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CAN WE STOP THE ATLANTIC LOBSTER FISHERY GOING THE WAY OF NEWFOUNDLAND'S ATLANTIC COD? A PERSPECTIVE

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ABSTRACT

The cod and lobster fisheries of Atlantic Canada are managed in very different ways. Regulatory policy for Atlantic cod has traditionally been based on population or biomass measurements, something that has never been done for the management of Atlantic Canada's lobster. While these traditional methods differ, an alternate logical or analytic approach to management is perhaps one way that sound and rational fisheries can be managed. The recommendations that follow derive from asking: can we learn analytic lessons from the collapse of Atlantic cod that might allow us to avoid a similar collapse in Atlantic lobster? A landings-per-unit-of-effort (LPUE) index could be constructed for the lobster 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. Crucially, an LPUE index should only be used as an argument *a posteriori* involving feedback in the form of trends. This index should never be used as an argument *a priori* to estimate lobster abundance or lobster biomass.

INTRODUCTION

The Newfoundland fishery for Atlantic cod (*Gadus morhua* Linnaeus 1758) was once the largest and most productive cod fishery in the world (McGrath, 1911; Thompson, 1943). In the early 1990s, this fishery suffered a major collapse that has become one of the world's most prominent case studies of failure in fisheries management (Charles, 1997). This paper attempts to answer the question: can we learn lessons from the collapse of Newfoundland's Atlantic cod that can be used to avoid a similar collapse in Atlantic Canada's lobster (*Homarus americanus* H. Milne-Edwards, 1837) fishery? Newfoundland is not the only jurisdiction that has suffered a shortage of cod. For example, Britain ten years ago had an annual demand for cod of 170,000 metric tonnes (MT), well above the British fishing fleet's EU quota for North Sea cod which in 2002 was just under 34,000 MT. By contrast, over the same period Iceland and Norway both had cod fisheries that were in excellent condition with 'fishing quotas of both countries fluctuating only slightly from year to year, around an average of 190,000 MT'(Globefish, 2003).

Can we learn lessons from Iceland's successful management of it's cod fishery, lessons that can be applied to Atlantic Canada's lobster fishery? Perhaps if we make a comparative study of successful (Iceland and Norway) and unsuccessful (Canada and Britain) cod fisheries, we might gain some insight as to how lobster fisheries could be better managed? This would doubtless be of interest but it is not the approach taken in this discussion paper. Here, I do not look for factual answers based on a comparative analysis; rather, I look for analytic answers based on a logical analysis. Analytic answers are of particular interest since they apply to the sound and rational management of fisheries world-wide. Similar analytic methods could be used for management of Canada's, Iceland's, Britain's and Norway's cod fisheries and for the Atlantic Canada lobster fishery.

1. Traditional differences between the management of cod and lobster

The applied science of managing Atlantic Canada's ground fish stocks has traditionally involved the use of catch limits based on population abundance, often in the form of biomass measurements. Biomass measurements, however, have never been part of Atlantic Canada's lobster management plans. Perhaps it is just because these plans have not involved biomass based advice such as: 'The maximum sustainable yield (MSY) of lobster in LFA 33 is 2 thousand MT', that lobster stocks have not yet 'gone the way of the cod'. To understand why biomass based advice has been so devastating for ground fish stocks, we need to understand why a decision cannot be derived solely from facts or data. Nobody knows how many lobsters are on the sea bottom but, even if that were known, a management decision should not be obtained from this information. Decisions still have to be taken. A failure to understand this fact would mean that the mistakes made with the management of the Newfoundland cod would be repeated in the management of Atlantic lobster.

