

# Utilization of trawl bycatch in Gujarat (India)

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## Abstract

Bycatch from trawlers forms a significant quantity of the total marine fish landings along the northwest coast of India, particularly in the state of Gujarat, which contributes about 23 percent of the total marine fish landings in the country. This paper discusses the composition of this bycatch, its significance in terms of nutritional value, its present utilization pattern and the scope for improvement.

## Introduction

During 1999-2000, marine fish production in India was 2.8 million tonnes. Gujarat ranked first among the maritime states in the country with 0.67 million tonnes of marine landings and 0.74 million tonnes of total fish production. The value of the catch in Gujarat is estimated to be over Rs.14 529 million (Anon. 2001). Most of the fish landings are from mechanised fishing boats numbering over 17 000. Of these fishing boats, 39 percent are trawlers. The trawl nets contribute about 71 percent, while gillnets and dol nets (bag nets) together account for 19 percent of the total quantity of fish landed in the state. The remaining 10 percent of the catch comes from dugout canoes with outboard motors (OBM) and non-mechanised boats operating mainly gill nets and catching quality fishes. Apart from various quality fishes, prawns, squid, cuttlefish and lobsters, the trawlers bring in large quantities of bycatch. This bycatch comprises juveniles of quality fishes, small sized prawns, crabs, squillas etc. Bycatch, locally known as *kutta* is mainly used for dried fish, fish meal and fish manure. In India, exports constitute 8 percent of the trawl catch, distant domestic markets 12 percent, local consumption as fresh fish 15 percent, local consumption as salted and dried fish 15 percent, and fish meal of three grades 50 percent. (A. Kungsuwan 1999). Recently, the global trend has been towards a better utilization of bycatch and to reduce the quantity of bycatch landed. This paper discusses the

present status of bycatch composition, its utilization and possible improvements.

## Materials and Methods

Surveys were conducted in the four major fish landing centres in Gujarat, namely, Veraval, Porbandar, Mangrol and Jaffrabad, during the peak fishing season from September to February for two years (2000-2001 and 2001-2002) to identify the important species in the bycatch of trawl fisheries. Every week, two samples weighing 1-2 kg each were collected at random from daily trip and long-trip trawlers from each centre. On average, a long-trip boat brings 1 t of fish as by catch per trip, while for a daily trip it is 100-500 kg. The samples from long-trip boats were limited to 25 percent of the total, since most of the long-trip bycatch was in putrid condition by the time it was landed. The samples were washed and sorted in the laboratory and important species of fishes, squids, cuttle fish and prawns were identified (Fisher and Bianchi 1984; Roper et al. 1984; Jhingran 1982). The approximate composition of important groups in the bycatch was determined according to the AOAC Procedure (1990).

## Results

### Composition of bycatch

The major species in trawl bycatches were sciaenids, engraulids, ribbon fish, penaeid and non-penaeid prawns, squids,

cuttle fish, etc. Sciaenids constituted 15.6 percent of the catch, followed by engraulids (12.84 percent), ribbon fish (8.9 percent), squid and cuttle fish (7.7 percent). Other species included polynemids (4.9 percent), Lactarius (4.2 percent), nemipterids (3.9 percent), leiognathids (3.3 percent), carangids (2.8 percent), flat fish (2.7 percent) and others like shells, jelly fish, squilla, crabs, etc. (Pravin and Manoharadoss 1996). At the beginning of the season, in mid-September, the major species observed were non-penaeid prawns, (*Nematopalaemon* spp. 29.3 percent, *Acetes* spp. 11.3 percent, and *Exhippolysmata* spp. 4.5 percent), sciaenids (7.7 percent), engraulids (5.4 percent), ribbon fishes (4.7 percent) and penaeid prawns (*Parapenaeopsis stylifera* 2.4 percent). The important species of fish and shellfish in the bycatch along with their scientific, common and local names are given in Table 1.

### Present utilization

About 75 percent of the marine fish in Gujarat are landed at 10 major centres. Veraval is the most important one, with landings of over 0.17 million tonnes, which is 27 percent of the total landings of the state. Other major centres include Porbandar, Mangrol and Jaffrabad, which together accept 25 percent of the catch. Thus, over 50 percent of the catch of the state is landed in these four centres. There are over 60 export-oriented fish processing

Table 1. Important fish and shellfish found in the trawl bycatch in Gujarat.

