

Fishing adventures in mathematicaland

by

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“...Because $U(t)$ is a linear function of population biomass for $U(t) < \gamma K$, there are an infinite number of equilibrium solutions when the replacement line $U(t) = \beta B(t)$ coincides with the replacement line $U(t) = UB(t) / \gamma K$ (i.e. when $\beta = U/(\gamma K)$). ... Nevertheless, the relative equilibrium population size structure, N_j^/N_{j+1}^* for all j , will be identical at all possible equilibria on the interval $0 < B(t) < \gamma K$ regardless of the harvesting strategy which maintains each equilibrium...”*

(extract from a scientific document on the management of a deep sea rock lobster stock by the authors of this article)

“Speak English!” said the Eaglet. “I don't know the meaning of half those long words, and, what's more, I don't believe you do either!” (Lewis Carroll: Alice in Wonderland)

A new breed of high profile fisheries scientists is commanding increasing influence in the worldwide management of fish stocks. Like the knights of old on horseback, they fly around the world, waving powerful computers like swords and dispensing mathematical models like magic potions. They use complex scientific jargon to communicate amongst themselves and are dismissive of others who are unable to understand or participate in their complex rituals. They recognise no masters and take no prisoners. They are the protectors of the sea and its fish. Uncontrolled fishers are their enemies and unsustainable utilisation is their war cry.

Many of these scientists have no biological background and little knowledge or interest in fisheries biology or ecology. Never having been exposed to the harsh and smelly realities of fishing or the challenges of running a competitive business, to them fishing is the manipulation of binary digits on their virtual fish stocks, productivity occurs at peaks on different probably curves and reality is defined by the minimum “negative log likelihood” parameter estimates that appear on computer printouts.

Some of these fisheries gurus treat fishers with great suspicion and contempt and use their scientific wizardry and skill to promote ideological or wider political objectives, while others regard themselves as the protectors of the environment from ruthless exploiters. Yet others sell their craft to fishing companies or fisheries associations in order to ward off harsh management decisions. The latter are often perceived to be biased or dishonest, and their scientific work is treated with suspicion by the established scientific community.

Not surprisingly, fishers often view fisheries scientists as parasites who live off their hard work, sucking them dry with ever increasing costs, fisheries regulations, operational restrictions and cuts in allocations. Some simply do not trust fisheries scientists who they see as a threat to their livelihood. At best they do not believe in the scientific craft, and at worst they regard scientists as puppets of insincere political forces or radical environmental groups.

Fishers' conduct is also often questionable. There are probably good reasons why, in many circles, fishing is synonymous with illegal activity. The use of indiscriminative fishing gear which kills large numbers of non-commercial species is widespread. There is a general disregard by many commercial fishers for the environment and for non-commercial marine species such as sea birds, seals, dolphins and valueless finfish species. Sharks are finned and released to the sea, doomed to a slow painful death. High seas fish stocks where control is lax due to the absence of an enforcement presence or political disagreements are mercilessly overexploited (e.g. recent high seas Patagonian

toothfish and orange roughy fisheries). Often catches are not honestly reported to management agencies and gear regulations are simply ignored.

The fishing industry receives a far greater share of public and scientific interest and comment compared to other more aggressive exploiters and polluters of the environment. Farmers, miners and manufacturer who are associated with significant environmental degradation are often treated much more leniently than fishers. This intense public interest in fishing does not contribute to easing the tensions between the fishing industry and management authorities, and, as a result, what should be a straightforward technical communication often becomes an emotional arena in which facts and science are mixed with personal ideological, environmental convictions and political agendas. The often venomous email exchanged between subscribers of internet user groups like “fishfolk” demonstrates the level of emotion that is being generated. The result is an unmanageable cacophony high on emotion and low on the delivery of workable management regulations.

This mess can be partly attributed to the different philosophies governing science and fishing as occupations. Scientists are by definition scientists. Fishing stories in their view are just that – stories. Real life fishing experiences and views are regarded by them with great scepticism. Either they do not believe in them or alternatively they do not know what to do with them. The reason is that relevant information can often not be properly quantified. Scientists only use and analyse information which can be applied to their “accurate” craft – this includes for example CPUE data, catch records and growth rate and fish age and size information. Scientist are inclined to avoid the often thankless task of making sense of large amounts of unstructured or qualitative information which is not in the usual scientific format.

Scientists are also, by virtue of the discipline of their craft, extremely conservative. Prolonged poor catch rates should, even if not proven, be treated as an indication of declining fish stocks, just to be safe. If the data upon which management is based are dubious or incomplete then this must be matched by more conservative management objectives.

Fishers, on the other hand, are hunters, who operate in an unforgiving environment. Their expertise is not neatly tabulated in columns of figures, but rather in a bag of memories, experiences, other fishers’ stories, legends and facts, all mixed together to form a picture with many hues and shades but little structure. Hardened by the high level of unpredictability associated with fishing, fishers prefer to treat poor catches as bad luck, or temporary environmental fluctuations, just like a drought after some years of good rains. They seldom accept that poor catch rates and diminishing catches are due to declining fish stocks.

The above sentiments are intended to act as an opening piece to a forthcoming series of articles on the interaction between fishing and the science (art) of fisheries management. Few people (the authors included) would dispute that there are numerous fish stocks around the world which are severely depleted and that concerted and constructive management strategies are needed to conserve them. Nevertheless, scientific jargon and numerical calculations are often presented as a replacement for good quality fieldwork and real information. As a result unnecessarily conservative and costly fishing regulations are at times imposed to compensate for a lack of or for poor quality data.

In forthcoming articles we plan to demystify the jargon used by fisheries scientists and contribute to greater knowledge and understanding amongst fishers and hence greater effectiveness in resource management debates. Topics that will be covered include mathematical models, stock assessments, sustainable utilisation, over and under-fishing, risk assessment, management procedures and others of a technical or non-technical nature. The language and terminology will be accessible to the layperson and will, where possible, be aided by diagrams. We will draw on examples from our southern African experience or where appropriate, from the literature. Given our scientific

backgrounds we will try to be factual but nevertheless provocative in order to stimulate a productive debate.

The authors are the founders and owners of the OLRAC fishing consulting group located in Cape Town, South Africa. They are also the developers of the OLFISH electronic fishing logbook recently presented at the Glasgow Fishing 2001 exhibition. For more information please visit www.olrac.com.