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ON RUINING THE COMMONS AND THE COMMONER
The Political Economy of Overfishing

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Introduction

There is now a considerable body of literature on the issues and problems relating to the use and overuse of common property resources -- sometimes referred to as "commons" (See for example Berkes, 1985; Christy, 1966; Ciriacy-Wantrup & Bishop, 1975; Gordon, 1954; Hardin, 1968; Runge, 1986; Schlager & Ostrom, 1987)

A commons is an economic resource or facility subject to individual use but not to individual possession. Hence all commons face one problem: how best can one coordinate individual uses to attain an optimal rate of production or consumption for the whole community. (Oakerson, 1988). A very popular and forcefully argued answer to the problem is to grant property or access rights to the users. (See Christy, 1982 for the case in fisheries)

In developing countries, use of common property resources is closely related to the survival and sustenance of a vast population of persons such as pastoralists, forest dwellers and fisherfolk. As a result, issues pertaining to the use and overuse of these resources are not merely questions that can be resolved solely by resorting to granting of access or property rights to the array of claimants to the resource. They raise more fundamental socio-economic and political issues which can only be understood and addressed in the larger context of the history and dynamics of change that have taken place in relation to the access to, and use of the resource. Equally important are

the very special nature-related aspects of the resources that must be taken particular cognisance of when analysing questions of overuse.

However, if access to a commons results at some point in time to unrestricted entry, it generally results in social and political tensions. These tensions more often than not arise only after a certain threshold limit is crossed and is rarely due to one single cause. Generally it is a variety of complex causes which include among others: changes in technology, increased market demand for the produce of the commons, population pressure, nature-related changes and political forces. These causes also mutually interact and thus tend to exacerbate the tensions. Too often these causes have been confused, and very influential opinions ascribe the problem to the very institution of common property itself or to one single cause like population pressure. It is also argued that the ruin of a commons brings ruin to all those who use it. The most popular expression of the above points are found in Hardin's (1968) famous article entitled 'Tragedy of the Commons'. [1]

This paper will examine the case of one such common property resource -- the coastal sea eco-system and the fish therein. It seeks to highlight how a combination of economic, technological and social factors interacting in a specific context results in overuse of the commons leading to its near ruin. It points to the fact that the ensuing detrimental economic consequences are

by no means equitably distributed.

In geographic coverage the paper is restricted to Kerala State. Being the leading maritime state in India it provides an interesting case study of what has been referred to as the 'life cycle' model (Berkes, 1985). This model, when applied to the fishery, is essentially the study of the whole diachronic process of initial harmonious and sustainable harvesting of the coastal fishery resources followed by rapid and excessive harvesting verging on a very serious economic and ecological crisis. For the other maritime states in India that have not yet reached the latter condition, it provides an example of a model, the final stages of which, they may try to avoid by making appropriate policy interventions at the appropriate time.

The paper is divided into eight parts. It begins by providing a backdrop which very briefly sketches the relevant aspects of the history of the fishery development process in Kerala State. In the subsequent parts the attempt will be to: enumerate the various factors leading to the overuse, which in fishery parlance is called overfishing; provide evidence of overfishing; assess the impact of overfishing on the various social groups depending on the resource; analyse their responses to the effects of overfishing and finally examine possible ways of resolving the crisis.

1. BACKDROP

Fishing, as a subsistence occupation of a caste-bound community, has a long and hoary tradition in India. Traditional marine fishing communities have over the centuries of learning-through-labour evolved a keen understanding of the aquatic eco-system and perfected fish harvesting artifacts which were appropriate to that milieu. Their technology was appropriate for fishing merely as a source of meagre livelihood. Such a situation obtained in India until the dawn of independence in 1947.

Fisheries gained importance with the onset of post-independence economic planning in India. The long coastline and the productive continental shelf gave fisheries the status of a sector capable of accelerating the growth of the rural economy of the country. Accordingly, planned marine fisheries development had the multi-faceted objectives of increasing the fish harvest, improving socio-economic conditions of fishermen, augmenting export earnings and generating new employment opportunities. These objectives were to be achieved through initiatives promoted by the state and private efforts.

To achieve them the "modernisation growth-oriented" model of development, largely premised on the experience of the more developed temperate water maritime countries, was accepted. This approach primarily implied the superimposition of a modern, capital-intensive, specialised technology over the existing

traditional base which was largely labour-intensive and of great technical diversity. It assumed that this base was a hinderance to development and had to be either transformed or completely phased out.

In Kerala State, the leading maritime state of India, the approach to fisheries development was initially radically different. The states's fishery policy in the first decade of planned development -- 1956 to 1966 -- can be summarised as having been based on "the judicious exploitation of marine resources by effectively and gradually raising the productive capabilities of the existing facilities giving primacy to the accumulated skills of the fishermen." (Kurien, 1985)

During this phase increased fishing effort was applied by the artisanal fishermen using their traditional non-mechanised craft and a wide array of fishing gear and tackle. There was a rapid change from cotton to nylon nets. The overall fish harvest, and that of species like prawns, also increased substantially.

This approach did not last long. By the mid-1960's the "modernisation growth-oriented" model soon came to be introduced in Kerala. The single most important factor responsible for this was the rising demand for prawn in the international market. The waters off Kerala, being one of the world's richest resource for the penaeid prawns, virtually became the main "breeding ground" for this model.

Fisheries development in Kerala state soon became synonymous with increasing prawn harvest and earning foreign exchange. With the phenomenal rise in the number of small trawlers -- introduced initially by the former Indo-Norwegian Project -- the prawn harvest and export earnings increased steadily. The earlier caste-bound nature of the fishery sector ceased to be a barrier to entry. The main investors involved in the new development model were non-fishermen. (For details of this see Kurien, 1985) For a decade -- until mid-1970's -- it was smooth sailing. The direction of the tide changed after 1974. The levels of overall fish and prawn harvest began to fall. By the end of the seventies the marine fishery sector of the state heading towards an ecological crisis of overfishing.

