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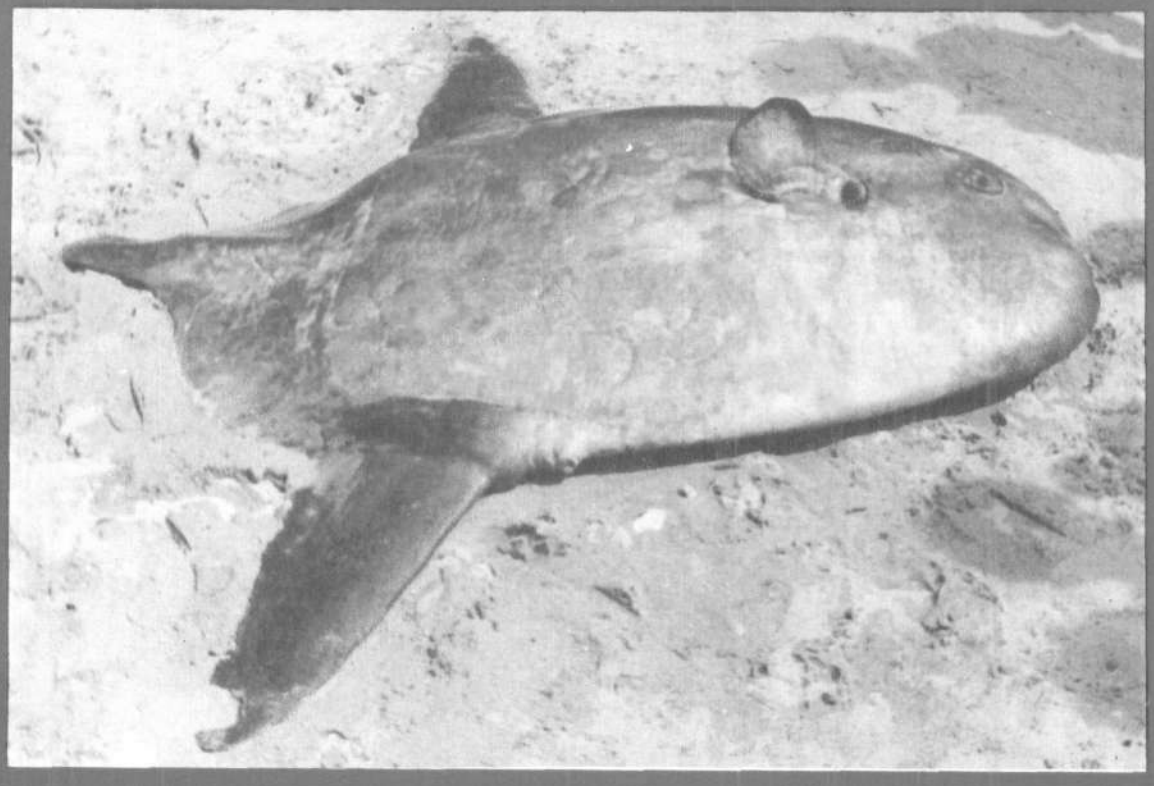

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NEED FOR PROTECTING THE NON-EDIBLE BENTHIC BIOTA OF THE INSHORE WATERS FOR THE BENEFIT OF THE COASTAL RESOURCES AND THE FISHING INDUSTRY

P. Benaam, N. G. Menon, K. Balachandran and Joseph Andrews

Central Marine Fisheries Research Institute, Cochin - 682 014

Introduction

Over the past five decades, the Indian marine fisheries have been subjected to modifications and development. The modifications have transformed a subsistence oriented traditional fisheries into a market-oriented semi-industrial sector, with tremendous growth in fish production which in turn has increased the total revenue in terms of national as well as foreign currency turn over. The fast development of modern technologies in the harvesting sector, coupled with the rising demands for Indian marine products abroad have paved the way for reaping incessantly the vast expanses of coastal waters sometimes even beyond the sustaining capacity of the habitat. Inspite of these advances, it is disheartening to note that our present marine fish production has been swinging around 1.2 to 2.3 million tonnes during the past two decades, with only marginal annual increase even with increased fishing pressures, new innovations, diversification, industrialisation, etc. Assessment of the stocks of the major fish resources in the exploited grounds have categorically revealed that the stocks of target groups/species of relatively high value and easily vulnerable ones are on the verge of overexploitation and therefore warrant immediate management measures. Today's Indian marine fisheries thus face challenging problems in trying to achieve the kind of sustainability that will assure its own long-range survival.

