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The cost of fisheries management: An economic perspective

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The first of mankind had in common all those things which God had given to the human race. This community was not a positive community of interest…… it was a….negative community, which resulted from the fact that those things which were common to all belonged no more to one than to the others, and hence no one could prevent another from taking of these common things that portion which he judged necessary in order to subserve his wants….
Men portioned among themselves the earth and the greater part of those things which were on its surface….this process is the origin of the right of property. Some things, however, did not enter into this division, and remain therefore to this day in the condition of the ancient and negative community.

Pothier in Traité du Droit de Propriété

This seminar has as objective to pose some questions and to make some asseverations concerning fisheries management, its costs, the influence of these costs, the problems that arise due to the public good characteristics of some of the management services and the difficulties for implementing an efficient fisheries management service.

In order to achieve this goal I have structured this session as follows:

I. Introduction

II. Analysis of Fisheries

-Conventional results that serve as basis for public management. (Clark and Munro 82)

-Results obtained with the assumption that management is costly. (Arnason, Hanneson and Schrank, 2003)

III. Difficulties in management.

-Public interventions do not always maximize social welfare even though they achieve efficiency, i.e. Public interventions sometimes do not constitute Pareto improvements. (Atkinson and Stiglitz 1980).

-Management services can be characterized as public goods or more precisely as “club goods”. (Cornes and Sandler 96))

-Asymmetry in the distribution of costs and benefits obtained from management and the lack of correct incentives imply that we may have public interventions even though social costs exceed social benefits. (Cornes and Sandler 96)

IV. Discussion of different alternatives for fisheries management. (Arnason 2003)

V. Some references to the EU Common Fisheries Policy. (EU 2004)

I. INTRODUCTION

→Fishing industries, especially in the industrialized world, black holes in which governments throw money without achieving noticeable improvements.

→Many industrialized countries subsidize their fishing industries with substantial amounts of money, in relation to the gross value produced by the industry.

→This happens in spite that the underlying fish resources are highly productive and the fisheries are in principle capable of generating high salaries and good profits.

→Fisheries need management. But management costly.

→Implications of management costs

Should the level of management change?

→ What are the main components of management costs?

→What are the main characteristics of management activities?

→Who benefits with fishery management? And who pays?

→Empirical evidence on management costs?

→Who should undertake the role of managing fisheries?

II. ANALYSIS OF THE FISHERY: SOME WELL KNOW RESULTS

II.1 *Theory*

→Fundamental reason for state of affairs well known (Gordon (54), Scott (55), Hardin (68)).

→To escape consequences of common property problem fisheries must be managed.

→Almost all fisheries in industrialized world now subject to extensive management measures.

→Management takes many forms but always expensive and sometimes ineffective.

Expenditures on:

→ Biological and economic research

→ Design of management rules

→ Implementation of rules

→ Enforcement

Governments assume role of protecting *fish from fishermen and fishermen from themselves*.

At the best success in protecting fish.

Governments, in general, have not managed to ensure profitability of the industry in accordance with the richness of the underlying resource.

II.2 *Some Questions*

→Do management costs have impacts on optimal fisheries policy?

→Can the government be an "efficient" provider of fisheries management services?

- Management services as "Club Goods"

II.3 *The model*

(1) $\pi(y,x)$ $\pi_y>0,\pi_x>0$ Profit function

y :instantaneous rate of harvest

x: biomass level

(2) $\dot{x}=G(x)-y$, G(x) usual biomass growth function

(3) $\pi_y(y^c,x)=0\ \forall t$ Behavioural rule for competitive (unmanaged) utilization of the resource

(4) $y^c=Y(x)$ Competitive harvesting rule
Monotonically increasing in biomass

Optimal utilization of the fishery should satisfy:

(5.1) $\pi_y(y,x) - \lambda = 0$

(5.2) $\dot{\lambda} - r\lambda = -\pi_x(y,x) - \lambda G(x)$

(5.3) $\dot{x} = G(x) - y$

where λ represents shadow value of biomass
r represents discount rate

Note that if $\lambda \neq 0$ (5.1) differs from (3) $\pi_y(y^c,x) = 0$

for all t.

Optimal equilibrium equations (Clark and Munro)

(6.1) $$G_x \frac{\pi_x}{\pi_y} = r$$

(6.2) $$G_x - y = 0$$

where $\frac{\pi_x}{\pi_y} = \Lambda$ "marginal stock effect"

→Marginal stock effect is positive.

→Fundamental behavioural equation in optimal equilibrium (6.1′)

(6.1′) $$\pi_y = \frac{\pi_x}{(r - G_x)}$$ that determines y.