The artisanal fishermen who were only peripheral beneficiaries of this modernisation model responded to this crisis at two levels. The more rapid, widespread and vocal response was in the form of organised protest demanding state regulation of what they perceived as destructive fishing methods. (For details see Kurien & Achari, 1988) The slower response was in the form of adoption of new technologies for propulsion of their fishing crafts and greater investments in fishing gear in a desperate attempt to enhance their share of falling harvests. This response only further aggravated the level of overfishing particularly after 1984.

Overfishing not only implied a fall in the fish harvest but led to a very skewed distribution of the benefits and costs in the fish economy. This in turn came to attain larger socio-political implications which today plague the state.

2. THE MEANING OF OVERFISHING

Overfishing of the near shore marine waters -- the coastal commons-- is a problem besetting many developing countries today. It is however rather complicated to decide with precision the stage at which the coastal commons gets overfished. (For a theoretical understanding of the issues involved see: Beverton & Holt, 1957; Caddy, 1984; Gordon, 1954; Hannesson, 1978; Panayotou, 1982; Pauly, 1979; Schaefer, 1954) The evidence available points to the fact that overfishing has come as a result of many interrelated factors of which the "common property" nature of these marine waters is but one.

It is customary to distinguish between two types of overfishing: economic and biological.

Economic overfishing occurs when marginal costs of an additional unit of fishing effort are higher than marginal revenues. The economy experiences loss (even though total fish catch may still increase) because of a mis-allocation of capital and labour which might have produced higher economic yields in alternative activities.

Biological over-fishing occurs when the marginal yield of an additional unit of fishing effort is negative.[2] At such a level of effort the fish population stock is prevented from generating its maximum sustainable yield.[3]

Overfishing, or the application of excessive fishing effort, thus in a sense, heralds a turning point in the dynamics of exploitation of a fishery resource. It is the threshold of "development" and the last call for "management" (Aguero, 1987). It is a juncture, which if left unattended could spell ruin to much of the fishery resource and to a significant section of those whose lives are dependent on it.

In the context of developing countries it would therefore be appropriate to seek policies to avoid problems of excessive effort. This can be achieved through management measures that seek to maintain a development process of the fishery which will keep the resource at a high level of productivity by matching fishing effort to the biological and ecological condition of the fish stock.

To achieve such a desirable situation presupposes not merely an attack on the effects of overfishing the coastal commons but rather a clear understanding of the factors which caused it in the first place.

3. THE FISHERY RESOURCES OF KERALA

The sea off the South-West coast of India, comprising the maritime states of Goa, Karnataka and Kerala, forms a relatively homogeneous aquatic eco-zone. The inshore or coastal waters (upto a depth of 50 metres) of this region measures 23,400 square kilometres and has a maximum sustainable yield (MSY)[4] of 700,000 tonnes (George et al,1977). The average fishery productivity potential of these waters works out to 30 tonnes per square kilometre (or 300 kg for every hectare) making it the most productive fishing zone in India. (The all-India figure is 12.5 tonnes per sq. km). Kerala State accounts for just 12,570 sq.kms of this coastal sea area which has an estimated MSY of 400,000 tonnes.

The fishery resources in the tropical seas off Kerala State are marked by the multitude of species attaining varying sizes at age of maturity. They are widely dispersed in the coastal commons. Each specie is available in relatively small quantities. There are complex prey-predator relationships between them as well as competition for food.

The above are distinctly different from the characteristics of fish resources temperate waters. In temperate waters one finds a relatively smaller number of species which grow to larger sizes and each specie is available in teeming millions. The inter-specie interactions are also less complex than what obtains in

the tropical waters making it easier to "target" fishing operations to specific species.

Fish species are generally divided into two broad categories in accordance to the niche that they generally inhabit in the marine environment. Pelagic species are the predominantly surface dwelling fishes. The demersal species are those that generally inhabit the bottom of the sea. The behaviour and life cycles of pelagic species are more prone to influences of oceanographic conditions like changes in water temperature, salinity, dissolved oxygen content and so forth. Demersal species remain largely unaffected by such changes.

For the purpose of data collection the numerous fish species of Kerala have been clubbed under about 54 broad names. The fish harvest pattern of 1984-85 indicate the important species to be oil sardines, mackerals, anchovies, ribbon fish, carangids (all pelagic) penaeid prawns, soles, sciaenids, perches and catfish (all demersal). Of these, oil sardines, mackerals and penaeid prawns have traditionally been considered the three prime economic species. Their MSY's are estimated to be 126,000 tonnes, 56,000 tonnes and 56,000 tonnes respectively.

4. FACTORS CONTRIBUTING TO OVERFISHING

There are several factors contributing to excessive fishing effort in a fishery. We will restrict our assessment to five major areas: (a) the open access nature of the fishery (b) the use of inappropriate technology (c) the demand-pull factors that create galloping prices (d) financial subsidies offered by the state which encourage investment and (e) the pressure of population on the coastal commons.

Open Access Nature

When traditional technologies and the custom-bound organisation of the fish economy predominated, the common property nature of the marine fish resource did not pose a major problem. Technical barriers, such as the need to have fishery specific skills, and social barriers, like fishing being the occupation of a lower caste, prevented free entry of capital and persons from outside the traditional fishing communities into the fishery.

The introduction of mechanised boats and the perceived profit opportunities from involving in activities like prawn exporting changed this scenario considerably. The vibrant merchant class of Kerala took the first initiatives to break these barriers. They shifted some of their capital from land based activities-- such as coir and cashewnut exports -- to fishing, processing and exporting of prawns. Rapid entry was facilitated by the free access to the sea: mechanised boats could be operated without any

form of licence or registration. There was also no regulation limiting the ownership of fishing assets only to those who were active fishermen. As a matter of fact, entry into the fishery was given greater impetus by the liberal financial assistance of the state (more details about this below). As a result, the post-1966 period witnessed a considerable influx of non-fishermen owners of fishing assets -- particularly mechanised trawlers. Between 1966 and 1985 the number of trawlers increased from a couple of hundred to around 2800.

Use of Inappropriate Technology

Traditional fishing technologies (nets, tackle and the methods of fishing) were in general evolved to suit the particular ecological context of the seas and the varying behaviour patterns of the fish. Deserving special mention is the selective nature of fishing nets (a special mesh-size/shape for catching a specific specie of fish) and the "passive" nature of fishing operations (allowing fish to get entangled in the net rather than going in hot pursuit of them or catching them by disturbing their milieu).