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

Regulatory management policies for a fishery are made by a collection of people - the decision makers. In the management of an Atlantic lobster fishery, these decision makers are members of a Lobster Advisory Committee together with the Regional Director General of Canada's Department of Fisheries and Oceans (DFO). No one claims that laws enacted by the decision makers of a parliament are derived from data; why should the policies for fisheries management be any different? That is not to say that scientific advice based on scientific fact is not one of the important inputs the decision makers seek in order to help them construct the policies needed to manage a fishery. But the connection between decision and fact must be a sound one. An example of the sound managerial use of scientific fact is to be found in the logical analysis of 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 fishery version of this engineering decision making by the analytic problem solving schemata provided by the philosopher of science, Karl Popper (1979), 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 arise as the result of the decision taken.

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

Under an analytic or logical view of the scientific enterprise, the laws, models, or theories of fisheries science apply world-wide and involve a falsifiable view of science (Corkett, 2009). A neoclassical view of bioeconomics meets this logical requirement. Rights-based models, for example, do not describe an actual world occupied by fallible people such as you and me, but describe a situation logic animated by 'agents' or 'actors', players whose rationality gives the model its great flexibility. It is this flexibility or simplicity that allows a rights-based model to explain the prejudicial nature of derby fishing - the rush for the fish. Just as the laws of physics apply universally (i.e. apply 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 (in this case, explains for both cod and lobster harvesting) what cannot be accomplished by regulatory policy. For example:

> One cannot obtain a sustainable cod and lobster fishery (goal) while at the same time providing unlimited jobs for cod and lobster fishermen (social objective).
>
> One cannot obtain unlimited jobs for cod and lobster fishermen (goal) without using tax payer's money (concomitant effect).
>
> One cannot obtain a sustainable cod and lobster fishery (goal) without controlling the prejudicial behavior of cod and lobster fishing derbies (unintended consequence).
>
> One cannot control cod and lobster fishing derbies (goal) without assigning property rights (for example, by the use of Individual Transferable Quotas [ITQs]).

The point is not that these examples are necessarily true or 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, as in the physical sciences, universal advice in the social sciences takes the analytic form of a politically neutral negative argument: If you choose to accept goal or objective A, you cannot at the same time achieve goal or objective B.

If you wish to achieve goal A, 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 the use of ITQs in managing Iceland's 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 makers 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 makers.

4. Rational management of a lobster fishery

Decisions for the rational and sound management of any lobster fishery require the institutional and structural support of a dual modeled system, comprised of two parts:

(i) a universal model of fishery economics that provides an understanding of the prejudicial nature of derby fishing (see section 3). This model is applicable to all fisheries (thus applying to both 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 informs us of the effectiveness of the regulatory policies put in place by the decision makers (see section 2). Feedback is used to assess the effectiveness of the chosen policy in meeting the goal of a sustainable fishery. The feedback model applies only to the lobster fishery in question (i.e. it is not universal).

5. Where does biomass modeling go so wrong?

The scientists at Canada’s DFO sometimes 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 that DFO advice is not necessarily 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 MT instead of 20 million MT? Or why should they not strive to raise the standard of decision making by applying the precautionary principle and setting a TAC of, say, 10 million MT or should it be 5 million MT?

Unlike the feedback model (1, above) where the empirical evidence provides feedback after the decision has been taken (a type of argument referred to as *a posteriori*), DFO fisheries scientists collect data that is used to form biomass models, that in turn provide advice for the decision to be taken (a type of argument referred to as *a priori*), as:

$$\text{database} \rightarrow \text{biomass model} \rightarrow \text{prediction} \rightarrow \text{decision} \qquad (2)$$

