

Status of trash fish utilization and fish feed requirements in aquaculture – India

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Background Information:

India has a coastline of 8118 kms having an Exclusive Economic Zone (EEZ) of 2.02 million sq. kms. including 0.5 million sq. kms of continental shelf. The estimated sustainable resource potential in the marine sector is 3.9 million tonnes fish per annum. Of this, 58% of the resources is distributed in the in-shore waters, 34.9% in the off-shore areas and the remaining 7% in deep sea. The major share of this resource is demersal consisting of 2.09 million tonnes followed by 1.67 million tonnes of Pelagic and 0.24 million tonnes oceanic resources. These resources are exploited by about 2.08 lakh Traditional Non-Motorised Craft, 55,000 Small Scale Beach Landing Craft fitted with out-boat motors and 51,250 mechanized craft mainly bottom trawlers, and some purse-seiners. About 80 deep sea fishing vessels are also in operation with the size of more than 20 metres OAL.

Composition of Marine catch:

A large number of fin fish and shell fish stock principally consisting of sardines, Bombay-duck, ribbonfish Indian mackerel, coastal tunas, seer fishes, penaeid and non-penaeid shrimps, stomatopoda, cephalopods, croakers, threadfin breams, silver belles and carangids trevallies, leather jackets, scads and horse mackerel are exploited using different craft and gear combinations. Presently, the estimated average annual landing of fish and shellfish is a little less than 3 million tonnes.

There is scope for further augmenting the marine fish production by about 1 million tonne if fishing is carried out deploying resource specific vessels mainly in the Oceanic Region. Since the present marine fish production from the coastal waters has already reached sustainable level beyond which there may be depletion of resource in Coastal Sector either species specific or location specific, the fish processing industry in this organized sector has concentrated mainly on shrimp which forms about 20% of the total catch. Seerfish, pomfret, rockcod, squid and cuttlefish are some of the species which are now processed by industries for export.

Although the total utilization of harvested fish in food and non-food users is the Central Theme of Government's policy on Marine Fishing, efforts are still underway to fully comply with international requirements in post-harvest care of fish in order to achieve highest standards in food safety both for domestic consumption as well as for exports..

Definition of 'Trash Fish' :

The use of the term "Trash Fish" varies from country to country and can change both seasonally and with locations. One category of trash fish are those not used for direct human consumption, which may be either landed and discarded at the sea itself. The other category is low value fish used for human consumption. In a country like India where marine fishery consist of multi-species composition, the occurrence of by-catch consisting of several species of fish is bound to

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happen, especially for the trawler operators with regard to on-board handling, preservation, storage, processing and marketing. Since the return from by-catch sometimes known as trash fish is poor compared to the valuable catch of shrimp and table fish, the trawler operators often tend to discard portions of the by-catch into the sea. With the dwindling catch of shrimp from a capture sources, these trawler operators have no other option but to increase the returns by utilization of the by-catch. The composition of the by-catch and the quantity depend on the gear, area of operation and season. The conservative estimate indicates that about 20% of the by-catch is lost during the trawling operations. The total landing of the by-catch of fish is estimated to be around 1.3 million tonnes, annually.

Fish Discards:

Discards of fish during fishing operations represent a significant proportion of global marine catch which are generally considered to constitute a waste or sub-optimal use of fishery resources. Discards are that portion of the total catch which is dumped or thrown over board at sea. According to the FAO's report (1994), it is estimated that 27 million tonnes or approximately 27 per cent of the global catch are discarded annually. In India, a study was undertaken on the shrimp by-catch sponsored by the Bay of Bengal Programme's post-harvest fisheries project executed by the National Resources Institute (NRI), U.K. and funded by the Overseas Development Administration (ODA) of the United Kingdom during the year 1988-90. The study was taken up to develop a methodology for the assessment of shrimp by-catch by volume and composition to consider option for its use as food or feed, to investigate the options for landing the by-catch including use of collector vessels, and to investigate the cost and returns associated with the landing of the by-catch including the technical, economic and financial constraints. This study estimated the quantity of by-catch have been discarded by the East-Coast Trawlers as 100,000-130,000 lakh tonnes during the year 1988. The abundant species in the by-catch were Sciaenidae, Leiognathidae, Nemipteridae, Clupeidae, Trichiuridae, Carangidae, Mullidae, Harpadontidae and Menidae. The selling price of these varieties of fish was less than Rs. 5/- per kg. Another study undertaken by a private company on Trash Fish availability (discards out at sea) on the East-Coast of India in the late nineties indicate that the total trash fish available from the trawling boats (numbering about 3450) from five major fish landing centres is about 2 lakh metric tonnes per annum. Although much of the by-catch is small, this does not preclude its use as food. About 10-12 per cent of the discards were used for retail markets which were found to be a little high value, the rest were normally sold for feed use. Since much of the by-catch is un-iced catch, they can only be used for fish meal purposes. When it is used for food purposes, it is consumed locally as the wet fish or distributed in dried form. With the increase in fish price and its shortage in certain seasons, this by-catch, these days is used as food fish in the fish scarce urban markets. Several methods were suggested for landing by-catch which include transfer of catch at sea to local fishing craft, greater retention of frozen by-catch and direct landing of the by-catch by small trawlers. The system, however, could not work due to problems in analysing the market system, communication facilities, market information and inadequate supply of key inputs like ice, etc.