As indicated earlier, the "modernisation" phase of fisheries development was premised on the need to introduce fishing crafts, gear and methods which were proven efficient in the temperate water milieu. These tended to be "active" fishing techniques using single gear combinations innovated for the fishery resources of the temperate waters. Trawling (the method of

scraping the sea bottom with a bell-shaped net to catch demersal fish) and purse-seining (the method of quickly encircling whole shoals of pelagic fish) were two such techniques introduced after the decade of the sixties.

Both these techniques were very capital-intensive and initially raised labour productivities. For the short-run unit harvesting costs were low and given the high prices of certain species of fish (see below), the profits to owners was very high. This led to a rapid increase in numbers and the extensive use of these techniques. This contributed very significantly to overfishing by destroying the sea-bottom eco-niche (trawling) and by indiscriminate and non-selective fishing of whole shoals of pelagic fishes (purse-seining).

Booming Demand

The introduction of trawlers into Kerala coincided with the rise in demand for prawns in the international market. This was spurred of by factors such as the enhanced domestic growth of the U.S and Japanese economies and also the former's loss of access to supply from China. These demand-pull factors were outside the control of the local economy and it was also difficult to insulate the fishery resources from being harvested in response to them.

From a commodity used to manure coconut palms, prawns grew to become the 'pink gold' of marine exports from India. In 1961-62 the beach price of prawns was only Rs.240 per tonne -- less than even the price of mackerels which were considered the "poor man's protein". In 1971-72 prawn prices reached Rs.1810 per tonne. Between then and 1984-85 it increased nearly seven-fold while the prices of oil sardines and mackerals rose by 184 and 213 percent respectively. (Table 1)

Table: 1 Trends in Prawn and Fish Prices in Kerala
(current prices; Index: 1971-72=100)

Year	Prawns		Oil Sardine		Mackeral	
	Rs/Tonne	Index	Rs/Tonne	Index	Rs/Tonne	Index
1961-62	240	13	90	24	340	38
1971-72	1810	100	380	100	890	100
1976-77	7260	401	850	224	1600	180
1984-85	14120	780	1000	284	2790	313

Source: Dept. of Fisheries, Kerala State: Administration Reports
(several years)

In the case of the domestically consumed fish species -- oil sardines and mackerals -- there is evidence to show that the increased prices were the result of the inability to enhance the harvests in keeping with the growing demand for fish from the local population (Kurien, 1978). Purse-seiners were first introduced in Kerala in 1976. Until then oil sardines and mackerals were caught exclusively by fishermen using traditional crafts and gear.

State Subsidies

Following the adoption of the "modernisation path" to fisheries development, the state became actively involved in promoting the direction of investments in the sector.

To give impetus to this policy the state instituted many attractive subsidies for the mechanisation programme. It invested in the capital-intensive and long gestation infrastructure facilities like harbours, landing centres etc. It also provided training facilities.

The initial spate of subsidies was very liberal. As much as 25 percent of the cost of the hull of the boat and 50 percent of the cost of its engine were provided as grants. The remainder was treated as a loan to be repaid in 64 instalments over a period of 8 years at 7 percent interest.

In theory all the 1200 mechanised boats so issued by the state between 1961-62 and 1977-78 were to fishermen cooperatives or genuine groups of fishermen. In practice however this hardly did happen as is evident from the evaluation of these cooperatives by a government report which concludes: "The failure in the operation of the scheme of distribution of mechanised boats were due to the fact that the fishermen cooperatives to whom or through whom the boats were issued were all benami (under false

name) cooperatives almost without any exception. The rich and influential among the fishermen sponsored and controlled the cooperatives." (Krishna Kumar, 1981)

It was this realisation which prompted the dropping of a similar scheme drawn up for the Sixth Five Year Plan (1980/81 to 84/85) which envisaged providing subsidies and soft loans for the introduction of purse-seiners. Although the state dropped the scheme, the private entrepreneurs went ahead with finance provided by commercial financing institutions.

State subsidies for mechanised boats were completely withdrawn in 1973. From 1985 onwards, following the rush of artisanal fishermen to obtain outboard engines, the state extended subsidies at the rate of Rs.3000 per engine and Rs.2600 per craft and gear. Though late, for the first time, state subsidies were enjoyed by genuine fishermen! The rapid increase in outboard engines in Kerala State from a handful in 1982 to as many as 8000 in 1988, is to a small extent due to these incentives.

Population Pressure on In-shore Waters

One characteristic of tropical water fisheries is that overuse even low productive, passive fishing gear can affect the renewability of stocks (Pauly, 1979). The pressure exerted by increasing numbers of fishermen using increasing amounts of fishing equipment within the limited area of the coastal waters has this effect

The active fishermen population has been increasing at a rate of about 2.3 per cent per annum. In 1961 there were 80,700 active fishermen in Kerala. Given Kerala's coastal sea area of 12570 sq. kms., the population density was about 6.4 fishermen per sq.km ensuring that on the average each fisherman had 16 hectares of coastal commons to fish. By 1985 the population increased by 65 percent to 134,000, increasing the fishermen population density in the coastal sea area to 10.6 per sq.km. This reduced the average coastal commons per fisherman to 9 hectares.

With the increase in the number of fishermen their fishing assets also increased. Traditional fishing crafts increased from around 21000 in 1961 to over 27000 in 1986. More important are the increases in the quality and the quantity of fishing gear. During the last two decades practically all the fishermen have shifted over from using cotton to nylon nets. Though no aggregate estimates are available, evidence from village studies indicate that the quantum of fishing nets and other tackle have increased significantly. (Achari, 1987a)

This fact became most evident with the post-1982 outboard motorisation drive which was induced by declining productivity due to overfishing of the coastal commons. (More details about this below)

This population-induced increase of fishing pressure can certainly be viewed as an issue which will now exacerbate the extent of overfishing if present trends continue.

From a reading of the five above mentioned factors which contribute to overfishing it should be evident that they are complementary and mutually reinforcing. This makes the issue of economic and biological overfishing a very complicated matter to deal with.

