Please note
The acronym DIAFE is no longer used internationally. We either use the full title "Danish Institute of Agricultural and Fisheries Economics" or the Danish acronym "SJFI", similar to LEI in Holland.

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PhD project: "Managing capacity in European fisheries"

Introduction

The exploitation of common pool fish stocks is traditionally characterised by externality problems among fishers. That is, a fisher's individual production function is interdependent, with his/her realised catch depending on the catches of other fishers. Because fishers do not have the incentives to conserve fish stocks, they tend to over-invest in capital to harvest fish. The theory of fisheries economics indicates that fisheries can be regulated efficiently if market forces are allowed to dictate the evolution of fishing fleets, discouraging the competitive build-up of excessive capacity. A management strategy that is based on output constraints and the internalisation of externality problems, through the use of landing taxation and individual property rights for example, would lead to a gradual optimisation of fleet capacity.

However, most global fisheries are in regulated open access conditions, where management strategies have been based on difficult input control measures. These measures fail to address the externality problem and, hence, management has been forced to address the issues of fishing capacity and overcapacity in order to implement fleet adjustment As a result, to create effective adjustment programmes one has to be able to correctly define and measure fishing capacity and ensure that the concept can be correctly linked to the concepts of fishing effort and fishing mortality, concepts that management measures are often based upon.

Global focus of capacity

The FAO of the United Nations has been the front-runner in research in the capacity debate and initiated a global discussion at a technical meeting in La Jolla in April 1998. The Technical Working Group (TWG) reviewed the various issues relating to the measurement and monitoring; management and reduction methods; broader policy and institutional considerations; as well as specific high seas aspects. The TWG emphasised the timeliness of the meeting and stressed the

crucial need for countries and the international community to urgently take steps to address and prevent overcapacity, as a recommended by the Code of Conduct for Responsible Fisheries (adopted by the FAO in 1995). The TWG produced a wide consensus on the need that included the need to develop more appropriate measurement methods and monitoring mechanisms.

In 1999, the FAO followed up with a Technical Consultation on the Measurement of Fishing Capacity in Mexico City. The main aim of the meeting was to ascertain what methods of capacity measurement were available to managers and to discuss the criteria (i.e. data requirements) for the use of these methods.

Fishing capacity in Europe

In Europe, fishing capacity has traditionally been defined and measured in terms of physical input characteristics of fishing vessels, namely the registered tonnage and engine power of vessels. The desire of the FAO is to alter this perception and measure capacity in terms of production output (i.e. catch) as defined in most other industries. Indeed, at the meeting in 1998 they defined fishing capacity as "*the maximum amount of fish over a period of time that can be produced by a fishing fleet if fully utilised, given the biomass and age structure of the fish stock and the present state of the technology*".

It may therefore be appropriate if a similar process is applied to the assessment of the European fishing fleets. The capacity reduction initiatives of the European Union, the Multiannual Guidance Programmes (MAGPs) have attempted to balance available fish resources with fishing fleet capacity. The programmes have received much critique over the years and it is now considered that the programmes require a fundamental overhaul. Among the problems include the lack of consistent measurement and monitoring of input characteristics, the lack of attention given to technical innovation, and the lack of an overcapacity measure of fishing fleets.

The latter is a fundamental stumbling block. The current fleet reduction targets are based on ad hoc biological advice and at no time has there been an assessment of the overcapacity that is perceived to exist. That is, the difference between the potential catch of fishing vessels has not been compared to the current capacity utilisation of vessels. If meaningful targets of future adjustment programmes are to be set then it must be ascertained to what extent there is overcapacity in European fisheries, and hence, what reductions are required to improve the long-term economic structure of fishing fleets and their operations.

Measurement tools

The extent of literature on the measurement of capacity in fisheries is limited. Although the measurement of capacity is a relatively standard concept in other industries, it is only recently that the measurement tools have been applied to fisheries. The most promising tools include:

- Data envelopment analysis (DEA) – a nonparametric mathematical technique that determines optimal solutions given a set of constraints, developed by Färe et al. (1989, 1994)
- Peak-to-peak method – nonparametric technique developed by Klein and Long (1960)
- Stochastic frontier approach

The FAO currently perceive that DEA is the tool that is most appropriate, at least in situations where data requirements are satisfied. In this case we can determine the maximum potential output (i.e. catch), given input data of the fishing fleet (e.g. tonnage, engine power, days at sea etc.), by solving a simple linear programming problem. The maximum potential catch corresponds to the output that could be produced given the full and efficient use of variable factors, but constrained by the fixed factors, the state of the technology, and the resource stock. The potential catch can hence be compared to the existing catch of the fleet and give an indication of the apparent level of capacity utilisation of the fleet. This in turn will lead to an estimate of the overcapacity that exists. Alternatively, the analysis can be reversed so that the output (e.g. TAC) is given where the analysis determines the maximum number of inputs that should be used to harvest the output at a full utilisation rate. This would give an indication of the number of inputs that should be in the fleet and could serve as appropriate indicators for capacity reduction programmes.

The peak-to-peak method is best suited when data is limited to catch and vessel number. The approach permits determining capacity output and capital to reduce in capacity adjustment programmes, although it does not indicate the actual operating units that need to be removed. Ballard and Roberts (1977) and Garcia and Newton (1997) have applied the approach to a few key fisheries.

The stochastic frontier approach offers another option since it gives the maximum output (Kalrirajan and Salim 1997). The frontier should be estimated with the stock of capital and with full utilisation of variable inputs, and not the observed level of use. One problem faced with this approach is that it does not readily accommodate multiple outputs.

The choice of measurement tool very much depends on data availability, where peak-to-peak is regarded as the least data dependant. One issue that also needs to be dealt with is the level of vessel/fishery aggregation (e.g. over species, gear-type, fishing area etc.) that is assumed for national, regional and global analyses. Various software packages are available to run the various approaches and are documented in a number of manuals that are available.

Provisional essay titles

"Critical review of the capacity policy in the EU"
"Global capacity estimates"
"Managing capacity – a review of management options"
"Multi-national comparisons of capacity measures"
"Capacity development over time"
"Vessel v. industry level capacity"
"Methodologies for measuring capacity"

Planned activities

For the period September 2001 to April 2002, Erik will be on placement at the University of Rhode Island, USA, with the purpose of research and following courses at the Department of Environmental and Natural Resource Economics.