THE ECONOMICS OF THE BCLME

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Introduction.

Why is the textbook economic theory of the fishery with its elegant Schaefer models and so on, so inadequate for policy makers addressing real world problems? Many good modellers reply that it isn't wrong, it's merely naïve; with stronger mathematical tools and a better biological foundation the same fundamental approach can address most current problems. Those arguing this view are generally single species modellers and often very good ones. They use an approach that hasn't really changed in the thirty years since Clark formalized it so elegantly, and their tools treat fisheries management as an exercise in Bayesian logic. As new information comes to light, whether it concerns measurement of regularly used variables, or recognition of new ones that science shows to be significant, it is incorporated into the model, but that model remains effectively a single species one. This approach can have merit: the current management policies in SA and Namibia effectively rely on such approaches. However, five fundamental flaws in this sort of approach have become apparent. These will provide the basis for this paper. These problem areas are:

- Property rights
- Implications for fisheries rents, their magnitude, estimation and policy mechanisms for their maximization
- Contractual design
- Eco-labelling
- Marketing, including dumping and other problematic behaviours.

Anyone who has worked with real fisheries data (as opposed to textbook economic examples) knows that modelling a fishery presents unusual difficulties. A modeller doesn't know how many fish there are, the scientists can't always age a catch, size and age and degree of sexual maturity may be poor proxies etc. These are standard issues no matter which approach is followed. However, while the conventional model effectively describes a system in which there are 'natural' mortality and recruitment rates, and man is the sole predator whose impacts are modelled, an ecosystem approach requires far more. Part of this is an understanding of ecosystem wide species interactions. Such scientific modelling requires a series of interlocking predator/prey models; robust ecosystem modelling is clearly far off. But what does it require of the economics and can something sensible be added before the scientific tools are ready?

Harvesting cost provides a sensible illustrative starting point. Each species has a different harvest function. Simple models assume that costs are density dependent, and there is always an element of truth in this. However, a multiplicity of other factors can be involved. Fuel prices, technology, and importantly, other species. As a simple example take the long line fishery for toothfish (*****) in the Southern Ocean. Average costs have been rising for a variety of reasons, the fuel prices rise is one, another is declining catches. Discussions with fishermen provide two causes, an obvious one, the stocks have fallen due to over-fishing, and a less obvious one, that recovery of sperm whale numbers in the Southern Oceans means that, not only toothfish more heavily predated in their natural state, but that longlines used to capture the fish are being increasingly targeted by whales that have learnt about fast food. Let's assume, just as a thought experiment, that whaling is still an option. In determining the optimal annual harvest it would make sense to consider, not only the maximum economic yield for the whaling sector, but also the potential implications for the toothfishery. If the latter were valuable enough it might be worthwhile harvesting the whale stock beyond the MEY!

The rationale for incorporating species interactions in bio-economic models is clear enough. But why extend these to the level of an ecosystem, and why broaden the economics to include socio-legal issues?

The most obvious reason is that natural boundaries and political boundaries rarely coincide at sea. The BCLME provides a good example; the Benguela is shared by three countries, South Africa, Namibia and Angola. Not only do they have differing internal markets for fish and fish products, but their overall levels of development differ markedly, and more importantly, so do their levels of dependence on the fishing industry. In such a system straddling or fugitive stocks present real problems.

Property Rights Issues

The obvious problem presented by a fugitive or straddling stock is that each state has a reduced incentive to preserve the resource. Conceptually, this is little more than an extension of the 'tragedy of the commons' to an international level, but the policy implications can be remarkably broad. In the BCLME there are only three nation states involved: this makes it relatively simple. Other large marine ecosystems may be less fortunate.

At its simplest level the fugitive stock problem describes a species that spends part of its life on one side of a national border and another part on the other side. It can also involve species that spend time in international waters. From a national perspective, the incentive to conserve the resource is diminished because the benefits are likely to be shared with others whose exploitation of the resource may be less responsible. Traditionally the problem has been addressed by international agreements, some of them very successful. It is over a hundred years since North Pacific sealing came under treaty, and the three state agreement between Britain, Russia and the USA has held up remarkably well.

There are three obvious aspects to the debate about straddling stocks:
a) dissimilarities in national legal systems and systems of local property rights
b) differences in levels of development (industrial and national)
c) value related migration issues (is there an optimal place and time to harvest?)