5. THE EVIDENCE OF OVERFISHING

Considerable data is now available to indicate that the above mentioned factors have in combination led to the ecological crisis in the coastal waters of Kerala. The evidence with respect to some parameters is substantial but patchy in the case of others. The total picture that emerges however points undoubtedly to a scenario of strong tendencies towards overall economic and eco-system overfishing with biological overfishing clearly established in regard to the most valuable specie--prawn.

Biological and Eco-system Overfishing

Kerala State has been the leading maritime state contributing between 20 - 35 per cent of the total marine fish harvest in India between 1956 and 1985.[5] The total marine fish harvest in

Kerala during this period fluctuated between 152,200 tonnes (1956) and 448,300 tonnes (1973). Within this the harvest of pelagic species ranged between 89,900 tonnes (1956) and 357,000 tonnes (1971) and that of the demersal species between 48,000 tonnes (1957) and 198,000 tonnes (1975).

One can discern two distinct phases in this time span of three decades: a phase of steadily increasing harvests -- 1956 to 1973 and a phase of stagnating or declining harvests -- 1973-1985. This broad periodisation is valid whether one considers the total harvest, the harvest of pelagic and demersal groupings or the major economic species -- oil sardines & mackerals and prawns. This is evident from the growth rates shown in Table 2 for the two periods mentioned above.

Table: 2 Compound Growth Rates of Fish Harvest of Kerala State#

Species Groups	Period I 1956-1973	Period II 1973-1985
Total Marine Fish Harvest	3.23*	-1.79*
Total Pelagic Fish Harvest	3.19*	-0.18
Total Demersal Fish Harvest	3.52*	-4.60*
Total Oil Sardine & Mackerel Harvest	5.01*	0.60
Total Prawn Harvest	6.21*	-8.30*

Estimated using semi-log function

* Significant at 5 %

To establish that a decline in fish harvests points to biological overfishing conventionally requires that at least two more indicators exhibit a downward trend. These are (i) the catch per unit (fishing) effort (CPUE) and (ii) the size of the harvested fish species.

In a multi-specie fishery these indicators can only be measured with respect to a particular specie. In our case we have such data only with regard to penaeid prawns -- the most important economic specie and the most controversial one in regard to the overfishing debate.

In the main prawn landing centre in Kerala (Neendakara) the catch per unit effort (CPUE) declined from 83 kg/hr of fishing effort in 1973 to 20 kg/hr in 1984 (George, 1988). Taking the three most important centres where trawler operations are concentrated (Neendakara, Cochin and Calicut) the CPUE for 1973 and 1984 are 50kg/hr and 20 kg/hr respectively.

As regards the declining size of prawns it is sufficient to quote one of the leading fishery scientists of the country who has specialised on the prawn fishery. On analysis, the variation in the size of prawns in the main landing centres he cautions:

"Regarding the range in sizes of the different species at these centres, one important point which emerges from a comparison of the data of 1978 and 1983 is that in the case of both dominant species, namely P. Stylifera and M. Dobsoni, much smaller sizes are coming in the catches of 1983 when compared to that of 1978. Along with the range in sizes there is also a drop in the sizes of the major groups represented in the fishery. This should be feature strengthening the suspicion about the depletionary tendencies noticed in the shrimp fisheries of Kerala and another point of concern from the conservation approach."
(George, 1988)

Another overall indicator, pointing at least to the possibility of eco-system overfishing, is the decline in the catches of the demersal species of fish. As indicated earlier, these bott

dwelling species are largely unaffected by nature induced changes in their eco-system. Hence, both the increase and the decline in their harvests can be attributed to man-induced interventions in the form of fishing. Between the years 1971-75 and 1981-85 the harvests of nearly all the important demersal species registered a sharp decline. (See Table 3) This can largely be attributed to excessive or destructive fishing -- particularly the use of trawlers.

Table: 3 Demersal Fish Harvest in Kerala

Species	*	*	#	@	
	1971/75	1976/80	1981/85	Percent change over 1971/75	
				1976/80	1981/85
Catfish	22	11	10	(50)	(55)
Perches	10	16	7	60	(30)
Sciaenids	10	9	5	(10)	(50)
Leiognathus	11	4	5	(64)	(55)
Prawns	59	41	29	(31)	(51)
Others	36	30	38	(17)	6
Total	148	111	94	(25)	(36)

@ Figures in () indicate percentage decline

Source: * Babu Paul, 1982 # Govt of Kerala 1985

Economic Overfishing

That economic overfishing had set in by the advent of the 1980's can be gleaned from the evidence of profitability calculations made for the trawler fleet at different points in time.

In 1968-69 trawlers in Kerala (above 10m length) operated on an average for 160 days and landed 30 tonnes of fish valued at

Rs.34,500 incurring a total operating cost of Rs.26,700. Net income after depreciation and interest worked out to Rs.7,800 or a 14 percent return on the investment. (Govt. of India, 1971). In 1978 an enquiry conducted by the Kerala State Planning Board indicated a net return on investment from trawling boats of 8.6 percent (Govt of Kerala, 1979). Results from an FAO/UNDP sponsored study indicated that in 1980-81 trawlers operated on the average for 157 days and landed 19 tonnes of fish valued at Rs.92,300 but incurring a larger total cost. This resulted in a negative rate of return (Kurien & Willmann, 1982).

A Task Force of the Government of India observed: "Due to the introduction of powerful engines and longer hours of operation, the consumption of diesel has increased considerably. In 1971, the average daily consumption of diesel by a boat was only 75 litres. It rose to 100 litres in 1976 and to 150 litres in 1981. Also the catch per unit effort has come down very much in the last five years, as more number of boats were operating in the same fishing grounds. The daily average catch around August 1981 was about Rs.825 as against the total cost of operation of Rs.1283 per boat." (Govt of India, 1982)

All the above figures are averages. The profitability range was likely to have been large. Despite "average losses" it is reckoned that as much as a third of the fleet was operating profitably. This fact, coupled with the fluctuating nature of fortunes from fish harvests, provides a strong incentive for

marginal loss makers to continue in the fishery. They pin their hopes on a bumper catch in the near future which could wipe out their accumulated losses.

