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PROBLEMS AND PRIORITIES IN RESTORING DEPLETED FISHERIES

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ABSTRACT

The paper notes the widespread prevalence of depleted fisheries, and the Nash equilibrium/prisoners' dilemma which is generally regarded as being responsible for their suboptimal state. It points out that considerable potential income is being lost by growth overfishing and comments on the strength and pervasiveness of this state of affairs.

It continues by discussing possible measures to bring depleted fisheries back to near optimal condition and seeks ways to commend these effectively to fishing industries. It concludes that restoration of depleted fisheries to optimise overall income should be feasible, but that as it would generally involve reducing activity, it would face a classical socio-economic efficiency versus equity clash of interests, which might be solvable but not very easily.

INTRODUCTION

It has been shown for many fisheries wholly or partly in EU waters that many fisheries which had been slowly declining in productivity for many years declined at accelerated rates over the ten years following the introduction of the Common Fisheries Policy with its main characteristics as we know it today, notably featuring regulation by TAC (Total Allowable (landed) Catch) and Quota. This is easily measurable from catch per unit effort time-series, and where these are unavailable by the useful surrogate of time-series of catch (Y) per unit fishing mortality (F) imposed (Y/F), since F is a log-transformed measure of the proportion of the stock taken, and is intuitively approximately linearly related to effort (Hillis *et al*., 1998).

In these years, the catch taken has been reduced even though effort and the efficiency of that effort have increased, because while increased effort takes an increased proportion of the stock it also reduces the total stock biomass (aggregate stock weight), and if not prevented will normally continue to do so with the result that gains from taking an increased proportion of the stocks are outweighed by reductions due to reduction in total stock biomass.

The reaction of most operators has been to work harder, if possible “capital stuff” i.e. upgrade their boats and equipment, and seek new areas and species to exploit. The competition in an open access fishery gives them no choice. Further, it is extremely difficult to set in place a regime designed to eliminate competition where one of the competitors feels that the competitive status quo puts them in an unfair position vis-à-vis the other(s) as is the case with Ireland and the United Kingdom, where immense areas of territorial waters under the United Nations Law of the Sea had to be shared with other member-states as a condition of entry to the EC, increasing the intensity of competition in those areas, and making their management considerably more complicated and difficult.

The fact that many existing fisheries could be managed so as to yield slightly increased or slightly decreased catches with greatly reduced costs means that such fisheries could be made to yield considerably increased profits as a whole does not penetrate beyond the Nash Equilibrium/Prisoners’ Dilemma, and further, it is not the case, as many in the industry seem frequently to think, that increased returns can come only from the sharing out of the returns being between fewer boats.

DISCUSSION OF MANAGEMENT METHODS

In a well restored fishery, increased returns can accrue to reduced number of boats or to an unreduced number of boats working short time taking a catch similar in size to when the fishery was depleted but as a smaller proportion of an increased stock with increased density of fish on the grounds, it requires less effort to take, saving on fuel and other operating costs. To do this they must of course fish less, - increases in catch as the stock increases will come from an increase in catch ***rate*** which will more than offset the reduction in activity - and this can be achieved either by limitation on fishing time or by individual catch quota.

Theoretically, it is relatively easy to calculate the most profitable proportion of a fish stock to take sustainably, even allowing for the inescapable biological imponderables in natural mortality and recruitment and the imperfections in almost any statistics on which calculations for predictions will have to be based. However, experience shows that confidence in any effort reduction programme is so low that very few fishers are willing to try to even advocate accessing increased returns by that particular means, despite the fact that it is the only relatively costless way of doing so.

Reducing the fishing mortality rate requires reduction of either the number of operators, the length of time during which they operate or both. In the European Union the first alternative has been effected by decommissioning, which has meant in effect that the fleet received substantial cash injections to reduce itself in size.

Cost reduction versus revenue increasing

When a fishery is badly depleted, the only ways to make more money out of it in the medium and long term are (1) to reduce running costs. and (2) to maximise catch size without increasing effort (if this can be done, which it can in the case of stocks which show a definite F_{max} point on their Beverton and Holt (1957) Yield per Recruit functions).