If compared with

(3) $$\pi_y(y,x) = 0 \quad \forall t$$

Competitive utilization optimal ($y^c = y$) only iff $\pi_x = 0$

Variable of enforcement: rate of harvest y

→Implementing harvest rate different from what individuals want is COSTLY.

→Reasonable: cost of enforcement depends positively on difference (absolute) between the harvest rate "imposed" and the harvest "desired" by the industry.

Level of harvest desired by industry $y^c = Y(x)$ and enforced harvest rate y.

Enforcement or management cost function

(7) $C_M\left(y - Y(x)\right)$

Properties $C_M(0) = 0$

$$\left(y - Y(x)\right) \neq 0 \Leftrightarrow C_M(y - Y(x) > 0$$

Assume management cost function as

$$C_M\left(y - Y(x), z\right)$$

where z index of management system

New profit function

$$\pi(y,x) - C_M\left(y - Y(x)\right)$$

Maximizing conditions

(8.1) $\pi_y(y,x) - C'_M\left(y - Y(x)\right) - \lambda = 0$

(8.2) $\dot{\lambda} - r\lambda = -\pi_x(y,x) - C'_M\left(y - Y(x)\right)Y_x(x) - \lambda \cdot G_x(x)$

(8.3) $\dot{x} = G(x) - y$

Marginal management costs play a role in (8.1) and (8.2). Then (5.1) and (5.2) not appropriate.

→How management costs affect optimal fisheries policy?

(8.1) includes marginal management cost and this term is negative, provided:

- enforcement is costly
- policy tries to maintain harvest rate below competitive level

Negative term works towards greater harvest and less biomass.

(8.1) includes also λ, shadow value of biomass.
With fisheries management λ reduced; change reinforces effect of marginal management costs.

Impact of management costs: *encourages harvesting and discourages biomass conservation and stock rebuilding. Result: intuitive.*

Revised equilibrium conditions in the optimal solution:

(9.1) $$G_x + \frac{\left(\pi_x + C'_M \cdot y_x\right)}{\left(\pi_y - C'_M\right)} = r$$

(9.2) $$G_x - y = 0$$

where $\Gamma = \frac{\left(\pi_x + C'_M \cdot y_x\right)}{\left(\pi_y - C'_M\right)}$ is the " new marginal stock effect".

Marginal stock effect under management costs is smaller that traditional marginal stock effect without management costs ie.

$\Gamma \leq \Lambda$ where Λ is marginal stock effect without management costs (Clark and Munro).

II.4 *Comparison of harvesting rules with and without management costs*

(9.1′) $$\pi_y = \frac{\pi_x}{r - G_x} + \frac{C'_M \left(Y_x + r - G_x \right)}{r - G_x}$$

→First term on the right: traditional harvesting rule.

→Second term: correction due to harvesting cost

Negative if $r - G_x > 0$ (stability condition)

→Implication of (9.1): In optimal equilibrium marginal profits of harvest should be less and therefore fishing effort greater and biomass smaller than in traditional models.

Difference increases monotonically with C'_M

Does it exists a level of management costs such that the best equilibrium option is not to manage at all?

Necessary condition for this to happen is

$$-C'_M(0) \geq \frac{\pi_x(G_x, x)}{\left(Y_x(x) + r - G_x(x)\right)} \tag{10}$$

→If in equilibrium, marginal cost of fisheries management, at zero fisheries management level, exceeds marginal contribution of biomass to profits (suitably normalized) then, management is not worthwhile.

Alternatively, the conclusion is true when:

$$-C'_M(0) \geq \lambda$$

Marginal cost of management, at the zero management level, exceeds the shadow value of biomass.

III. MANAGEMENT

→Actual economic benefits require optimal paths to be implemented and this is the task of fisheries management. Examples of control variables: total allowable catch, number of permissible fishing days, fishing gear mesh size restrictions, etc…

→Actual fisheries management costs:

(a) Are quite substantial,

(b) Vary widely between countries

(c) Do not maintain much of a relationship with economic productivity of the fisheries.

Questions:

→Efficiency conditions in the provision of fisheries services?

→Is it possible to obtain better fisheries management services at the same cost?

→Research done on the design of "appropriate" instruments for management but well known that achievement of efficiency may reduce aggregate social welfare. Change from inefficient allocation to efficient one may not be a Pareto improvement. (Gainers and losers).

→Fishing management implies provision of goods that have strong public goods characteristics.

→Fisheries management expenditures allocated into

a. Research
b. Policy and administration
c. Enforcement and compliance

→Above three categories of services can be characterized as a subset of public goods called *club goods*: not rival in use but excludable (those not belonging to the club can be excluded from their use).

