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The University of
British Columbia

FishBytes

Volume 4 Issue 3 May/June 1998

THE NEWSLETTER OF THE FISHERIES CENTRE AT UBC

Workshop Report: "The Use of Ecosim to Evaluate Strategies for the Sustainable Exploitation of Multispecies Resources"

By Dr Daniel Pauly

Fisheries science, based almost exclusively on single species population dynamics since World War II, has been conspicuously unable to answer, and often has failed even to pose, questions about the impacts of fishing on marine ecosystems. In fact, changes to ecosystems after the collapse of stock have generally caught fisheries science by surprise; now it is gradually being realised that the historical impacts of fishing have been large, dramatic and difficult to reverse.

The FAO Code of Conduct for Responsible Fisheries highlights the importance of multi-species approaches to fisheries management. For example, Paragraph 12.5 recommends that "States should be able to monitor and assess the state of stocks under their jurisdiction, including the impacts of ecosystem changes resulting from fishing pressure, pollution or habitat alteration. They should also establish the research capacity necessary to assess the effects of climate or environmental change on fish stocks and aquatic ecosystems." This issue was also identified as being of particular importance at the 1996 Kyoto Conference and in the resulting Kyoto Declaration. After the Kyoto Conference, the host Japanese government established a trust fund to be administered by the FAO Fisheries Department, to follow up on a number of recommendations contained within the Declaration, including that to promote a strengthened scientific basis for multi-species and ecosystem management.

In recent years, substantial progress has been made with the Ecopath (www.ecopath.org) approach for modelling fisheries resource systems, both in terms of the number of systems to which it has been applied and in the types of applications. Within the latter category, Ecoranger (allowing incorporation of uncertainty), Ecosim (allowing simulation of ecosystem changes over time) and Ecospace (adding a spatial

dimension to Ecopath) have been particularly important developments, as they allow for screening of policy options in multispecies/ecosystem contexts, a facility not previously available without the massive data sets required e.g., for the implementation of Multispecies Virtual Population Analysis.

Policy screening is particularly relevant to the multi-species requirements of the Code of Conduct and the Kyoto Declaration. FAO therefore approached the UBC Fisheries Centre, a base for several of the key scientists working on Ecopath, to host a workshop to evaluate the current status and capabilities of the Ecopath package for potential application in multi-species assessment and management. The objectives of the workshop were: To investigate the use of the Ecopath software package as a tool to study the impacts of different harvesting approaches on simulated ecosystems, with a view to application of suitable approaches in actual multi-species fisheries; and, To identify and document the strengths and weaknesses of the Ecopath approach in this role.

If the Ecopath approach was found, in some or all cases, to provide acceptably realistic representations of actual ecosystems, then it would open up the possibility of using Ecopath or Ecopath-type models to explore different management strategies and to identify the most appropriate option for implementation. The workshop was held March 25-27, 1998, at the Fisheries Centre and included more than twenty researchers from international organisations and academia. The full workshop report (presently being edited by Daniel Pauly and soon to be available as a Fisheries Centre Research Report), includes summaries of key lectures describing Ecopath 4.0 (V. Christensen), the background, capabilities and shortcomings of Ecosim (C. Walters), the use of Ecosim in an economic context (R. Sumaila), to assess the effectivity of marine protected areas (R. Watson), and as a conceptual tool for ecosystem rebuilding efforts (T. Pitcher). Also included is a description of Ecospace, recently developed by C. Walters and bundled, along with Ecosim, into Ecopath 4.0.

Particular emphasis was given in the report to results of various simulations, designed to test Ecosim predictions and thus to meet FAO's requirements of an analysis of the software's potentials and limitations. The report concludes with a general discussion of the level of prediction that can be expected as results of Ecosim/Ecospace applications. The single most important result of this workshop is a clear idea of the potential usefulness of the Ecopath approach in the varied circumstances of FAO member countries, tempered by a realistic understanding of the limitations of the software.

Diversity and Context in Managing Herring Stocks:

Observations and Opinions from the Central Coast Herring Seine Fishery

By Steven Mackinson

(Editor's Note: This article is an excerpt from a full article which appears in the May 1998 issue of Westcoast Fishermen.)