Clearly, if there are uncertainties in data quality and quantity, the scientific advice will be uncertain – a situation sometimes crudely summarized as: ‘Garbage in: garbage out’. The prediction or advice derived from schema (2) above deploys an argument *a priori* and is referred to as political advice since, unlike economic advice (see section 3), it is not neutral in policy terms. It describes a political or policy decision to be taken. For example: ‘The TAC should be 20 MT’ or ‘The MSY is 30 million MT’. The reason why an *a priori* argument is so damaging is that it sets the emphasis in decision making in entirely the wrong direction. Instead of understanding that all decisions have to be taken, we are now led to believe that decisions can be reduced to facts. Better decisions require better facts; find the ‘better facts’ and we have the ‘better decisions’. Instead, 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 reflect the values of the proponents and form part of the problem situation requiring solution (P_1, P_2… in [1] of section 2). Solutions require ingenious and creative policies, not accurate or ‘certain’ measurements of biomass! From an ethical perspective, the hope of the fisheries scientist that the establishment of norms such as sustainability can be based on an *a priori* argument results in a monism of scientific ethics (Corkett, 2005). An example of a fisheries monism would be the widespread use of reference points in a naïve attempt to guide the development of a sustainable fishery (Beddington *et al*., 2007, their figure 1).

CONCLUDING COMMENTS

The management decisions of Atlantic Canada’s commercial ground fisheries have been based on predictions derived from data-based models that combine within themselves the features of the dual model system advocated in section 4 (above). Unlike this dual system, the data-based models used by Canada’s DFO (i) are derived from data and so are not universal (they cannot possibly apply to both cod and lobster); (ii) are models of fish populations and not fishing behavior and so provide no understanding of the prejudicial nature of derby fishing; and (iii) advise the decision makers what to do by describing a policy to be adopted, rather than by taking a politically neutral position that sets limits to what can be done.

The ITQs were introduced into Iceland's cod fishery in 1984 (Einarsson, 2001). It is very easy to find objections to the ITQ system. For example, detractors point out that the smaller fishing boats are bought out, resulting in the larger boat owners and processors owning much of the available quota. If the goal is to maintain high employment for fishermen and processors, then one should never even consider introducing a management system involving quota ownership. If the goal, however, is to establish and maintain a sustainable fishery, the wisdom of involving market forces in both reducing and controlling overcapacity will be appreciated. The supporters of the ITQ system point out that, under this system of economic benefit, vessel owners have an incentive to buy out one another, a form of fleet downsizing that, contrary to the usual practice, reduces fishing overcapacity without involving government money. Iceland's successful management of its cod fishery, using rights-based models in the form of ITQs, is an example of a management tradition and regime that has effectively controlled its effort levels and overcapacity. It will come as no surprise that similarly, a sustainable lobster fishery has to contain its effort and fishing capacity as advocated in the universal scientific advice of section 4 (i), as: 'One cannot have a sustainable cod or lobster fishery (goal) unless you control fishing effort and overcapacity (concomitant effects)'.

RECOMMENDATIONS

Our ability to maintain a sustainable lobster fishery into the distant future depends on learning from those mistakes of method that have allowed the development of a gross overcapacity in our cod fisheries (Charles 1997). The basic mistake in managing Atlantic groundfish has been the use of biomass based advice to tell the decision makers which policy should be adopted (see [2] section 5), 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 2).

Lobster management has a long history of effort control; in Canada, some regulatory measures, such as fishing seasons and size limits, have been in place for more than eighty years (FRCC, 2007). The health of this industry has been monitored traditionally through the use of landings. This method, however, needs structural improvement in the form of a more effective feedback model (see section 2). For example, beginning in the mid-1970s, annual landings in the Atlantic region underwent a sustained increase from about 15,000 MT to a peak of 48,000 MT in 1991 (FRCC, 2007). Did the 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 LPUE index (also called a catch-per-unit-of-effort [CPUE]) can answer this kind of question.

A LPUE index should be constructed for the lobster industry, hence providing 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.

More 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 that the regulations were not effective; additional and more effective regulations would be needed.

Crucially, a LPUE index is only to be used as an argument *a posteriori* involving feedback in the form of trends. This index should never be used as an argument *a priori* to estimate lobster abundance or lobster biomass. Every care must be taken not to repeat the mistakes made by Canada's DFO in managing the stocks of Atlantic groundfish, methodological mistakes that many hold responsible for the collapse of the Newfoundland Atlantic cod stock by the 1990's, with its severe economic, ecological and social impacts.

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