The Effects of Unilateral Cost Recovery in an International Fishery

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Abstract: A recent analysis of the potential for management cost recovery in the UK suggested that such a policy would be detrimental to UK fishers if other European countries did not implement a similar charging policy. Most of the waters exploited by UK fishers are also exploited by fishers from other European member states, and hence the additional cost burden on the UK fishers may result in some boats leaving the fishery. In the longer term, the reduced effort may result in stock recovery, providing increased benefits to the remaining vessels. However, in an international fishery, these benefits may also accrue to boats that have not been subjected to the cost recovery charge. In this paper, a bioeconomic model of the English Channel fisheries is used to assess the effects of introducing a unilateral management cost recovery levy on UK boats on the competitiveness and long term structure of both the UK and French fleets.

Keywords: Cost recovery, bioeconomic model, genetic algorithms

1. INTRODUCTION

Management cost recovery has been introduced in a range of countries, including Australia (Department of Primary Industries and Energy 1994, Kaufmann and Geen 1997), Canada (Department of Fisheries and Oceans 1995), Iceland (Arnason 1993), New Zealand (NZ Department of Fisheries 1997), South Africa (Sea Fisheries 1997), and the USA (Office of Sustainable Fisheries 1997).[1] The system of cost recovery varies in these countries, but generally is based on either a percentage of the landed value or a charge per management unit.

In all these cases, the fisheries are specific to a single country. While foreign fleets may operate in the exclusive economic zones of these countries, their activity is heavily regulated. Further, they are generally charged an access fee to cover not only the cost of management, but also to extract an element of resource rent.

The situation facing fisheries in the European Union is quite different. While the fleets of Member States have exclusive access to their territorial waters (i.e. the first 12 miles from the low tide mark), most economic activity takes place in the waters subject to shared access (i.e. beyond the 12 mile zone but within the 200 mile exclusive economic zone). Fisheries management regulations in this area are globally imposed at the European level, but the management and enforcement of these regulations are the responsibility of the individual Member States. For example, the UK is responsible for licensing its own fleet, monitoring its activity and enforcing the catch limits imposed by the quota system.

At present, management cost recovery in Europe is largely limited to nominal administration charges for processing licences etc. Even these cost are not being recovered in all Member States. However, the high cost of managing fisheries relative to their economic contribution (generally less than 1 per cent of GDP) has called into question the advisability of continuing these subsidies.

A potential problem arises, however, if only one Member State introduces a management charge when its fleet competes with others for a shared stock. While higher costs are likely to reduce effort with consequent longer-term economic benefits to the industry, these benefits may not accrue to the Member State who imposed the charges. Instead, some (if not most) of these benefits may accrue to other fleets that do not introduce a charge and do not incur a subsequent effort reduction. As a result, the incentive is to wait until after other countries impose management cost recovery charges.

In this paper, a model of a European fishery (the English Channel) is used to investigate the effects of imposing management cost recovery charges on the fleet of one Member State only (the UK). In particular, the analysis will focus on the long term effects on fleet structure, and the re-allocation of any potential benefits arising from the charges.

2. COST RECOVERY CHARGES

Cost recovery as a goal in fisheries management is normally taken to mean charging the users of the resource for the public costs of management.[2] These may include all the public costs mentioned above, or perhaps just the costs of administration and enforcement, depending on the views of policy-makers about who should pay for the provision of public good services such as research and some enforcement activity. The rationale for cost recovery is that fishers are the main beneficiaries of management and hence the industry should bear at least a part of the costs of

[1] A recent review of all of these cost recovery systems is given in Hatcher and Pascoe (1998) and Andersen *et al* (1998).

[2] See, for example, Kaufmann and Geen (1997).

providing these services. The extent to which the industry should be made to pay for management may, however, depend upon the views of policy-makers about public support for private industry in general and for the fishing industry in particular.