Recent study on fish discards:

A recent study carried under a research project entitled "Impact of Bottom Trawling in the Sea Bottom and its Living Communities along the Coastal Waters of Kerala", sponsored by the Department of Ocean Development and implemented by the Cochin University of Science and Technology throw some interesting facts about the discards along the Western Coast of India, especially Kerala. More than 90 per cent of the mechanised boats operating along the Kerala Coast are bottom trawlers. Bottom trawlers being a non-selective fishing gear hauls up all the mechanisms dwelling at the sea bottom and, therefore, its destructive effect to the none-target mechanisms on sea bottom is a matter of great concern. This includes non-edible species and

species which are poisonous in nature, non-marketable and inferior quality. A quantification of discards has been made based on the discards landed at the harbour. However, no concerted attempts made to quantify the discards by collection of data on board the bottom trawlers operated along the Kerala coast. Another reason is lack of storage on board. The studies were carried out on collection of samples taken from 375 bottom trawlers operating from six major harbours during the period April, 2002 to March, 2002. The endurance of the selected units varied from 1-3 days and the number of hauls in each voyage varied from 1-8 depending on the endurance and availability of fish. The discards were categorised under finfish, soles, crabs, gastropods, shrimp, cephalopods, jelly fish, stomatopods, eggs, juvenile shrimp and snakes. The finfish were the dominant group representing 37.13 per cent of the discards followed by crabs 28.46 per cent, stomatopods 8.13 per cent, gastropods 9.94 per cent, shrimp 1.96 per cent, jellyfish 0.85 per cent, cephalopods 1.5 per cent and soles 1.17 per cent. The following findings are of interest for the planners and researchers :-

- Around 2.4 lakh tonnes of discards are thrown back into the sea from bottom trawlers operating along the Kerala waters annually due to non-edible nature, unpopular nature of species and size, low market value and lack of storage facilities, etc.
- The edible portion of the discards is worked out around 0.85 lakh tonnes per annum.
- The magnitude of destruction of eggs and juveniles is alarming.
- 94 per cent of the bottom trawlers are having Cod-end mesh size of 18 mm and below instead of 35 mm imposed by the Government.
- 232 non-targetted organisms are found killed and discarded in varying proportions, which may affect the life supporting system in the long run and may bring about serious biodiversity degradation in the coastal waters.
- With the high survival rate of crabs, stomatopods, gastropods, etc., there is a fear that their proliferation may amount to the transformation of the mature eco-system into the immature and inefficient eco-system over a period of time.
- The fishing pressure from water trawlers along the coastal waters of Kerala is reported to be very high compared to any other maritime State of India.
- The discards from multi-day fishing trawlers are higher compared to the single day fishing trawlers.

