Economic externalities of low value fishes in trawl operations in Kerala

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ABSTRACT

Fisheries over the years evolved from subsistence fishing towards a capital intensive enterprise. There has been structural transformation in the fishing fleet with motorisation and mechanisation. The current scenario of marine fisheries in terms of fishing fleets clearly indicates a situation "too many boats chasing too few fishes". Due to the tragedy of commons in operation, increasing fleet size as well as costs of fishing and the decreasing catch per unit efforts, the fishing operations have taken a toll. The mechanised sector is venturing into multiday fishing which negate the losses of fishing cost. Sizeable amount of low value fishes are landed across the landing centres on account of targeted fishing. Low value fishes include juveniles, bycatch, trash fishes and discards and it is estimated that around 30% of the mechanised landings constitute low value fishes which has a huge untapped economic value. Economic loss due to low value catch could be reduced by implementing mesh-size regulations to avoid juvenile catch, prevent discards and utilising bycatch. Appropriate utilisation strategies are to be developed with respect to discards, regulating multiday fishing operations or innovative measures may be adopted to land the catches on frequent intervals. There exists a huge consumer demand on account of the escalating domestic market prices of fish. The paper focuses on the targeted fishing and resultant huge amount of low value fishes that possess huge economic value which are being surpassed. The paper estimates the quantum of low value fish across the different fishing sectors. The paper suggests the possible policy intervention required for harnessing the market for low value fishes.

Keywords: Bycatch, Externalities, Incentives, Juveniles, Low value fishes, Multiday, Trash fishes

Introduction

Fisheries sector is gaining importance on account of being the fastest growing food sector in the world. Even in the aftermath of global economic recession and downward trend in the agricultural productivity, the fisheries sector continues to provide livelihood and employment to millions of people and contributes to food security of the country. India's marine capture production increased from 0.5 million t in 1950 to 3.2 million t in 2008 and the export earnings crossed 2 billion US dollars. The species composition of the marine landings comprises small and large pelagics, demersal finfishes, shrimps and cephalopods. Among the maritime states of India, Kerala occupies the foremost position in marine fish production, accounting for about 20% of the total landings. Fish production in the marine sector of Kerala over the last 10 years presents more or less a stagnant trend with a decadal average of 5.88 lakh t. The mechanised sector is venturing into multiday fishing, which negates the losses of fishing cost. Sizeable amount of low value fish is landed across the landing centres on account of the targeted fishing (Sarah *et al.*, 2007). Low value fishes include juveniles, bycatch, trash fishes and discards. It is estimated that around 30% of the mechanised landings constitute low value fishes which have huge untapped economic value. In 2003, nearly 2.7 lakh t of low value fishes were landed which constituted 10–20% of trawl catch in India (Zynudeen, *et.al*, 2004; FAO, 2005).

Low value or 'trash fish' is a broadly used term that relates fish species, by virtue of their small size or low consumer preference and have little or no commercial value (Dayton *et al.*, 1996). The term is not really appropriate in many cases as these fish form the basis of human nutrition in many coastal areas in the country. The term low value/trash fish is often used in different

ways throughout India and some confusion exists on what it actually means. It is often used interchangeably with the term bycatch. This incidental catch includes several species of fin and shellfish, which have varying values in the market. In some fisheries, a proportion of this low value/trash fish is discarded onboard (often to make space). Even within the landed catch, there are some species whose size, appearance, and consumer preference constrain them from being readily accepted as human food. Once caught, fish are either retained or discarded. Of those retained, they are either used for human food (in a range of product forms and markets), as livestock/fish food (either fed directly to livestock/fish or used indirectly by processing into fish meal/oil that is used to make feed pellets) or put in to other uses such as fertilizers (Biju Kumar and Deepthi, 2006). In general, prices can be used as criteria for considering fish as low value/trash fish (*e.g.*, fish fetching less than ₹5 per kg).

Due to the tragedy of commons in operation, increasing fleet size and costs of fishing and the decreasing catch per unit efforts, the fishing operations have taken a toll. The domestic prices of fish products continue to spiral up which leads to non-availability of fish products at affordable prices (Sharon *et al.*, 2007; Steve, 2007). But still fish is considered as poor man's protein which is being consumed by large number of middle-income groups in addition to poor people (Kabahenda *et al.*, 2009). Due to this demand-supply lag, low value fishes are landed and are used for fish meal preparations or for consumption purposes. For example, puffer fish (*Lagocephalus inermis)* which was earlier a menace to the trawl nets which used to be discarded, now fetches high price in local and overseas markets (₹40 per kg). The price of low value/trash fish is likely to go up owing to the ever-widening gap between the demand and supply (Simon *et al.*, 2005). So there is need to focus on the huge amount of bycatch/low value fishes/trash fishes which possess a huge economic value. The main objectives of this paper is to analyse the quantum of low value fishes landed, to estimate the economic externalities due to the low value fish landings and to suggest policy options for tapping the low value fishes for edible and non-edible purposes.