There are two principal categories of charges that could be applied to fishers. These are charges made for access to the fishery and charges made according to the amount of use of the fishery resource.

Access charges

Access (or entry) charges are charges which are made simply for access to the fishery and which therefore take no account of the actual amount of use that is made of the resource. An obvious example would be an annual licence fee.

Access charges are the simplest type of charge to administer, particularly where entry is already restricted by means of a licensing scheme. However, the fact that access charges take no direct account of resource use means that they run the risk of being inequitable. They tend to have a proportionately greater financial impact on smaller vessels, who generally take less of the resource than larger vessels.[3]

To counter this effect, an annual access charge can be scaled according to some parameter related to the fixed costs of effort, such as the size of the vessel or its engine power (or indeed to the actual capital value of the vessel). This is the case in Australian fisheries, where the management cost recovery levy is determined on a per unit basis[4]. The levy paid by the fisher is the product of the per-unit charge and the number of units attached to the boat. Any charge that is effectively a variable tax on a particular component of effort, however, may cause fishers to substitute the taxed component with a greater input of some other component that is not taxed. The extent to which such input substitution might occur, however, will depend on the constraints imposed by existing management regulations as well as the cost structure of the industry and the size of the tax.

Use charges

Use charges are variable charges which are made according to the amount of use that is made of the resource. Resource use, however, may be defined either directly in terms of output (the amount of fish that is caught and landed) or indirectly in terms of inputs (one or more components of effort). In practice, however, these charges have only been levied on outputs.

Output or landings taxes (charged on an *ad valorem* basis) will in principle reduce revenues for all fishers by the same proportion and so should be equitable. They should also be non-distortionary with respect to costs and so should have no effect on the efficiency of individual firms. Marginal fishers, however, would again be expected to be forced out of the fishery to an extent depending on the tax rate set. In the long run the total value of output would be expected to be reduced by an amount that would depend on a number of factors including the cost structure of the firms remaining in the industry.

3. UK MANAGEMENT COSTS AND COST RECOVERY OPTIONS IN THE ENGLISH CHANNEL

In 1996-97, the cost of management in the UK were estimated to be in the order of £45m (Table 1). Ideally, management cost recovery should aim to recover the marginal opportunity costs of providing additional services (Andersen *et al* 1998). However, in practice this is not possible. Only total, rather than marginal, cost information is available. Further, while the UK costs are disaggregated into main activities, these costs are not identified on a regional or fishery basis. Hence, it is not possible to determine if the costs vary from fishery to fishery. As a result, it is necessary to assume that the costs of management are equally distributed across the UK, and that cost recovery can be most efficiently undertaken based of an average cost per unit of activity in the fishery (rather than cost per unit of service supplied).

Table 1. UK fisheries management costs, 1996-97

Management activity	Cost ($m)
Monitoring and enforcement	£24.2
Administration	£4.2
Research and development	£16.5
Total	£44.9

Source: Hatcher and Pascoe (1998)

Given this assumption, an access fee or use charge can be estimated based on the total UK fleet characteristics and the total value of landings. In order to recover £45m from the industry based on the fleet size and value of landings in 1997, Hatcher and Pascoe (1998) estimated that the alternative charging options need to be either:

- A flat licence fee of £6000 a boat;
- A variable licence fee based on the number of VCUs[5], estimated to be £56/VCU;

[3] This is also true for less skilled fishers or those using less efficient methods. However, as increasing the efficiency of the fishery is often a goal of management, such a charge could be seen as a tool to help achieve this objective.

[4] This is a function of hull capacity and engine power.

[5] Vessel Capacity Units – a management unit of capacity based on engine power and boat size.

- An *ad valorem* charge on value of landings of all species (7.5%); or
- An *ad valorem* charge on value of landings of quota species only (10.5%).

