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A BRIEF APPRAISAL OF MARINE FISHERIES IN INDIA

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ABSTRACT

Using Relative Response Model and Maximum Contribution Approach, estimates on potential yield from the 0-50m depth area of Indian coastal waters are obtained as 2.20 and 2.00 million tonnes respectively. *Basing on productivity estimates, potential yield from 50-200 m depth area is expected to* be one million tonnes. It is suggested that no further increase in effort in 0-50 m depth is advisable. Instead, mechanisation of indigenous craft and/or replacement of existing small mechanised ones by medium sized vessels may improve the yield to 2.00 *million tonnes. In the case of* 50-200 m depth. *introduction of* 400 large vessels of length above 10 m is suggested.

INTRODUCTION

India with a vast coast line of more than 6500 km has rich marine fishery resources containing not less than 1000 species. Recent estimates indicate that there are resources accounting for about 4.5 million tonnes in the EEZ of this country for exploitation (George *et. al* 1977). These estimates are based on productivity studies and exploitation rates. At present the near shore areas stretching to not more than 50 m depth are intensively exploited by the small scale fishery sector comprising indigenous craft and small mechanised ones mainly operating trawls and drift/set gill nets. There are about 120 big trawlers in private sector, operating mostly in the east coast. Apart from them there are about 50 large vessels operated by the Government of India organisations for exploratory and research purposes. In fish production India ranks sixth in the world. In shrimp production and export it ranks second. From exports this country earns about Rs. 390 *crores annually*. This paper presents the existing overall status of marine fisheries in terms of quantity exploited groupwise and the role of small scale and large scale fishery sectors. It also indicates the level of potential resources for exploitation using Relative response model and Maximum contribution approach. It also discusses the scope for intensifying fishing effort by way of introducing more gears and the scope for increasing yield from marine sector.

The Central Marine Fisheries Research Institute has been collecting data on the exploited marine fshery resources of this country for more than three decades for assessing their level of exploitation in terms of quantity caught and effort expended and biological and environmental aspects in order to find out the levels of effort suitable to harvest maximum sustainable yields. For this purpose, the Institute has developed a stratified multistage random sampling design, the stratification being over space and time. This system of collection of data on marine fishery resources, vital for stock assessment studies is recommended by the FAO to other developed and developing countries. In the coverage of the CMFRI, data on exploitation of large vessels operated in the private sector are included as these are not made available to the National Marine Living Resources Data Centre of the CMFRI. The data base considered for this paper covers thus the small scale mechanised and non-mechanised fishery sectors only, the period of coverage being 1971-'84.

PRESENT STATUS OF EXPLOITED MARINE FISHERY RESOURCES

During 1971-'84 the total annual marine fish landings in India ranged from 9.8 to 16.3 lakh tonnes. This period witnessed the introduction of mechanised craft in the marine fishery sector and mechanisation of indigenous craft. The average during the first four years amounted to 11.45 lakh tonnes followed by 13.66 lakh tonnes during 1975-'79 and 14.46 lakh tonnes during 1980-'84 indicating the slow rate of increase during the period under consideration. This is an indicator to the fact that in the present area of exploitation substantial increase in the yield may not be expected from what is harvested at present. This period also witnessed intensive exploitation of demersal fishes particularly by smaller shrimp trawlers. The contribution from demersals was increasing from about 35% to almost 50% in the total landings, in this period. As expected the trend was similar in the case of mechanised sector but more impressive with about 20% initially and touching almost 70% in the end. (Anon, 1982; Anon, 1983 a; Anon, 1986 and Alagaraja *et. al*, 1982).

Clupeoids contributed about 27% of the total landings during this period out of which oil sardine accounted for 12%. The landings of oil sardine varied from 1.15 to 2.21 lakh tonnes. Prawns ranked second with 13% of which the share of penaeid prawns was 8%. The ranges of the landings of penaeid and non-penaeid prawns were 0.72-1.42 and 0.49-0.85 lakh tonnes respectively. The landings of Bombay duck varied from 0.52 to 1.38 lakh tonnes with an average contribution of 7% to the total landings. Sciaenids landed in good quantities varying from 0.37 to 1.15 lakh tonnes accounting for 6% in the total landings. Heavy fluctuations were noticed in the landings of mackerel during 1971-'84, the range being 0.28-2.05 lakh tonnes, like of which no other group has experienced during the period under review. It accounted for 5% of the total landings. Cat fish, ribbon fish and silver bellies contributed 4% each to the total, followed by pomfrets, perches (3% each) and seer fish (2%).

