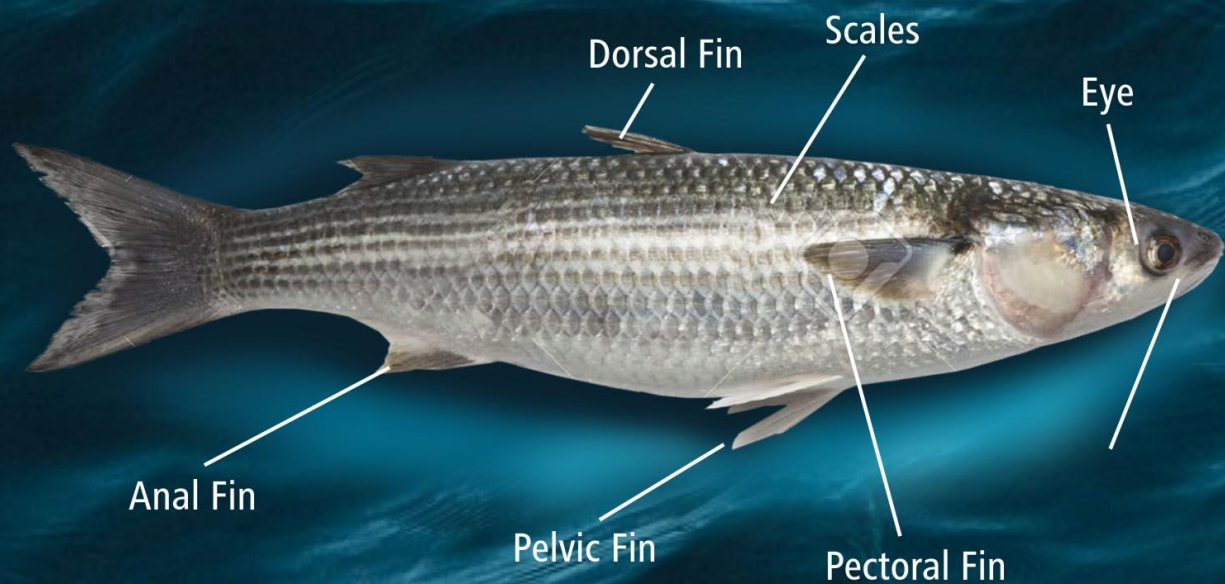


GOA'S STATE FISH

Stripped Grey mullet (Shevto)



Name: Stripped Grey mullet (Shevto)

Scientific Name: Mugil Cephalus

Description:

It is found in tropical, subtropical and temperate zones of world. In Goa it is abundantly found in estuarine and brackish water. It has a cylindrical body and abroad flattened head.

Stripped Grey mullet reaches a maximum total length of 100 centimetres in standard length, but are generally on an average 40-50 centimetres in length. Maximum reported age attained is 16 years. It is very nutritious, rich in protein and very tasty fish.



Issued by:

Directorate of Fisheries
Government of Goa

FLATHEAD GREY MULLET, MUGIL CEPHALUS – STATE FISH OF GOA

Flathead grey mullet, *Mugil cephalus* locally known as 'Shevto' is the dominant fish species of Goa both quantitatively and in terms of economic value. **Flathead grey mullet**, *Mugil cephalus* Flathead grey mullet (*Mugil cephalus*) belongs to the family, Mugilidae and order Mugiliformes. This fish is commonly found in the coastal waters of the tropical, subtropical and temperate zones of world.



The grey mullets are caught by different types of crafts (Artisanal, Motorized and Mechanized) and gears (gillnets, cast nets, stake nets, barrier nets, lift nets, beach seines and hook and lines). This species also hold scope for coastal aquaculture and value addition as game fish and bait.

It has been reported that *M. cephalus* reaches a maximum total length of 100 cm in standard length, but fishes caught are generally in the size range of 40-50 cm. Maximum reported life span is 16 years.