The choice of option has a significant effect on the amount of charges recovered from any particular fishery. For example, in the English Channel, which is characterised by a large number of small boats, charging £6000 a boat would raise about £12.9 million a year in revenue whereas charging £56/VCU would raise about £5 million a year. Consequently, a 7.5 per cent landings charge would raise about £5.25 million a year in revenue while a 10.5 per cent charge on the value of quota landings would be approximately £4.2 million a year.

A model of the UK component of the Channel fishery (Pascoe 1997) was used to assess the effects of these different charges on the long run structure of the fishery. An assumption of the model was that the effort expended by other fleets in the Channel (e.g. the French fleet) remained constant. The model also did not allow for increased stock size through reduced effort (although the non-linear catch effort relationships in the model enabled a proportionally smaller decrease in catch with decreasing effort).

The results of the model suggested that the least distortionary charge (in terms of relative changes in effort allocation) was an *ad valorem* tax on landings. However, as the charge increased the costs to fishers, total fleet numbers and catch decreased, requiring an even higher charge to recover the initial target level of management costs. For all charges examined, the fleet number decreased in response to the higher costs.

While not explicitly examined in the original model, it was recognised that such charges would have adverse consequences for the competitiveness of UK fishers within European markets if fishers from other EU countries do not have to pay similar charges. The resultant effort reduction in the UK fleet would result, in the long run, in higher stocks and higher catch rates to all participants in the fishery, including those who did not incur the higher costs.

As a result, an effect of a unilateral cost recovery charge may be an increase in economic rents accruing to fleets from countries that do not impose such charges. Under such a scenario, the industry in each respective country will no doubt pressure their governments not to impose such a charge in the hope that competing nations will impose a cost recovery charge on their fleets. In such a game, management costs will not be imposed.

The extent to which unilateral management cost recovery will reduce the competitiveness of a fleet in an international fishery has yet to be tested empirically. Further, as most fleets are subject to some form of license limitation, the potential to benefit from higher costs in competing fleets is limited. In this study, a bioeconomic model of the English Channel fishery that includes long run stock dynamics and both the UK and French fleets is used to estimate the effects of imposing a cost recovery level on UK boats only.

4. DESCRIPTION OF THE BIOECONOMIC MODEL

The bioeconomic model of the fishery used in this study was developed as an optimisation model. A detailed description of the general economic and biological relationships underlying the model is given in Pascoe (2000).

The model is comprised of three interacting components: an effort component, a biological component and an economic component.

The fishing effort component estimates the level of fishing effort by fleet, boat length class and métier. The UK and French fleets are subdivided into 23 sub-fleets based on their main fishing activities and location. These groups are further disaggregated into six size classes. These sub-fleets use differing combinations of seven principal gear types (beam trawl, otter trawl, mid-water trawl, dredge, lines, nets and pots). In total, 55 Channel métiers are explicitly included in the model with the other fishing activities in the Channel aggregated for the UK and France into 2 extra métiers. In addition, a further 12 external métier are included in the model, representing fishing activity that takes place outside of the Channel by the Channel fleet.

The biological component of the model calculates the expected yield for the given level of standardised effort, using model parameters derived from reference year data (1993-95). A total of 53 different species (including separate stocks) are represented in the model. Catches of each species are estimated based on the level of fishing activity in each métier and the relative catchability in the métier.

Age structured biological models were developed for 27 of the species. The models were incorporated as equilibrium yield-per-recruit models, with the equilibrium stock structure estimated for the given levels of effort. Recruitment was assumed constant, based on mean recruitment levels estimated using VPA (Virtual Population Analysis). For the remaining 26 species, surplus production yield curves were estimated from observed catch and effort levels in the fishery.

The distribution of effort across the different métiers by each sub-fleet is assumed fixed, and was based on the observed distribution of effort of the boats over the period

1993-95. Many of the different métiers are exploited on a seasonal basis. It is assumed that the allocation of effort reflects the changes in abundance and relative profitability of the activities over the year. As the model has only an annual time frame, these seasonal effects are not represented in the model.