There is another important reason for the continued expansion of the fleet despite the overall profitability decline indicated by the cost-earnings calculations. Having initially obtained subsidies and long term loans from the state, the owners of several boats have defaulted in their repayments. In fact, since most of them have appropriate political connections the repayment of loans seems more closely correlated to one's contacts rather than the economics of operation of one's boats. This makes the private return from the boats to the owners still lucrative when calculated on the basis of their own investments in it! In March 1986 a provisional estimate of the Government of Kerala, assessed the total accumulated arrears on loan repayments due from mechanised boats (mostly trawlers) issued by it to stand at Rs.75 million. Of this Rs.58 million was the principal amount -- or Rs.42,000 per boat which on the average ~~is~~ about 30 - 40 per cent of the investment cost. The experience of the commercial banks in this regard is unlikely to have been very different.

An Expert Committee was appointed by the Government of Kerala to study the question of resource depletion and overfishing. (See below) This Committee was of the unanimous opinion that the

investment in Kerala's coastal waters was far above the desirable optimal levels.

Table:4 Estimates of Excess Fishing Craft in Kerala

Craft Type	Existing# Number	Committee * Recommendation	Excess Number	Percent
Trawlers	2807	1145	1662	59
Purse-seiners	54	Nil	54	100
Motorised Crafts	6934	2690	4244	61
Non-motorised Crafts	20170	20000	170	negligible

Source: # Department of Fisheries (personal request-Sept 1986.
Mechanised gill-net boats not accounted here)

* Kalawar, 1985

From the above calculations it was estimated that the extent of overcapitalisation in the fishery was of the order of Rs.530 million -- an amount equal to the total development assistance given by the state to the fisheries sector in Kerala during the three decades of planned development. (Achari, 1987b)

The economic, eco-system and biological aspects of overfishing were integrally linked. They reinforce a downward spiral which could in time lead to the complete collapse of the fishery.

6. IMPACT OF OVERFISHING

The overfishing of the coastal marine fishery resources of Kerala has brought ruin primarily to the commoners -- the vast majority of working fishermen of Kerala State whose livelihoods are at stake, and the poorer sections of consumers for whom fish forms a

major source of nutrition and a culturally indispensable part of the diet.

Productivity and Incomes of Fishermen

The productivity of the working fishermen dropped significantly with the overfishing. Incomes however did not plunge to abysmal levels because shore prices of fish exhibited considerable increases. They rose from around Rs.1260/tonne in 1974 to Rs.2300/tonne in 1982

The trends in productivity and income were similar for both the workers on the mechanised trawlers and the artisanal fishermen working with their traditional crafts.

Taking 1974 as a base we see that productivity and income levels declined across the board. Trawler crew who harvested 10 tonnes of fish in 1974 landed only 7.7 tonnes in 1982. Their real per capita incomes during this period fell by 45 percent from around Rs.2700 to Rs. 1500. In the case of the artisanal fishermen the extent of setback was similar. Productivity registered a 50 percent decline between 1974 and 1982 -- falling from 3.3 tonnes to 1.6 tonnes. Real per capita incomes also dropped from Rs.850 to Rs.420 during this period. (See Table: 5)

Table: 5 Productivity and Income of Fishermen in Kerala
(Income per capita in 60-61 prices)

Year	Fishermen on Trawlers		Artisanal Fishermen	
	Productivity (Tonnes/yr)	Income (Rs)	Productivity (Tonnes/yr)	Income (Rs)
1961	NA	NA	3.54	330
1965	NA	NA	3.82	380
1969/70	5.15	790	3.34	630
1974	10.04	2700	3.20	850
1979/80	7.54	2630	1.78	540
1982	7.70	1560	1.62	420

Source: Kurien & Achari, 1988

Recent estimates made by the state government also indicate that the per capita state domestic product (SDP) is increasing faster than the per capita fishery sector product (FSP). In 1973-74 when the SDP was Rs.811, the FSP was 18 percent lower. By 1980-81 the gap increased to nearly 30 percent and quick estimates for 1986-87 place the SDP at Rs.2371 and the FSP at Rs. 1415 -- a difference of 40 percent. Though the population growth of the fishing community is higher than the state average, this increasing disparity is primarily due to the slower rate of growth of the fishery sector product. This is due to the change in the composition of fish harvests towards species commanding lower market values following the overfishing of high value species.

Income Disparities Between Workers and Owners

Overfishing has not only reduced the income levels of the the working fishermen it has also increased the level of disparity between them and the non-worker capitalist owners of mechanised boats. From a small share of 12 percent of the total value of output of the sector (1969) their slice of the fish-pie increased to 27 percent in the boom period of 1974. Thereafter, with the phase of overfishing setting in, their share increased further. It reached 43 percent by 1982. (See Table: 6)

Table: 6 Distribution of Value of Output of Fish between Workers and Owners
(In Rs. Million)

Year	Workers *	Owners of Mechanised Boats
1969	144 (88)	19 (12)
1974	392 (73)	143 (27)
1982	428 (57)	314 (43)

* Artisanal fishermen (workers and worker-owners) and workers on mechanised boats. Figures in () are the shares.

Source: Kurien & Achari, 1988

With the increase in the number of mechanised boats between 1969 and 1982 the number of owners has increased. This partly explains the increase in their shares. However, assessments of profitability (mentioned in section above: Govt of India, 1971; Govt. of Kerala, 1979; Kurien and Willmann, 1982) indicate that until 1980-81 the net returns on investment on mechanised boats on the average were positive and that the private returns were lucrative.

Less Fish for the Masses

Fish was at one time considered to be the poor man's protein in Kerala. No more. Viewed from the perspective of the avid fish eating population of the state more investments for fisheries development have yielded less fish for domestic consumption. The availability and quality of fish sold in the markets have deteriorated and the retail prices have increased faster than the general cost of other food items. (Kurien, 1984). There is evidence to indicate that middle and higher income households are shifting to more readily available and cheaper sources of protein. (Nair, 1978). The poorer consumers do not exhibit easy changes in diet patterns and are therefore the ones most affected by this scarcity of fish. Per capita availability of locally consumed fish has decreased from around 19 kilogrammes in 1971-72 to around 9 kilogrammes in 1981-82. (Kurien, 1985)

7. RESPONSES TO OVERFISHING

The responses to the overfishing crisis have come from several quarters. We shall here deal with only the responses of the key actors -- the fishermen; the boat owners and exporters; the state and the scientific community. Understanding the nature of their reactions and the logic behind them is crucial. Any attempt to resolve the crisis will have to necessarily involve all to them.

