

# NPAFC – PICES joint symposium

## “The status of Pacific salmon and their role in North Pacific marine ecosystems”

By Richard Beamish

Pacific salmon are the dominant daytime group of fishes in the surface waters of the subarctic Pacific. Pacific salmon are also the indicator of ecosystem health most familiar to the general public. The health of ecosystems has become a focus for most marine stewardship studies. Thus, it was natural, that the North Pacific Marine Science Organization (PICES), with its focus on marine ecosystems, and the North Pacific Anadromous Fish Commission (NPAFC), with its focus on Pacific salmon, would combine efforts to assess the current status of Pacific salmon and explore the possibility that Pacific salmon dynamics provide measures of the state of large marine ecosystems.

The NPAFC – PICES joint symposium on “The status of Pacific salmon and their role in North Pacific marine ecosystems” was held from October 30 to November 1, 2005, in the Lotte Hotel on beautiful Jeju Island, Republic of Korea. Vladimir Radchenko and Richard (Dick) Beamish co-chaired a steering committee consisting of: Jack Helle, Yukimasa Ishida, Ichiro Kanto, Vladimir Karpenko, Suam Kim, Chae Sung Lee, Katherine (Kate) Myers, Toru Nagasawa, Ian Perry, John Stein, and Vladimir Sviridov.

The symposium program was built around three main topics: (1) status of Pacific salmon, trends in abundance and biological characteristics; (2) role of Pacific salmon in the function of North Pacific marine ecosystems; and (3) Pacific salmon as indicators of climate variability in the North Pacific. There were 32 oral and 20 poster presentations. All presentations were in English. Presenters who did not have English as a first language did an excellent job of giving their papers clearly and, on occasion, passionately.

It was evident that Pacific salmon, in general, are very healthy. In recent years, the total catch throughout the distribution has been at historic high levels (Fig. 1). Well-researched papers on the status of individual species were presented by Vladimir Radchenko, Alexander Kaev, Masaaki Fukuwaka, Alexander Starovoytov, Douglas Eggers, William Heard and Leon Shaul. There were examples of some stocks that were in low abundance off the coasts of British Columbia, Washington and Oregon, but the general trend was towards higher abundances.

Kate Myers reviewed the distributions, migration routes, migration timing and feeding areas of Asian and North American Pacific salmon. She proposed that species, populations, age and maturity groups occupy different habitats in the open ocean, and these niches can change in response to climate changes. Several papers provided

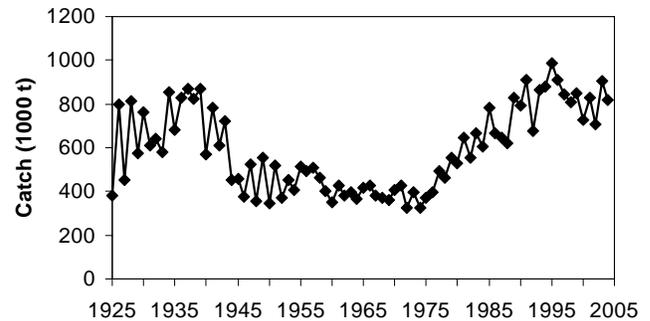


Fig. 1 The total catch of all species of Pacific salmon. The largest catch in history was in 1995 with the second largest in 2003. The preliminary catch in 2004 is slightly smaller than previous years because 2004 was the reduced abundance cycle for pink salmon from Russia.

convincing evidence that the long-term trend of decreasing individual size had reversed and average sizes were typical of lengths at the beginning of the decline. Some spectacular historic photographs of monstrous chinook salmon clearly showed that there were some stocks that have not recovered their historic growth patterns.

Franz Mueter showed that regional ocean scales of 500-800 km had similar impacts on the marine survival of salmon which was linked to ocean conditions early in the marine residence. There was also coherence in the ocean conditions that produced the best marine survival, and those conditions producing the poorest survival that were consistent with the positive and negative phases of the PDO, respectively. Mitsuhiro Nagata reported that hatcheries in Japan would get the best production when fry were released into ocean waters ranging from 7 to 12°C. Sukyung Kang and colleagues examined the ocean conditions that affected the run timing and biological characteristics of chum salmon from Korean hatcheries. The timing of the return to rivers is now about three weeks earlier than about 20 years ago. Masahide Kaeriyama looked specifically at the impacts of global warming on Pacific salmon of Asian origin. There was a better relationship between early marine survival and the coastal environment than the open ocean areas. Survival was related to growth in the coastal areas, and thus global warming impacts that affect the early rearing environment of chum salmon in the Sea of Okhotsk will have important impacts in Japanese chum salmon production. David Beauchamp showed how bioenergetic models can be used to identify the separate effects of temperature, food availability and food quality. Eventually, such models may