Materials and methods

Trawl operation is one of the major mechanised fishing operations in Kerala. Ernakulam District possess 1020 trawlers forming 27.73% of the total trawlers operated in Kerala (Ministry of Agriculture and CMFRI, 2012). The trawl operations contribute to more than 50% of the total landings in Kerala (CMFRI, 2013). In the present study, Cochin and Munambam harbours were selected in Ernakulam District of Kerala to estimate the

quantum of low value fish catches across the different fishing sectors and for evaluating the externalities. These two harbours contribute to more than 75% of the marine fish landings in Ernakulam District. A total of 90 trawlers conducting multiday fishing trips of 3-4 and 5-6 days duration were drawn randomly from these harbours and the data on craft and gear, species composition of high value and low value fishes, prices and quantities of low value fishes were collected. Conventional analyses were employed to estimate the losses and to evaluate the economic externalities.

Results and discussion

The general details of fishing regarding the length of craft, engine capacity, depth of fishing, fish holding capacity, number of hauls per trip and number of labourers employed are presented in Table 1. The average engine capacity and average number of hauls per trip for both type of trawlers were 90-140 hp and 4 respectively. The depth of fishing for multiday (MD) 3-4 days and MD 5-6 days was 60 and 80 m respectively. The fish holding capacity varied across the multiday trawlers

Table 1. General details of fishing

Parameters (Average)	Multiday fishing	
	3-4 days	5-6 days
Length of craft (ft)	40-60	>60
Engine capacity (HP)	90-140	90-140
Depth of fishing (m)	60	80
Fish holding capacity (t)	6	10
No. of hauls per trip	4	4
No. of labourers employed	8	8*

*Normally 10 for Tamil Nadu trawlers operating from Colachel

Quantum of total catch and bycatch

The total catch per trip was found to be 1.1 t and 2.1 t from MD 3-4 days and MD 5-6 days respectively. A weighted average of low value fish (discards and bycatch) in Kerala is 25% of the total marine catch. The discards were found to be more for MD 5-6 days than MD 3-4 days. For the MD fishing of more than 5-6 days, the discards are thrown for the first three days and the rest will be landed to the shore, whereas in MD 3-4 days, they will bring maximum catches to the shore. The limited fish hold capacity of the trawlers is the main reason for discards. The discards and bycatch were estimated at 275 and 600 kg per trip per trawl for MD 3-4 days and MD 5-6 days respectively. The bycatch, which includes trash, juveniles and damaged fish is 400 kg per trip per trawl for MD 5-6 days. The trash landings, which is used for fish meal, is more for both types of fishing when compared to juveniles and damaged fish (Table 2).

Table 2. Quantum of total catch and bycatch (kg per fishing trip)

Particulars	Multiday fishing	
	3-4 days	5-6 days
Total catch per craft per trip	1100	2100
Discards and bycatch (kg)	275	600
Discards (kg)	75	200
Bycatch (kg)	200	400
Trash (kg)	120	240
Juveniles (kg)	60	120
Damaged (kg)	20	40

Species composition of total catch

The species composition includes shrimps, mackerels, threadfin breams, perches and scads. Total value of catch was ₹1.1 and 1.9 lakh for MD 3-4 days and MD 5-6 days respectively. Shrimp catches accounted for the maximum revenue in both types of trawlers with revenue of ₹2.3 lakhs per t when compared to other fish species. Details about the quantities and values of fishes are presented in t Tables 3 and 4.

Table 3. Species composition of catch per trip per craft (MD 3-4days)

Species	Qty (t)	Value per ton (₹ lakhs)	Total value (₹ lakhs)
Shrimps	0.35	2.38	0.83
Mackerels	0.2	0.313	0.06
Threadfin breams	0.2	0.23	0.04
Perches	0.2	0.3	0.06
Scads	0.1	0.25	0.02
Trash fish	0.2	0.07	0.01
Others	0.2	0.35	0.07
Total	1.1	-	1.1

Table 4. Species composition of catch per trip per craft (MD 5-6 days)

Species	Qty (t)	Value per ton (₹ lakhs)	Total value (₹ lakhs)
Shrimps	0.6	2.38	1.42
Mackerels	0.2	0.31	0.06
Threadfin breams	0.2	0.22	0.04
Perches	0.2	0.3	0.06
Scads	0.12	0.25	0.03
Trash fish	0.36	0.07	0.03
Others	0.44	0.6	0.26
Total	2.12		1.91

Species composition of low value fishes

Low value fishes include discards, bycatch, juveniles, trash fish and damaged fish. Discards which have no value comprised of sea shells (gastropods), chilly (squilla),

sciaenids, red nund (*Charybdis smithii*) and kurichi (silverbellies); juveniles include threadfin breams, shrimps, anchovies, crabs, lizard fish (*Saurida tumbil*), sardines and mackerels. Bycatch includes threadfin breams, mackerels, sardines and lizard fish (*Saurida tumbil*). Trash fishes which are mainly used for fish meal include puffer fish (*Lagocephalus inermis*), uluvachi, udathodu, clathy (*Odonus niger*), myctophids and kora (*Otolithes* sp.). Damaged fish fetches a low value on account of abrasion and lack of freshness when compared to good quality fish.