It has long been recognized that a fishing right differs from a normal property right: since one does not own a fish till it has been caught, a permit is merely a right to try to catch it. The way in which that right is framed regarding restrictions on access, bycatch, gear etc, the quality of enforcement and the penalties for infringement are likely to differ across borders. These differences may mean more intense exploitation on one side of a border than the other. This is not the only way in which exploitation in one area may impact on returns in another. Fishing in breeding areas or during breeding seasons, targeting prey species during periods when commercial species are particularly dependent on them etc all can impact on yields elsewhere. The problem is accentuated by differences in taxation and subsisdy, and the status of international joint ventures. Put simply, no country wants to share a resource with a state that either subsidizes its fishing industry or encourages local permit holders to enter into joint ventures with states that do. Pressures to allow such joint ventures can be persuasive; China and the EU have both tried to gain access to Benguela waters through joint ventures. … is it worth commenting on SA and Angola?????

Development levels present further dimensions to the problem. The value added to a catch depends on a variety of factors, some of them counter-intuitive. The market may demand that the fish have only minimal value added, and indeed be willing to pay a premium for this. This is typically the case with high value fish being sold into a high income market in which cooks prefer to add the value themselves. It is often low valued species and very small fish that have the greatest levels of value added. 'Baby' hake, shark, pilchard, anchovy, horse mackerel and sardinellas. Are typical of the low value species that are more likely to have value added, creating more jobs and broadening the income created beyond that provided by the fish itself. While scarce and highly priced species and size categories of fish can command a true economic rent, it is the smaller, more abundant and less intrinsically valuable species that present opportunities for employment and value adding along a value chain. However, such value adding presumes an infrastructure of roads, reliable electricity supply, marketing opportunities etc. The absence of such an infrastructure, or its decay, can prove a real barrier to the profitable beneficiation of such fish.

The last point of debate is the fugitive stock aspect. A fishery is increasing an industry… it represents a considerable financial investment. Two sources of uncertainty immediately present themselves: the first is the security of access to the resource, and the second is the condition of the resource itself. Small pelagic are typically short lived species whose populations follow natural cycles. The volatility of such cycles can be amplified by fishing effort. It is also commonplace that population cycles may vary geographically. In 2002 a pilchard crash in Namibia coexisted with a pilchard boom in South Africa and with reasonable population estimates for sardinella in Angola. The risk facing investors is reduced if as happened then, access across borders can be requested in such situations. There is a third point worth considering however, many migratory species are at their most valuable during certain periods of the year. Fat levels and general condition may change through the year, and breeding cycles may support the closure of a fishery in particular areas at specific times of year. The implications are interesting. The same tonnage of fish harvested can fetch very different prices, and have profoundly different opportunity costs depending on the date and place of the harvest. It may be rational to allocate permit regionally in terms of a bilateral agreement between contracting states, with a view to maximizing the regional value of the catch, rather than nationally.

