On Demand-side approaches to Solving the « Tragedy of High Prices » in Fisheries

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Introduction

Opinions have changed radically since Huxley(1883) characterised sea fisheries as essentially « inexhaustible ».[1] But, while the need for fisheries management is enshrined in the FAO's Code of Conduct For Responsible Fisheries and other international agreements, as is evident from recurrent crises and not infrequent stock collapses, in practice, considerable scope for improvement remains.

Representing essentially an attempt to counter economic incentives to overfish, fisheries management can be characterised as relating primarily to problems of rationing fishing opportunities. While overfishing frequently is explained in terms of «the Tragedy of the Commons» model, it is argued that the economic causes of such long-run resource problems could be more accurately characterised in terms of a «Tragedy of High Prices» due to landings prices exceeding fishing costs at the socially optimal level of resource use.

In tackling over-exploitation problems, the feasibility and relative efficiency of demand-side measures in attaining management objectives without necessitating introduction of other fishing rights is discussed. Distributional issues associated with using a market mechanism to allocate use rights and potential adoption of demand-side measures within a co-management framework are considered.

Despite apparently desirable properties, solutions based upon demand-side regulation have been much neglected in the literature, and rarely put into practice. Discussion of such systems provides a contribution towards the continuing debate regarding how best to improve fisheries management, to ensure that economic rents are neither purely dissipated, nor simply captured by a first generation of resource users.

1 Cited by Gordon(1954).

Long-run Causes of Over-fishing: A Tragedy of the Commons or of High Prices?

Economic theory explains over-fishing in terms of a mis-match between the private costs of fishing faced by individual fishing enterprises and the social costs incurred by society as a whole. The lack of mechanism for individual fishing enterprises to take account of externalities imposed on others results in market failure, providing an incentive for enterprises to increase their fishing operations until marginal revenue is equated to their marginal private cost (rather than the marginal social cost), for maximum profits [e.g. see Anderson(1986)].

In his pioneering article, Gordon(1954) argued that it was freedom and competition which results in over-exploitation.[2] Measures limiting output might temporarily increase profits, but as such regulations are generally designed by biologists without taking costs into consideration, this tended simply to encourage investment, resulting in shortened season length and increased fishing costs, dissipating the economic rent.

Frequently economists have subsequently characterised

2 with equilibrium established where total landings value equals total cost, and economic rent dissipated due to the equalisation of average, rather than marginal, productivity.

the causes of overfishing in terms of «the Tragedy of the Commons» model. In coining the term the « Tragedy of the Commons », Hardin(1968) referred to a range of problems, including the nuclear arms race, world population growth, and over-grazing of common pastureland, which he argued were associated with freedom in the Commons, to which no technical solution was possible without instituting social arrangements involving mutual coercion mutually agreed upon. Stating that: « ..the inherent logic of the commons remorselessly generates tragedy » Hardin(1968, p.1244) argued: "Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in freedom of the Commons. Freedom in a Commons brings ruin to all".

While Hardin(1968) focused upon the lack of mutual coercion mutually agreed upon as engendering problems, common property and open access regimes have often subsequently been confused in ascribing the causes of resource over-exploitation, creating unwarranted emphasis on solutions based upon property rights. For instance, arguing that « ..confusion between open access and common property resources has not had benign consequences », Stevenson(1991, p.3) notes that ignoring divergence in social and private discount rates and other factors affecting the optimality of the solution obtained: « Certain authors, launching from the assumption that all commonly used resources are overexploited, conclude that there is only one solution: private property. » However, even under private ownership, or sole ownership, over-exploitation (and, in theory, even stock extinction),[3] can result if harvest costs are low relative to landings prices.

In the economic theory, resource over-exploitation occurs in the long-run under open access only where marginal revenue exceeds marginal cost of increasing resource use at the socially optimal aggregate output level.[4] As output price higher than input cost is a necessary condition, while common property does not necessarily involve open access, over-exploitation problems could more accurately be characterised in terms of a «Tragedy of High Prices»,[5] rather than a «Tragedy of the Commons» [Valatin(1999b)].