Responses of the Fishermen

There were two types of responses by the fishermen -- political and technological.

The first, beginning in 1979, was more vocal and publicly visible. Decline in productivity and drop in incomes began to get correlated in the minds of the artisanal fishermen as a direct result of the destructive fishing by mechanised boats. Isolated physical conflicts at sea between trawlers, purse-seiners and fishermen using traditional craft were on the increase. Soon there were strong waves of organised dissent by the artisanal fishermen. They demanded that anarchic and destructive fishing by trawlers and purse-seiners be stopped. They wanted a zoning of the coastal waters in what can be considered a plea for state regulation of the commons by the creation of distinct fishing zones. This would compel the mechanised boats to fish in deeper waters. They also demanded a total ban of trawling operations during the monsoon months of June, July and August -- the breeding season for many fishes. This socio-ecological movement extracted rich dividends from the left-wing dominated government in power at that time. Most important was the legal enactments providing for comprehensive measures restricting and regulating fishing activities in coastal waters.[6]

From 1981 onwards the ides of May brought the onset of the monsoon in Kerala and along with it the organised struggles of the fishermen.

Until 1983 it was an independent trade union (i.e. one which had no affiliation to any political party -- an anomaly in the Kerala context) which spearheaded the fishermen's agitation. In 1984 all the major political parties in Kerala without exception created (and in a few cases revived) their own fishermen unions and joined the fray. The movement developed from strength to strength and reached its zenith that year. The movement's slogans and its non-violent agitational tactics brought it into the limelight of the national information media. It received the support of many environmentalists and ecology groups all over the country. (For details of this process see Kurien, 1988a)

A second type of response -- the technological -- which set off in 1981/82, was slower. Fishermen -- individually and in groups -- were taking on to using outboard engines on their traditional crafts. These artefacts were to reduce the drudgery of their work, provide the flexibility to fish in deeper waters and thus hopefully catch more fish. What started as a cautious experimentation soon acquired the proportions of a tidal wave and had the tacit support of the new right-wing government in power.

(See below)

The new artefact resulted in a phenomenal reduction in the drudgery of fishing. (Most artisanal fishermen switched over from using a combination of oars and sails to a total dependence on the outboard engine for propulsion of their crafts.) The technical possibility to enhance their range of fishing beyond

the overfished coastal waters also fructified. However, for both these desirable conditions to be simultaneously realised entailed a significant rise in operating costs. This fact, combined with the unfamiliarity to deeper waters, left only one option open: to continue fishing in the coastal waters for longer periods of time and with more fishing gear. Mechanical power provided the flexibility to use more active fishing techniques -- including smaller versions of trawl nets and purse-seine nets.

The political upheaval of the fishermen was basically a response to being deprived of their traditional, historical, communal rights over the coastal commons. The state legislations of 1980 zoning the coastal waters was an ipso facto recognition of these rights. Their subsequent widespread and anarchic expansion of investment and fishing effort within this zone was basically a succumbing to a crisis of survival brought about by declining productivity and incomes. Engulfed in the euphoric wave of the new technology, they did not stop to think of the long term implications of their pursuits. The potential gains from zoning the coastal commons was almost totally lost by these actions. (Kurien, 1988)

Responses of the Boat Owners and Export Lobby

Opposing the agitation of the fishermen was the economically strong, and hence, politically influential boat owners' associations and export processors lobby. They had strong connections with both the left and the right wing coalition

governments. They contested the ecological views of the artisanal fishermen as being based on myths and argued forcefully that a ban on monsoon trawling would result in a major drop in the foreign exchange earnings from prawns. The unemployment implications of a three-month trawling ban was also highlighted. They argued that this would create an explosive social situation in the overall context of high unemployment in Kerala.

The boat owners' associations also went to court questioning the validity of government promulgations regulating and restricting their free access to the coastal commons. They deemed fishing in the commons their fundamental right enshrined in the Indian Constitution. The High Court ruled in their favour. It held that while the state did have a right to regulate the coastal commons, it could take action to exclude persons from it only if sufficient scientific evidence was available to substantiate that these persons' activities were socially or ecologically harmful and against the interests of the majority in society. Such unambiguous evidence could not be mustered up by the state.

This was a victory for the boat owners and the exporters. Despite fresh legislations enacted by respective governments making amends for the loopholes in the law, in reality the status quo prevailed: the coastal commons continued to be open to all.

Responses of the State

The state began to recognise the issue of overfishing only after the social upheaval in the coastal areas in the late 1970's became widespread. Thereafter, irrespective of the political colour of the government in power, the conflicts between the traditional fishermen and the trawlers at sea created intense pressure on the political system. In a parliamentary democracy with a multi-party system and a predominance of coastal electoral constituencies, no political party could take the restive fishing community for granted.

A left-wing dominated coalition was in power in the state in 1980. They were in basic sympathy with the movement of the artisanal fishermen who were a big vote-bank. However they could not overlook the economic interests of the boat owners and the exporters. In a democratic polity functioning in the overall capitalistic framework of society, the vote-bank strength as well as the economic clout of the various interest groups involved must necessarily be carefully balanced. The left-wing dominated coalition therefore (as mentioned above) enacted legislations to regulate and manage the commons. They also postponed taking hard decisions, which would necessarily be biased, by constituting an expert committee (see below) composed of scientists working in fishery institutions located in the state, government bureaucrats and representatives of fishermen and the boat owners, to examine the ecological and economic aspects of the issues raised. The onus of suggesting remedies was also bestowed on the committee.

Elections in 1982 brought a more conservative right-wing dominated coalition government into power. However, the swing in the coastal votes towards the left did not go unnoticed by them. They realised the gravity of the situation and its future electoral implications. The fact that the Chief Minister himself chose to hold the hitherto insignificant fisheries portfolio was a clear indicator of this.