The excessive fishing pressures exerted by the mechanised/motorised sector in a climatically limited coastal habitat upto a depth of about 50 m have not only affected the sustenance of some easily vulnerable resources, but also challenged the very existence of some shell fishes, finfishes and bottom organisms, including the biota which are non-edible to man but vital in the food web of all exploitable resources. The mechanised bottom trawling especially with the objective to mass produce the target groups of export-importance, has resulted in a disproportionate destruction of juveniles/subadults/of heterogenous species of shrimps and finfishes and a wide spectrum of bottom organisms, most of them having low or no edible or economic value. Finfish component has accounted for the major share in the shrimp trawl landings which is caught unintentionally; and being a less priority item, it is generally thrown away at sea. This post-harvest loss to the capture fisheries is a matter of grave concern to most of the nations; and as such a lot of thought effort and action have gone into to recover and utilise the by-catches. Developed nations have devised ways and means to reudce the by-catch-target ratio by modifying the gear. Quite a lot of work has been done in several countries to estimate the quality and quantity of wasted by-catch from trawlers and to recover and utilise the enormous quantities of heterogenous fish species. The Food and Agriculture Organisation has conducted technical consultations on shrimp by-catch utilisation in 1981 at which twenty countries have co-operated and discussed all problems connected with the above issue and have formulated specific recommendations.

But quite surprisingly, there has been no mention about the unintentional but damaging postharvest destruction of a vast array of bottom inhabitants (invariably non-edible) of the coastal trawling grounds in any of the conferences, technical consultations and workshops organised by national and international governmental or non-governmental agencies. So far no attempt has been made to estimate the quality and quantity of this wanton post harvest wastage of benthic biodiversity. Such an information is essential to assess the impact of coastal bottom trawling on the habitat, its biota and its relationship with the fisheries. With this objective, a preliminary study was conducted along the south west and south east coasts to estimate the non-edible benthic faunistic components caught, landed and discarded by

mechanised trawlers and motorised trawl nets in the shallow grounds within 50 m depth (Fig. 1 and 2). This seemingly unimportant catch of bottom non-edible organisms, though rarely fetches any economic returns, needs monitoring, estimation and periodic documentation, in order to impress upon the beneficiaries of the coastal fish wealth, about the seriousness of the biotic devastation and habitat alteration/degradation.

Fig. 1. A portion of the discarded trawl by-catch including non-edible biota.

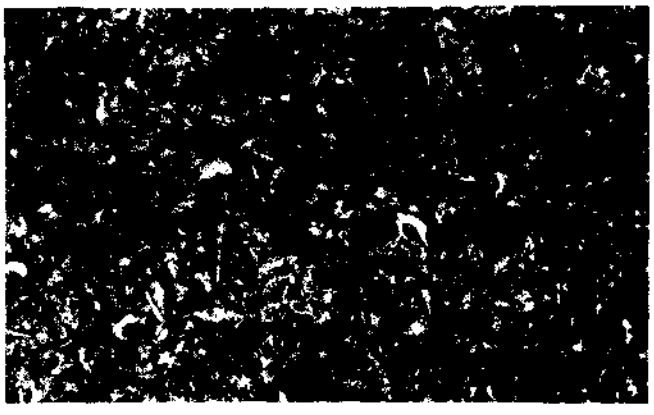

Fig. 2. Sorted gastropods from the trawl by-catch.

A part of the data for this investigation has been drawn from the National Marine Living Resource Data Centre of Central Marine Fisheries Research Institute. Since the trawl catches of the first few hauls are generally sorted out on board the vessels and the less valuable, undersized fishes and non-edible bottom fauna are thrown over board, reliable estimates of the total discarded catch is rather difficult. However, usually, the last haul's catch is brought ashore in an unsorted condition; and from such landings the estimates of the non-edible biota caught have been made. The present account is based on random samplings carried out at selected trawling centres along Kerala, Karnataka and Tamil Nadu during 1985-'90.

