

ICES – complexity in science and advice

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The founders of ICES wanted to explain why certain fish stocks varied as they did; why cod or herring fisheries could be so productive at some times, and so poor at others. They posed research questions as ambitious as knowledge of the day allowed; many are still not fully answered. They planned and implemented projects that were likewise visionary for the time; some of the data collection schemes they developed are still worth maintaining. The fact that we have not answered the first research questions set by the founders has not impeded our scientific drive to pose ever more challenging questions, requiring ever more ambitious and costly research projects. By the 1980s, the Multispecies Assessment Working Group was trying to combine many single-species assessments into a dynamic, interacting unit, apparently believing that by linking the variability among species we had somehow explained it. Not satisfied to just create such a marine stew, we have tried, in the present decade, to make ocean circulation stir the stew and ocean climate vary its temperature as well. Not only have scientists within ICES convinced each other that we are capable of pursuing ever larger and more complex research projects, we have convinced governments and management agencies that our conclusions are worth listening to. Done informally for a long period, this advisory role, in latter decades, became formalized, bifurcated, and tried to generate wealth. I will sketch how these trends to increased complexity in both ICES research and ICES advice have accelerated in recent years. Correspondingly, I will present trends in some indices of the status of the marine ecosystems which have been objects of ICES research and subjects of ICES advice. Forecasts of how much more complex our research and our advisory actions can become will be tempered with conjectures on how much more complexity on our part can be tolerated by those ecosystems.

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When ICES was founded, its founders were few in number and their scientific vision was clearly laid out on a few pages of text. However, size is not everything. As illustrated clearly in Helen Rozwadowski's history of ICES (Rozwadowski, 2002) and in presentations at this Symposium, although relatively few in number and thrifty in text, their intellects and vision were large. They were thinking internationally, in very much a multidisciplinary mode. They shared a desire from the outset to integrate knowledge from fields now known as fish biology, hydrography, biological oceanography, population dynamics, and meteorology.

ICES has kept this conceptual foundation. Many of the research questions posed in the first decades of the existence of ICES would be competitive project titles for funding today if the buzzwords of the first decade of the 20th century were replaced with buzzwords of the last decade of the century. Conversely, we can retrofit the language of the ICES Vision and Mission State-

ments (ICES, 2000a), and these statements sound very much like the early texts of ICES correspondence.

The current ICES Vision is:

An international scientific community that is relevant, responsive, sound, and credible, concerning marine ecosystems and their relation to humanity.

A century ago, the Vision might have been:

An international Assemblage of learned scientific Colleagues, that provides scholarly Discourse and Counsel on the Oceans, the diverse Creatures therein, and their many Benefices given unto Fisheries and the general Populaces of our Countries.

The current ICES Mission is:

To advance the scientific capacity to give advice on human activities affecting, and affected by, marine ecosystems.

A century ago, the Mission might have been:

To take our rightful Place at the forefront of the coming Grand New Age, by applying the methods of Sci-

entific Inquiry, to advance Mankind's Understanding and provide wise Counsel on the diverse consequences of Man's industry in the Oceans, and the Shifting Fortunes of Nature.

The phrasings of the day sound no more stilted than today's, and the concepts move comfortably across centuries. We may consider it humbling that what we think is visionary today is similar to what was visionary 100 years ago. However, we may just as readily be reassured that our predecessors were thorough in their thinking, and they chose a sound course. If so, it may not be precautionary to tinker too liberally with that course, at least without good cause. After all, if philosophers are still asking updated versions of the same questions asked by the Greeks more than two millennia ago, ICES scientists should not be embarrassed to be asking versions of the same questions posed by the founders a mere century ago. Our titles are, after all, doctors of philosophy, not doctors of marine ecosystems. Maybe that is part of the problem today. We have many marine ecosystems ready for the emergency ward, and the doctors are incapable of better diagnoses than "bad case of over-perturbation".