When the fishermen announced renewal of their monsoon agitation in 1984, this government was firm about its stand. It was unwilling to negotiate with the fishermen and tried its best to break the agitation using strong arm tactics. It also attempted to wean away sections of the fishermen through the influences of religious leaders. These met with limited success.

When the "stick approach" failed, the "carrot approach" was tried. This met with considerable success. The government warned against militant unionisation and divided the ranks of the fishermen by placating those under its political influence with direct financial assistance -- subsidies and loans -- as well as access to intermediate technology. Implicit in this strategy was the tenet: "if you can't beat the trawlers join them with your outboard engines !" With this the private initiative of some fishermen on this score (mentioned above) got a big boost.

Further, the government conceded to the demands of the unions to appoint a second committee to re-examine the issues regarding overfishing and destructive fishing. The committee was to consist only of reputed scientists and the government vouched to accept its recommendations. Such a committee was appointed in 1984 (see below) and was expected to give its recommendations within a year.

Responses of the Scientific Community

None of the fishery scientists in their wildest dreams had imagined that the question of where and when fishes in Kerala laid their eggs and breed would become a hot political issue! When it did, they were at a loss on the position they should take. Most of them being government servants, and working in highly bureaucratic and hierarchical institutions had little academic freedom. When confronted by the fishermen representatives who on occasions did point to inconsistencies in scientific publications, they had little choice but to get defensive.

In the first expert committee appointed by the government in 1981, one of the most reputed fishery scientists in India failed to participate at meetings on the plea that the fishermen's demands were "more political than scientific." He thought it best to leave it to the bureaucrats to resolve the diametrically opposing positions of the fishermen and the trawler owners on the fishery-ecological issues. This committee, not surprisingly, could not arrive at any consensus.

The second expert committee appointed in 1984 consisted of only three fishery experts -- one experienced fishery administrator and two leading fishery scientists. It was significant that the trio were from outside Kerala State. Though never stated explicitly, this was to ensure that the socio-economic and political forces at work in the fish economy of Kerala State would not bias their working.

They travelled along the length of Kerala's coastline and met with all the sections and groups which had a stake in the fish economy. The committee submitted its findings in 1985.

It cautioned the government about the impending crisis which could affect the coastal waters if the existing configuration of fishing assets and fishing effort continued to grow in an unregulated fashion. They did not approve the need for a monsoon trawling ban but favoured a drastic reduction of the fleet size of the trawlers to half the then current level. They recommended the use of more passive fishing techniques of the type used by artisanal fishermen; were in strong favour of a total ban on purse-seiners; cautioned the government and the artisanal fishermen about the massive motorisation drive; and highlighted the need for active fishermen's participation in managing the coastal commons.

8. RESOLVING OVERFISHING

It would be a truism to state that the fish economy of Kerala is in the throes of a crisis. From our above analysis it is also clear that, in the long run, it is the coastal commons and the working fishermen rather than the capitalists that have been most affected.

The primary reason for this is that the capitalists can easily move out of the fishery while the fishermen are more or less tied to it owing to a lack of alternative economic opportunities. For the fishermen, their future lies in the sea and its common resources. For capitalists, given their short-term perspective and under the given conditions of investment, the ratio of profits from indiscriminate harvesting of the commons to the profits from regulated and sustainable harvesting, are large. For them it actually pays to bring ruin to the commons!

It is such conflicting motivations and actions which provide the basis for the unequal bargaining power of the two classes and the rationale for the state to regulate the coastal marine waters.

An action plan to resolve it is indeed the priority of the day. The objective of any programme of action must be two-fold: (a) to revive the sustainability of the coastal commons and (b) ensure that it provides a basis for a decent livelihood and inexpensive food for as large a population as is possible. To ensure the achievement of these objectives demands a policy approach in

which development and management of the marine resources and the fish economy are seen as two-sides of the same coin.

The scale and type of harvesting technology should be in consonance with the known biological and ecological parameters of the resource. Small-scale of fishing crafts using multiple sources of energy, selective fishing gear, and operations from decentralised centres along the total length of the coastline should be encouraged. Economically efficient but ecologically destructive fishing artefacts should be strictly controlled irrespective of the user.

The ownership of harvesting technology -- fishing craft and gear -- should be restricted exclusively to those who are willing to fish. An aquarian reform of sorts to ensure this needs to be enacted by the state. Such a community of workers and working-owners should be entrusted with the collective rights and responsibility of managing the coastal commons within the jurisdiction of their decentralised operations at the micro and mezzo levels.

Conscious efforts to enhance the biological productivity of the coastal waters should be given adequate encouragement. Attempts such as the collective creation and establishment of fish aggregation devices in coastal waters are good examples of this.

Moving to the hitherto unfished deeper waters is an essential step to reduce the pressure on the coastal commons. This is an area for diverting some of the excess investments presently in the coastal waters. Making fresh investments in the deep sea should be preceded by thorough resource estimation surveys and economic viability studies. These need not be excessively preoccupied with export potentials. Subsidies to those who move out to these waters may be more economically and socially justifiable.

The above options with regard to conserving and enhancing the fishery resource; the choice, ownership and operation of the technology; as well as the social institutions for management of the resource provide the basic framework for a fresh policy approach. This will be required to pull Kerala's fish economy out of its ecological crisis and provide a sustainable future for the fishery resources in the coastal commons and the commoners --the fishworkers as well as the poorer consumers

POSTSCRIPT

Fish production continued to drop in Kerala after 1985. The political and technological responses of the fishermen continued unabated. The state played to both the tunes.

In 1988, responding to the continued demands of the fishermen's unions for a monsoon ban on the operation of trawling boats, the government, dominated by left parties, promulgated a partial ban. All the trawler operating centres in the state -- except the largest one, Neendakara -- were ordered closed for the months of July and August. The reason given for not closing Neendakara was that the heavy concentration of a marine prawn (*P. Stylifera*) in the inshore area during these months would perish if not harvested (mainly by the trawlers) resulting in loss of foreign exchange and employment.

The partial ban turned out to be ineffective. It could not prevent trawlers from the other centres operating from out of Neendakara. The boat owners also went to court charging the government of discriminatory treatment of trawlers located in different parts of the state. The traditional fishermen's unions were also unhappy with the situation. There seemed to be no significant political, economic or ecological gains from this management measure.