Revenue is estimated based on the level of landings and the price. Running costs are determined as a function of revenue and the level of effort while fixed and capital costs are determined by the fleet size and structure. Revenues and costs determine the level of economic profits in the fishery, which in turn determines the optimal fleet size and configuration. Cost data were derived from economic surveys of the fishery. Price data were obtained from local landings statistics and auction markets.

Several variants of the model were developed, including a simulation model (Ulrich and le Gallic 1999), and a multi-objective optimisation model (Pascoe and Mardle 1999), The model used in this analysis was a single objective optimisation model based on the multi-objective model of Pascoe and Mardle (1999). The model was used to simulate the effects of a regulated open access fishery by maximising revenue subject to the constraint that the profits of each fleet are non-negative. In addition, upper bound constraints on boat numbers in each sub-fleet were imposed on the assumption that the current licensing system would prevent new entrants (except for replacement boats). As a result, long run boat numbers would be less than or equal to the existing number of boat.

5. MODEL SIMULATIONS AND RESULTS

A number of policy simulations were run using the model. First, the model was run with the current fleet fixed in order to provide an indication of the current state of the fishery. From this, the current UK fleet is estimated to be earning an economic loss while the French fleet is accruing an economic profit (Table 2). These results are consistent with recent economic surveys of the fishery (Boncoeur and Le Gallic 1998, Coglan and Pascoe 2000). While non-labour costs are roughly equivalent between the French and UK Channel boats of the same size (Boncoeur *et al* 2000), average revenues of the French boats were considerably higher, particularly for the smaller size classes[6].

As the UK fleet is not likely to continue to exist in its current form in the long run (due to the economic losses), the model was run with the objective of revenue maximisation and the constraint that profits must be non-negative. This is assumed to provide results consistent with the long run equilibrium in a regulated open access fishery. As would be expected, the estimated long run number of UK boats was less than the current number, with most of the decrease occurring in the smaller size classes (Figure 1). The reduction in UK boats was estimated to result in an increase in economic profits in the French fleet of around 8 per cent, as the reduced effort eases the pressure on the stocks, resulting in higher average catch rates.

Table 2. Benchmark simulations

	Current	Long run equilibrium	7.5% levy UK only
Revenue (€m)			
• UK	155.8	152.1	146.6
• France	257.6	261.1	264.9
Economic profits (€m)			
• UK	-6.1	0.0	0.0
• France	31.7	34.1	36.0
Costs recovered (€m)			
• UK	-	-	4.0
• France	-	-	-
Management Costs (€m)			
• UK	18.5	11.6	6.6
• France	15.1	14.8	14.8
Total boat numbers			
• UK	2054	1285	738
• France	1674	1646	1645
Total employment			
• UK	4343	3215	2260
• France	4840	4763	4762

Introducing a levy of 7.5 per cent on the UK fleet was estimated to result in a further decrease in boat numbers (Table 2), again mostly smaller boats (Figure 1).[7] As a result, the economic profits of the French fleet increased by a further 6 per cent.

The reduction in the UK fleet was estimated to result in lower fishing revenue and hence lower revenue raised from the levy. However, as the fleet size had decrease, presumably management costs would have decreased as well. Assuming that management costs are related to fleet size, then the 'cost' of managing the UK fleet would decline from €18.5m under the current fleet structure to €6.6m under the estimated long run fleet with the 7.5 per cent levy[8]. However, revenue collected by the levy was estimated to be only €4m.

The model was used to estimate the levy that would need to be charged in order to achieve the estimated management costs (which were assumed to be a function of boat numbers). This required varying the levy until the estimated

[6] In 1996-97, the average revenues of French boats under 10 metres in length were between 50 and 90 per cent higher than equivalent sized UK boats (Boncoeur *et al* 2000). As many small UK boats operate on a part time basis, this difference is largely a result of under-utilisation of the UK small boat segment.