Figure 1 below illustrates such a « Tragedy of High Prices » in terms of the Gordon-Schaefer model, with Maximum Sustainable Yield (MSY), Maximum Economic Yield defined taking account purely of economic rent in the catching sector (MEY_0) and more broadly defined (MEY_1),[6] shown on the fleet's long-run total revenue curve associated with different « fishing effort » levels. In cases such as S_0 where total fishing costs are below total fleet revenue at the optimal aggregate output level, under open access « fishing effort » tends to increase beyond the optimum level to a point where they are equalised (in this case E_0),[7] whereas if total costs are greater than or equal to total revenue at the optimal output level (e.g. S_1),[8] no over-exploitation occurs.

In countering economic incentives to overfish, fisheries management relates primarily to problems of determining the desired exploitation levels, and rationing fishing opportunities in line with these. Associated partly with the relatively strong influence of biological advice in fisheries management decision-making, regulations have generally been based upon supply-side instruments, such as landings quotas, restrictive licensing, days at sea and other fishing « capacity » and « effort » controls, and technical measures (mesh sizes, minimum landings sizes, area closures, etc.).

Economists have sometimes suggested introducing taxes to equate total costs with revenues at the desired output level (e.g. shifting the total cost curve from S_0 to S_1), thereby capturing the economic rent and creating a source of public finance, while not requiring fish to be discarded unnecessarily.[9]

3 once time is taken into account, extinction is likely if resource users' implicit discount rate exceeds twice the maximum percentage reproductive potential of the stock [Clark(1973)].

4 assuming future returns are of value (i.e. an infinite discount rate is not applied) [Clark(1973)].

5 or of low input costs.

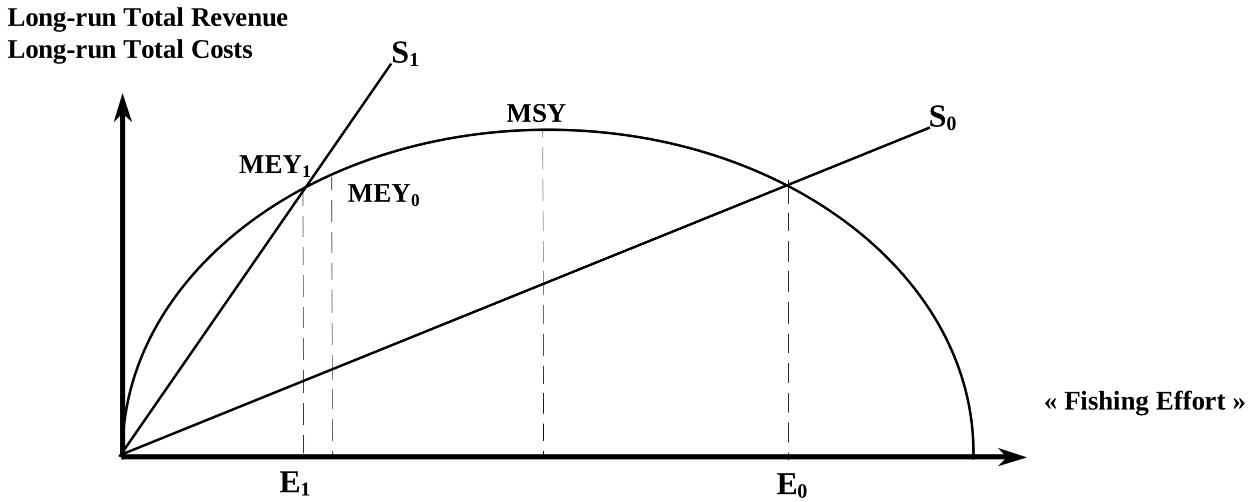
6 Stone(1999) includes non-market existence and biodiversity values. Other factors which could also be important include consumer surplus, producer surplus of onshore sectors, regulatory and social costs. (Their combined impact could lead to MEY_1 being either above or below MEY_0).

7 government assistance to the fishing industry tends to reduce fishing costs, increasing exploitation rates [Stone(1999)]. Similarly, this could be termed the « Disaster of Subsidies ».

8 i.e. the marginal cost of increasing production exceeds the output price.

9 i.e. without causing « regulatory discards » once quota restrictions are reached. (Although measures might also affect incentives for high-grading).