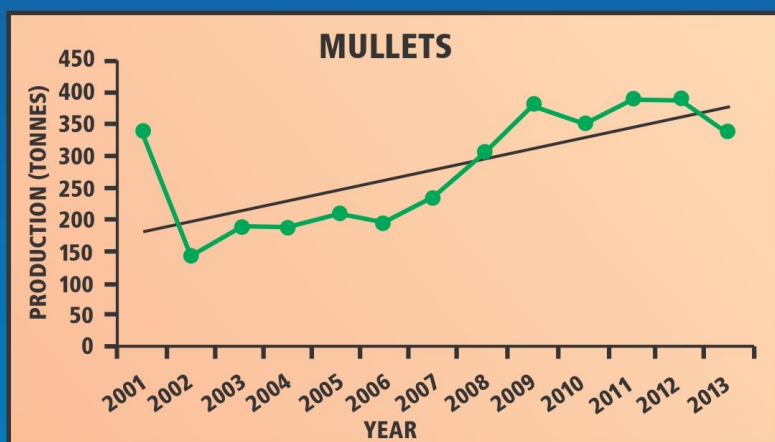
Catch of grey mullets Adults are found in coastal waters, often entering estuaries and rivers, sometimes far-up-river, lagoons and hyper-saline environments. They are usually in schools over sand or mud bottom, between 0 and 10 m. They are mainly diurnal, feeding on detritus, micro-algae and benthic organisms. Juveniles feed on zooplankton until about 3 cm of standard length. Reproduction takes place at sea, at various times of the year depending on the location. Females spawn 0.8 to 2.6 million eggs which develop at sea. Sexually mature at 3 to 4 years at an average size of 35-45 cm. The spawning usually occurs during October to December along the southwest coast of India including Goa.



Mullet fish curry This species is known for its delicacy around the globe and is consumed in various forms (fresh, dried, salted, and frozen; eggs are sold as fresh or smoked). It is a delicacy in Goa and various types of preparations such as fried, smoked, dried and fish curry are made. It is nutritionally superior with high quality protein, essential amino acids and fatty acids. Flathead Grey mullet are much in demand, particularly in monsoon when the sea catches are low.

With an average catch of 280 tonnes per annum, mullets contributes to about 7% of the total inland fish production along Goa and the major contribution (about 80%) is from flathead grey mullet, *Mugil cephalus*. Thus, grey mullet holds an important role in the fisheries livelihood and socioeconomic scenario of the coastal fishermen in Goa. **Year wise catch (tonnes) of grey mullet along Goa during 2001-2013**

Considering its ecological and economic importance in the state of Goa, Flathead grey Mullet (*Mugil cephalus*) has been declared as 'State Fish of Goa'.



Issued by:

Directorate of Fisheries
Government of Goa

A brief Report on state-fish for Goa



Stripped Grey Mullet, *Mugil cephalus*

Submitted to
Directorate of Fisheries, Govt. of Goa, Goa

Prepared by
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Stripped Grey Mullet, *Mugil Cephalus*-State fish for Goa

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Introduction

The contribution of marine and coastal fisheries to the Indian economy is very significant which is shown by the huge employment opportunities that it creates in primary, secondary and tertiary sectors, foreign exchange and meeting the food security. The Indian fisheries industry contributes to about 1-1.4% of the total GDP. The value of the marine fish landings at the point of first sale- 30,000 crores and 40, 000 crores at the point of last sales (CMFRI, 2015). Fish assumes greater significance to the people of Goa and it forms an integral part of Goan life and culture as it forms one of the most important items of the food of more than 90% percent of population. Goa is the state with a coast line of 104 km (1.28% of Indian coast line of 8117 km) with numerous bays and headlands. The continental shelf area of Goa extends to about 10,000 km² of about 100 fathoms depths. The fisheries sector contributes to about 2.5% of the total GDP of the state (third position after West Bengal and A.P.) and 17.1% of the agricultural GDP of the State. Thus fishing industry of Goa plays a vital role in socio-economic development of Goa by contributing substantially towards Net State Domestic Product through export and domestic trade annually. In India fish eating population is about 56% of the total population (Planning Commission, Govt. of India), Per capita fish consumption is about 8.49 kg. Goa contributes to about 1.85% of the total marine fish landings of our country (CMFRI, 2013).

Marine and coastal fisheries contribute 97% of the total fish production from Goa. Goa is bestowed with 330 ha of brackishwater resources which hold good potential in the fisheries development, particularly through capture and coastal aquaculture. The total estuarine area in Goa is 13,157 ha with Mandovi and Zuari are the two major estuaries known as life lines of Goa. These are inter-connected by Cumbharjua canal, 14 km and 11 km away from the mouth of the respective estuaries. Both the estuaries open into the sea at Dona Paula beach. The salinity and tidal effects are very much pronounced, except in June-September of the year, when there is heavy inflow of fresh water into the Sea. Mandovi estuary is five kilometers wide at the mouth region, where as Zuari is about seven kilometers wide. The estuarine bed of the 253 Mandovi River is mostly sandy or muddy, whereas, Zuari is mostly rocky.

