Remarks at a reception for participants at the PICES Tenth Annual Meeting

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Dr. William Doubleday joined the Public Service in 1973 as a research scientist at St. Andrews Biological Station (Fisheries & Oceans Canada), New Brunswick. He was Director of the Fisheries Research Branch (1981–1986) and Chairman of the Canadian Atlantic Fisheries Scientific Advisory Committee (1983-1984), and worked as Director, Policy and Program Coordination for Science (1986-1991) and as Director General, Policy and Strategy Directorate for Science (1991 to 1994). He also served as Acting Assistant Deputy Minister, Science (May 1998 - February 1990, and January 1992 - June 1994), and after that, as Director General, Fisheries and Oceans Science Directorate. Dr. Doubleday first became involved with PICES in 1986, and participated in some of the discussions leading to the establishment of PICES. He had been Canadian Delegate of the PICES Governing Council from 1994 to 2001, and Chairman of PICES from 1996 to 1998.

I would like to share with my colleagues how PICES has changed my perspective on fisheries research. In a sense, PICES has made me aware of the water I was swimming in as a fisheries scientist, something I was not conscious of ten years ago.

The inaugural symposium for PICES was held in the Victoria Convention Centre in October 1992. Canada had closed the fishery for Northern cod (off Newfoundland) a few months earlier, with the expectation of reopening it after a three-year moratorium. We expected a substantial recovery from the sudden, unexpected decline of 1991.

I presented a paper at the PICES symposium linking the productivity of Northern cod to the North Atlantic oscillation, an indicator of the winter climate regime in the North Atlantic. The paper observed that Northern cod had been much less productive in the 1980s than in the 1960s as the North Atlantic oscillation changed from mainly negative values to mainly positive values. The paper did not predict the future of Northern cod because I was uneasy and unsure that the underlying correlations would be sustained. Dr. Richard Beamish, the conference convenor and editor of the conference volume repeatedly encouraged me to publish the paper in his volume. I repeatedly refused. Everyone involved in the Northern cod fishery sought reliable predictions of the coming years. I felt a duty to predict the future course of Northern cod and considered my inability to do so a failure.

Subsequent events were dramatic and unexpected. Research survey abundances continued to decline after the cosure, suggesting that total mortality for adult cod increased after the closure instead of decreasing to a low level as expected. What happened was worse than my model suggested and far worse than projections based on standard assessment techniques, which suggested recovery after three years of moratorium.

The predictions of fisheries science often fail, and when they do, scientists often respond by saying "we must do better". We must obtain larger samples or more detailed data or seasonal data to allow better understanding of the marine ecosystem and better prediction of the future. The goal of the fisheries scientist has been to understand nature, finding and modeling the smooth relationships governing stock and ecosystem dynamics, then to monitor, estimating model parameters and the current state of the system, and, finally, to project the models into the future in order to predict and control a fishery. This goal is very much alive in the minds of scientists today. You can see it, for example, in the Proceedings of the PICES/CoML/IPRC Workshop on "*Impact of Climate Variability on Observation and Prediction of Ecosystem and Biodiversity Changes in the North Pacific*" (PICES Scientific Report No. 18, 2001).

Since the 1992 PICES symposium, I have been privileged to attend many PICES Annual Meetings. I have seen the evidence for decadal scale ocean climate regime shifts accumulate. I have seen how these shifts are linked to dramatic changes in the productivity of major fish stocks. After ten years, the evidence is overwhelming and widely accepted.

The world's fisheries are dominated by a few highly productive species and stocks. Robust and resilient, they may sustain huge fisheries employing thousands of fishermen for a decade or more. I once believed that this high productivity and resilience were inherent qualities of these species and stocks. I still believe that productivity and resilience are intrinsically linked, but papers on climate regime shifts have convinced me that high productivity is not a timeless property of successful species and stocks. When the ocean climate regime shifts, highly productive, resilient stocks can lose their productivity and become fragile while formerly minor species become robust and dominant. The alternation of shrimp and crab with groundfish in the Bering Sea is one example of this.