Small mechanised trawl landings

About 5800 small mechanised trawlers (7 to 14 m overall length) regularly operate in the coastal waters of Karnataka, Kerala and Tamil Nadu. The trawling is almost throughout the year except for peak monsoon months. Their non-operation is chiefly due to the unfavourable sea conditions or bans imposed by the governments as in Kerala or socially self imposed bans as in Karnataka. Intense mechanised trawling in the coastal fishing grounds by using a trawl net of 30 m horizontal, 3-4m vertical mouth opening, a cod end mesh of 18-35 mm and a heavy tickler chain in the foot rope, could scrape and trample a sea bottom area of about 0.3 km^2 daily, in 8 hours of trawling operations. These operations yield the target resources, shrimps and cephalopods, along with a by-catch of heterogenous species of ground fishes and non-edible benthic biota belonging to many taxa. In the region studied, stomatopods and non-edible biota together have constituted about 12% of the total trawl landings, with the former accounting for about 9.7% and the latter 2.3%. The quality and quantity of the non-edible biota caught usually depend on the type of trawl nets operated such as; shrimp trawl or fish trawl; the target groups like shrimps, cephalopods or finfishes; the time of operation, say day or night; the ground on which the net is dragged such as muddy, sandy or rocky; the season such as pre-monsoon, monsoon or post-monsoon; and the prevailing weather conditions like calm or turbulent sea. Generally, the non-edible fauna caught is rich and varied in species composition and more abundant from muddy grounds than from sandy or rocky areas. Their landing is invariably more in the night-operated shrimp trawls than in the fish trawls.

Along the southern Indian coast during 1985-'90 period about 1.14 million trawl unit effort was expended annually, with an average yield of about 0.35 million tonnes of fish catch, landed at 30 major trawl landing centres. The ratio of target group:by-catch is 1:3.6 which is higher than the tropical region average of 1:10.

An approximate quantity of 43,015 t of non-edible bottom organisms including stomatopods has been landed annually by the trawlers with the total fish by-catch: non-edible

biota landing ratio of 1:0.18. In the total non-edible biota landings, stomatopods have accounted for about 81%. It is estimated that roughly about 67% of the total non-edible items caught are thrown overboard, in order to save fish hold space for the low-volume-high-priced items. In the southern coasts alone, the small mechanised trawlers discard about 16,682 t of non-edible organisms back to the sea annually. The non-edible biota landed at different trawl landing centres include several species of low-volume ground fishes, crustaceans, gastropods, bivalves, polychaetes, anemones, sponges, etc. The trawl landings of finfish, target groups and non-edible biota in Karnataka, Kerala and Tamil Nadu during 1985-'90 are shown in Fig. 3.

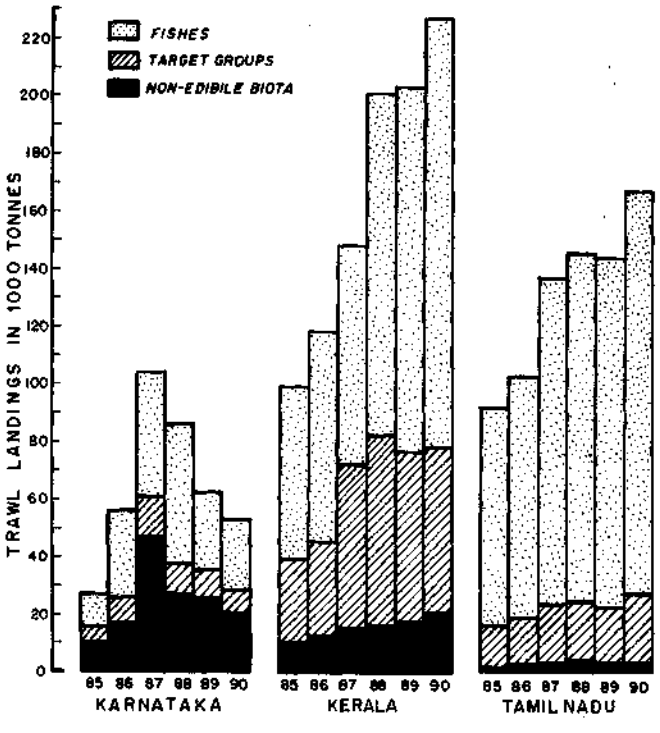

Fig. 3. Annual trawl catches of fishes, target groups (prawns and cephalopods) and non-edible biota in Karnataka, Kerala and Tamil Nadu during 1985-'90.