provide a method of forecasting the impacts of changes in coastal plankton composition, such as reported by Hiroki Asami and colleagues, and marine survival of Pacific salmon. Laurie Weitkamp and Joe Orsi stressed the importance of remembering that salmon species use their habitat differently. The different behaviour of coho and chinook is an important consideration when assessing the impacts of changing prey and predator distributions. Peter Lawson reported that the body weight increases could be an index of improved feeding conditions in the rearing areas of the various stocks. He also speculated that recent anomalies in trends of climate indices may be an impact of global warming. Edward Farley linked Pacific salmon early marine growth and recruitment through the critical size, critical period hypothesis. Results of studies of juvenile Bristol Bay sockeye, Prince William Sound pink salmon and coho from British Columbia showed that sufficient growth in the first marine summer was necessary for subsequent marine survival.

Diet studies are an essential contribution to the understanding of the linkage between ecosystems, ecosystem changes and Pacific salmon production. Detailed studies representing the results of extensive field research were presented by Vladimir Karpenko and Svetlana Naydenko. Many biologists continue to be amazed at the selectivity of some species and some stocks. Research is progressing on interpreting how the quality and the quantity of prey is linked to marine survival as reported by Edward Farley, Jack Helle, Mitsuhiro Nagata, David Beauchamp, Brian Beckman, and Vladimir Sviridov.

A number of papers described the factors that influence salmon distribution and the methods used to identify stocks and stock aggregates. Amazing progress has been made. Through cooperation and integration of research it has become possible to identify where stocks rear in the ocean seasonally for the entire period of their ocean residence. We are in the early stages of this research, but it is only a matter of money before we are able to use climate information to model how climate is affecting marine survival and migration timing. Dick Beamish, in his plea for improved communications with the general public and among us, pointed out the recent public outcry as sockeye salmon returning to the Fraser River did not do what was expected. Material presented at the symposium showed that it is possible to minimize these surprises in the future. The research by Japanese scientists that has worked out the movements of chum salmon from juveniles to adults impressed the audience as chum were shown to migrate south from the Bering Sea into the Gulf of Alaska in the winter and back to the Bering Sea in the summer. The new information on archival tags was reported by Robert (Trey) Walker. These vertical migration graphs always hold the attention of the audience as participants theorize in their own minds why salmon undergo these sometimes extensive vertical migrations.



*Symposium in session.*



*Symposium Poster session.*

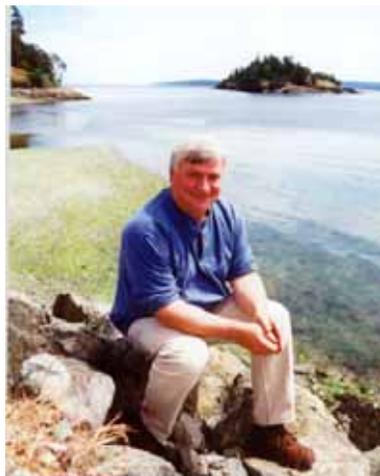
A major threat to the future management of Pacific salmon is climate variability. Natural variability has several modes, but it is the regime scale that appears most influential for Pacific salmon. A number of speakers addressed the issue of the impact of climate variability but it was apparent that global warming impacts are not well discussion topic at the end of the symposium. What will the future oceanographic regime look like in the North Pacific? Will global warming enhance the natural cyclic changes or will winter storminess become weaker resulting in reduced mid-ocean upwelling and reduced Pacific salmon abundance?

Climate change may affect the abundance of salmon predators. Several presenters from Russia provided perhaps some of the best information available on the types of predators and their impact. It was suggested that an atlas of salmon injuries, symptoms of disease and prevalence of parasites be produced. This suggestion was enthusiastically supported by the audience; but again, the limitation is money.