Implications for Rents

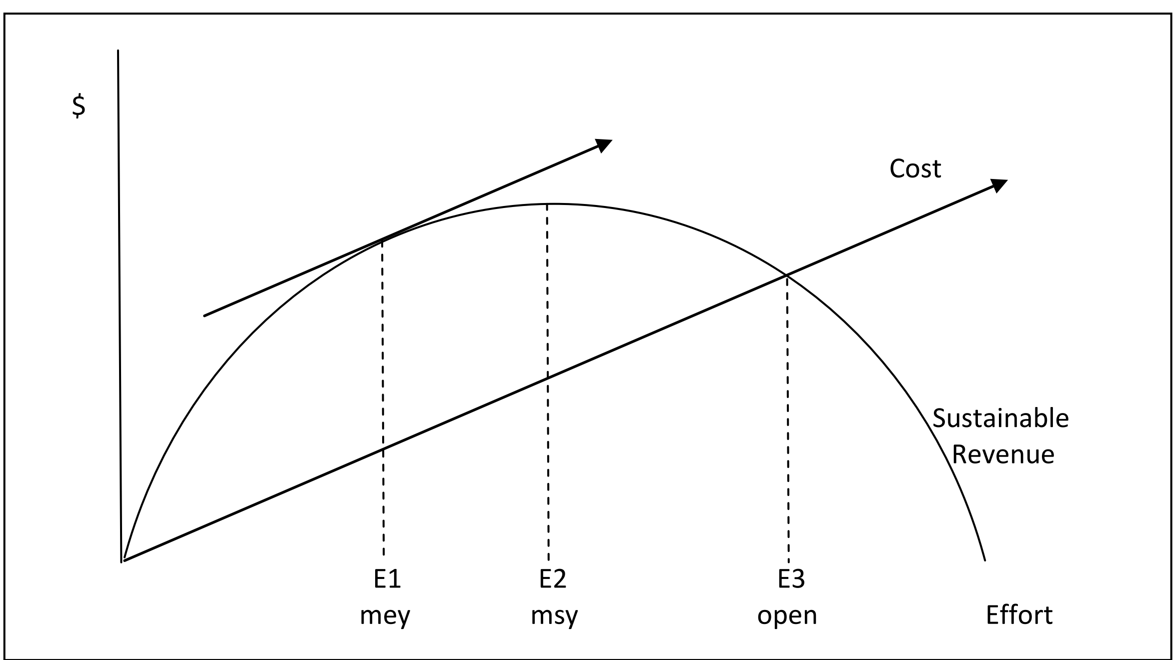
The conventional models utilized in fisheries economics presumes fish species that exist independently, each with a with known stock, population growth rate and harvest function. The stock of each is modeled and the optimal harvest assessed with a view to maximizing the profit obtained from that individual fishery. The first fisheries to be exploited would be those offering the most immediate and greatest rewards for effort. Because the most rewarding fish are typically the high value species at the top of the food chain, these are generally fished first, followed by less progressively valuable species lower down the food chain. This view was popularized in Pauli's phrase, "fishing down the food chain". The question this leads to is whether or not such an approach is economically rational? Should we be fishing our way back up Pauli's food chain?

One way to answer this is through a thought experiment: if all fishing rights to every species were held by a single profit maximizing permit holder, would that sole owner's harvesting pattern across species be identical to that actually found?

One way to visualize the problem is to consider the ocean as a giant feedlot in which there are a number of different species each of which commands different market prices and involves different harvest costs. Each of these species is situated at a different point along the food chain. The system therefore has to be seen as involving a large number of predator prey interactions. Carrying the feedlot allegory a little further suggests that one could treat these interactions as part of an extended feed conversion system. The owner of the access rights has the choice of leaving prey species in the sea and harvesting a larger number of predator species, or of harvesting the prey species and seeing catches fall and costs rise in the predator fisheries.

Putting this problem tritely one could ask whether it makes more financial sense to spend money catching anchovy, converting them into fishmeal and feeding them to chickens, or to leave them in the sea and let higher value commercial fish eat them in situ, after which these would be harvested themselves? The notion seems straightforward, but the data and predictive modelling requirements are far beyond those currently available.

This issue becomes central when trying to estimate the loss of potential economic rents in the industry as a whole. One can see the problem using a simple single period Schaeffer model as a heuristic tool.



If the fishery is to maximize rents the effort level should be E1, which provides the maximum economic yield. At E2 the sustainable revenue is at its greatest (maximum sustainable yield), but if access to the fishery is open then fishers will continue entering until all rents have been dissipated, total cost equals total revenue and effort level is E3. If time is introduced the result would change; given a positive time preference (positive real interest rate) fishers will add effort beyond E1. The key point is that the only market structure likely to yield an effort level of E1 is a sole access right – only one fisher has rights to the resource (though this could be achieved by mutual cooperation if a small number of fishers share access).

If one wanted to use such an approach to depict rent dissipation and maximization across an ecosystem the first point to note would be the interrelationships between species; harvesting levels of one species would impact on sustainable yields of others and could also affect harvesting costs. There would be no single unique outcome for any species. Optimal effort and harvest levels across the whole range of species could change as a result of natural population fluctuations in any one species.

Contractual Design

At the heart of many cases of rent dissipation in the fishing industry lies the 'principal/agent' problem. It arises where those responsible for the resource, and those engaged in harvesting it, have different objectives. The outcomes are varied, some of those that are cause for concern in the BCLME area are the targeting of high value 'by-catch' species, high-grading, use of illegal gear and activities such as trans-shipping intended to circumvent quota allocations.