Karnataka

An annual average of 1,57,400 trawler effort was expended along the coastal Karnataka by about 800 mechanised trawlers, with a mean catch of 63,202 t. Target groups like prawns and cephalopods have accounted for 14%, finfish by-catch for 47% and the balance of 39% by stomatopods and non-edible benthic organisms. Out of the non-edible components, the proportion of stomatopods was more than 36% and the remainder of less than 3% was composed of bottom organisams from several taxa. The annual estimated average quantity of non-edible organisms landed by trawl nets in Karnataka was about 24,634 t. Invariably, this portion of the landing was discarded; but in recent years some items fetch foreign exchange, while the majority of them find thier way into fish meal plants or are sold for the preparartion of crude organic manures. Although they occur throughout the year, the peak season is December-April, from a depth range of 5 - 40 m. The frequently occurring groups/species are: stomatopods, gastropods, bivalves, echinoderms, jelly fishes and finfishes. The less frequent non-edible benthic organisms caught in the trawl nets are: crabs, sponges, gorgonids, polychaetes, alcyonarians, ascidians and hermit crabs (Fig. 4).

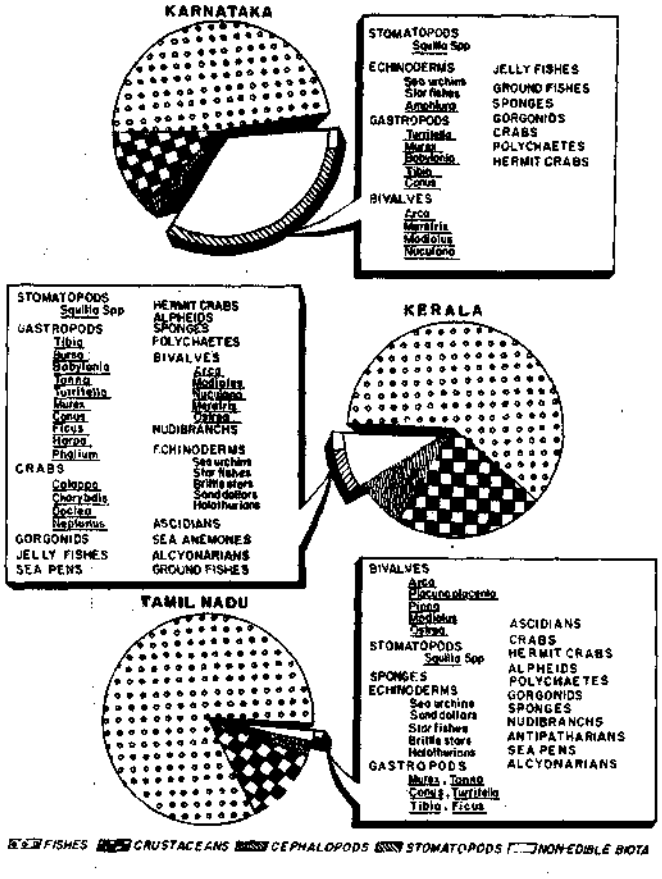

Fig. 4. Mean composition of trawl catches in Karnataka, Kerala and Tamil Nadu showing the dominant non-edible benthic fauna caught and destroyed.

Kerala

About 2,800 small mechanised trawlers operate in the coastal waters of Kerala, sometimes venturing even upto 120 m; and are mostly targetted for prawns or cephalopods. During 1985-'90 period, the annual average effort input

was 5,58,250 unit operations with a mean total catch of 1,62,275 t composed of finfishes (60%), target groups (30%) and non-edible animal groups (10%), landed at ten landing centres. In the non-edible components, stomatopods have accounted for about 7% (11, 164t). The estimated annual average landing of other discarded benthic organisms is 4,019t. Their catch was fairly high during September-March months, when a large number of trawlers have trampled the coastal bottom of the inner shelf waters within 40 m depth. The most dominant items, other than stomatopods landed are: gastropods (about 10% of non-edible biota), bivalves (3%), crabs (2%), echinoderms (2%), benthic fishes (2%) and jelly fishes (1%). The remaining portion was composed of a large spectrum of organisms like: hermit crabs, alcyonarians, ascidians, crinoids, gorgonids, alpheids, sponges, polychaetes, gastropod and cephalopod egg masses, nudibranchs, echiurids, sipunculids, etc. (Fig. 4).