The report, therefore, makes the following suggestions for serious consideration

- It is imperative to initiate urgent steps for the effective utilization of discards for preparation of protein rich fishery products, by-products and value added products for local and export market.
- Storage facilities for bottom trawlers should be improved to make available the edible discards for human consumption.
- There should be a reduction of trawl fishing pressure during February-May to prevent destruction of eggs and juveniles of commercially important fish.
- The exploited fishery potential needs to be revalidated on the basis of the data generated on discards for framing any policies and legislation on Conservation and Management of Marine Fisheries.
- The statutory mesh size for Cod-ends should be strictly imposed under the Marine Fishing Regulation Act.
- It is necessary to make technical modifications in the design and operation of trawl gears to make bottom trawling more eco friendly in order to minimize the mortality and devastation of benthic organisms.
- Steps should be taken to avoid proliferation of unwanted species in the fertile fishing grounds (snakes, stomatopods, echinoderms, etc.) by killing them on board itself or bring them to the shore for effective utilization instead of throwing them back into sea.

- "No Trawling Zones" in selective regions may be established as a measure to recoup the benthic communities for the sustenance of demersal fishery.
- Research work needs to be pursued on post-fishery survival of discards and the juveniles of fin and shell fish in particular to consider rearing facilities.
- Minimum landing size system needs to be fixed and implemented to stop landings on juveniles and young ones.
- There is an urgent need for regulating the fishing effort.
- Cold storage facilities for multi-day fishing trawlers should be increased in consonance with their endurance.
- Mass awareness programmes may be conducted for all the stakeholders on the adverse impact of bottom trawling on sea bottom and its living resources.

Discards for human consumption:

Although the trend is changing over the years and instead of throwing the by-catch into the sea, the practice of bringing them to the shore and selling it to the poorer sections of the consumers is gaining momentum, no further works relating to the transfer technology by using floating net bags, etc. is in progress. It is, however, felt that more intensive studies are required on this issue to utilize the by-catch more profitably taking into account the existing market systems, identifying the constraints to distribute larger volumes of fish and to assess the value of the catch to make this activity more attractive. Incentives for landing this by-catch and for the processors to produce a value added product both attractive to the consumers and remunerative to the processors are to be given due consideration. A sampling programme for data collection on population parameters of selected species occurring regularly in the by-catch is necessary to assess the effect of shrimp fishery on the key demersal fish population. Such a study in conjunction with the present practices would ensure suitable solutions for the use of by-catch in an optimal way.

Fish like pomfret, polymiers species, cephalopods, lactarius, seerfish, some of the perches are considered as high value fish and care is being taken while handling and processing. Although other species which are considered low value are having almost the same proximate composition and nutritive value, on account of the wide variations in size and species causing problems in sorting and handling, they do not receive the desired attention. Efforts which have been taken to develop methods of processing the by-catch into products for human consumption and with a view to utilize them for filling the gap between supply and demand as well as for animal nutrients or for preparing products of commercial importance. The major share of by-catch are non-conventional low value fish caught from deep sea fishing operations and the profitable method of utilization of these fish for human consumption is through a traditional method of preservation, namely curing. These are dried in the sun after salting. Smoking is also adopted for increasing the shelf life of fish. Other popular method is the pickled products made out of the by-catch. Although there are a few fish meal plants set up in the country, they do not produce edible fish powder or a fish meal to meet the standards of shrimp feed meals. The fish meal produced in these plants in a limited quantity are mainly used as fertilizers and poultry feed. Thus, the low value fish out of the by-catch is not mainly used for aquaculture purposes or for fish feed plants. The limited quantity of live fish is used as the feed in the culture of certain caught fish like pangassius species, murels and catfish.

Present status of feed requirement in aquaculture:

Fish production in the country (2002-03) is 61.8 lakh tonnes comprising of 32 lakh tonnes of inland fish and 29.8 lakh tonnes of marine fish. The entire marine fish production is through capture sources for which no estimates of feed could be worked out. The inland sector consists of both capture fisheries (riverine fisheries and reservoir fisheries) and aquaculture (both freshwater

aquaculture and coastal aquaculture fisheries which entirely rely on the natural food chain. Aquaculture constitutes 70% of the total inland fish production where feed is an important constituent which forms 50-60% of the operational cost. At present, only indigenous feed consisting of rice bran and oil cake (50:50 basis) is used in fish culture and formulated feed evolved by research organizations is still in a nascent stage and has not picked up commercially. Pelleted feed developed through bilateral (external) projects is available mainly for trout, produced through feed mills set up in J & K and Himachal Pradesh. Assistance has been provided to 4 Himalayan States under a pilot project on cold water fisheries under which feed mills for trout are being installed. Although there is a provision under the FFDA scheme to set up small scale feed mills by private entrepreneurs, so far there are no takers. The only organized sector for production of feed is the coastal aquaculture sector which is mainly for shrimp- both brackishwater and freshwater shrimp (scampi). Major constituents of feed are imported by the 27 feed mills set up in the States of Andhra Pradesh, Tamil Nadu, Kerala and Karnataka. Pelleted feed in finished form mainly for shrimp and to some extent for sea bass is imported by a few companies who supply them to the shrimp/fish farmers.