By 1988 the motorisation wave had swept through every fishing village in the state. Power propulsion of traditional fishing craft was here to stay.

Motorisation of traditional crafts did result in fishing in deeper waters leading to an increase in physical productivity and harvesting of new species. This was however at a much higher investment and recurring cost. In the central and northern regions of the state, motorisation gave a big boost to the use of fine meshed encircling nets called 'ring seines' used to harvest pelagic shoaling species. These were nothing but a smaller version of the larger destructive purse-seine nets. This trend created new tensions within traditional fishermen groups in these areas.

Quite oblivious of the economic, social or ecological implications of the above, the government actively promoted the earlier subsidy scheme for the purchase of outboard motors and introduced a new one for ring-seines.

The continued conflict between fishermen using traditional fishing crafts and those using trawlers as well as the emerging conflicts between traditional fishermen themselves (over the use of nets like ring seines), prompted the government to seriously re-examine the overall crisis in the fish economy. The government had before it the recommendations of two earlier

Expert Committees (mentioned above). Most of these had not been fully implemented. It however deemed it necessary to constitute a third Expert Committee to review the situation once again in the light of the recommendations of the earlier Committees. The main terms of reference of this Committee included: a re-examination of the question of the monsoon trawling ban; an appraisal of the unprecedented increase in the number of outboard engines and their power rating; and also a review of the ecological and social impact of the rapid increase in the use of gear like ring seines by the traditional fishermen.

This Expert Committee submitted its report to the government on 26 June 1989. The government decided to immediately implement one of the recommendations made by the Committee: a total monsoon trawling ban. The other recommendations which included restrictions on the use of ring seines; limitations on HP rating of outboard engines; and measures for protection of estuarine areas, were kept in abeyance.

The enforcement of the total trawl ban -- an effective measure to regulate access to the coastal commons -- resulted in bloody confrontations between the enforcement police and the boat owners at the major trawler landing centre, Neendakara. The boat owners took the matter to the High Court and the Supreme Court. Both courts were unwilling to issue a stay order to the government's decision. This legal ruling and the unwavering stand of the

government, despite the possible adverse political fallout, ensured that the ban was fully effective.

The ban did result in a considerable loss of employment for the workers in the processing industry. A fair number of the fishermen from the traditional fishing communities who worked as crew on the trawlers found opportunities to go fishing on the motorised boats operated from their home villages. A large number were however unemployed. The loss of current foreign exchange earnings has not been assessed.

The total monsoon trawl ban was the most important fishery management decision made by any government in the country since independence. The government also constituted an interdisciplinary task force to assess the total impact of the ban.

Two months after the ban was lifted (October 1989) very large pelagic fish harvests were reported from all over the state.

It would be wrong to attribute this phenomenon entirely to the trawling ban though both the ruling party politicians and the traditional fishermen's unions have done so.

Much of the credit should go to the yet-to-be-well-understood nature-induced changes in the sea -- e.g the effect of enhanced rains and known cyclic fluctuations of pelagic stocks.

However the total ban of trawling probably did contribute significantly to this phenomenon. The non-disturbance of the aquatic milieu during the monsoon months could be an important cause for the more pronounced shoreward movement of the pelagic fish shoals in pursuit of food which is found in abundance in the inshore water areas cooled by the inflow by rivers swollen by the heavy monsoon rains.

The ability of the motorised units -- particularly those using ring-seines -- to harvest whole pelagic shoals also provide an important reason for the increased harvest given the favourable nature-induced conditions and the after effect of the trawl ban mentioned above.

Shore prices and retail market prices dropped drastically. Reminiscent of the 1950's, fresh fish was sold as manure for coconut plantations ! It is unlikely that this bumper harvest has had a commensurate positive effect on incomes of fishermen. However it certainly provided a temporary boost to the nutritional status of fish consumers -- particularly the poorer among them.

This increased harvest (the quantitative details of which will be available only by early 1990) therefore seems to have been brought about by a strange combination of factors: largely unpredictable nature-induced processes, strong political will leading to firm management measures and the use of ecological over-efficient harvesting technology.

Only a medium-term ex-post analysis will unravel which of these factors was the determining one.

1. This famous article of Hardin (1968) talks about the way a herdsman will try to keep as many cattle as possible on the common pastures. Every "rational herdsman" is expected to behave in the same manner since he "is locked into a system that compels him to increase his herd without limit -- in a world that is limitedFreedom in the commons brings ruin to all." Dasgupta (1968) analysing the key passage in Hardin's article (from which the above quote is taken) comments that it would be difficult to locate another passage of comparable length and fame containing as many errors as the one above. There are assumptions which Hardin makes himself which by an act of transference he foists on the poor unprotesting herdsman. For example animals are not costless and such private costs set limits on the number of animals each herdsman finds most profitable to introduce into the common pasture. Whether or not the common will be ruined depends on a number of factors, one of which is the price of the output (milk or beef) relative to the private cost of rearing cattle. That the pasture is a commons is not a sufficient condition to lead to its ruin.

2. In tropical multi-specie fisheries, biological overfishing may occur even though total catch is still increasing because the decline in yield -- or complete extinction -- of one or several specie may be compensated through higher yields of other species.

3. Biologists further distinguish between "growth overfishing", "recruitment overfishing" and "ecosystem overfishing" depending on which is the most important factor preventing full recovery or growth of the stock. (Pauly, 1979)

4. The maximum sustainable yield (MSY) is subject to changes due to biological and ecological factors. Hence, MSY estimated for a year need not be the same for all years. The estimates quoted in the article are taken from George et al, 1977 and are the only available and comprehensive estimates made so far.

5. Output figures in this and other parts of the paper (unless otherwise mentioned) are taken from the published data of the Central Marine Fisheries Research Institute. Price data is taken from the Administrative Reports of the Department of Fisheries.

6. The Kerala Marine Fishing Regulation Act (1980) provided for the comprehensive measures for registration of all fishing craft. It also restricted the fishing by mechanised boats -- in particular the trawlers and the purse-seiners -- to a depth outside the 20 fathom depth contour line in the coastal sea. The zone on the shore-side of this contour was reserved exclusively for the non-motorised and motorised craft.

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