Scientific name	Common name	Local name
<i>Upeneus</i> spp.	Yellow goatfish	Ratamachala/chiri
<i>Saurida tumbil</i>	Lizardfish	Chor bumla
<i>Lepturacanthus savala</i>	Ribbon fish	Bagga
<i>Otolithus</i> sp.	Croaker	Dhoma
<i>Apogon</i> sp.	Cardinalfish	Kuttamachi
<i>Decapterus russeli</i>	Russell scad	Bhangadi
<i>Pellona microgaster</i>	Shad	Katti
<i>Tryssa mystax</i>	Moustache anchovy	Katti
<i>Muraenesox</i> sp.	Eel	Wam
<i>Leiognathus</i> sp.	Silver belly	Kittli
<i>Nemipterus japonicus</i>	Threadfin bream; Pink perch	Rani/ lalmachala
<i>Coilia dussumieri</i>	Golden anchovy	Mendili
<i>Pellona ditchela</i>	Indian pellona	Tellus kati
<i>Lactarius lactarius</i>	White fish; Big jaw jumper	Chapala
<i>Cypsilurus</i> sp.	Flying fish	Kumnga
<i>Priacanthus</i> sp.	Big eye	Raja/ lal machi
<i>Sepia</i> sp.	Cuttlefish	Dedka/makool
<i>Loligo</i> sp.	Squid	Narsinga
<i>Acetes</i> sp.	Paste shrimp	Jawla
<i>Nematopalaemon tenuipes</i>	Tiny prawn	Safed kolmi
<i>Exhippolysmata ensirostris</i>	Red prawn	Lal kolmi
<i>Solenocerus</i> sp.	Red prawn	Lal jinga
<i>Oratosquilla nepa</i>	Mantis shrimp	Hijara
<i>Charybdis cruciata</i>	Cross crab	Karackala

plants with a combined freezing capacity of 2 464 t per day and a storage capacity of 30 501 t.

In Gujarat, the bulk of the quality fishes (prawns and cephalopods), are exported in a frozen condition, while a small portion goes for fresh consumption. The remaining low value bycatch is used mainly for fish meal production and fish manure (Table 2). During 1999-2000, dried fish production was 22 000 t, fishmeal 14 000 t and manure 1 120 t (Anon. 2001). All the large-sized fishes are split open, cured and dried. Small fishes like sole, coilia, etc. are salted and dried whole. Sharks are processed mainly in semi-dried form and have a good market in the southern states and the northeast region. Another major product from bycatch is fishmeal. In

Gujarat there are three fishmeal plants and 54 fish pulverizing units with the capacity to utilize 928 t of bycatch per day.

In voyage fishing, which lasts for 7-8 days, the catch is sorted on board after each haul and quality fish and shellfish are separated and iced immediately. Other low value fishes and juveniles are dumped on the deck without icing. They remain in this condition through the trip, with the quantity increasing after each haul. This bycatch deteriorates and becomes a putrid and foul smelling semi-solid mass. Once landed, it is transported to the drying yards in open vehicles for drying and fishmeal manufacture. In addition to this bycatch, wastes from processing plants, curing and drying yards, prawn shells and

cephalopod wastes from pre-processing units are used as raw material for fishmeal (Ravishankar et al. 1996).

A trawler operating from Veraval harbour lands 500-1 000 kg of bycatch per trip, on average. This is approximately 30-50 percent of the total quantity of fish landed. During December-January, cephalopods dominate the trawl catch and the landings of bycatch are relatively less. The normal price for spoiled bycatch is Rs.1 per kg and for fresh bycatch the price may go up to Rs. 1.50 per kg.

The composition of various species of fish and shellfish in the bycatch indicates that it is a good source of protein and minerals. The approximate composition of important groups in the bycatch is given in Table 3. It shows moisture in the range of 74-81 percent, lowest in ribbon fish and highest in penaeid prawns. Prawns have a low protein content (11.5 percent), while some fishes like anchovies and ribbon fish have a high protein content of 23 percent. A high mineral content was noted in whole prawns and crabs. The dry fish, fish meal and manure are a rich source of protein, minerals and vitamins.