Principle/agent problems are rooted in the perverse incentives that may be implicit in contracts. These can be present at all levels. Thus within the BCLME one can ask at an international level whether foreign fleets be trusted when granted access to local waters? Regionally the same problem arises when the LME authority has to trust the bona fides of contracting states. At a national level one can ask whether or not governments trust the industry, and at an industry level one can ask whether companies can trust the crews they themselves employ.

There are numbers of recent contracts that show the problem at different levels. One, that is now fortunately behind us, was the arrangement between the Government of Angola and the E.U. Using information obtained from Lankester 2002Thus, the 2002/2004 EU-Angola fisheries agreement proposed a catch limit of 5000 tonnes for shrimp vessels, allowing that this limit could be raised through a joint decision. No catch limits were specified for other species. Instead there were vessel and gear restrictions.

EU fishing opportunities[⌖]	*2000/2002*	*2002/2004*	*EU Member States*
shrimp vessels	22 vessels	max. 22 vessels Spain	
demersal vessels	3750 GT	4200 GT	Spain/Port/It/Greece
freezer tuna seiners	18 vessels	15 vessels	Spain/France
surface longliners	25 vessels	18 vessels	Spain/Portugal
small pelagics trawling[†]	2 vessels	2 vessels	Netherlands/Ireland

(Lankester, K. 2002):
www.onefish.org/cds_static/en/eu_**angola**_fisheries_agreement_fisheries_en_13812_116465.html

The objective should be to find contracts that avoid perverse incentives; to do this their aims should coincide. i.e. The ideal contract is one in which what is good for the principal is also good for the agent: *what's good for the fishers should also be good for the fish.* If this can't be achieved then the next best outcome is a contract in which the costs of the necessary monitoring are minimized.

In terms of large marine eco-systems the problem is largely one of managing straddling or fugitive stocks. A fundamental problem is that legal systems, legal penalties, and methods of fishing effort control vary across borders; so too do the levels and systems used for payment of crew. Important issues for management include whether or not multi-national/foreign firms should take second place to local ones? Whether or not permit should be regional or local, be tradable to non-tradable, and whether or not crew should be paid a share of the catch?

Implications for Eco-labelling

The original aim of eco-labelling in marine fisheries was to assist them to achieve sustainability and restore depleted rents. The intention was to demonstrate the benefits of conservative management directly to participants in the industry and to reward those who made the effort needed to operate sustainably. In the BCLME only one fishery has achieved this so far; South African Hake (M. capensis and M. paradoxus). An informal survey of industry participants yielded no clear-cut agreement as to whether or not the effort involved was worthwhile, views were mixed. Despite M. capensis occurring along the entire length of the BCLME, and M. paradoxus being bound in both South African and Namibian waters, few regard these are genuine fugitive stocks. The biological sustainability of the South African hake stock is generally regarded as independent of the fishing effort occurring in Namibian and Angolan waters, though as the comments on trade policy below will show, this may not be true of economic sustainability. But can eco-labelling offer any genuine hope for species like the deep sea red crab (...)

which are shared by two countries (Angola and Namibia) unless regulations, systems of quota allocation and effort control, intensity of monitoring and effective penalties are equivalent across the two states? Where the species involved is a true straddling or fugitive stock, ecolabelling only makes sense if all affected states buy in and commit to the eco-labelling process.

Trade Policies

Each of the three BCLME states is exporting a portion of its annual catch. Some portions of the catch are in particularly high demand abroad, others far less so. What happens to fish for which demand is limited? Broken fish and extremely low value by-catch can be processed into fishmeal and some is dried for export elsewhere in Africa. Some, however, is exported to other BCLME states. The classic problem species in recent years has been hake. The international market pays a premium for large fish, but export of small fish into these markets is rarely financially worthwhile. Sadly, in recent years the Namibian and South African catches have been dominated by juvenile fish. It is not the catch alone that has to be sustained, but also the market value. It is in this context that things like sale of low value catch become an issue. Effective dumping (sale at below marginal cost) can destroy regional markets. The risk became apparent in recent years when the South African market for baby hake was hit by low cost sales from Namibia, Benguelan baby hake. Why was Namibian baby hake being sold in the streets of Cape Town at R3/Kg and what were the implications of this for the local market.