Projection for feed by 2009-10 :

Taking into account that 70% of the present inland fish production is through aquaculture (22.4 lakh tonnes) the current level of feed requirement in the aquaculture sector is 33.6 lakh tonnes with a feed conversion ratio of 1:1.5. The projection of inland fish production with an 8% growth rate for the year 2009-10 is worked out as 46.5 lakh tonnes and out of this the aquaculture sector is expected to contribute about 32.5 lakh tonnes. Taking into account the same feed conversion ratio of 1:1.5, the feed requirement for this sector would be 48.8 lakh tonnes. It is to be noted that the projected fish production for the year 2009-10 has been worked out only on the basis of increased culture area and not on the basis of increased productivity level for which a feed rich in protein (40% animal protein) is necessary. For this purpose no estimation has been made as we do not have the particulars regarding the present level of fish meal production and its availability. Although, it is roughly worked out that about 15% of the total fish production goes for fish meal production the exact quantity of fish meal production in the country is not known. It is, however, a fact that the domestic fish meal is largely used by cattle and poultry feed manufacturers with small quantities going to the small scale shrimp and scampi feed manufacturers. If there is any problem in bringing the anticipated area under fish culture the projected achievement of fish production during 2009-10 can only be achieved through increase in the productivity level which has to come through use of formulated feed with a high content of animal protein etc. which has to be worked out in detail.

Shrimp feed :

Feed is a major input in shrimp farming accounting for 50 to 70 per cent of the total variable cost of production. Feed quality and cost are critical factors in determining the profitability of a shrimp farm. Unlike the fish, the scenario in the case of shrimp feed is a little more clear on account of the reliance of formulated and standardized feed in this sector. India has about 26 shrimp feed mills, both big and small, with an installed capacity of about 0.38 million tonnes and an annual production and sale of about 150000 metric tonnes (mt). Out of these, 6-7 companies are manufacturing feed with overseas collaboration and technical know-how. It is estimated that about 5000 mt of the feed is being imported from overseas. The feeds imported are 'Hanqua', 'Gold Coin', etc from Taiwan, Singapore and Thailand respectively. The price ranges from US \$ 1 to 1.22. The list of key ingredients used in the manufacture of shrimp feed are: Fish meal, Squid Meal/Squid Liver Powder, Fish Oil/ Squid Oil, Shrimp Head Meal/Shrimp Shell Meal, Fish Solubles/Squid Solubles/Squid Paste, Binders, Immuno Stimulants/ Nucleotides/ Cholesterol, wheat Flour, Soya Flour/Soya Doc, Ground Nut Cake (Scampi Feed), Trash Fish, Lecithin Powder/Lecithin Liquid, Vitamin Premix, Biotin, Panto Acid, Nicotinic Acid, Inositol,

Folic Acid, Vitamin C, Mineral Premix, Mono-Calcium or Di-Calcium Phosphate, Zeolite, Molasses Yeast, Rice Bran and Broken Rice.

Of all the ingredients, fish meal is the most critical ingredient as it is required in large quantities and most of the quality supply of fish meal is imported from Peru (Peruvian anchovy based fish meal). The domestic fish meal industry is small and unable to provide fish meal with the required protein contents for the shrimp feed. In addition to this, there is a demand of 30,000-40,000 mt of feed for fresh water prawn (Scampi), which is fully met from the domestic production.

Presently, the area under shrimp culture is estimated at 152,000 ha producing about 115,000 mt of shrimp annually. Scientific farming practices are followed in about 110000 ha and the feed requirement is estimated at 150000 mt per annum. The production during 2002-03 is 115,320 tonnes from an area of 152,000 ha. The area under scampi production is 34,600 ha with production touching 30,500 mt during 2002-03.