Figure 1: Gordon Schaefer Model illustrating the « Tragedy of High Prices »



Although fisheries economists have generally considered quotas to be superior to price regulation, recent work implies that management based upon fees per fish may in general be more efficient than quotas, given ecological uncertainty concerning recruitment, as well as being more equitable [Weitzman(2000)]. Furthermore, the relative complexity of quantifying fishing inputs devoted to catching a particular species [Valatin(1992)] and the scope for substitution to circumvent controls,[10] as well as inefficiencies associated with output quotas (e.g . regulatory discards), suggests that demand-side measures could be more efficient than supply-side ones.

Demand-side approaches to Solving the « Tragedy of high prices »

Associated partly with the increasing ethical concerns of consumers, there has been growing interest in demand-side measures and their potential role in improving fisheries management. For instance, Sproul(1998, p.139) claims that « In the 21st century, consumer demand can be the means of creating economic market incentives that endorse and promote sustainable fisheries harvesting and management practices ».

Figure 2 below illustrates a demand-side solution to the « Tragedy of High Prices » in terms of the Gordon-Schaefer (G-S) model. Total fishing costs (S_0) are initially below total fleet revenue at the optimal aggregate output level, providing an economic incentive for « fishing effort » to increase beyond optimum levels (to E_0), where total costs (from S_0) are equated to total revenue (TR_0).[11] By introducing measures that reduce the price paid for fish landed (without necessarily affecting the price at which fish is subsequently bought),[12] the fleet's total revenue curve is shifted downwards from R_0 to R_1, such that total costs (from S_0) are equated to total revenue (TR_1) at the optimal aggregate output level (e.g. MEY_1), such that no over-exploitation occurs.

In practice, even where stocks are deemed over-exploited, demand-side measures have tended to be aimed at increasing demand (e.g. by public expenditure on advertising, and withdrawals where fish landed do not reach minimum price levels) for short-term reasons, while those creating economic incentives consistent with desired long-run stock management objectives are scarcely considered.[13]

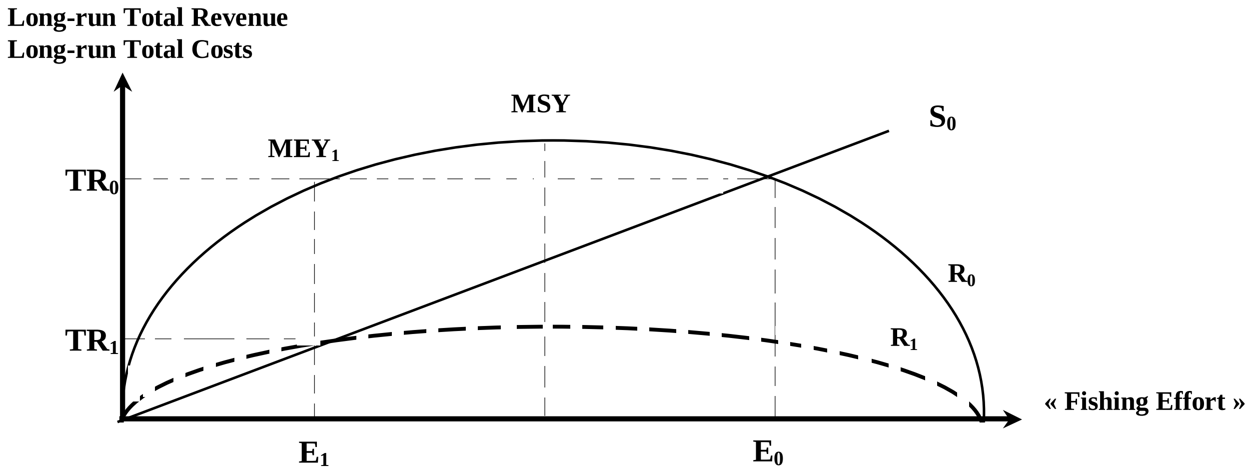
10 e.g. in the UK and the Netherlands introduction of regulations to restrict vessel « capacity » resulted in widespread modifications in vessel design to create so-called « rule-beaters », with main engines often de-rated to a fraction of their nominal continuous ratings and auxiliary engines installed with combined power exceeding that of the main engine [Valatin(1999a)].