This year, things were different! Spurred by the need to reduce overages, harvest control of the roe herring fishery experienced a significant change. This season, vessels were lumped together into voluntary groups of 8. The rationale behind the 'pool' fishery is basically to ensure the elimination of competition, and reduce catch rates. All licenced boats share equally in the catch. With lower catch rates, this 'nibbling' at the quota ensures a longer fishery with greatly reduced tension for all involved. Attitudes

at a pre-fishery meeting displayed serious commitment to provide a clean and responsible fishery with fishers and fishery managers working in close co-operation.

Catches in the Strait of Georgia and West Coast of Vancouver Island were almost bang on target (just under, if I am not mistaken). This is a good sign, but there are issues which need to be addressed before future pool fisheries. Firstly, a clear policy regarding fish sorting devices which appeared unexpectedly for the first time this year, and secondly, an issue regarding release sets deemed to contain fish of unsuitable quality. Despite the issues noted, the overall approach of the pool fishery appeared successful. It achieved its primary target of eliminating overages.

Taking a broader view of the management, it is worth asking; 'really, how different was the roe herring fishery this year?' In a nutshell, the answer is not different at all. Let me elaborate: Harvest quotas are set on a coast-wide 20% fixed harvest rate; that is, throughout the coast of BC the fishery attempts to harvest 20% of whatever is forecast to come back based on pre-season stock assessment models. The central tenet of this management policy is that there are several stocks of herring which broadly coincide with 5 management regions. This concept is in itself questionable and the notion of these stocks is thus a compromise between biology, ease of stock assessment calculations and practicalities of management. While debatable in the biology / ecology arena, it is clear from field observations that herring within a management area do not behave in a unified way. Improving our understanding of the spatial diversity is an essential task. So far as the science goes, it could be an everlasting debate as to whether or not one group of herring is different from another, but in practice, fisheries management in general requires a working theory of what constitutes a 'stock'.

I assert that for practical and true precautionary reasons a more functional approach, with its roots in local context and an emphasis on diversity, should be applied to the stock concept. The notion of what constitutes a 'stock' differs from person to person and this is the key to a contextual functional approach. The development of pool fisheries may have provided a mechanism by which management may now diversify its herring fishing interests. The concept is simple, if there are eight pools, there are eight areas, or perhaps say 8 pools in 4 areas. The basic idea is to diversify effort. Regardless of 'absolute' scientific knowledge of stocks, it has utility.

There is also a purely rational ecological reason to diversify harvest effort in herring fisheries. If (heaven forbid) there should be drastic downturn in the health of the total herring 'stock', a more diverse spatial structure would undoubtedly provide greater opportunity for rebuilding of stocks. Similarly, spatial diversity of herring stocks may be fundamental to the 'health' of other fish, birds and mammals that prey upon them.

(Steven is a PhD student at the Fisheries Centre, working with Dr Tony Pitcher)

The Director in Oz – Part Three

(Editor's Note: In this third report, Dr Tony Pitcher relays further observations from his leave 'down under'.)

Mauritius is not exactly renowned for its deep cold waters, yet this tropical Indian Ocean island turns out to be a surprising hot-spot for the world's trade in Patagonian toothfish, worth over \$5000 a tonne wholesale, which most of us encounter as Chilean or Valparaiso sea bass in posh restaurants. In Tasmania, Alistair Graham's ISOLFICH (International Southern Oceans Longline Fisheries Information Clearing House), funded by the Australian fishing industry, has tracked 2.5 kilotonnes a month of illegally caught toothfish to dealers in Mauritius and Reunion, where they are sold on to the wholesale fish trade. Australia, Chile, South Africa and French waters around Crozet and Kerguelen Islands have quotas, but the bulk of the world's international catch is managed by the Tasmania-based Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). Unfortunately, it appears that illegal catches may be as

large as legal ones and CCAMLR's stock assessments of this slow-growing 3m-long fish suggest this level of exploitation would make the toothfish's days numbered. Already, serial depletion is rearing its ugly head as a fishery for a related, more southerly species of toothfish opens up. Alistair is attempting to encourage governments to stamp out the illegal trade - he may well succeed as this energetic man was instrumental in the Madrid convention which controlled the exploitation of minerals in Antarctica. CCAMLR's director, Spanish-born Esteban Salas, is anxious about political spin-off from ISOLFICH activities because some of the illegal fish trade takes place inside CCAMLR member country's waters and CCAMLR depends for its existence on support from those governments. Let us hope that public outrage at the illegal toothfish trade will outweigh the political embarrassment of governments caught exhibiting less enforcement capacity than they would wish.