The inland fish production of Goa, which is 4678 tonnes in 2013, is majorly supported by the brackishwater and estuarine fish production. The major fisheries resources are prawns and shrimps, clams, mullets, catfish, pearlspot, crabs, glassy perchlets, ladyfish, silverbiddies, scat, milkfish and anchovies. There is a significant hike inland fish production in Goa during the last five years. It is also observed that there is abundant natural stocks of seeds of brackishwater fishes like Pearlspot, *Etroplus suratensis*, Asian Seabass, *Lates calcarifer* and

Mulletts (*Mugil cephalus*, *Valamugil cunnesius*, *Liza parsia*, *L. tade*) etc. in the estuaries and backwaters of Goa which can be utilised for culture purpose (Sreekanth, 2015). The state also holds enormous scope in developing coastal aquaculture activities including finfish cage culture, mussel and oyster culture etc. Coastal and brackishwater finfishes, clams, mussels and oysters have a great demand for consumption in the fish markets of Goa. The production from the coastal water bodies can be also increased using the strategic interventions in coastal aquaculture systems. The group mullets with 4-5 species contribute significantly to the coastal and brackishwater fisheries of Goa and the species stripped Grey mullet, *Mugil cephalus* is the dominant species in this group. This species provides significant contribution in quantity and value of the coastal fisheries of Goa. There is a good demand for this fish from the retail markets and hotel industry in Goa. Apart from fishing it also holds scope as a candidate species for coastal aquaculture. Further, this fish can be also used for preparing various value added products and thus provides an opportunity for processing and value addition. In the following sections, the scope for recommending grey mullet as state fish for Goa is discussed

Stripped Grey Mullet, *Mugil cephalus*

Stripped grey mullet (*Mugil cephalus*) is a species of mullet in the Mugilidae family under the order Mugiliformes. It is commonly found in the coastal waters of the tropical, subtropical and temperate zones of world. It is an important food fish around the globe. It is also significant as a potential aquaculture species and a game fish. It is even used as bait (smaller size) for catching the larger pelagic and demersal fishes. The grey mullet is exploited by different types of gears (gillnets, castnets, stake nets, barrier nets, lift nets, beach seines and hook and lines) and crafts (Artisanal, Motorised and Mechanised). Besides, all the major, medium and minor landing centres along South and North Goa land mullets as a one of the fish groups. The species also hold scope for coastal aquaculture and value addition.



Fig. 1. Grey Mullet, *Mugil cephalus*



Fig. 2. Landings of Grey mullet in Goa

Taxonomic classification

Scientific name: *Mugil cephalus*

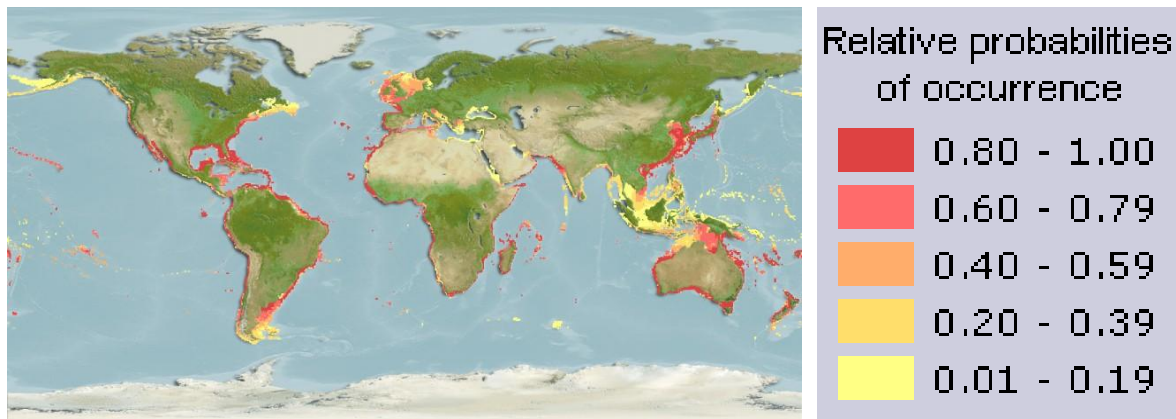
Common name: Stripped grey mullet

Local name in Goa: Shevto

| Classification | |
|-----------------------|-----------------------|
| Kingdom | Animalia |
| Phylum | Chordata |
| Subphylum | Vertebrata |
| Class | Actinopterygii |
| Order | Mugiliformes |
| Family | Mugilidae |