Externalities in trawl operations due to low value fishes

There exist positive and negative externalities in the trawl fishing operations with reference to low value fishes. Discards are thrown back due to non-realisation at the landing centers. Bycatch that includes trash fish, damaged fish and juveniles are brought back to the landing centres because of its economic utilities. Thus the low value landing possesses considerable incentives (positive externalities) and disincentives (negative externalities). The positive and negative externalities have been calculated to find net economic losses due to low value fish catch. Damaged fishes are marketable but at very low price. Juveniles of many commercial fishes are being sold at less than ₹10 per kg. If it is harvested at the table size or with superior quality or caught in proper gears, it may fetch a higher price. So the negative externality was calculated with regard to discards, damaged fish and juveniles. Trash fishes, which were discarded earlier and fetching good market price now are being used for fish meal which has generated an incentive. Based on the incentives and disincentives, the net economic loss/gain by trawl fishing and the landings of low value fishes are worked out.
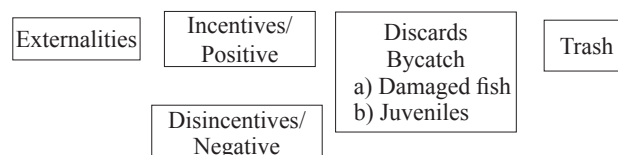

Fig 1. Externalities in trawl fishing due to low value fishing

Economic disincentives due to discards

The average catch per trawl per trip was 1.5 t for which the discards accounted for more than 10%. The discard per trip was 150 kg and valued at ₹6 per kg. Thus the economic disincentive due to discards was ₹900 per trip (Table 5). The average intrinsic externality per year per trawl due to discards was ₹90,000 for around 80-100 fishing trips per annum.

Table 5. Total economic disincentives due to bycatch and discards

Low value fish	Economic loss per trip per trawl (₹)
Discards	900
Bycatch	2250
Juveniles	1350
Damaged fish	900
Total	3150

Economic disincentives due to bycatch

The average bycatch landed per trip per trawl was 0.2 t consisting of 90 kg of juveniles per trip per trawl valued at ₹10 per kg. Thus the price realisation to juveniles was ₹900 per trip per trawl. The price which can be realised at attaining a table size be ₹25 per kg and the economic incentive will add to ₹2250. Thus the economic disincentive due to juveniles was ₹1350 per trip per trawl. The damaged fish landed per trip per trawl was 30 kg valued at ₹20 per kg. The price realisation if harvested at the table size or with superior quality or caught in proper gears would have been ₹50 per kg and economic benefit would be ₹1500 per trip per trawl The economic loss due to damaged fish estimeatedwas ₹900 per trip per trawl (Table 5).

Economic incentives due to use of trash fish

In the past, trash fish has been discarded into the sea due to non realisation of value at the landing centres. Now trash fish is used for fishmeal and it is being sold at ₹5 per kg. Trash fish landed per trip per trawl was 180 kg and the economic benefits is worked out at ₹900 per trip per trawl.

Net economic loss due to low value fishes

The economic disincentive due to low value fish in trawl fishing was found to be ₹3150 per trip per trawl (Table 5). The economic incentive due to low value fishing was ₹900 per trip per trawl. Thus the net economic disincentive due to low value fish per trip per craft was ₹2250.

Price comparisons of juveniles and adults of commercial fishes

The landing centre prices of juveniles and adults of commercially important fishes are worked out and presented in Table 6. The difference in prices indicates the vast scope of enacting regulatory mechanism thereby preventing the juvenile catch.

The low value fishes were being discarded totally due to its low consumer preference, size and its appearance.

Table 6. Average landing centre price comparisons of juveniles and adults (₹ per kg)

Fish species	Juveniles	Adults	Difference
Threadfin breams	25	37	12
Shrimps	55	237	182
Anchovies	28	65	37
Crabs	19	35	16
Lizard fish (*Saurida tumbil*)	15	40	25
Sardines	11	20	9
Mackerals	20	31	11

But now trend has been changed and low value fish is being used for fish meal, export purpose and for meeting the domestic consumption needs. Externalities of low value fishes created multiplier effect in terms of employment generation and revenue realisation in the secondary and tertiary sector. But still economic disincentive is more than incentives due to its low usage. The diminishing catches of high value fishes and increased consumer demand offer vast scope for reaping the economic benefits from low value fishes. The problems in low value fish utilisation includes low marketable surplus, lack of reaping economies of scale, low price realisation, limited number of marketing functionaries, lack of domestic consumer demand, lack of knowledge in processing and geographical limitations. There is need for policy interventions to alleviate these problems and to properly harness economically optimum usage of low value fishes. The main cause of low value catch in fisheries is the non-selectiveness of the fishing gear and very small size of mesh. So there is need to regulate the mesh size to avoid juvenile catch and develop adequate utilisation strategies for the usage of the discards. Multiday fishing operations should be regulated and innovative measures may be adopted to land the catches at frequent intervals. Traditionally functioning boats can be engaged as carrier boats to land the fish which would otherwise turn as discards. There is a need to create awareness among fisherfolk regarding the consequences of juvenile catches and corrective measures may be adopted to discourage such catches by mechanised boats.

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