Why is this relevant to the fishery scientist's duty to predict? The prediction process is strongly rooted in the past. We study the laws governing stock dynamics and monitor to estimate parameters during a phase of an ocean climate regime. We project these laws forward into the future. The projection assumes that the future will be a mirror image of the recent past.

An analogy can help to make this clear. Imagine driving a car with the windshield covered by mud. You can see the road behind using the rear view mirror, but you cannot see the road ahead. You could steer the car by projecting the most recent few hundred metres forward and adjusting the course as you see yourself drifting to one side or the other. This could succeed if the road is straight and you drive slowly enough. It would lead to disaster if you encountered a sudden turn in the road where the hundred metres behind you were unrelated to what lies ahead.

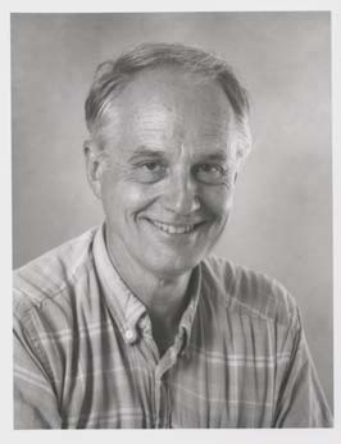
An ocean climate regime shift is like a sharp curve in the road. Just when the demand for predictions is greatest because the productivity of major stocks is weakening, the normal prediction process fails. When the climate regime shifts, the models of the past decade are no longer valid. Projecting the models of one climate regime across the transition into the next regime is the worst action a scientist could take in these circumstances. Assuming that the productivity of major stocks will remain high when it is falling rapidly will lead to very high exploitation rates and will drive these stocks rapidly down.

PICES has taught me that the smooth relationships and models governing stock and ecosystem dynamics during a climate regime can shift suddenly and dramatically during the transition between regimes. Stock and ecosystem dynamics might be inherently predictable during a stable ocean climate regime but they are intrinsically unpredictable during the transitions. We should not feel obliged to predict when prediction is unreliable. We should not feel we have a duty to hold our mirror up to the recent past to see the future at these times. We should recognize that stock and ecosystem dynamics is inherently unpredictable during transitions between ocean climate regimes and we should follow a different course.

I do not see all of the course we should follow, but the first part seems obvious. We should become skilled at early detection of shifts in the ocean climate regime so that we will know when not to predict in the usual way. We should study how the productivity of species and stocks changes when climate regimes change. We should understand how recruitment, growth and natural mortality can be affected, how the laws of population dynamics are rewritten by a regime shift. We should resist the obligation to predict at these times and find another basis for scientific advice to fishery managers.

I hope that, in the coming decade, PICES will lead the world's fishery scientists in building a new foundation for advice on fisheries conservation and management just as, over the past decade, PICES has shown the world the reality and importance of ocean climate regime shifts.

First Annual Wooster Award to Michael M. Mullin



The late Professor Michael M. Mullin (Scripps Institution of Oceanography) was honoured with the first annual Wooster Award at the PICES Tenth Annual Meeting in Victoria, Canada. The Wooster Award, named after the principal founder and first Chairman of PICES, Dr. Warren S. Wooster (University of Washington), is given annually to an individual who has made significant scientific contributions to North Pacific marine science. Mike's excellence in research and teaching, and his broad involvement in North Pacific marine science spanned many nations, disciplines and scales (see Mike's biography in PICES Press Vol. 8 (1), 2000). His career sets a standard for future Wooster Award recipients to equal (**call for nominations for the 2002 Wooster Award can be found on page 36**). Dr. Wooster presented a commemorative plaque to Professor Mullin's widow, Constance, and son, Stephen (photo on page 16). A permanent plaque identifying Wooster Award winners will reside at the PICES Secretariat in Sidney, British Columbia, Canada.