Distribution

Cosmopolitan in distribution along coastal waters of the tropical, subtropical and temperate zones of all seas. Eastern Pacific: California, USA to Chile. Western Pacific: Japan to Australia. Western Indian Ocean: from India to South Africa. Western Atlantic: Nova Scotia, Canada to Brazil; Cape Cod to southern Gulf of Mexico; absent in the Bahamas and most of West Indies and Caribbean. Eastern Atlantic: Bay of Biscay to South Africa, including the Mediterranean Sea and Black Sea. Reported in Sea of Okhotsk.




Source: Fish base, 2014

Fig. 3. Global distribution of grey mullet

Description

Dorsal spines (total): 5; Dorsal soft rays (total): 7-9; Anal spines: 3; Anal soft rays: 8 - 9. Diagnosis: body stout, cylindrical in cross-section, slightly compressed; head broad and flattened. Well developed adipose eyelid covering most of pupil. Upper lip thin and without papillae, armed with 1-6 rows of fine teeth; hind end of upper jaw reaching a vertical line from anterior eye margin; maxillary pad not visible below corner of mouth when closed; origin of 1st dorsal fin nearer to snout tip than to caudal-fin base; anterior parts and bases of 2nd dorsal and anal fins with a moderately dense coverage of scales; pectoral axillary process; 14-15 scale rows between origins of dorsal and pelvic fins.

| | | | | | |
|---|-----------------------|------------------|----------------------|---|---------------------|
| Species | <i>Mugil cephalus</i> | | Centre | Goa | |
| Common Name | Stripped grey mullet | | Period | 2013-2015 | |
| Family | Mugilidae | | Gears exploiting | Gillnet, castnet, stake net, barrier net, lift net, beach seine | |
|  | | | Ecological group | Omnivore | |
| | | | Annual avg. Catc | 280 | |
| Length-Weight Parameters | | | | | |
| Growth parameters | | a | male | Female | Combined |
| L_{max} | 85.6 | b | | | 0.03 |
| L_r | 10.4 | r | | | 2.96 |
| L' | 20.2 | n | | | 0.93 |
| L_{mean} | 38.2 | | | | 280 |
| | | | Selection Parameters | | Maturity Parameters |
| L_{∞} | 97.8 | L-25 | 20.5 | L_m | 38.4 |
| K | 0.76/yr | L-50 | 35.1 | Peak bre | October -December |
| ϕ' | 3.86 | L-75 | 51.2 | L_m/L_{∞} | 0.39 |
| W_{∞} | 23361 g | L_c/L_{∞} | 0.36 | Generatio | 1.2 yr |
| t_0 | -0.042 | t_c | 0.42 yr | | |
| Population Parameters | | | | | |
| Z | M | F | E (F/Z) | L_{opt} | F_{opt} |
| | 4.7 | 0.8 | 3.9 | 0.83 | 35.1 |
| | | | | | 3.2 |

Source: Fish base, 2014

Fig. 4. Species life history sheet for grey mullet

Growth

It is reported that Grey mullet reaches a maximum total length of 100 centimetres in standard length, but are generally on an average 40-50 centimetres in length. Maximum reported age attained is 16 years. The maximum reported weight is 12 kg seems too high for the area and it remains to be confirmed (Fishbase, 2014).

Biology (Habitat, feeding and spawning)

Adults are found in coastal waters, often entering estuaries and rivers, sometimes far-up-river, lagoons and hyper-saline environments. They are usually in schools over sand or mud bottom, between 0 and 10 m, occurring equally in tropical, subtropical and temperate waters. They are mainly diurnal, feeding on detritus, micro-algae and benthic organisms. Juveniles feed on zooplankton until about 3.0 cm of standard length. Reproduction takes place at sea, at various times of the year depending on the location. There is absence of an obligatory freshwater phase in the life cycle. Females spawn 0.8 to 2.6 million eggs which develop at sea. Sexually mature at 3 to 4 years at an average size of 35-45 cm. The spawning usually occurs during October to December along the southwest coast of India and in Goa also. Generally, the fecundity ranges from 1 to 5 lakhs. One spawning aggregation was observed in detail. This consisted of five fish, a female and four males. Males would press against the female, which took place as the entire group moved along slowly, facing into a fairly strong tidal flow.

