Can we stop the lobster going the way of the cod?

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This report is a response to the Fisheries Resource Conservation Council (FRCC)'s request for opinion on how to reduce risk and address problems in Atlantic Canada's lobster fishery. See www.frcc-ccrh.ca for further details about this request.

1. Introduction

As we all know Newfoundland's Northern cod fishery has been under a fishing moratorium since 1992 with the stocks still showing no real sign of recovery some 13 years later. However Newfoundland is not alone in being short of cod. Britain, for example, now has an annual demand for cod of 170,000 t well above the British fishing fleet's quota for North Sea cod which, in 2002 was just under 34,000 t.[1] By contrast, Iceland and Norway both have cod fisheries that are in excellent condition with 'fishing quotas of both countries fluctuating only slightly from year to year around an average of 190,000 t.'[1]

So what lessons can we learn from Iceland and Norway? Perhaps if we study the history of their cod fisheries we can find some factual difference from those of Canada and Britain, differences that might explain the successful management of their ground fisheries and Britain's and our own failure. This is not the approach I take in this report; here, I do not look for *factual answers* based on historical analysis, but look for *analytic* answers based on logical analysis. Analytic answers are of particular interest to us since they apply world wide; that is they are relevant to an understanding that includes *both cod and lobster*.

2. Traditional differences between the management of cod and lobster

The science of managing groundfish stocks has traditionally involved the use of catch limits based on biomass measurements. However, biomass measurements have never been part of lobster management plans. It is just because these structural plans have not involved biomass based advice such as 'The maximum sustainable yield (MSY) of lobster in LFA 33 is 2 thousand pounds' that lobster stocks have not yet 'gone the way of the cod'. To understand why biomass based advice has been so devastating for groundfish stocks, requires us to understand why a decision can not be derived from facts or data.

Nobody knows how many lobsters are on the sea bottom but even if we did a management decision could not be obtained from this information.

Decisions have to be taken; a failure to appreciate this simple fact will ensure our mistakes with the management of cod are repeated with lobster.

3. How are management decisions to be based on scientific fact?

Just as laws are made by a collection of people in a parliament; so regulatory management policies for a lobster fishery are made by a collection of people - *the decision makers* - in a Lobster Advisory Committee together with the Regional Director General of the Department of Fisheries and Oceans (DFO). No-one claims that laws enacted in parliament are derived from data; why should fisheries management be any different? That is not to say scientific advice based on scientific fact is not one of the important inputs the decision makers seek in order to help them make the decisions needed to manage a fishery. But the connection between decision and fact must be a sound one. An example of the sound use of scientific fact is to be found in the logical analysis of a physical engineering.

The engineer makes decisions all the time and this is done by *trial and error*; that is, a decision is taken (trial) and factual feedback is obtained by 'seeing what happens' (error elimination). We can represent a fisheries version of this engineering decision making by the *analytic problem solving schemata* provided by the philosopher of science, Karl Popper [2], as:

$$P_1 \rightarrow TD \rightarrow EE \rightarrow P_2 \rightarrow TD \rightarrow EE \ldots \text{etc.} \qquad (1)$$

where P_1 = the initial problems including the goal to be pursued (How do we obtain a sustainable fishery? How do we obtain further employment for our fish processors?); TD = tentative decision, a tentative policy that reflects the chosen goal; EE = error elimination, objective feedback by which the effectiveness of the policy is assessed and P_2 = the new problems and consequences that arises as the result of the decision taken.

4. How are management decisions to be guided by universal laws?

Under an analytic or logical view of a scientific enterprise the laws or models of a science apply world-wide; that is *they are universal*.

Models of a theoretical economics meet this logical requirement and are built around 'agents' that represent a world-wide rationality. These models thus apply to *cod and lobsters*. In fisheries economics this modeled rationality involves a totally unregulated fishery, referred to as an *open-access* fishery that allows the prejudicial nature of derby fishing (the rush for the fish) to be assessed logically. Just as the laws of physics apply universally (world wide) and set limits on what can be accomplished by the engineer (i.e. show what cannot be done), the logical models of fisheries economics give *negative advice* that *universally explains* (explains for cod and lobster) what can not be accomplished by a decision; as:

'You *cannot* obtain a sustainable cod and lobster fishery (goal) while at the same time providing unlimited jobs for cod and lobster fishermen (social objective)'

'You *cannot* obtain unlimited jobs for cod and lobster fishermen (goal) without using tax payer's money (concomitant effect)'

'You *cannot* obtain a sustainable cod and lobster fishery (goal) without controlling the prejudicial behavior of cod and lobster fishing derbies (unintended consequence)'

'You *cannot* control cod and lobster fishing derbies (goal) without assigning property rights (by for example, the use of Individual Transferable Quotas [ITQs])'.