The operating costs of fishing are approximately correlated with F, (fishing mortality, a log-transformed measure of the proportion of the stock taken), and not with absolute catch size. Operating cost reduction is much the more effective component

than increased revenue from fish in increasing profits, as is shown in the table below, taken from Hillis and Keogh (1997), which demonstrates that (with reduction of F by 50% in five annual steps of 10%), changes in costs always have smaller losses and greater – and more frequent - gains than have changes in revenue in contributing to changes in profit, illustrated by changes calculated for five Irish Sea species, shown accumulated over periods of 1, 2, 5 and 10 years:-

	Revenue				**Costs**				**Overall**			
Year(s):-	1	1~ 2	1~5	1~10	1	1~ 2	1~5	1~10	1	1~ 2	1~5	1~10
Cod	*-6.6*	*-7.5*	*-7.0*	**6.1**	*-0.6*	**2.1**	**16.2**	**43.4**	*-7.2*	*-5.6*	**8.1**	**52.1**
Whiting	*-6.5*	*-7.5*	*-10.4*	*-1.7*	*-0.5*	**2.5**	**14.4**	**39.4**	*-7.0*	*-5.2*	**2.5**	**37.0**
Plaice	*-8.3*	*-11.3*	*-19.1*	*-13.0*	*-3.6*	*-3.7*	**0.6**	**20.8**	*-11.6*	*-14.3*	*-17.6*	**5.1**
Sole	*-8.3*	*-10.7*	*-7.7*	*-1.7*	*-6.0*	*-6.0*	**7.3**	**17.1**	*-13.8*	*-16.6*	*-1.0*	**15.1**
Nephrops	*-7.0*	*-7.8*	*-6.3*	**13.9**	*-1.9*	**3.5**	**30.7**	**83.3**	*-8.8*	*-4.6*	**22.5**	**108.8**

Hence management measures which get costs down have much more income boosting potential than those which do not, such as mesh regulation (which tends not to mitigate the race foe fish and tends to have high enforcement costs, Anon., 1997). There is probably an optimum mesh with which to accompany any F reduction programme, but there is absolutely nothing in mesh regulations *per se* to stop excessive overfishing of fish large enough to be selected by the net in use, or put more simply, to stop an excessive number of boats dragging modern efficient gear over largely empty grounds.

Efficiency versus Equity

Given that sustainable profits are maximised at significantly reduced levels of F (achieved after the reduction has resulted in corresponding increase in stock size), it follows that effort must stay at the reduced level to maintain the high stock size which keeps the harvesting of the fish cheap, and the problem in making such regulation work effectively will lie in restraining effort to stay at that level.

Management is faced with the necessity to make several options based on value judgements; is it desirable to use:-

1. Funded reduction of effort without any other constraint. This would usually be achieved by **decommissioning** of boats, whereby operators are compensated for removing them from the fleet. This has the advantage of being relatively quick and free from enforcement problems, boats which have been removed obviously needing no further policing. It has the disadvantages of being administratively expensive and frequently, - apparently despite the compensatory payments, - traumatic for the operators who thus submit to permanent exclusion from the fishery and for their communities which are likely to undergo some consequent reduction in population size.

2. Unfunded reduction of effort without any other constraint using market forces. This is the normal course of action resulting from **Individual Transferable Quota (ITQ),** by which operators are given property rights consisting of rights, which may be traded, to catch specified amounts of fish, usually in the form of specified proportions of the overall total allowable (landed) catch (TAC). This method has been applied in a number of fisheries since the 1980's with varying success. It has the administrative advantages of (1) not costing the amounts required for the buy-out payments of decommissioning, (2) its use of market forces to maximise freedom of movement of effort within the regime area, (3) its lack of motivation of operators to 'race for fish'.

   It has the disadvantages of (1) embodying the concept of donating property rights in the fish stock to some operators, which automatically extinguishing the rights of all citizens to fish if they should wish (though these are rather circumscribed already, and local opposition to people perceived as 'outsiders' attempting to join a fishery is a well-known phenomenon), (2) requiring a high level of policing based on swift and detailed information, (3) motivating operators to land fish secretly ("black fish") and (4) motivating them to discard at sea, this discarding including "high-grading", discarding of low quality marketable fish if higher quality fish are caught later in a trip.

   Experiences in a number of countries reported to OECD (Anon. 1997) indicate this method of fishery management as comparing favourably with most others in effectiveness in conserving the stock, though serious problems remained with initial allocation and compliance and enforcement. In the European Community

however, ITQ has been opposed by fishers in countries without a decommissioning programme at the time as “decommissoning by the back door”, based on the feeling that they were being treated unfairly by only being offered unfunded fleet reduction when fleet reduction in other countries was being funded by decommissioning.

3. Unfunded reduction of effort subject to avoidance or minimising of job losses. **(Individual Quota, I.Q., Individual Allocation, I.A.)** In operation, ITQ will always tend to result in concentration of quota in a reduced number of hands, as the price of quota, if the improvement of the fishery is perceived to be proceeding reasonably successfully, will rise and the strongest operators will buy out those on the margin.