[7] This result differs from that of Hatcher and Pascoe (1998), who found that such a levy had a lesser impact on the overall size of the UK fleet.

[8] This is based on £6000 a boat (Hatcher and Pascoe 1998).

levy revenue was equal to the estimated management cost. From the results, a 10.5 per cent levy on UK revenue would be required to meet UK management costs. The effects of such a levy, however, would be to further decrease the size of the UK fleet (Figure 1), and further increase the profits of the French fleet (Table 3). Employment in the UK fleet would be less than 60 per cent of that of the long run equilibrium (Tables 2 and 3), while employment in the French fleet would be unaffected.

Table 3. Effects of 10.5% management levies

	Management revenue equals management costs (UK only) levy 10.5%	Both fleets incur levy of 10.5%
Revenue (€m)		
• UK	144.4	144.4
• France	266.1	266.1
Economic profits (€m)		
• UK	0	0
• France	36.6	21.8
Costs recovered (€m)		
• UK	5.4	5.4
• France	-	24.8
Management Costs (€m)		
• UK	5.3	5.3
• France	14.8	14.8
Total boat numbers		
• UK	592	592
• France	1645	1645
Total employment		
• UK	1890	1890
• France	4762	4762

Imposing an equivalent levy on the French fleet, however, was estimated to have little effect on the size of the French fleet (Table 3), and hence provide no benefits to the UK fleet. This was because the French fleet was estimated to be making an economic surplus in the long run, and the cost recovery levy just reduced this surplus. If an equivalent levy was imposed on the French fleet, then the resultant revenue would exceed the estimated costs of management (based on the UK measure). Hence, an equivalent levy (10.5%) on the French boats would effectively contain a resource rent charge. As these boats are estimated to be making an economic surplus, such a charge may be justified. However, the equity argument for imposing an equivalent charge becomes distorted, as the UK boats are charged for management costs only.

6. DISCUSSION AND CONCLUSIONS

The results in this study are preliminary, but highlight some of the interesting challenges for management cost recovery in Europe.

In the UK, many of the smaller boats operate on a part time basis. Pascoe (1997) estimated that around 90 per cent of UK boats under 7 metres were operated on a part time basis.

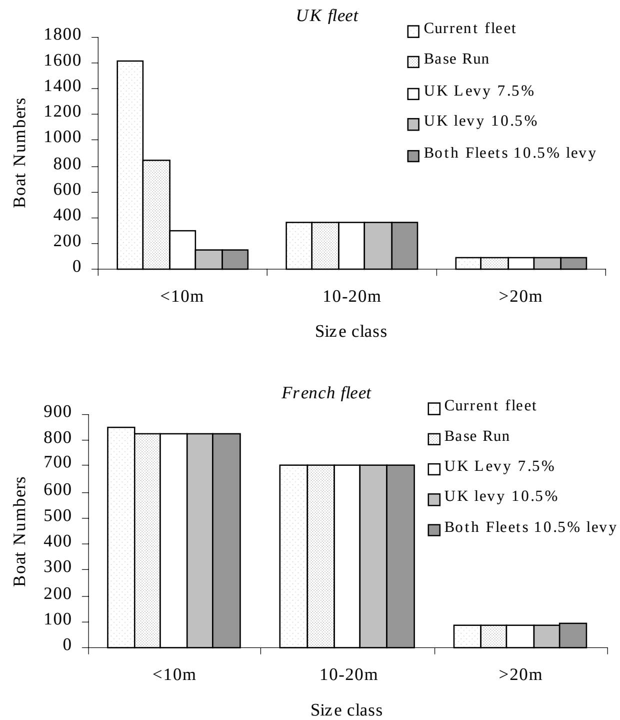

Figure 1. Effects of cost recovery levy on fleet structure

These boats make up over half the UK under 10 metre fleet, and around one third of the total UK fleet. The persistence of these boats in the fleet is most likely due to cross-subsidisation by the owners, most of whom either have other work or are retired. In the model, these boats were not economically viable in the long run, and hence were largely removed in the long run equilibrium simulation.