The point I am making here is not that these examples are necessarily true or even particularly good and I am certainly not advocating the adoption of ITQs for the lobster fishery. The important point is that the examples illustrate how, just in the physical sciences, universal advice in the social sciences takes the analytic form of a *politically neutral negative* argument, as:

'*If* you choose to accept goal or objective A *then* you *cannot* at the same time achieve goal or objective B'

'*If* you wish to achieve goal A *then* you have to control unintended consequence B' or: 'You *cannot* achieve goal A without also controlling concomitant effect B'

From a logical point of view, a fisheries economic tradition, such as that involved in managing Iceland's successful cod fishery, involves *negative apolitical advice*, advice that explains what you should *not* do. Limitations on, and the potential consequences of options are presented to the decision takers by fishery economists, but the decisions are not derived from the science: the decisions, *and the responsibility that goes with these decisions*, remain entirely in the hands of the decision takers[3].

5. Rational management of a lobster fishery

Rational management decisions for any lobster fishery require the institutional and structural support of a *dual modeled system* comprising;

(i) a universal model of fishery economics that gives us an understanding of the prejudicial nature of derby fishing (see section 4). This model is applicable to all fisheries (cod and lobster) and provides politically neutral negative scientific advice of the form; ‘You *cannot* have a sustainable cod or lobster fishery (goal) unless you control fishing effort and overcapacity (concomitant effects)’

(ii) a feedback model of the lobster fishery in question that lets us know the effectiveness of the regulatory policies put in place by the decision makers (see section 3). This feedback is used to assess the effectiveness of the chosen policy in meeting the goal of a sustainable fishery. This feedback model applies only to the lobster fishery in question.

6. Where does biomass modeling go so wrong?

The scientists at DFO frequently complain that the politicians do not listen to their advice, and indeed there is some truth to this; but, from a logical point of view, it is not at all surprising DFO advice is not adhered to: since this advice itself is not politically neutral, there is no reason why other policy or political considerations should not override it. Why should the decision makers not strive to reduce unemployment (goal) by favoring a total allowable catch (TAC) of, say, 30 million pounds instead of 20 million pounds? Or strive to raise the standard of decision making by applying the precautionary principle (standard) and setting a TAC of, say, 10 million pounds or should it be 5 million pounds?

Unlike the feedback model of (1) where the empirical evidence provides feedback *after the decision has been taken*, DFO scientists collect data that is used to form biomass models that provide advice for the decision *to be taken*, as:

database → biomass model → prediction → decision… (2)

Clearly, if the database is uncertain the scientific advice will be uncertain; sometimes summarized as: ‘Garbage in: Garbage out’. The prediction or advice derived from this model is referred to as *political advice* since, unlike economic advice (see section 4) it is not neutral in policy terms. It describes a decision, a political or policy decision to be taken as, for example: ‘The TAC should be 20 million pounds’ or ‘The maximum sustainable yield (MSY) is 30 million pounds’

The reason why this approach to decision making is so damaging is that it puts the emphasis in entirely the wrong direction; instead of understanding that all decisions *have to be taken* we are now led to believe decisions can be *reduced to facts* - better decisions require better facts – find the ‘better facts’ and we have the ‘better decisions’. Whereas it is a matter of elementary logic that decisions together with goals (such as sustainability) and standards (such as the precautionary principle) cannot be produced from, or be reduced to, facts or data. Decisions, goals and standards, by reflecting the values of the proponents, form part of the problem situation requiring solution (P_1, P_2… in [1] of section 3); solutions require *ingenious and creative policies* not accurate or 'certain' measurements of biomass!