Personally, I do not consider it a blow to my ego that our Mission and Vision Statements can be made to sound like ideas a century old. However, I do find it humbling that after over a century of the best marine research anywhere on the globe, ICES had to conclude at Århus II that, although large ecosystem changes can be documented, it remains impossible to disentangle the roles of the various potential causal factors (Daan and Richardson, 1996). This inability to diagnose ecosystem maladies is not from lack of trying, however. From its outset, ICES was much more than philosophers thinking great concepts. ICES got practical things done. When research programs had to be planned or scientific results were ready to be shared, the scientific community got together and did it. The coordinated hydrographic cruises of the early 1900s were as ambitious in their day as the International Bottom Trawl Surveys, or the Year of the Stomach in 1981, or the Return of Year of the Stomach in 1991. It was probably no easier then than now to plan multidisciplinary projects scientifically, and almost certainly much harder logistically, lacking e-mail, Internet, and cellular phones.

These were truly dedicated professionals, who set high standards for internationalism and boldness. Then, as now, it seems that few individuals or countries gave identical emphasis to each discipline in these multidisciplinary projects. Anyone who reads Helen Rozwadowski's history of ICES (Rozwadowski, 2002) can see how agreements on the balance of emphasis in the early ICES cooperative research initiatives shifted, depending on who was at the table. Those descriptions sound hauntingly familiar as one thinks of current debates at ICES science and advisory committee meetings where the presence or absence of key individuals impacts at least the words chosen to convey what the meeting con-

cludes or recommends. Nonetheless, the interests of good science seemed to win the day a century ago, and good science continues to emerge today, as sound, multi-national, research programs continue to characterize research in the ICES community.

One may point to the three planning meetings and extensive correspondence preceding the establishment of ICES and challenge my assertion that the founders of ICES were persons of action. However, organizational planning always takes time, and three years is not bad. Consider that for a decade after the 1989 Statutory Meeting (now Annual Science Conference – ASC) in The Hague, each subsequent ASC devoted time to the Strategic Plan that has yet to be finalized, or the number of committees which failed to resolve the proper structure for the advisory committees. Three years is swift indeed.

What other precedents did our founders set? From the beginning there were committees. Uncharacteristically, the committees had unimaginative names: Committee A, Committee B, and Committee C. Through a sequence of expansions and purges, ICES has managed to keep the number of committees small enough that we could have maintained that tradition of giving them letter names. Nonetheless, we have gone descriptive; for example, Resource Management Committee (suggesting it is the resources we manage, instead of the human activities that affect them), and the Consultative Committee (which does not really consult at all, but spends its time talking to itself). In principle, this should make it much easier to know what each committee does. In practice, we need several pages of instructions to guide committees in how to formulate recommendations, plan a scientific session, and so on. Moreover, those of us with interests as broad as those of our founders require cloning, so we can attend meetings of all the committees whose chairs demand our presence.

Never wishing to waste a good precedent, ICES has retained the convention of naming things with letters. These are no longer committees, though, but working groups and study groups. This practice may show a rare lapse of judgment, however, in that we seem incapable of keeping the number of such groups to 26 or fewer. The 1998/1999 Annual Report (ICES, 2000b) includes 79 such groups. Of course, ICES has risen to the challenge; whereas single letters were good enough for the founders, we take WG, SG, or PG (planning group, not parental guidance) and add more letters. This gives us group names such as WGS AEM (which keeps changing), WGHARP (which has nothing to do with music – celestial or otherwise), WGBAST (few of whose members are actually illegitimate), and even HAWG (which has nothing to do with pigs). Note our foresight; this naming tradition of WG, SG, or PG plus four letters allows more than 30 million working groups before we have to start borrowing extra vowels from the Danes or extra consonants from the Icelanders.

There is another important feature that has character-

ized ICES from its gestation. The dynamic tension between applied research for improving sustainability and conservation, and basic science to understand marine ecosystems, was already present in the earliest days of ICES. Many founders wanted to contribute to the conservation of fish stocks and increased opportunity for social and economic benefits even without the help of such useful terms as "precaution", "sustainability", and "ecosystem". Over time, this role has become more and more formalized, with the creation of first one, then two, and now three different advisory committees.