→ "Club good" nature of fisheries management services particularly clear in the case of enforcement.

The case of research is not as clear cut.

→Market failure; need of government intervention.

→Most fishing nations, management services provided by government and paid for by public funds.

⟶Is Government failure possible?

→Fundamental reason: inappropriate incentives made worse by certain structural and technical difficulties.

Inappropriate incentives

→Government decision makers allocate other people's money. Incentives far from appropriate.

→Unfavourable situation on incentives made worse by *asymmetry problem*: groups receiving services often quite different from the group/s actually paying for these services.

→Asymmetric distribution of costs or benefits

→Can a better arrangement be suggested?

		Distribution of costs	
		Narrow	Wide
Distribution of Benefits	Narrow	I	II
	Wide	III	IV

→Projects in Box I. Everything depends on who these groups are and their relative political power.

→Projects in Box II. Good chance of being carried out even when aggregate costs exceed aggregate benefits.

→Projects in Box III. Unlikely to be undertaken even when they are socially beneficial.

→ Box IV. If both costs and benefits fall to the same group no problem.

If groups are different little chance of an efficient outcome. Most likely outcome is no action.

→Government actions included in *boxes I and II* prime target for rent seeking. →Rent seeking cause of government failure.

→Fisheries management services tend to belong to box II. Benefits concentrated in fishing industry. Costs shared among all tax payers.

⇒Government actions likely to be undertaken even when aggregate benefits do not cover aggregate costs.

→Fisheries management services may be oversupplied.

→The smaller the fisheries sector relative to the rest of the economy the greater is this likelihood.

Explanation for the very high fisheries management expenditures relative to the value of the landings seen in many countries?

III.1 *How to provide fisheries management services*

→Public goods nature of fisheries management makes the market system an unsuitable provider of these services.

→ Inappropriate incentive structures & asymmetric distribution of costs and benefits, renders the government unattractive as provider of fisheries management services.

→ How should fisheries management services be provided?

Alternatives.

	Arrangements	Provider	Payees
1	Current	Govern.	Govern.
2	Cost recovery	Govern.	Fish Ind.
3	Contracting out	Private sect.	Govern.
4	Self-manag.	Fish. Ind.	Fish.Ind.
5	Partial system	Mixed	Mixed

→ Arrangement 1. Presents problems.

→Arrangement 2. Eliminates problem of asymmetric distribution of costs and benefits.
Does not avoid incentive problem (exacerbated).
Government agencies receive payments for their activities and do not have to compete with other agencies for limited government funds.

→Third arrangement: reverse of cost recovery.
Private sector provides fisheries management services according to contractual arrangements with the government, presumably on the basis of some sort of competitive bidding.

Government pays the cost (works toward eliminating the incentive problem). Some incentive problems expected to remain in the actual contracting out and supervision of the services. Problem of asymmetric distribution of costs and benefits remains.

→ Fourth arrangement: Industry takes care of the management services itself. Eliminates government incentive problem and greatly alleviates the asymmetry problem.

Management services are still a public good to the members of the "club": fishing industry members.
Within the club, management need to be centralized. As a result, incentive problems will pop up again.

→Forced to choose between several imperfect alternatives.

III.2 Fishing Industry Self-management

Fisheries management consists of

(a) Biological and economic research needed to determine the optimal fisheries path
(b) Setting of the corresponding fisheries rules
(c) Enforcement of theses rules.

→Decentralization means that some or all of these functions would be moved to a lower authority closer to the fishing activity.
→Co-management and community management are terms often used to describe this arrangement.

→In the limit, management responsibility would be transferred entirely to the fishing industry itself. This is fishing industry self-management.

→Ability of the industry as a whole to select the rent maximizing management policy?

Consider a fishery. (Arnason´s model)

Let u represent fisheries management actions. Single variable.

Let $V(u, x)$ represent aggregate value (rents) of the fishery when the fish stocks are x and the management actions u are undertaken.

V(u, x) may be regarded as a present value function or even an expected present value function.

The problem, from a social perspective, is to adjust management controls, *u*, so as to maximize the value function.

Assuming continuous *u* and an interior solution, the solution to this problem may be characterized as:

$$V_u(u) = 0$$

More generally the solution may be characterized by

$$V(u^*) \geq V(u), \forall u \neq u^*$$

In both cases the rent maximizing management actions defined by

$$u^* = \arg\max V(u)$$

Let there be *I* members of the fishing industry. Each one has a profit or value function.

Denote value function for industry member *i* by v_i .