7. Concluding comments

7.1 The management decisions of Canada's commercial ground fisheries (such as Newfoundland's Northern cod) have been based on predictions derived from *singular models* that combine within themselves the features of the *dual model system* advocated in section 5. Unlike this dual system, the 'combined' DFO biomass models are (i) derived from data and so are *not* universal (do *not* apply to cod and lobster), (ii) are models of fish populations and *not* fishing behavior and so give us no understanding of the prejudicial nature of derby fishing, (iii) advise the decision makers what *should* be done by describing a policy to be adopted rather than adopting a politically neutral position that sets limits to what *can* be done.

7.2. Individual Transferable Quotas (ITQs) were introduced into Iceland's cod fishery in 1984. It is very easy to find objections to the ITQ system; detractors point out, for example, you end up with the smaller fishing boats being bought out; the larger boat owners and processors end up owning much of the available quota. Quite so: if your goal is to maintain high employment for fishermen and processors then you should never even consider introducing a management system involving quota ownership. However, if your goal is to establish and maintain a sustainable fishery you will then appreciate the wisdom of involving market forces in both reducing and controlling overcapacity. The supporters of the ITQ system point out that under this system of economic benefit vessel owners have an incentive to buy one another out, a form of fleet downsizing that, contrary to the usual practice, reduces fishing overcapacity without involving government money[4].

7.3 Iceland's successful management of its cod fishery is an example of a management tradition and regime that has effectively controlled its effort levels and overcapacity. It should come as no surprise that a sustainable lobster fishery has likewise to contain its effort and fishing capacity as advocated in the universal scientific advice of section 5 (i), as: 'You *cannot* have a sustainable fishery (goal) unless you control fishing effort and overcapacity (concomitant effects)'

8. Recommendations

8.1 Our ability to maintain a sustainable lobster fishery into the distant future depends on us learning from those mistakes of method that have allowed the development of a gross overcapacity in our cod fisheries. The basic mistake in managing groundfish has been the use of biomass based advice to tell the decision makers what policy should be adopted (see [2] section 6), rather than using a feedback model to assess if the policy decided upon has in fact enabled the fishery to meet the stated goal being pursued (see [1] section 3).

8.2 Lobster fishermen are chasing lobsters harder than ever; by attending traps twice a day, moving traps more frequently, expanded their traditional fishing grounds, refuges for lobsters are being continually diminished; more regulations, such as shorter seasons, more licensing requirements, and a reduction in allowable sea days are needed to control this increasing effort. Which regulations should be adopted is best determined by the industry itself and does not form part of this report's recommendations. However, whatever additional regulatory measures are finally taken (or indeed if no new measures are taken) the question will always arise – are the regulatory policies presently in place having the desired effect of putting the industry on a sustainable footing? Answering this question will require the effective operation of a feedback model (see section 3).

8.3 Lobster management has a long history of success; some regulatory measures, such as fishing seasons and size limits, having been in place for more than eighty years. The health of this industry has been traditionally monitored through the use of landings (t); however, this method needs structural improvement. For example, beginning in the mid-1970s annual landings in the Atlantic region underwent a sustained increase from about 15,000 t to a peak of 48,000 t in 1991[5]. Did these increased landings indicate increases in lobster abundance or was it a reflection of increased effort levels or was it a bit of both? Only a landings-per-unit-of-effort (LPUE) index (also called a catch-per-unit-of-effort [CPUE]) can answer this kind of question.

8.4 A LPUE index should be constructed for the industry that would provide a continuous trend over time. This trend would form an effective feedback model; a declining trend over time would indicate the goal of sustainability was in jeopardy, whereas a level or increasing trend over time would indicate that the industry was maintaining its sustainability.

8.5 Most importantly, if it is determined that new regulatory policies are required to reduce effort levels and avoid overcapacity; a failure of the LPUE index to increase over time would indicate the regulations were not effective; further more effective regulations are needed.

8.6 Most crucially, a LPUE index is to be used as a feedback model involving trends and only trends. It should never be used as an estimator of total lobster abundance or biomass.

8.7 The recommendations in this report maintain the general philosophy of the current lobster management system as well as taking into account the universality of scientific advice (sections 4 and 5). The details of how an LPUE index (recommendation 8.4) might be incorporated into the present management system would have to be determined by the industry itself.

References

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