As these boats are most likely cross-subsidised, it is not likely that they would all leave the fishery in the long run, as the owners may get some non-market benefit by remaining in the fishery. However, these boats no doubt add to the cost of fisheries management. If costs are proportional to boat numbers, then the costs of managing these boats no doubt exceeds the market benefits they generate, and may even exceed any non-market benefits to their owners.

Levying a charge on these boats would result in most of them becoming more unprofitable, and may result in the large reduction in boat numbers estimated using the model. This raises the issue as to whether the UK wishes to have a smaller professional fleet, or a larger fleet that adds little direct economic value, but may add indirect value through maintaining the illusion that many small coastal communities are fishing communities, hence attracting tourism to the area. This is an issue that is well beyond the scope of this study.

As would be expected, the imposition of a levy on the UK fleet made these boats less competitive in the model, resulting in a reduction in their numbers. Also as expected, the reduction in UK fleet numbers was estimated to have a direct benefit to the French fleet, who were not subject to any levy. In such a case, it is unlikely that a management cost recovery scheme could be implemented unilaterally as the UK fishing industry would vehemently oppose a policy that was both to their detriment and to the benefit of another EU member state.

An unexpected result was that imposing an equivalent levy on the French fleet did not have any impact on this fleet. This was largely because the fleet as a whole were making a profit greater than the levy revenue collected.

This last result may be an artefact of the model. Because of the large number of non-linearities in the model, individual boat group profits could not be estimated directly within the optimisation procedure. Instead, only an aggregate UK and French profit could be estimated separately. Hence, the constraint placed on the model was that total profits of each fleet were greater than zero. As a result, fleet segments that were profitable could offset those that made a loss once a levy was introduced, resulting in no loss in boat numbers. Consequently, some adjustment in the French fleet may have been observed in the model results had individual profits been constrained to be non-negative.[9]

The analysis has not looked at the efficiency of management. An assumption has been that the costs of management are given, and that these could not be reduced through more effective management strategies. Andersen *et al* (1998) suggested that who pays and how they pay influence the actual costs of management. Public provision of management services may lead to inefficient use of research and excessive levels of enforcement resources (Andersen et al 1998). Further, the analysis has not looked at how much of the costs of management should be borne by fishers. Department of Primary Industries and Energy (1994) concluded that not all costs of management are attributable to fishers, as some have a public good element. This includes some research and enforcement activities.

Imposing a management charge on a country basis in an international fishery may not be appropriate as differences in the supply of management services will affect the costs, and hence competitiveness of the individual fleets. Further, the benefits of effective management at the country level also accrue to the other participants in the fishery. For example, enforcement activities by the UK not only protect UK interests, but also the interests of the French fleet who are sharing the resource.

For effective cost recovery in international fisheries, such as those in European waters, management must be co-ordinated and the total cost of all management services (i.e. from all countries) needs to be shared proportionally (and equitably) between all participants. This effectively requires fisheries to be managed regionally, with one co-ordinating body having overall management jurisdiction for the fishery being managed. Under the current European management framework, this is not possible. As a result, it is unlikely that cost recovery will be implemented in European fisheries until such a management structure can be developed.

The model results presented here should be considered only indicative of the effects of implementing a unilateral cost recovery levy on the UK fleet operating in the English Channel. Nevertheless, the model results do reinforce the conclusion that unilateral cost recovery in an international fishery is unlikely to take place.

7. ACKNOWLEDGEMENT

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[9] A version of the model using a genetic algorithm (rather than traditional optimising technique) has been developed that could over come this difficulty. However, the results from this model were not available in time for the Conference. As a consequence, the results presented in this study should be viewed as preliminary and subject to change.

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