Whereas the history of ICES scientific accomplishments gives great hope for the future, the history of ICES advice appears much less encouraging. These comments focus on the Advisory Committee on Fishery Management (ACFM), although the Advisory Committee on the Marine Environment (ACME) has had its own successes and challenges. Consider, for example, the results of a study of ICES advice on North Sea plaice in which Frans von Beek (2000) summarized the advice, the management action, and the stock response for more than a decade. Perhaps no one should be surprised that the management actions did not perfectly follow the ICES advice. More disturbingly, though, even when the management action was at least in the direction advised (and that occurred with reassuring frequency), the response of the stock was often not in the direction expected. Those of us in the science community often complain that managers do not listen to us enough. We should, however, share a bit of compassion for the managers who find that the fish are no better at listening to them.

Do managers really not listen to our advice? I have actually looked at the language issue to see if part of the reason we feel this is so is because our advice was not clear enough. I took the easiest case – where the advice was to close fisheries. We even said "close the fishery" in several different ways: 1) no directed effort, 2) lowest possible catch, and 3) closure. Since 1990, ACFM advised closing particular fisheries 39 times. In only three of those cases were the fisheries, in fact, closed. However, those three cases were not a result of particularly well-phrased pronouncements. In all three cases, the same phrasings were used in advising closures of other fisheries; for the 36 other cases, the modal management response was a 15% catch reduction. What characterized the three cases where closures followed the ICES advice? The fisheries had limited participation, highly structured industries, and a corporate entity, as well as a government or governments that could take action. It was the setting into which the advice was delivered, and not the advice itself, which determined its impact.

Maybe my selection of extreme cases was inappropriate. It may be good science to seek treatments with high contrast, but advice to close fisheries may be the most difficult for managers to implement. Unfortunately, concern about the effectiveness of ICES advice is not restricted to cases where closure is advised. Even more unfortunately, the problem cannot be laid exclusively on

the doorstep of the managers. Without going into an inappropriately technical analysis of the correspondence between ICES advice and actions of managers, consider some bottom lines. This follows the precedent already established at this Symposium. We have rightly concluded that ICES science has been a success, not on the basis of the number of meetings held, papers published, or research questions put permanently to rest. We take our satisfaction from how much more we now know about the marine ecosystems and their components than we did a century ago. Can we take comparable satisfaction that, overall, fish stocks are in better shape now than when we began assessing their status and providing advice on them?

In the 1999 Annual Report of ACFM (ICES, 2000c), full analytical assessments were the basis for advice on 51 stocks. We can classify stocks according to where the current estimates of biomass and fishing mortality lie in three zones that ICES has identified:

- 1) A SAFE zone where fishing mortality is below the precautionary limit and sustainable in the long term, and biomass is above its precautionary reference point allowing good recruitment.
- 2) A RISKY zone where fishing mortality and/or biomass is within the limit reference point, but outside the precautionary level. Because of the uncertainty in both the assessment and future states of nature, there is a high risk that the stock is being overexploited.
- 3) The potentially UNSUSTAINABLE zone where we are quite confident that the stock cannot support exploitation at this rate, and biomass is too low for good recruitment to be assured.

In the last calendar year, only seven of 51 stocks were in the SAFE zone, whereas more than twice that number were in the UNSUSTAINABLE zone. Moreover, that is not a short-term anomaly. ICES has conducted analytical assessments of various stocks for varying numbers of years. However, for each stock, if one counts the number of years when it was considered in the SAFE zone, compared with the number of years when it was potentially UNSUSTAINABLE, only 14 stocks have spent more time in the SAFE zone than in the UNSUSTAINABLE zone. A frightening 37 out of 51 stocks have spent more years in the UNSUSTAINABLE zone than in the SAFE zone. This record does not broadcast to the world that the ICES advisory role is an unqualified success.