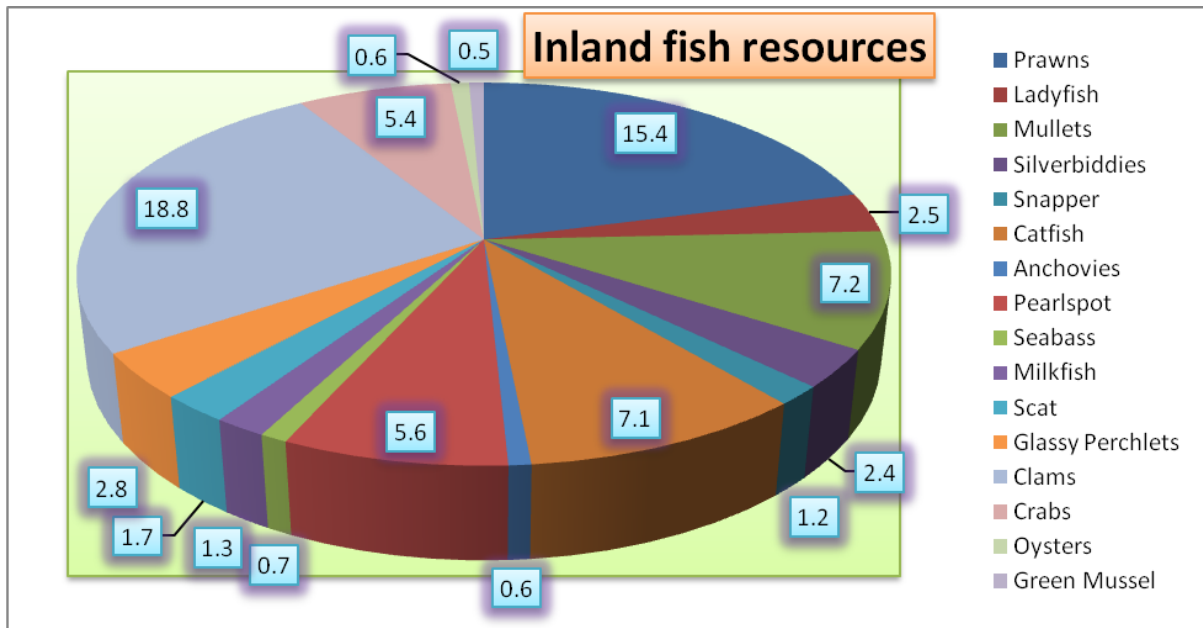
Gears of catch

The grey mullet is exploited by different types of gears (gillnets, castnets, stake nets, barrier nets, lift nets, beach seines and hook and lines) and crafts (artisanal, motorised and mechanised).

Utilisation

It is marketed fresh, dried, salted, and frozen; roe sold fresh or smoked; also used in Chinese medicine. It is a delicacy in Goa and various preparations like fried, smoked, dried and gravy preparations are made from this species. It is nutritionally superior with high quality protein, essential amino acids and fatty acids. The proximate composition of grey mullet is reported by Gopakumar (2002) as: Moisture: 74.9%, Protein: 20.8%, Fat: 5.1% and Ash: 0.6%.