CCAMLR itself can claim some success for limiting another consequence of the toothfish fishery, the incidental mortality of oceanic seabirds such as albatross. Birds dive after baited hooks as longlines are set, but birds can be confused by jiggling streamers attached to 'bird lines', and by not discarding fish offal when lines are set. CCAMLR's campaign publicises these simple, cheap measures, and their well-designed leaflets have been copied for use in North Pacific long-line fisheries.

The long-awaited expansion of the Antarctic krill fishery is almost upon us as Vancouver's Dave Saxby marshalls his consortium of Ukrainian vessels fitted out with high-tech gear to produce pigments for the salmon farming industry and wound-healing enzymes. Fisheries Centre members will recall Mr Saxby as one of the sponsors of the FC workshop on krill fisheries in 1995 (FC Reports Vol. 3; No. 3). We have to hope that CCAMLR's stock assessment models are capable of predicting the impact of this expansion on spatially aggregated stocks of krill and the Antarctic ecosystem.

Flying from Sydney to Hobart, we were astounded to see our Tasmanian hosts, Dr David Ramm and family, smiling out from the front page of the newspaper handed out on the plane. Dave has made several extended visits to the Fisheries Centre, and was the architect of our MOU with Darwin fishery lab in Australia's NT. He moved to Tasmania as the CCAMLR's data manager last year and, on the day of our visit, had won a plot of land in a government draw for new migrants to Tasmania. We celebrated with a good Tasmanian wine, (rivalled during our trip only by Esteban Salas' excellent rioja cellar) and tried to avoid being swept off to Chile by the roaring 40s on the top of Mount Wellington overlooking the beautiful city of Hobart. We visited a forestry centre in Geeveston, which highlighted the sustainable harvest of the magnificent, fragrant Huon pie and anxiously hoped that forest scientists were better at their trade than fishery scientists. Touring the harbour on a lovely warm day, we interviewed the delicious local trevalla fish.

I gave two seminars in CSIRO, where section director and FC International Advisory Council member Dr Keith Sainsbury was recently asked to comment to the Australian press on Daniel Pauly's 'fishing down the food web' paper (see the Special Insert in *FishBytes* 4(1)). Keith has also been quoted in the national press here on Australia's south-east trawl fishery, where seven new species have been found being sold under other guises. Keith is quoted as saying that it shows how little we know of deeper water resources inside the EEZ. Given FAO's adoption of the precautionary principle in the Code of Conduct for Responsible Fishing, and the recent move to 'reverse the burden of proof' in fisheries (Dayton 1998 *Science* 279: 821), I begin to wonder how we can continue to justify such fisheries. Similar problems are found in BC's deepwater trawl fishery, where DFO continues to set quotas based on the fast growing Pacific Ocean Perch when even the basic ecology of many of the slower growing species in the catch is almost unknown. An example is the new fishery for 'idiot longspine rockfish', a viviparous, large-eyed, red deep water fish very popular with Vancouver's up-market seafood restaurants. We are increasingly realising that by removing such slow growing specialised-niche fish, we may irreversibly alter the nature of marine ecosystems. In the face of our ignorance both of these species' ecology and the nature of the ecosystem in which they are embedded, should these deep-water trawl fisheries in Australia and Canada be allowed to continue in the same way?

Quantification of Flux Rates of Adult Coral Reef Fishes

Across Reserve Boundaries

By Dr Dirk Zeller and Dr Garry Russ

One major objective of marine fisheries reserves in fisheries management is the possible maintenance or enhancement of catches in areas adjacent to the reserve due to fish leaving the reserve – the "spillover effect". Demonstrations of such an effect are rare and evidence is often circumstantial. This project, funded by the Australian Research Council, uses a novel, high-technology approach (ultrasonic telemetry) and a rigorous sampling scheme to quantify flux rates of fish across boundaries of marine reserves on coral reefs. Demonstration of the spillover effect will substantially enhance support from the fishing communities for no-take marine reserves on coral reefs.