PRESENT LEVEL OF FISHING

Though there was an increase in the total marine fish landings during 1971-'84, the trend was not uniformly increasing. There were fluctuations in the total as well as groupwise landings. In this context it is better to know the condition of the exploited marine fish stocks at the present level of fishing. Heavy fluctuations in the landings of some of the groups and later reaching a plateau raised doubts on overfishing. Overfishing can be considered under three categories. In economic overfishing, though the landings are not adversely affected, fishing activity becomes economically not viable. In such cases the effort pressure is automatically reduced so as to maintain the economic viability of fishing operations. Such a situation has arisen in some parts of the country leading to clashes between the indigenous fishermen and those operating mechanised boats. Clashes in Tamil Nadu, kerala, Karnataka and Goa are indicators of this situation. These clashes are being averted by properly scheduling fishing operations (Jacob *et al*, 1979; Balakrishnan et al 1984 and Alagaraja *et. al*, 1982). The second type of over fishing is 'size overfishing'. Due to reduction in the mesh size it has been noticed that the size at first capture is very much reduced particularly that of prawns (Rao *et al*, 1980). In the initial stages the capture of larger fish and their reductions in the stock, leads to reduction in the average size of fish caught. This reduction gives chance to the younger fish to grow better in the absence of competition for food from the older ones. However, when the effort pressure is increased and mesh size reduced even the younger ones are caught indiscriminately without allowing them to use their fast growing potential. This adversely affects the biological efficiency of the system. Hence such a tendency should not be encouraged. Finally comes the 'recruitment overfishing'. Since all living resources are renewable resources, their renewability could be maintained only when the recruitment is not affected. Capturing young fish in large quantities before they spawn may leave only a few fish to spawn and the resultant recruitment to the fishery may not be able to balance the loss due to natural and fishing mortalities. Hence once recruitment overfishing sets in, it adversely affects the stocks leading finally to their disappearance from the regions of fishing. Such a situation may happen purely by fishery dependent factors as in the case of cat fish in Karnataka (Silas et. al. 1980) or by the combination of fishery independent and dependent factors as in the case of Peruvian anchovies (Anon. 1983). All these three effects are felt though not in full extent in some region or the other in the Indian coastal waters demanding care and attention to the marine fishery in this country.

POTENTIAL YIELD IN 0-50 M DEPTH REGION

In the context of the above observations it is pertinent to know the level of potential yield. Estimates on potential yield or maximum sustainable yield could be obtained by using the well known macro and micro analytic models. Under micro analytic models the often used Beverton-Holt model is applicable for a fish stock and the non selective gear employed for its exploitation. As this model is gear and species specific its use is restricted to only those species for which information on growth and mortalities is available. To get an estimate on all India level such a model has to be used for the most important groups of fishes and their MSY are to be added to get the total estimate. At present such studies have been made on a few groups namely prawns (Alagaraja *et al*, 1986), *Nemipterus* spp (Murthy, 1983) and cat fishes (Anon. 1987) to cite a few references These studies have clearly indicated the necessity for mesh regulation in those regions where these stocks were exploited. However, an over all estimate on all India basis are not available even for these groups.

Under macro analytic models two models are used to find the level of potential yield and to examine their comparability. As per the Relative response model (Alagaraja, 1984) for the period 1980-'84; the estimate of potential yield is 2.20 million tonnes as given in the Table 1.

TABLE 1.
Estimate of potential yield using relative response model

c_t	$c_t + 1$ ('000 t)	$c_t = c(1 - e^{-k}) + e^{-k} c_t$
1250	1379	= 263.5 + 0.88 ct
1379	1421	r = 0.94
1421	1550	
1550	1630	c = 2200

Specieswise estimates of exploited marine fishery resources in India have not shown any interactive effect among them. In the absence of interaction among the exploited species 'Maximum Contribution Approach' (Alagaraja, 1986) could be used to obtain the potential yield. Under this approach during the period under review, the maximum landing of each group is taken. For this purpose the total landings are considered under 14 major groups. For example landings of penaeid prawns were the maximum in 1975 touching 1.42 lakh tonnes. Such maxima are obtained for all the 14 groups as indicated in Table 2.

TABLE 2.
Maximum contribution approach

Groups	Maximum landings ('000 t)	Percentage	Year
1. Oil sardine	221	11.2	1981
2. Other clupeoids	283	14.5	1984
3. Mackerel	205	10.4	1971
4. Bombay duck	138	7.0	1981
5. Penaeid prawns	142	7.2	1975
6. Non-penaeid prawns	85	4.3	1972
7. Sciaenids	115	5.8	1975
8. Catfish	76	3.9	1974
9. Perches	71	3.9	1974
10. Silver bellies	92	4.7	1983
11. Ribbon fish	78	4.0	1978
12. Pomfrets	54	2.7	1983
13. Seer fish	37	1.9	1984
14. Others	370	18.8	1984
Total	1967	100.0	

The grand total of these maxima is about 2.00 million tonnes which is the potential estimate under the Maximum Contribution Approach. This estimate is closer to the one obtained under Relative Response Model Hence the exploitable potential yield may safely be taken as 2.00 million tonnes from the present heavily exploited area extending upto 50 m depth. It may be interesting to note that the estimate of 2.26 million tonnes obtained by George *et al.* (1977) for this region is very close to that obtained through Relative Response Model.