11 with marginal input cost (assumed equal to average input cost) equated to output price.

12 e.g. through operation of a fixed landings price system, with fish subsequently auctioned.

13 e.g. the Sea Fish Industry Authority (SFIA) in the UK is funded primarily by a mandatory levy on first-hand buyers of sea fish, (standing at 0.84p per kg for main white fish species in 1998 and providing £8.2 million in revenue in 1997/98), but there has never been any attempt to use the levy as a tool to counter over-exploitation (even if the possibility has been raised internally in the past). Instead, most of its budget is spent on marketing initiatives to stimulate the demand for fish.

Figure 2: G-S Model illustrating a demand-side solution to the « Tragedy of High Prices »



As with the provision of other subsidies, future economic consequences are often neglected, but, as also can be seen from figure 2, even if a stock is initially exploited at the socially optimum level, demand-side measures shifting the total revenue curve upwards (e.g. from R_1 towards R_0), would be counter-productive in the long-term by encouraging stock over-exploitation. Only if fisheries are initially under-exploited,[14] and landings prices do not increase such that total revenues then exceed total costs at optimum exploitation levels, would such measures not be expected to provide economic incentives for long-run over-exploitation.

Mauritania and the Maldives provide rare examples of countries which adopted demand-reducing measures in regulating their fisheries. In both cases a state agency purchased fish landed at fixed prices and exported it at a higher price. In Mauritania 25% of the government's total budget was financed in this way, while fishermen also benefited from quicker payment for their landings [Catanzano & Cunningham(2000)]. In both countries the system was subsequently dismantled following pressure from the World Bank, which viewed it as an impediment to free trade.[15]

A non-market example of use of demand-reducing instruments was the Spanish government's advertising campaign (co-funded by the EU) aimed at persuading consumers not to purchase the smallest fish, thereby encouraging fishermen to allow the latter to grow and reproduce before catching them. Judging from industry perceptions, the campaign met with some success,[16] even if there remains a large market for undersized fish.

Although neither aimed at restricting fishing to an optimum in the sense outlined above, nor using a market mechanism, another of the few examples of demand-reducing measures used in fisheries is the dolphin-friendly tuna campaign during the 1990s. In the US, under the Marine Mammal Protection Act, an embargo was placed on tuna caught in purse-seine tuna fisheries targeting tuna by setting nets around schools of dolphins, and from June 1994, the International Dolphin Conservation Act 1992 prohibited purchase, sale, or transport of such fish. (The 1992 agreement between Governments with vessels fishing Yellowfin tuna in the eastern tropical Pacific Ocean to reduce dolphin mortality to approaching zero, codified in the 1995 Panama Declaration, also provided for annual dolphin mortality limits (quotas) initially to be set and subsequently be phased out, once other methods of catching tuna have been found).[17] While in the 1960's and early 1970's around half a million dolphins may have been killed annually, dolphin mortality in the fishery is estimated to have been reduced progressively from 97,000 in 1989 to 27,292 in 1991, to 2,738 in 1996 [Policansky (1998)].

Eco-labelling initiatives provide a further example of demand-side measures. Aiming to encourage consumers to purchase only suitably labelled items (meeting set criteria), to the extent that they succeed, they raise

14 i.e. exploited below the optimum level.

15 Personal communication.

16 Personal communication.

17 Although six countries contested the desirability of a ban on setting nets on dolphins, arguing that other methods would cause more harm to ecosystems, the U.S. International Dolphin Conservation Act passed in 1997 only allowed tuna imported providing no dolphins were killed.

demand for such products, while reducing it for others, so that such schemes are characterised by providing incentives both for increased exploitation of stocks currently classified as well-managed and for reduced exploitation of over-exploited stocks. Inspired by the example of the Forest Stewardship Council (FSC),[18] the Marine Stewardship Council (MSC) was established in 1997 to create economic incentives for sustainable fishing, backed by a partnership of the world's biggest voluntary sector conservation organisation, the World Wildlife Fund for Nature (WWF), and one of the largest frozen fish processing operations, Unilever. This initiative is too recent to allow evaluation of the overall impact on resource use.