The first year of the project (1997) involved the establishment of replicated experimental and control sites at Lizard Island (northern Great Barrier Reef), the acquisition of baseline density data, intensive tagging and underwater visual census programmes, and ultrasonic tracking work. In 1998 we hope to make extensive use of an automated ultrasonic tracking system currently being delivered. This will allow us to obtain unique time series data on simultaneous movement patterns from multiple fish and provide an opportunity to assess potential flux rates across reserve boundaries due to fishing induced density gradients.

(The authors can be reached at: Department of Marine Biology, James Cook University, Townsville 4811 Australia)

Publications

Adaptive Management of Renewable Resources

A reprinted edition of Dr Carl Walter's classic 1986 work on adaptive management has been made possible by his kind assignment of the copyright to the Fisheries Centre.

The Fisheries Centre is pleased to re-introduce this book in a low cost student edition, as it has been out of print for some time. This work has lost none of its relevance to the management of natural resources since Dr Walters wrote it. An implementation of some of the principles of adaptive management as applied to fisheries management may be found in:

- Hilborn, R. and C.J. Walters. 1992. *Quantitative fisheries stock assessment: choice, dynamics and uncertainty*. Chapman and Hall, New York, 570 p.

To order a copy of Adaptive Management of Renewable Resources for Can\$50 (includes surface mail) contact either the Fisheries Centre Events Officer (events@fisheries.com) or Projects Officer (preikshot@fisheries.com). Payment may be made by credit card, cheque, or money order.

Conference Calls

A reminder of the **16th Lowell Wakefield Fisheries Symposium**, to be held September 29-October 3, 1998, in Anchorage, Alaska, USA. For details, contact Brenda Baxter at (907)474-6701, fax (907)474-6285, or email FNBRB@uaf.edu.

Advanced notice for an **ICES/SCOR Symposium: "The Ecosystem Effects of Fishing"**, 16-19 March 1999, Montpellier, France. The aim of the Symposium is to provide a world-wide synthesis of the impacts of fishing on the marine ecosystem, to report on new methods for quantifying these impacts and to provide a forum for discussion on how objectives related to nature conservation can be integrated in future fisheries management. The oral contributions will be based on invited papers prepared by groups of experts, but posters will form an important part of the Symposium. Poster contributions documenting case studies of fisheries impacts in different ecosystems, methods to quantify fisheries impacts at the ecosystem level, or integration of environmental considerations in fisheries management are especially encouraged. Invited papers and papers based on poster presentations will be considered for publication following peer review in a special issue of the ICES Journal of Marine Science. Further Information can be obtained from Ussif Rashid Sumaila (Sumaila@fisheries.com), the ICES Secretariat or from the co-convenors: Mike Sinclair (e-mail: sinclairm@mar.dfo-mpo.gc.ca) and Henrik Gislason (e-mail: hg@dfu.min.dk).

News and Notes

Advanced notice for **"Pandalid Shrimp Fisheries – Science and Management at the Millennium"**. Marking the 50th anniversary of ICNAF/NAFO, hosted by NAFO and co-sponsored by ICES and PICES, this symposium will be held September 8-10, 1999. (Venue to be announced.) Some aspects of management of pandalid shrimp management to be considered include environmental and ecological influences, stock assessments and associated biological research, management strategies, and harvesting. For more information, please contact either: O. Koeller (NAFO - koellerp@mar.dfo-mpo.gc.ca; phone (902) 426-5379; fax (902) 426-1862); J. Boutillier (PICES - boutillierj@dfu-mpo.gc.ca); or S. Tveite (ICES - Stein.Tveite@imr.no; phone +47 37 05 90 00; fax +47 37 05 90 01)

Congratulations to **Silvia Salas** on being selected for a Government of Canada Award through the International Council for Canadian Studies. Silvia is a PhD student working under Dr Tony Pitcher, and her thesis topic is "Short term fishing strategies of fishers in small-scale fisheries of Yucatan coast, Mexico."

Congratulations also to **Melanie Power**, who has been awarded a Doctoral Fellowship by the Social Sciences and Humanities Research Council of Canada. Also a student of Tony Pitcher, Melanie's thesis research will consider allocations within and the structure of the British Columbia salmon fleet.

Best regards to **Rashid and Miriam Sumaila** on the birth of their second son. Haske (meaning "Bright" or "Brilliant" in Hausa) was born April 21, weighing in at a healthy 8.7 lb. Mother and baby are well. Rashid is an economist at the Fisheries Centre.



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