El Niño brings significant increases in productivity in western North Pacific waters. Michael M. Mullin found that larger phytoplankton cells were more abundant off southern California during El Niño years, especially during periods of low grazing pressure. William T. Peterson examined zooplankton assemblages during cold and warm

PDO (Pacific Decadal Oscillation) years on the Oregon coast, finding a replacement of cold by warm water species (and vice versa) consistent with a shift in the latitude of the coastal transition between temperate and sub-polar waters. Further north, on the coast of Vancouver Island, Ronald W. Tanasichuk (paper presented by Richard D. Brodeur) found a significant interannual variability in euphausiid species, the main food item of many pelagic fishes, in response to changing ocean conditions. In California waters, Paul E. Smith described shifts in the areas inhabited by four assemblages of fish larvae in response to large-scale ocean variations. Mitsuyuki Hirai (invited speaker) reported on sea-surface temperature variations in the Japan Sea and their marked effects on sardine and squid spawning areas. Across the ocean, Salvador Lluch-Cota presented a simple but successful model of atmospheric forcing of sardine biomass in the Gulf of California. Francisco Chavez discussed the influence of upwelling fluctuations and the PDO index on the Peruvian anchovy stocks, arguing applicability to the California coast by symmetry across the equator. Kerim Y. Aydin presented an analysis of the transmission of variability through trophic levels in models forced at different frequencies at the phytoplankton level. He found, in applications to Bering Sea pollock as well as to east-Pacific tuna, that the response was highest for zooplankton and lowest for the higher trophic levels (marine mammals). Nancy D. Davis reported on studies of temperature dependence on the food habits of salmon in the eastern North Pacific and the Bering Sea. Anne B. Hollowed brought together a whole series of environmental and fish abundance indices in a comparative approach to the study of variability. Ruben Rodriguez-Sanchez found that tuna catches dropped in the eastern tropical North Pacific during El Niño, accompanied by shifts in population distributions. Studies of birds in British Columbia (Doug F. Bertram) and in the CALCOFI domain (K. David Hyrenbach) showed that they are very sensitive to changes in water properties, especially food availability. Whales, on the other hand, appear rather insensitive to climatic variability, at least in the Bering Sea (Cynthia T. Tynan).

After two days of emphasis on the characterization of long-term variability, it was good to be reminded by David W. Pierce (invited speaker) of the intrinsic variability of an ocean forced by an equally variable atmosphere. He insisted that the null hypothesis for most ocean variability is simply “red” noise, increasingly energetic at low frequencies, a point he illustrated by showing four synthetic randomly generated series nearly indistinguishable from the Pacific Decadal Oscillation. The day focused on the exploration of mechanisms linking physical and ecosystem variability. Considerable progress has been made, as illustrated by many of the presentations. Ocean-scale models of the tropical Pacific successfully accounted for nutrient and phytoplankton (Fei Chai, James R. Christian) and tuna (Patrick Lehodey, invited speaker) variations during ENSO events. Robert J. Olson presented an ECOPATH-ECOSIM analysis of the response of the eastern tropical North Pacific ecosystem to

ENSO, examining the response to amplitude, frequency and cadence of the events, with results similar to those presented by Kerim Y. Aydin on the previous day. Michio J. Kishi reported on the accomplishments of the January 2000 Nemuro modeling workshop, which yielded two versions (tuned respectively to an offshore Hokkaido station and to Station P in the Gulf of Alaska) of an 11-box upper layer model. Further presentations focused on mechanisms effective in specific areas: Vladimir I. Radchenko discussed Bering Sea variability; Konstantin A. Rogachev described the influence of modulations of tidal mixing in the Okhotsk Sea; Ann Gargett tested the applicability of the optimal stability window hypothesis to variations in the North American salmon stocks; Richard J. Beamish speculated on the presence of “growth-based” mortality in British Columbia salmon; Elizabeth A. Logerwell presented a bio-energetic model demonstrating the importance of offshore mesoscale eddies for the production of California sardines; Jeffrey J. Polovina illustrated the role of the convergent Tropical Zone Chlorophyll Front in albacore tuna and sea-turtle concentrations; Kerim Y. Aydin studied the effect of temperature and food availability on salmon growth in the Gulf of Alaska, finding a good correlation between Fraser River sockeye body weight and the size of the area where 2 year old and older fish can feed on squid; Michael G. Hinton described the links between El Niño and the habitat of the blue marlin. Invited speaker Andrew Bakun encouraged us to reconsider some fundamental aspects of the population dynamics of schooling fish, suggesting that the influence of remembered affinities of individual fish on schooling behaviour might perpetuate and amplify evolutionary useful options and help understand responses to varying conditions.