Discussion

Characterisation of fisheries management problems in terms of G-S and similar single-species models is highly simplistic, neglecting the biological characteristics and population structure of fish stocks, the different types of over-exploitation that can occur, multi-species interactions and ecosystems effects. Viewing fisheries as essentially tending towards equilibrium can be misleading, not least if, due to increasing technical efficiency, total costs are continually decreasing over time,[19] implying that, if demand-side measures were used, a continual reduction in total revenues would be required to match falling fishing costs to avoid incentives for over-exploitation at optimum output levels.[20] Many factors affecting stocks, catches, landings prices, quantities and costs are subject to significant perturbations, while « fishing effort » is generally an incomplete index of fishing inputs, often associated with catching several species simultaneously, costs do not necessarily vary linearly, and prices can vary with output levels, trip length and other factors [Valatin(1998)].

Nonetheless, despite the simplification entailed, the long-run characterisation of the principal economic cause of over-exploitation problems in commercial (as opposed to subsistence or recreational) fisheries as arising primarily from a « Tragedy of High Prices » appears sound. Estimating long run revenue and cost curves may not be simple, but this information is also necessary for identifying optimal exploitation levels such as Maximum Economic Yield.

Demand-side measures appear appropriate instruments in tackling the long-run economic causes of over-exploitation, but how vessel operators respond to price changes in the short-term is important in deciding the extent to which they can be of use in attaining more immediate fisheries management objectives. Economic incentives exist for vessel operators to adjust their fishing patterns to maximise returns in the long-run to remain competitive, but short-term responses to price changes may be inelastic, or even contrary to management objectives, were backward-bending supply to exist,[21] due to income-leisure trade-offs [Guatam, Strand & Kirkley(1996)], satisficing behaviour, or other factors.[22]

Many more commonplace regulatory measures (e.g. minimum landings size, increased mesh sizes, license and quota fees) also result in a fall in catch and the associated landed values or raise fishing costs, and might similarly encourage vessel operators to increase, rather than reduce, their fishing activity in the short-term. However, despite behavioural assumptions being implicit in most fisheries economics models, relatively little empirical research has been carried out investigating supply responses, an area which Bockstael & Opaluch(1983) have argued « ..is perhaps the most important type of behaviour to be understood ». A notable recent exception is the survey in connection with marketing initiatives of French fishermen in the English Channel bass fishery reported by Charles & Boude(2000), implying that although there were variations in strategies, overall, a 40% increase in landings prices was associated with a 15% reduction in time spent at sea, principally through a reduction in trip frequency.

18 formed in 1993 to promote market-based solutions to the destruction of the world's forests, by the end of 1996 the FSC had certified the sustainable harvesting of over 20 million hectares of forestry, with over 100 purchasers committed to purchasing only timber certified to FSC standards [Sutton (1998)].

19 e.g. in terms of figure 2, S_0 becomes less steep over time due to increasing catching efficiency.

20 in an anlogous manner to the continual tightening of regulations under the EU Mult-Annual Guidance Programmes (MAGPs) and similar schemes aiming to balance fleet « capacity » and « effort » with fishing opportunities.

21 i.e. not just in the long-run. (See Copes(1970) for analysis of the latter case).

22 Despite considerable heterogeneity in behaviour, a 1989 survey reported in Valatin(1996) found that most of the UK fishing skippers indicating that landings prices affect trip length tended to return to port sooner if particularly good, while most stated they tended to stay out longer if poor. However, there were indications that such behaviour was partly due to fluctuations in the quayside market and the desire to achieve the best prices on landing, rather than to backward sloping supply, particularly as most skippers stated that they aimed for the greatest possible return each month.

Thus, despite creating the requisite economic incentives for maintaining stock exploitation at optimal levels in the long-run, demand-side measures by themselves might not induce the short-run supply responses needed to approach desired fishing mortality levels.[23] Nonetheless, in conjunction with other instruments altering the short-run opportunity costs of fishing and level of activity (e.g. diversification, re-training, early retirement, or decommissioning schemes) they could still prove useful, particularly by providing a source of funding for such other measures.[24]

Despite being globally consistent with long-run stock management objectives, to the extent that they affect allocation of fishing opportunities, demand-side measures might have undesirable distributional consequences. Not least as redistribution of fishing opportunities is likely to be strongly resisted by those expecting to lose out, adapting demand-side measures to existing fishing opportunities of fleet segments or fishing communities could be deemed preferable to equal application of the same rules to all vessel operators fishing a given stock. For instance, within the European Union any measures adopted would almost certainly have to be compatible with the maintenance of the existing distribution of fishing opportunities between Member States under the TAC and quota system (as codified under the principle of « Relative Stability »), while also being deemed non-discriminatory.