There were 20 posters, exactly the number that was planned. Typical of poster sessions, there was stimulating descriptions of experiments, expeditions and interpretations. Many of these posters will be written up for the publication.

The organization of the symposium and the setting for the meeting allowed for good discussion despite the ever-present language barriers. The NPAFC Secretariat, and

Vladimir Fedorenko, and Toshinori Uoya in particular, worked hard to provide flawless organization. There is no question that this was a successful symposium. Dick Beamish concluded that PICES and NPAFC are healthy organizations that are finding ways to complement each other's scientific strengths at a time that is exciting for researchers and potentially dangerous for salmon if we do not quickly work out how climate change will affect their productivity.



*Dr. Richard (Dick) Beamish is a fisheries scientist at the Pacific Biological Station Nanaimo, B.C., Canada. He represents Canada on a number of international commissions and is an editor for Transactions of the American Fisheries Society. In 2006 he will have worked for the Department of Fisheries and Oceans for 35 years and it will be time to decide what to do next. Currently, Dick is finishing some papers on the age determination of sablefish and rockfish and the pelagic life history of spiny dogfish. There are three or four new species of lampreys that also need to be reported. He is involved in the controversial topic of salmon farms and researches how their management can ensure that wild salmon are not harmed. A current project of great interest is the follow up from the Working Group 16 report on the impact of global warming on the key fisheries in the subarctic Pacific. Dick and a group of colleagues will hold a workshop immediately before the next PICES Annual Meeting to detail how climate and ocean conditions have affected the production of species that make up the major fisheries in the North Pacific. This information will be the first step in an effort to provide a database that can be used by all scientists interested in developing forecasting models.*

## PICES Calendar

- A CCCC/CFAME Workshop on “A comparison of regional mechanisms for fish production: Ecosystem perspectives”, January 12-13, 2006, Tokyo, Japan;
- Panel discussions at the “Marine Science in Alaska” Symposium, January 25, 2006, Anchorage, U.S.A., and during the meeting of the North Pacific Fisheries Management Council, February 8, Seattle, U.S.A., to involve the Bering Sea and international communities in development of a set of operational objectives;
- Inter-sessional Science Board/Governing Council meeting, April 17-18, 2006, Honolulu, U.S.A.;
- PICES/GLOBEC symposium on “Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis”, April 19-21, 2006, Honolulu, U.S.A.
- PICES/NPRB workshop on “Integration of ecological indicators for the North Pacific with emphasis on the Bering Sea”, May 31-June 2, 2006, Seattle, U.S.A.;
- PICES/GLOBEC Workshop to develop comparative studies of the sub-Arctic seas, June 12-14, 2006, St. Petersburg, Russia;
- Symposium on “Time series of the Northeast Pacific Ocean: A symposium to mark the 50<sup>th</sup> anniversary of Line-P” (co-sponsored by DFO Canada, PICES and CLIVAR), July 5-7, 2006, Victoria, Canada;
- CREAMS/PICES workshop and summer school on “Model-data inter-comparison for the Japan/East Sea”, August 2006, Seoul or Donghae, Korea;
- ICES/PICES theme sessions on “Large-scale changes in the migration of small pelagic fish and the factors modulating such changes” and on Operational Oceanography (title TBD) at the ICES Annual Science Conference, September 19-23, 2006, Maastricht, Netherlands;
- PICES Fifteenth Annual Meeting, October 13-21, 2006, Yokohama, Japan;
- International Conference on “The Humboldt Current system: Climate, ocean dynamics, ecosystem processes and fisheries” (co-sponsored with IMARPE, IRD, NASA, FAO, GLOBEC, ICES, PICES and IMBER), November 27-December 1, 2006, Lima, Peru;
- ICES/MBC/PICES Symposium on “Marine bioinvasions”, March 2007, Cambridge, U.S.A.
- 4<sup>th</sup> International Zooplankton Production Symposium on “Human and climate forcing of zooplankton populations” (co-sponsored by PICES, ICES and GLOBEC), May 28 - June 1, 2007, Hiroshima, Japan;
- PICES/ICES Young Scientists Conference on “New frontiers in marine science”, June 2007, Maryland / Washington D.C., U.S.A.;
- PICES XVI, October 26-November 4, 2007, Victoria, Canada;
- ICES/PICES/IOC Symposium on “Effects of climate change on the world oceans”, spring 2008, Gijón, Spain.