   Views about whether this is a desirable development and should be permitted are divided. On the one hand it tends to make the fishery more efficient, providing increased quantities of an improved product, and is perfectly compatible with developments in business all over the developed world; farm, shop and other business operators are in the great majority of cases becoming much larger and much fewer; business is more efficient, the product better, the customer gains. Why should fishing be any different? On the other hand, just as the situation in farming has threatened to depopulate many rural communities, to the extent that the EU has for some years devised the most elaborate measures to motivate farmers to stay in business in circumstances where it would otherwise be quite unfeasible, so even though fishing is a generally smaller industry in most European countries, fishing communities have some of the same features as farming communities, and it can be argued from socio-economic grounds that fishing ought to be assisted in the same way as farming and for the same reason, to prevent isolated communities from depopulation. If such a view is adopted it follows that regulatory measures which increase the total returns of a fishery should if possible be structured in accordance with the Pareto principle that whilst making at least some operators better off they should make none worse off.

There are potentially a great number of rules which could be put in place to effect such an outcome, and they all act by placing restrictions on the free transferability of quota, ranging from restricting total amounts of quota which one person may possess down to simple non-transferable short term allocations.

4. Unfunded effort reduction without fleet reduction by time quotas. This, to avoid the job-losing potential implicit in fleet size reduction in keeping with socio-economic objectives of keeping remote fishing communities viable has been tried in a number of cases notably in Iceland 1985-1990 where it was called **(individual) "effort quota" (I.E.Q.),** carefully monitored, and abandoned in 1990 (Arnason, 1995). The problem with this method is that it aggravates the race for fish and it leaves it open to boats to 'capital stuff' (i.e. upgrade their efficiency), as operators strive to maximise catch in limited time available to them. To avoid this, it must be accompanied by regulations to prevent boats from indulging in competitive investment which will increase catches in the short term, but will hamper the programme of making fish cheaper to catch by making them more abundant by letting the stock grow larger. The Icelandic experience bore testimony to this effect with capital investment in vessel alteration increasing when effort quota was introduced and decreasing when it was abolished.

The intense and ultimately successful opposition of British fishers to "days at sea" as time quota was called when proposed there, may have been partly due to the fact that they saw effort reduction in other member-states of the EC by decommissioning and were influenced by the view that if other industries could get paid for effort reduction then they ought to have had access to the same treatment.

CONCLUSION

As already noted, the twin motivating elements in the Nash equilibrium of competition and distrust have often meant that it has been very difficult to put in place a structure to get all operators to reduce effort to let such an improvement take place.

The point has been made that reducing effort by reducing numbers of operators is much easier to put into effect than by forcing an unreduced number of operators to work less than full time, so the choice for the manager is either for (1) maximisation of efficiency and profit by normal developed world means of shedding labour or (2) by use of socioeconomic-orientated devices such as upper limits on amounts of quota which any individual may hold, and eligibility conditions for qualifications to hold it. Any such regulations will subdue the quota market and reduce efficiency in the Fisheries.. While the socio-economic ethic appears important in the fishing communities where such measures are proposed, experience has tended to show that the evolution of management schemes has been in the direction of increased market economic freedom and efficiency and away from situations of equity and protection of jobs for those on the margin (i.e. from non-transferable allocations to transferable quotas). It is intuitive that strong operators will advocate freedom of markets and weak operators will call for equity and job protection; perhaps the former will be more likely to prevail in influencing the pattern of management.

To initiate successfully programmes of fishing cost reduction by stock rebuilding, several areas need more research than currently appears to be taking place in western Europe. The subjects needing to be addressed include:-

1. Relationship of cost of effort to fishing mortality exercised on the stock.
2. Density-dependent changes in in growth rates of fish in stocks increasing under restorative management.
3. Fish prices, especially in relation to fish size.
4. More effective explanation of the benefits of taking optimal proportions of optimally sized stocks, especially those resulting from reduction of variable fishing costs.
5. Appropriate rates of Marginal Rate of Time Preference (MRTP) discountingto apply to cost benefit analysis of depleted fishery restoration programmes.
6. The most appropriate paths of effort reduction to move into increased profit as quickly as possible subject to avoiding excessive initial reductions in revenue.
7. The range of appropriate measures to curb concentration of quota (and hence job losses) in application of quota-based measures to reduce - and maintain at optimal level – fishing mortality.

These are among the main areas where urgently needed data are poor, and where good data are required to enable decisions to be made on question of how to manage fisheries for distribution of returns in a situation of sustainably maximised returns due to reduced fishing effort.

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