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Session Summary: Use and Misuse of Science in Fisheries Management

Session chaired by: Donald Ludwig
University of British Columbia

The following are brief summaries of two talks presented during a panel session. The final presentation by Leah Gerber appears as the next paper in this volume.

FISHING DOWN MARINE FOOD WEBS

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It is widely recognized that marine fisheries are in a global crisis, mainly because of open access policies and overcapitalization driven by subsidies. One might think that the problem therefore is mainly one of economics or of governance. However, recent analysis of extensive global data sets has added an ecological dimension to this, by showing that major changes may be occurring in marine food webs as a consequence of runaway fishing mortality. Although total catch levels for marine fisheries have been relatively stable, there has been a steady succession of species harvested. A trophic analysis of the data shows that landings from global fisheries have shifted from large piscivorous fishes toward smaller invertebrates and planktivores. This shift can be quantified through assignment of a fractional trophic level to each species depending upon the composition of the diet. The values of these trophic levels range from a value of 1 for primary producers to over 4.6 for a few top predators such as a tuna in open water and groupers and snappers among bottom fishes. For data aggregated over all marine areas, the trend over the past 45 years has been a decline of the mean trophic level from over 3.3 to less than 3.1. In the Northwest Atlantic the mean trophic level is now below 2.9. There is not much room for further decreases, since most fish have trophic levels between 3 and 4. Indeed, many fisheries now rely on invertebrates, which tend to have low trophic levels.

One might expect the size of catches to increase as the trophic level drops because of a broader resource base at the lower levels. Plots of trophic level versus catch indeed show such an increase in the size of catches in the early phase, but typically this is followed by a decrease in catch as well as in trophic level. The reasons are obscure, but possibly increases of discarded by catch, unreported catch, decreases in catch ability as size decreases, or changes in the food web induced by the harvest may be responsible.

In recent decades, global trends appear to show a decline of .1 trophic level per decade. This is an underestimate of the actual change, since data from many areas, especially in the tropical developing countries, are lumped into categories such as "mixed fishes" that do not reflect changes in trophic level. Moreover, the analyses performed so

far did not consider the decline in trophic level that occurs within species due to the increased removal of older fishes, which tend to have higher trophic levels than the young of the same species. It is likely that a continuation of present trends will lead to widespread fisheries collapses. These trends also cast doubt on the idea of estimating of future catches by extrapolation of present trends.

We lack scientific understanding of the effects of species replacement in the fisheries. It is therefore important that we improve our methods of data collection and analysis to better understand the coming changes. In the meantime, we must guide our actions by the crude indicators that are presently available. Prudence would dictate that we limit future impacts by setting up as many large marine protected areas as we possibly can.

Reference:

Pauly, D., V. Christensen, J. Dalsgaard, R. Froese and F. Torres Jr. 1998. Fishing down marine food webs. *Science* 279: 860-863.

WHY HAS CANADA'S FISHERIES MANAGEMENT FAILED TO PROTECT THE STOCKS?

Carl Walters
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The recent collapse of the northern cod stocks off the coast of Newfoundland is the greatest social and political failure in our history. Recently I collaborated in two retrospective studies of this collapse and other managment failures in order to understand the causes and suggest corrective measures. Hutchings, Walters and Haedrich (1997) raised the issue of government information control as a cause of poor scientific advice and public misinformation. The perspective of that paper is one of a greedy industry, interfering bureaucrats, virtuous scientists and a confused public. This characterization was applied to the collapse of the Newfoundland cod fishery and the advice concerning the Kemano completion project, which involved a massive diversion of the Nechako River in order to generate power for aluminum production. The issue there was whether or not the diversion would have deleterious effects upon the salmon stocks in that river and elsewhere in the Fraser River system.

In the case of the Newfoundland fishery, Walters and Maguire (1996) pointed out flawed methodology which resulted in absurd overestimates of abundance and future stock growth, coupled with failure to revise these estimates and methods properly as new information became available. In the case of the Kemano Project, some of the Department of Fisheries and Oceans (DFO) scientists held that further water withdrawals would represent severe risk for chinook salmon stocks, while others believed that the habitat was still adequate and that further impacts could be mitigated by instream activities. A team of advisors came to the conclusion that we haven't a clue what would happen if additional diversions were to occur. We suggested that Alcan conduct a series of experiments to obtain better information about such impacts. The subsequent behavior of the DFO in formulating a policy concerning the future flows was characterized by Hutchins et al as "a poignant example of how government bureaucrats can, and do interfere with science