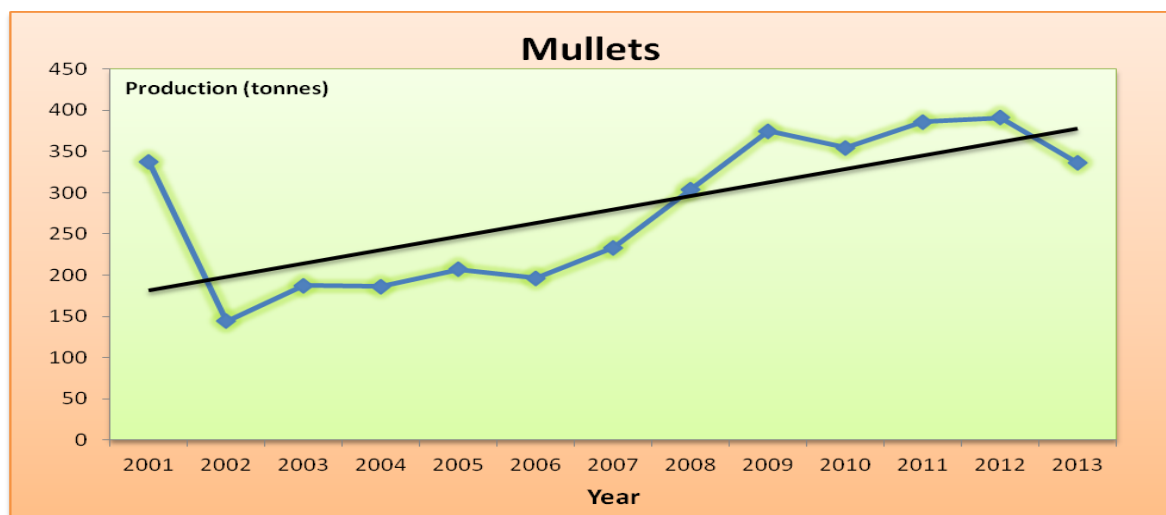
Production and economics



Directorate of Fisheries, Govt of Goa, 2009-2014

Fig. 5. Contribution of various fisheries groups to total inland production

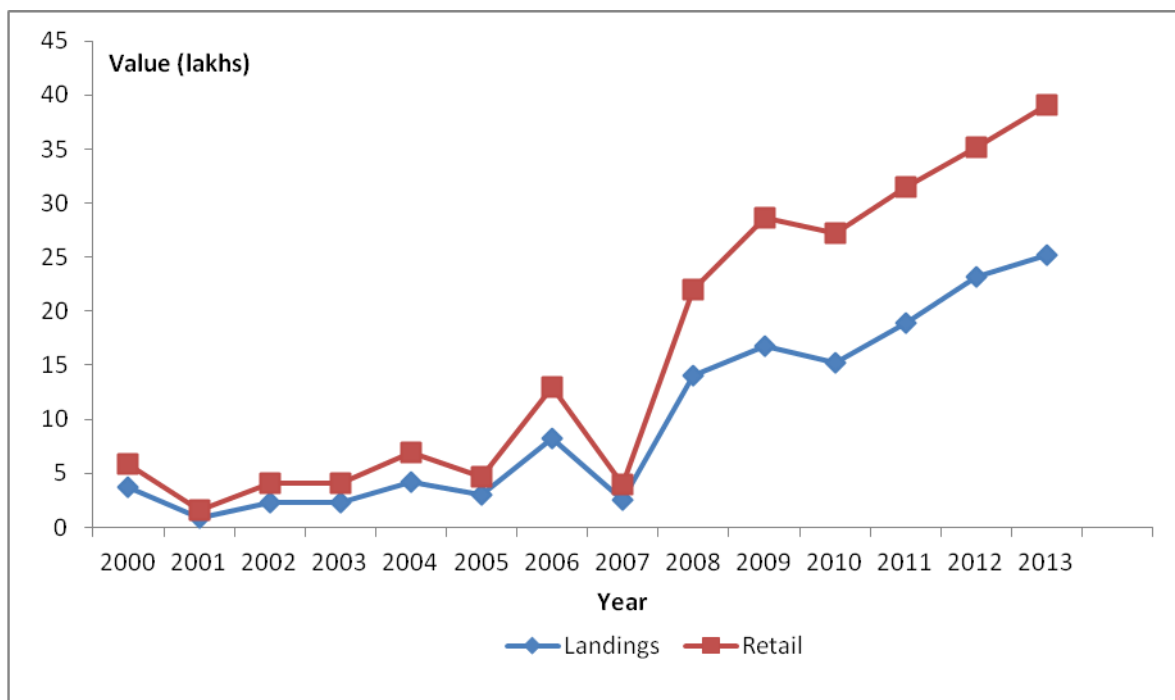
With an average catch of 280 tonnes per annum, mullets contributes to about 7% of the total inland fish production along Goa and the major contribution (about 80%) is from grey mullet, *Mugil cephalus* (Fig. 5). Thus grey mullet holds an important role in the fisheries livelihood and socioeconomic scenario of the coastal fishermen in Goa. In terms of value of the inland and coastal fish production in Goa, this species holds a significant contribution.