The bycatch from long-trip trawlers is in a putrid and decomposed state and is not fit for human consumption. It is still landed for the following reasons:

- It serves as a source of additional revenue for the fishermen because it is bought by manufacturers of fishmeal;
- In long-trip boats, it is uneconomical to ice the entire catch and the fishermen ice only the quality catch;
- Lack of ice storage capacity in the fish holds of the vessels; and
- Use of small-sized cod ends in trawl nets result in landing a sizable quantity of small fishes and juveniles.

The spoiled bycatch releases various odoriferous compounds, such as ammonia, skatols, indole, putrecene,

Table 2. Production of fish, dry fish, fishmeal and manure in Gujarat.

Year	Total fish production (t)	Dried fish (t)	Fishmeal (t)	Fish manure (t)
1995-96	658 509	36 772	23 541	1 001
1996-97	725 346	35 059	15 787	1 360
1997-98	772 802	36 915	15 746	1 519
1998-99	631 782	20 091	14 849	1 171
1999-00	741 280	22 508	13 985	1 127

Table 3. Composition of important groups in trawl bycatch.

Group	Moisture %	Protein %	Fat %	Ash %
Sciaenids	78.90-79.20	13.60-17.50	0.21-0.32	1.39-2.20
Anchovy	76.36-78.86	18.50-23.50	0.15-0.61	1.65-2.15
Ribbon fish	74.00-78.10	18.00-22.66	0.42-2.50	1.40-1.96
Prawn (Whole)	78.00-81.00	11.40-14.60	0.58-0.75	4.00-6.62
Crab (edible part)	78.90-79.20	13.6-17.5	0.21-0.32	1.39-2.2
Squid	78.00	16.00	1.50	0.75
Acetes	78.49-81.26	11.45-14.68	0.62-0.67	4.06-6.50

cadaverine, etc., which cause a foul smell in the harbour and surrounding areas. It contains a high load of spoilage bacteria which can contaminate the quality fishes. It also attracts flies and is an attractive breeding ground for them, which leads to poor sanitary conditions in and around the harbour.

### Improved utilization

The Code of Conduct for Responsible Fisheries calls on states to “encourage those involved in fish processing, distribution and marketing to improve the use of bycatch to the extent that is consistent with responsible fisheries management practices” (FAO 1995). In countries like India, where the per capita protein availability is below the recommended level, the proper utilization of bycatch from trawlers is important.

Fishing bycatch contains a considerable quantity of small prawns and low value fishes of marketable size. Non-penaeid prawns like *Acetes* spp., *Nematopalaemon* sp., etc. from daily trip boats, can be hygienically dried and marketed. The dried fish and prawns have a good

market and fetch a good price. Various products like cutlets, wafers, spirals, soup powder, etc., are manufactured using fresh *Acetes indicus* (Zynudheen et al. 1998). Protein powder is made from *Acetes* by drying heat-coagulated pulp in the sun and under a vacuum and can be used as flavoring agent for various preparations (Garg et al. 1977). Mince extracted from fishes like small sciaenids, engraulids and carangids, etc., can be used for making products like fish balls, crackers and burgers (Yu and Siah 1996).

The marketable size fishes of the bycatch can be sorted on board for salting when icing is not feasible. The salted low-value fishes can be stored in containers on the deck, subject to availability of space. While salting on board, care should be taken to see that the salted fish does not contaminate the other quality fishes in the fish hold. The remaining trash fish can be effectively utilized for the preparation of fish ensilage. This is a highly nutritious product that can be incorporated into animal and poultry feeds. The Central Institute Fisheries Technology (CIFT) has developed a technology for the

production of fish ensilage from low value fishes and bycatch. It has better nutritional properties than fishmeal. It is rich in water-soluble proteins and contains thermolabile vitamins and important minerals.

Since fish production in Gujarat has reached its maximum sustainable level, the need of the hour is to utilize the resource judiciously. Bycatch is an inevitable outcome of trawl fishing and it should be properly managed for better returns from the fishery. Globally, there is now an emphasis on reducing the bycatch. Increasing the cod end size of the trawl nets to the recommended 35 mm and use of square mesh cod ends will considerably reduce the landing of trawl bycatch. This will help in conserving the fishery resources of this region, particularly the commercially important species.

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