Black Tiger :

The shrimp feed industry has evolved significantly from the early 1990s when small scale shrimp feed manufacturers dominated the market. Before the white spot syndrome virus (WSSV) struck the industry, the market was dominated by small unorganized feed manufacturers with 30-40 feed mills (which were also producing cattle feed and poultry feed) supplying feed to the shrimp farmers. Imports also dominated the market from companies like CP, President, B-MEG and a few companies from Taiwan.

However, post-WSSV, the complexion of the market totally changed and it is today dominated by big companies, all of whom have captive plants set up for shrimp feed manufacture. Almost all feed mills are based on production technology from Taiwanese companies. Besides the broodstock and WSSV issues, there are certain other issues, especially with respect to exports (sluggishness in the Japanese market, antibiotics residue problem in the European Union (EU) market and antidumping issue in the USA market). While these issues might slow down the exports, the production may not be impacted to any appreciable extent.

Keeping in view the availability of area in the coastal zone of the country and the fact that shrimp farming can be a source of livelihood for the coastal poor (besides an export commodity), sustainable interventions may be necessary to accelerate the growth in the sector. It is estimated that a growth of about 15 per cent per annum is achievable on sustainable basis and could be further accelerated if solutions are available for quality broodstock, diversification, regulatory measures etc.

Assuming that the above aspects are looked into, an estimated production of about 401,000 mt of black tiger and *L.vannamei* can be obtained by the year 2010. This increase would be almost 3 times the existing production of about 115,000 mt.

The freshwater prawn farming has also become highly popular with farmers, especially in the coastal areas of Andhra Pradesh and in States of Haryana and Punjab. Gujarat is also promoting scampi farming and a large capacity scampi hatchery has been set up with external assistance (Government of France) in the State.

Presently, an area of 34,630 ha is estimated to be under freshwater prawn farming with the latest production figure of 30,450 tonnes during 2002-03. During the last four years, scampi farming has shown an increase of approximately 70 per cent per annum. While this high growth rate is due to a very small base, but keeping in view the availability of seed and feed for farming, about 20 per cent growth rate is expected per annum in the coming years. As there are no major issues

with respect to scampi farming and if good management practices are adopted by the farmers, the 20 per cent growth rate per annum can result in a production of about 110,000 mt by the year 2010, which would be about three times the present production of scampi in the country.

Projection for shrimp feed :

The brackishwater shrimp production during 2009-10 is expected to reach a level of 4.01 lakh tonnes from the present level of 1.15 lakh tonnes registering a 15% growth rate. The feed requirement for this purpose would be 5.23 lakh tonnes. Similarly, the scampi production is expected to reach a level of 110,000 tonnes during 2009-10 from the present level of 30,450 tonnes. The feed requirement would, therefore, be about 1.45 lakh tonnes. The total requirement of feed for shrimp (brackish water and scampi) would, therefore, be 6.68 lakh tonnes.

Quality Requirements for Shrimp Feed:

A balanced shrimp diet requires about 40 or so essential nutrients. The nutrients composition of marine animal protein sources approximates vary closely to the known dietary requirements of shrimp. About 20 – 50 per cent of the ingredients in most commercial shrimp aqua feeds are derived from marine capture fisheries, which includes fish meal, fish oil, shrimp/crustacean meal, squid meal and other miscellaneous products such as fish, fish silage, fish/squid liver meals and seaweed extracts.

Shrimp feed processing and manufacturing requires judicious selection of feed ingredients, their formulation and compounding by both conventional milling and extrusion cooking. Diets are formulated to help ensure optimal digestibility and growth. Greater protein digestibility and low phosphorus levels will help reduce effluents, which negatively impact water quality. All these factors need to be taken into consideration while working out the strategy of utilising trash fish for productive use of fish meal for aquaculture purposes.

Conclusion:

As explained above, the use of trash fish for direct feeding in the Aquaculture Sector is on a reduced scale in India mainly due to the fact that there is very little culture of carnivorous fish. Most of the exotic varieties of carnivorous fish like big-head, Thai magur and certain varieties of cat fish are banned for culture. However, the concerns regarding large scale landings of trash fish and their indiscriminate use need to be checked. The various issues involved in the utilization of trash fish need to be addressed in a comprehensive manner so that the landings could be optimised and their utilization planned properly for the benefit of all the sections involved in this activity taking into consideration the protection of the biosphere and the ecology of marine environment.