Source: CMFRI Annual reports and Department of Fisheries, Govt. Of Goa, 2014

Fig. 6. Year wise catch (tonnes) of grey mullet along Goa during 2001-2013

The fishery of mullets especially the grey mullet has shown linear increasing trend over the last decade in Goa (Fig. 6). In the last decade, the fishery started declining from 337 tonnes in 2001 to 144 tonnes in 2002. This decline was followed by a continuous increase in the mullet landings from 2002 to 2012 with a peak values during 2012 and 2009. The average catch during this period was found to be 280 tonnes. Recently there was a decline in the landings from 391 tonnes in 2012 to 336 tonnes in 2013. In general, the catch was increasing and this may be attributed to the increased demand for this fish triggered by the increase in price for the other preferred marine species. In Goa, Grey mullet can be considered as an optimally exploited fishery with an optimal catch. However, the statement should be refined or substantiated with planned population studies along the coast.

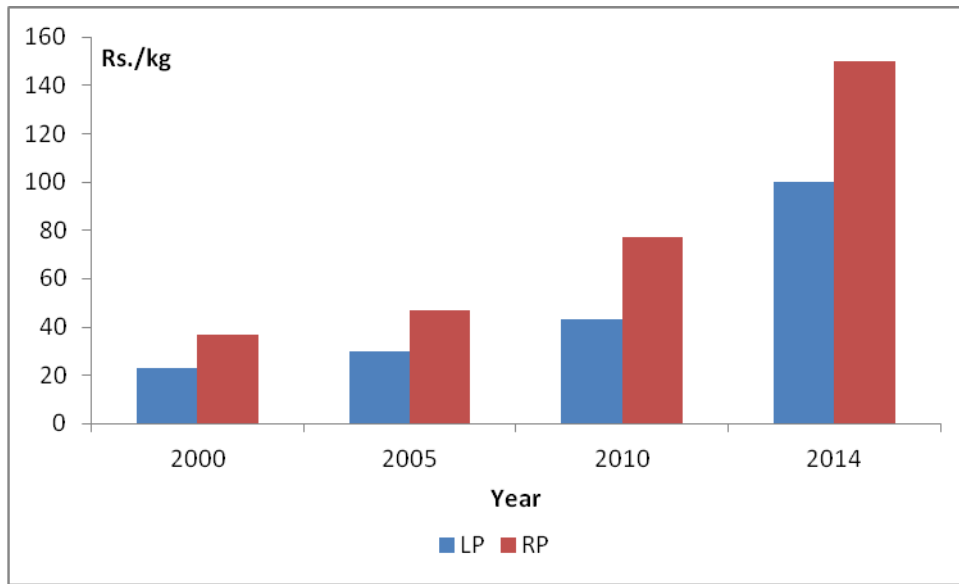


Source: Sathiadhas et al., 2012 and Directorate of Fisheries, Govt of Goa, 2014

Fig. 7. Gross value (crores) for mullets at landing and retail points in Goa

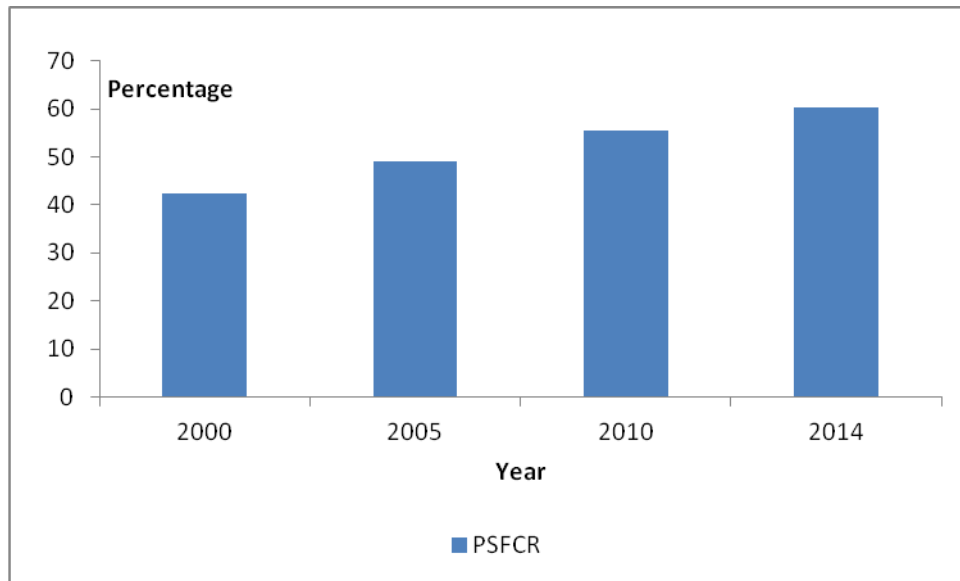
The gross value of landings at landing and retail level were gradually increasing over the years. The gross values at both landing and retail have shot up to ₹ 25.2 and ₹ 39.1 lakhs during 2014 from ₹ 3.68 and ₹ 5.92 lakhs in 2007 (Fig. 7). Thus it is obvious that mullet contributes major share to the fisheries livelihood of the state and the state's fisheries GDP. The average landing and retail prices for mullet stood at ₹ 100 and ₹ 150 along Goa during 2014 from ₹ 23 and ₹ 37 respectively in 2000. However, these prices are average prices estimated using the weekly prices of the fish for the entire year. Moreover, this is expected to increase further in the coming future. The average annual price at landing and retail points for grey mullet has followed a continuous linear trend. The price at landing was increased from ₹ 23 to ₹ 100 with an annual average growth rate of 23.9% (Fig. 8). Similarly, the price at retail was increased from ₹ 37 to ₹ 150 with an annual average growth rate of 21.8%. The Percentage Share of Fishermen in Consumer Rupee (PSFCR) for mullet was reducing from 42.3% in 2000 to 60.3% in 2014 (Fig. 9). The higher rate of increase in the retail price at