SCOPE FOR INTRODUCING ADDITIONAL CRAFT IN THE 50 M DEPTH REGION

From the foregoing it may be stated that the present yield of about 1.60 million tonnes could be raised to 2.00 million tonnes. For obtaining this additional yield of 4 lakh tonnes one would like to know whether the present level of effort, in terms of number of craft and gear, should be increased or not. As indicated earlier, clashes between small scale mechanised sector and the indigenous one have been reported in different parts of India particularly in the south west and south east regions. These clashes have affected the fishery very much. Hence introduction of additional small mechanised craft in these regions for exploiting the resources available in the 0-50 m depth area is not advisable. However motorisation of indigenous craft for operating gear and tackle such as drift/gill nets and hook and line may enhance the contribution from these units. Since the existing craft would be motorised under this scheme, clashes may not be expected and this approach may help the traditional fisherfolk to increase their revenue as the area of exploitation of each motorised indigenous craft would be extended, its mobility increased and hence such craft would be able to land fish in good and fresh condition fetching higher price. It is worthwhile, in this context to think in terms of replacing smaller crafts by medium sized ones so as to increase the fish hold capcity and the space for carrying ice.

POTENTIALITIES OF 50-200 M DEPTH REGION

At present exploitation of the resources in 51-200 m depth region is not as intensive as in the aera within 50 m depth. Hence a precise and reliable estimate on potential yield from this region on the lines indicated for the 0-50 m region, could not be made. This region is not supposed to be as biologically productive as the near shore areas. However, George *et al* (1977) have indicated its potential yield equivalent to that of 0-50 m depth region In otherwords according to them there exists another 2.0 million tonnes outside the present area of fishing ready to be exploited. From Jones and Banerjee (1973) primary production rate for 0-50 and 50-200 m on all India level are estimated at 1.21 and 0.28 c_g /m²/day respectively and the corresponding areas are 193 and 401 thousand sq km respectively. On the basis of these estimates, the potential yield of 50-200 m depth area may be equal to about half that of 0-50 m depth area. Regionwise break-up of potential yield is given in Table 3. The potential yield of the 0-50 m region is estimated at 2 00 million tonnes. Hence the estimate of the potential yield for the region 51-200 m is 1.00 million tonnes. This estimate appears to be a modest one.

TABLE 3.

Regionwise potential yield (lakh tonnes) and required no. of large vessels

Region	0-50 m	50-200 m	0-200 m	No of large vessels (above 17 m length) required in 50-200 m depth area.
North East (West Bengal and Orissa)	2.00	1.00	3.00	40
South East (Andhra Pradesh, Tamil Nadu and Pondicherry)	5.00	2.50	7.50	100
South West (Kerala and Karnataka)	6.00	3.00	9.00	120
North West (Goa, Maharashtra and Gujarat)	7.00	3.50	10.50	140
Total	20.00	10.00	30.00	400

To determine the level of effort required to exploit these resources information on types of vessels their holding capacity and break even point is needed so that their operations become economically viable. For instance for a larger vessel of about 23 m length, the fish holding capacity is 25 tonnes and it can stay out at sea for about 20 days. Out of this about 15 days are spent in fishing. On an average the vessel is expected to catch about 1.7 tonnes of fish per day. If this catch is made up of low quality fish, then the operation may not be economically viable. Hence to fix the No. of vessels required to exploit multispecies resources more information on the distribution of the resources over space and time and the economic viability of harvesting them by various types of gear-vessel combinations is needed In the case of north east coast of India where large trawlers of length 23 m and above are operating mainly for shrimps required information is available. Hence it is possible to calculate the maximum yield of shrimps that this area can sustain and the optimum No. of vessels of length 23 m and above needed to judiciously exploit this resource. The MSY estimated for this region is 4800 t of shrimps and the optimum No. of trawlers is 104 Now there are about 120 trawlers operating in this region. Hence it is suggested to reduce the No of trawlers from 120 to 100. Since such details are not available for the 50-200 m depth region, it is difficult to estimate the No. of vessels which should be deployed to optimally exploit the marine fishery resources of this zone.

Assuming, however, that large trawlers are expected to catch on an average 10 tonnes/day and taking 250 days in a year as the effective operation period for each vessel, total expected annual landings for each vessel may be put at 2500 tonnes. On this basis 400 such vessels are needed to catch 1.00 million tonnes.

From Table 3 it may be mentioned that large vessels numbering 40 may be introduced in the north east region, 100 in the south east region, 120 in the south west region and 140 in the north west region to fish beyond 50 m depth At present there are about 120 large trawlers operating off the coasts of West Bengal, Orissa and Andhra Pradesh. These vessels are exploiting mainly prawns. As these prawns are not deep sea prawns it appears that these large trawlers are operating in the relatively shallower regions. In the absence of the data on the exploited marine fishery resources by these vessels no conclusion could be drawn on the effect of operations of these vessels on the fish stocks exploited by them. However, it may be stated that large vessels may be directed to exploit deep water resources and the area with 0-50 m depth may be left to small vessels for exploitation.

Before the advent of mechanised craft, fishing gear in India was passive in the sense that gear was operated on the stocks approaching the fishing areas After the introduction of mechanised craft, gear has became active and stocks are 'hunted' and fished as in trawling and purse-seining. While the gear is passive, exploited stocks are not adversely affected by the fishing effort. But when the gear is active and when the effort is intensive there are chances for recruit overfishing. Hence constant monitoring of the resources exploited by the active gears is required for their judicious management.

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