Tamil Nadu

An annual average of 4,24,267 trawler unit operations were conducted along Tamil Nadu coast during 1985-'90, within 70 m depth, with an annual mean landing of 1,29,059 t composed of finfishes (82.7%), target groups (14.6%) and non-edible biota (2.5%). The discarded non-edible organisms caught was estimated around 3,208 t out of which stomatopods have accounted for 687 t (0.4% of total trawl landings), whereas bivalves have accounted for about 0.7% followed by sea urchins (0.3%), gastropods (0.2%), sand dollars (0.2%), sponges (0.2%), and non-edible ground fishes (0.2%). The organisms which appear as infrequent catches are: crabs, hermit crabs, polychaetes, gorgonids, sea pens, ascidians, alcyonarians, alpheids, brittle stars, antipatharians, nudibranchs, echiurids, jelly-fishes, etc. (Fig. 4).

Outboard motor fitted traditional boats operating mini-trawls

Since the late eighties traditional country crafts have entered the trawl fishing sector with the aid of outboard motors, mostly within the 10 m depth zone. The innovation was first made in Alleppey District of Kerala and it has later spread to Malappuram, Calicut and Trichur districts. At present about 1,600 such trawls operate along Kerala coast. Already used and partially worn out traditional canoes and used as well as less efficient out board motors, which are unsafe for fishing in distant areas are converted for such coastal trawling operations. The gear is a mini trawl net of 6 m length with samll otter boards and with a cod end mesh size of 10-20 mm. During 1985-'90, the OB trawl units have landed an annual average catch of 5038 t with a cpue of 169 kg, composed of finfishes (57%), crustaceans (29%), cephalopods (4%), and non-edible organisms (10%). Stomatopods were the most dominant item of the non-edible biota (6%). The other important items were: gastropods, bivalves, crabs, ground fishes, echinoderms, hermit crabs and polychaetes. The fishing by OB trawl has been restricted to post and premonsoon seasons: and invariably high catches of non-edible biota is reported during Sept-Oct and March-April. A high percentage of the finfish and prawn "Karikkadi" *Parapenaeopsis stylifera* catches was composed of their juveniles.

Discussion

Although our Exclusive Economic Zone is wide open for any type od fishing, the major fishing activities by both the traditional and mechanised sectors are undertaken around the shelf waters up to a depth of about 70 m or nearly upto 120 m in some centres, by larger vessels. The coastal zone is thus subjected to intense fishing pressure by both the sectors, often leading to conflicts of interest and tension between them. The coastal trawling has mass harvested the target groups along with large quantities of finfish by-catches and a vast spectrum of 'bottom dwelling organisms. The less valuable and undersized fish by-catches and the non-edible benthic biota are thrown overboard or dumped at the landing centres, in many of the latter, the discarded portion has created pollution and evironmental hazards. But of late, the discarded quantities find their way to fish meal plants or are used as manure. Recently, gastropod shells and their opercula, gorgonids, sponges, echinoderms and jelly fishes are exported to Saudi Arabia, UAE, Germany, Singapore, Japan and Hongkong, but unfortunately, the Indian exporter is not at all aware of the use and value of such exported items.

No serious study has so far been made on the impact of the post-harvest loss and non-edible biota devastation on the coastal fisheries, the migration of various species and the predator - prey relationship of major component species in the affected habitat. The bottom faunistic diversity degradation might seriously affect not

only the food web of the migrant population of fish but also the production and supply of neritic zooplankton populations. The partial denudation of trawling grounds off Visakhapatnam has been attributed to as the major cause for the depletion of catfish stocks there. The effect is further aggravated along coastal waters of Kerala by the irrational OB Motor trawling in depths less than10 m and by using nets with still smaller mesh sizes.

Since the per capita income of those involved in the fishing is registering a continued growth, any amount of appeal to restrict the mechanised trawler operations in the coastal areas may not yield desired results. Therefore, in order to rationally manage the coastal fisheries and their habitat, resource sustenance/environment protection considerations should receive priority over the prevailing economic considerations. Based on the available information and the present study, the following recommendations are suggested for a sustainable resource management and habitat protection in the coastal waters:-

(1) Coastal bottom trawling by mechanised trawlers upto a depth of 20 m may be banned.

(2) The number of OB Motor trawl units may be restricted and their cod end mesh may be increased to a minimum of 30 mm.

(3) The use of tickler chains in bottom trawl nets may be banned.

(4) The mesh size of the bottom trawl belly may be increased so as to allow the benthic macrofauna to escape the gear.

(5) The export of several non-conventional marine organisms and their products, whose exact use and value are not known to Indian producers or exporters, may be reviewed. A study may be conducted on their biology and sustainability of production before allowing exploitation and unbridled foreign trade.