We should not lay all the blame at the feet of the managers, even if we dare say that the advice which ICES has been providing has been better than the management decisions that the managers have been making. The chain of fault-finding is elastic in both directions. As a researcher on ecosystem-scale questions, I have had countless discussions with research colleagues who point out numerous ways in which the research being done is much more advanced and integrative than the information used in assessments. As a participant in both assessment and advisory committee meetings, the

assessment teams complain just as often that the assessments are better than the advice which comes out of the end of the process. The advice, as already noted, is considered better than the decisions made by the managers. Anyone listening to a fisheries manager will hear the litany of woes of how the management decisions are far wiser than the ways that the fisheries unfold in reality. And, finally, anyone reading trade journals or newspapers will know that most participants in fisheries have a long list of criticisms of the science being done on "their" stocks: scientists too much in love with their survey designs, high-tech gadgets, and models, and completely out of touch with the experiences of fishermen who are on the water every day.

In general, there is some truth to each bit of finger-pointing. Fixing this pathologic circle is the great challenge facing ICES in its second century. We can always continue to improve the science, but we have been on a productive, progressive course for a century. A philosophy of "more of the same" with regard to the ICES approach to science will serve us well for another century. However, a philosophy of "more of the same" with regard to the advisory role will be a disservice not only to ICES, but also to the fish stocks and marine ecosystems of the North Atlantic. We have to attack the task of *using* knowledge of the marine ecosystems with the same vigor with which ICES has always vigorously tackled the task of *acquiring* knowledge. Many more ecosystem scientists have to become active in assessment groups (as was the case with the old Multispecies Assessment Working Group – the only successful incorporation of trophodynamics into analytical stock assessments in any jurisdiction!). ICES has to carry on with smoother bridging between assessment working groups and advisory committees and better synthesizing in the advisory contexts. The Dialogue Meetings are a step ahead, but only a step on a long path towards more effective interactions between science advisers and managers. Science needs to use fishing industry knowledge better. The Canadian experiments with resource users and environmentalists participating in the assessment and advisory meetings have had both successes and setbacks, but we are learning from experience and improving our processes. The ICES advisory role has no future if it fails to explore some avenues in that direction, even if the processes must be different to accommodate different geopolitical realities. Finally, partnerships in research seems to be the buzzword everywhere. This may assist in bridging the science–industry chasm, although many people misinterpret the suitable roles that are required for each side of the partnership (Rice, 1998).

In short, my view from inside the dragon is very optimistic, but conservative with regard to the ICES science. By conservative, I do not mean that the ICES science should be unimaginative in the future. I mean just the opposite, that it has always been visionary, and holding to the past course will serve the scientific community, the marine ecosystems, and the global popula-

tion well into the future. However, my view is very pessimistic with regard to our advisory role, and the improvements needed are quite radical. We will not see substantial improvements in the status of exploited resources until several things happen. The ecosystem scientists and modellers have to get "down and dirty" in the regular cycle of fish-stock assessments. Science advisers and managers have to fraternize much more than they have in the past – intellectually, not just socially. And we all need to find some way to break through the dual stereotypes that the fishing industry's job is to catch fish and create wealth, whereas conservation is someone else's job, or that scientists and managers really know what is best and industry's experience can be patronized.

Taken together, my views ahead suggest that ICES has more challenges in its second century than in its first. It has won many well-deserved laurels for its scientific accomplishments, but must continue to earn them the same way – vision, integration, and hard work. However, without lowering the bar for science, ICES must really tackle the job of making its advice not just scientifically defensible, but really effective. These seven safe stocks have to be joined by the dozens of others whose status is unknown, risky, or considered unsafe. Finding ways to make our advisory role as effective as our science coordination role and our advisory accomplishments as numerous and widely acknowledged as our science successes guarantees those of us still in the system, and those behind us, challenges as great as we can envision. And, unfortunately, we cannot afford to fail.

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