Measures which reduce vessel returns are unlikely to be popular, with mechanisms to reduce demand more likely to engender industry support if implemented through a system of community co-management in which fishermen play a role in deciding the use of funds collected,[25] than a more centralised system,[26] while also reducing non-compliance problems and enforcement costs. Especially with regulatory instruments impacting directly upon vessel returns, industry acceptability is likely to be a key factor in determining whether measures are adopted and their subsequent success.

23 Of course, were trip revenues to fall below trip operating costs (of fuel, ice, etc.), vessel operators would be more likely to stop fishing, rather than increase their activity [Valatin(1996)]. However, comparable in impact in extreme cases to closures, or establishment of « no-take » zones, demand-side measures compromising vessel viability would be extremely unpopular without financial assistance for associated « structural adjustment ».

24 as could other projects designed to improve the health and productivity of marine ecosystems.

25 to prevent the purpose of the regulations being circumvented, such uses (which might include research, environmental and educational projects), would have to exclude activities affecting fishing returns that could provide further incentives for over-exploitation.

26 without a say in the use of funds generated, the immediate financial impact is more likely to be viewed by the industry as a « pauperisation » of the catching sector of no short-term benefit.

Conclusions

The way in which the causes of over-exploitation is characterised is important in considering solutions. Characterisation of such resource problems in terms of «the Tragedy of the Commons» model has led to unwarranted emphasis on private property rights as providing the only efficient instruments for solving over-exploitation.

In practice, introduction of rights-based management has often resulted in undesirable distributional effects, such as economic rents being captured purely by an existing generation of resource users. In both the UK and the Netherlands, for example, free allocation ('grandfathering') of quotas and other fishing rights to vessel operators effectively created (more by accident than design) a « millionaire's club », with some quota-holders now living purely by renting out their allocations to others. Not only did the measures significantly increase barriers to entry, but they raised the cost of subsequent regulatory adjustment (e.g. decommissioning schemes and public purchase of fishing rights aimed at protecting local communities) [Valatin(2000b), Valatin(2000c)].

Legal challenges, such as recent ones in Iceland to ITQ allocations, underline the contentious nature of the initial distribution of fishing rights, with Weitzman(2000) reporting that Icelandic ITQs are now perceived as '..having caused an unjust and disturbingly-large government-engineered alteration in income distribution'. Others have also argued that the inequitable character of allocations may ultimately undermine such systems [Catanzano & Cunningham(2000)].

Under private property rights-based management, economic rents tend to be capitalised in the market values of the rights. In contrast, demand-reducing (or tax-based supply-side) instruments are generally more equitable [Catanzano & Cunningham(2000)], and can provide a significant source of funding for public expenditure.[27]

27 similar issues arise with allocations of greenhouse gas emission quotas. 'Grandfathering' such quotas could effectively reward the worst polluters with the largest (and therefore most

Introduction of systems of individual fishing rights tends to result essentially in the enclosure and de facto « privatisation » of the marine Commons.[28] This process often extinguishes a public right of utilisation, and does not occur if demand-side (or tax-based supply-side) instruments are used instead.

Characterising the fundamental economic cause of long-run resource over-exploitation in terms of a «Tragedy of High Prices» [29] provides a contribution towards the conceptualisation of the problem, and the continuing debate regarding how best to improve fisheries management and the extent to which property rights are needed.

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valuable) allocations. Instead, in accordance with the 'polluter pays' principle, allocations might be made to organisations undertaking environmental protection and research, and countering negative impacts of global warming, which companies would fund in return for quotas [Valatin(2000a)].

28 details on UK and Dutch cases can be found in Valatin(2000b) and Valatin(2000c) respectively.

29 and the « Disaster of Subsidies »

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