Sunday, the last day of the conference, was devoted to discussions of the implications of climate variability on stock assessment and exploitation and other aspects of fisheries management. Lead speaker Alec D. MacCall showed examples of periodic climate shifts on single and multiple species systems, concluding that long-term interspecific interactions and climate change effects are very difficult to distinguish without a sufficient understanding of the workings of the ecosystem. Many speakers presented case studies of climate change impact on specific stocks. Jae-Bong Lee described how to arrive at an Acceptable Biological Catch level in the Korean horse mackerel fishery; Jacquelynne R. King showed how an environmental “report card” could provide a useful summary of ecosystem information for managing the British Columbia sablefish stocks; Mark N. Maunder explained how the impact of environmental dependence of growth parameters could be tested and used in snapper population models; Daniel B. Lluch-Cota presented a study of the impact of temperature changes on the Gulf of California brown shrimp fishery; Eleuterio R. Yañez described the impact of El Niño on the pelagic fisheries of northern Chile, illustrating the alternation of anchovies and sardines; Miguel N. Carranza extended the discussion to the Peruvian fisheries to the immediate north; Dagoberto F. Arcos showed

that El Niño also affected the more southerly stocks of jack mackerel, through temperature impacts on their more northerly nursery area. David W. Welch argued that the growth rate of coastal salmon stocks of southern British Columbia had been severely limited in recent years by lack of food in nearshore areas. Katherine W. Myers reviewed information pertaining to oceanic influence on Bristol Bay salmon stocks, finding it insufficient. Ernesto A. Chavez showed the importance of temperature effects on the growth rate and longevity of Californian anchovies, arguing for a management regime that would recognize the differences between different parts of the population. Franklin B. Schwing suggested, with illustrations, that patterns of long-term change might have sufficient similarities with those of ENSO that the latter might be used as a guide to understand the former. Tsuyoshi Kawasaki (invited speaker) drew on the global synchrony of some fish stock variations to suggest a 65-70 year cycle driven by fluctuations in the formation rate of the North Atlantic Deep Water. Might this correspond to the periodicity found by Baumgartner in the sedimentary record? An archaeological report by Yukimasa Ishida revealed the presence of salmon remains in 5,000 year old middens, associated with warmer water shells, an indication of former warm climates and possible shifts in the zoogeographical limits of salmon species.

The many posters were of a generally superb quality, informative and supportive of the oral presentations. Overall, the 200 conference participants gained an intensive perspective of the interdisciplinary issues of ocean climate variations and of the significant advances made in recent years.

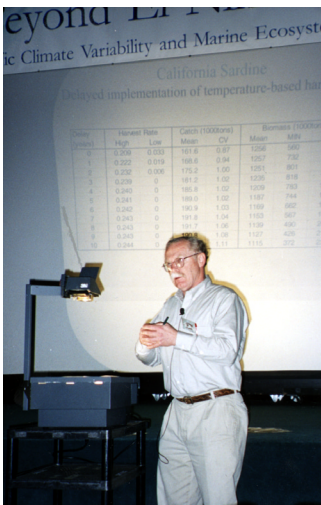
Paul H. LeBlond
Co-Chairman
Beyond El Niño Steering Committee
Galiano Island, B.C., Canada



Highlights of the Beyond El Niño Conference



Beyond El Niño Conference co-sponsors from left to right: Vladimir Fedorenko (NPAFC), Alexander Bychkov (PICES), Hyung-Tack Huh (PICES Chairman), Robin Allen (IATTC), Vera Alexander (PICES Vice-Chairman), Michael Tillman (ISC), Warren Wooster and Paul LeBlond (Steering Committee Co-Chairmen), and Bruce Leaman (IPHC).



Dr. Alec D. MacCall giving a presentation on fish management and low frequency climate variability.



Dr. Kimio Hanawa giving his presentation on climate changes in the North Pacific during recent 100 years.



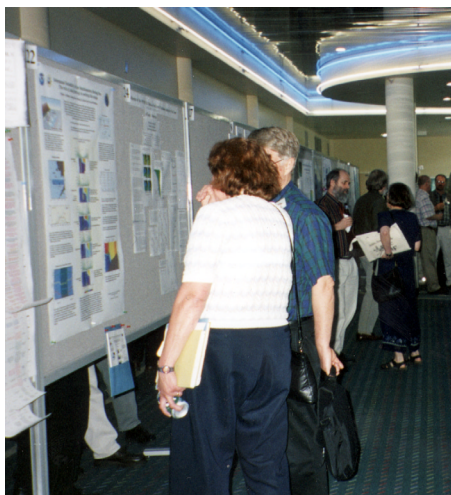
PICES and NPAFC Secretariats collaboration: Ms. Christina Chiu and Ms. Christie McAlistler from PICES (left & right), and Mrs. Wakako Morris of NPAFC (center).



Lt. Governor Fran Ulmer (NPAFC President) behind Dr. Al Hermann, checking out his state-of-the-art visual presentation techniques.



Dr. L. Scott Parsons (ICES President) giving his opening speech on ocean climate change from an Atlantic perspective.



The dynamic 'beer & wine' poster session.