Obviously

$$v_i = F(u)$$

Assume individual value function depend on u only via $V(u)$. Each member of the fishery is a *stakeholder*.

$$v_i = \Psi\left(V(u); i\right)$$

Industry member returns depend *only* on aggregate returns or aggregate returns sufficient statistic for individual returns.

Each *i* *selects* u_i^* such that:

$$\Psi_i \cdot V_u(u_i^*) = 0, \quad i = 1,2,....I$$

or

$$\Psi\left(V(u_i^*); i\right) \geq \Psi\left(V(u); i\right), \qquad \forall i \text{ and } \forall u \neq u^*$$

In both cases, rent maximizing management implies:

$$u_i^* = \arg\max \Psi\big(V(u); i\big)$$

If individual profit functions are monotonically increasing in the industry value function then social optimality conditions coincide with private counterparts.

Monotonicity is sufficient but not necessary condition.

Proposition 1

If every industry member wants to maximize his return from the fishery, if fisheries management does not affect his returns independently of aggregate returns and if his returns increase with aggregate returns, he will choose the management that maximizes the aggregate value of the fishery.

Proposition 1 economic rationale for fisheries self-management. But assumptions very stringent.

→Stakeholder assumption implies that management controls do not affect fishing firms separately.

→Stakeholders and monotonicity implies that there can not be fisheries management measures that benefit some members and hurt others.

IV. LESSONS FROM AND FOR EU FISHERIES

→EU has the most complex fisheries management task in the world in terms of: number of species, number of countries, complexity of ecosystems, density of fishing effort.

→ Multi-jurisdictional, mixed fisheries extremely difficult to manage. No clear cut solution available.

→No way to avoid management problem even with "nationalization of fisheries management". Biological reality demands a shared management approach in each region of the EU.

→Institutions of the Community provide a framework in which decisions are taken and fisheries managed. Tasks divided between Community institutions and Member States.

→Commission proposes overall catch limits for regulated species, other management measures and recovery plans for stocks outside safe biological limits.

→Plans debated in the Agriculture and Fisheries Council which makes final decision.

→Enforcement and capacity reduction responsability of Member states with Commission oversight.

→Member States and Commission have powers to deal with emergencies and differing powers on broader marine environmental issues.

→At present EU management not succesful; all countries will gain from better management of stocks.

→Need for developing new and innovative management systems to ensure sustainable stocks in the long run.

→Sustainability also requires profitability of fleets.

→Intense co-operation between EU countries and improvements in management and innovation impossible unless basic levels of compliance with fisheries rules and transparency of information drastically improved in all EU fishing grounds.

→Governments must promote transparent competition and remove overcapacity.

→Fisheries management suffers from fragmentation and lack of clear direction.

Lessons learned:

Three pillars upholding effective management:

→ Sophisticated responsive management systems

→ System for taking decisions in a timely and enforceable manner

→ Agreed allocation method

→ CFP scores well on second and third pillar but poorly on first.

→Community has effective structures for taking decisions in the Fisheries Council and has the legal mechanisms to enforce them.

→Qualified majority voting is an improvement over weaker forms of consensus-based decision-making.

→Community has an agreed method for allocating the resource: “relative stability principle”.

→ “National control” is not a solution to the problems facing fishing industry in different EU countries.

→Given the strengths of the reformed CFP system, best uses of Governments´ resources is to reform current EU management system so that in future develops innovative approaches to EU´s specific management problems.

→Recent reform of the CFP includes institutional changes. Centralisation promotes *“one-size-fits all”* common denominator solutions.

→This approach means that the Community manages fisheries by a combination of lowest common denominator measures (TACS and quotas) and derogations to deal with the fact that there are exceptions.

→RACs: In the 2002 reform of the CFP Regional Advisory Councils were agreed upon. *Change plans to bring stakeholders closer to decision-making and for this to take place on a more appropriate geographical scale.*

→At the UK level proposal to create Regional Fisheries managers to address fragmentation and realign resources to mirror the structure of RACs.

V. ADDITIONAL MEASURES (Proposed)

→Community quotas for vulnerable and dependent fishing communities.

→Progressive introduction of *partial recovery of management and enforcement costs* from the fishing industry matched with their greater input into management decisions.

→Name fisheries managers for specific sea regions.

→Move to “effort” control in some fisheries in the medium term.

→Greater requirement for traceability and transparency, stricter administrative penalties and greater use of on-board observers.

Conclusion

Proposals in EU look towards:

1. Taking into account cost of fisheries management.
2. Greater decentralization and “Self-management”

These proposals are a consequence of the fact that management is costly and it has not been sufficiently effective.

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