retail point in comparison with the landing point might have widened the gap between landing and retail price which in turn reduced the PSFCR.



Source: Sathiadhas et al., 2012 and Sreekanth et al., 2014 (unpublished)

Fig. 8. The trend in Landing Price (LP) and Retail Price (RP) of grey mullet in Goa



Source: Sathiadhas et al., 2012 and Sreekanth et al., 2014 (unpublished)

Fig. 9. The trend in PSFCR for grey mullet in Goa

Aquaculture potential

The grey mullet, *Mugil cephalus* is the most dominant species of the mullet groups and it is the fastest growing mullet species. Though it primarily feeds on the diatoms and epiphytic algae, it can adapt itself to artificial diet. The size at maturity of the species is at 3 to 4 years at an average size of 35-45 cm. The spawning season in India is from October to May and the fry availability along the coastal regions is strictly seasonal. Along the west coast the fry availability is maximum during the monsoon (July-September) and in the east coast, the peak abundance will be in pre-monsoon season (February to April). Spawning occurs in offshore waters where warm water current exists with a surface temperature of 20-23°C. The common marketable size is 500-800 g (30-50 cm). It is a hardy eurythermal (0 to 40°C) and euryhaline (0 to 145 ppt) species which make it suitable for the coastal aquaculture activities. Grey mullet possesses hardiness and ability to tolerate considerable fluctuations in salinity and temperature, ability to grow fast in brackishwater ponds, adaptability to supplementary diet, high survival rate and good market demand. The monoculture of this species is not found lucrative because of the low production rates. There is a practice of growing this species in mixed or polyculture systems based on the natural seed availability. The combined culture of fish (1-2 species) and shrimps are reported to augment the production in coastal aquaculture systems. Since the grey mullet satisfies all favourable characteristics to be part of such a coastal aquaculture system, it can be undoubtedly recommended as a fish species for inclusion in the coastal aquaculture system.



Fig. 10. Seed collection and culture of grey mullet

Value addition

The flesh of this lean fish species is with firm texture, light meat with moderate flavour and the meat yield from this species is reported as 42%. The protein and lipid content of this fish is about 21 mg/g and 1.91 mg/g respectively. Extremely versatile and with low cholesterol content, mullet can be prepared in a variety of ways without fear of its becoming too dry: barbecued, baked, broiled, deep-fat, fried, over-baked, pan fried or smoked. There are possibilities for the development of mince based products from this fish like surimi and surimi-based products, sausages, protein concentrates and hydrolysates, and extruded products. In addition to the mullet flesh, the roe (both white and yellow) and gizzards are also edible.



Fig. 11. Value added products prepared from grey mullet

Conclusion

Thus, the grey mullet, *Mugil cephalus* undoubtedly contributes significantly to the coastal fisheries of Goa in terms of quantity and value. The utilisation of this species in Goa is incomplete as it is commonly used for traditional preparations and fresh consumption. The value of the fish at landing and retail points were increasing since the last few years. As this species contribute significantly to the coastal fisheries of Goa, the precious resource should be conserved by different management approaches with the limitation of effort, regulation of mesh size and adoption of sustainable coastal aquaculture practices. Hence, there is possible scope for proposing grey mullet, *Mugil cephalus* as the state fish for Goa with the underlined background.

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