Demersal Finfish Resources of Gujarat

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The marine fishery of Gujarat is by and large sustained by the operation of three major gears, *viz.*, trawls, gill nets and *dol* nets. Demersal finfish resources have played a major role in shaping the fishery of the state ever since the inception of commercial fishery, especially by trawlers about four and a half decades ago. The fishing grounds off Saurashtra and Dwarka have been identified as among the best in the world, with an abundance of large-sized demersal fishes, best exemplified by the "*ghol-koth-dara*" fishery of the state. Elasmobranchs, catfishes, lizardfishes, threadfins, croakers, perches, pomfrets and whitefish are major contributors to the state's marine fish landings. Together, these resources accounted for about 30-37% of the annual average marine fish catch of the state during the period 1971-99. However, an analysis of the contribution of each of these resources to the total fish catch over the years reveals a considerable shift in the dominance of these resources in the landings. Major changes include the virtual disappearance of whitefish, threadfins and pomfrets from the first fifteen slots and the dominance of croakers, especially the lesser-valued species. The "*ghol-koth-dara*" fishery which was supported by large-sized sciaenids and threadfins, has now become practically non-existent. The growing prominence of cephalopods and some pelagic resources like ribbonfishes, clupeids and carangids, along with the emergence of non-penaeid shrimps as a major component of the trawl net and *dol* net catches has diminished the role of these demersal resources. However, the decline in contribution by these groups has been balanced by an increase in the contribution of other resources like lizardfishes, threadfin breams, catfishes and elasmobranchs, thus sustaining the role of this group in terms of quantity of catch.

Key words : Marine fishery resources, demersal fishes, finfish resources, Gujarat

The marine fishing industry of Gujarat is supported by a fleet of over 21,000 fishing vessels, of which 65% are mechanised. The major part of the fish production is obtained by the operation of trawls, gill nets and *dol* nets. The fishery resources can be broadly classified into four main groups – pelagic finfishes, demersal finfishes, crustaceans and cephalopods. Demersal finfish resources have played a major role in shaping the fishery of the state ever since the inception of commercial fishery, especially by trawlers, about four and a half decades ago.

Exploratory trawl operations along the north-west coast of India began as early as the turn of the 20th century (Nair, 1974). Commercial trawling became an established activity by 1960s. Descriptions of the trawling grounds off Gujarat and the resources available have been given by Jayaraman *et al.* (1959), Bhatt *et al.* (1964) and Rao *et al.* (1966) for grounds up to 80 m depth and by Bapat *et al.* (1982) for grounds between 55-360 m depth, identifying five major trawling grounds along the Gujarat coast, *viz.*, Cambay, Veraval, Porbandar, Dwarka and Kutch. These studies describe the richness of the grounds off Dwaraka (Jayaraman *et al.*, 1959) and Kutch (Rao *et al.*, 1966), especially in relation to fishery of large-sized demersal fishes.

Trends in fishery

Demersal finfishes constituted about 34% of the total marine fish production of the state from 1971-99 (Fig. 1). The major groups contributing to the fishery are elasmobranchs, croakers, catfishes, perches, pomfrets, lizardfishes, threadfins, whitefishes and flatfishes. The prominent species in each resource in the commercial landings along the coast of Gujarat is listed in Table 1. The increase or decrease in percentage contribution of each resource to the average annual catch of demersal finfishes from 1975-79 to 1995-99 (Fig. 2-4) indicates that while threadfins, whitefish and pomfrets appear to be declining, lizardfishes, flatfishes and perches show promise and catfishes, elasmobranchs and croakers appear to be plateauing.

Table 1. Major exploited demersal finfish resources of Gujarat

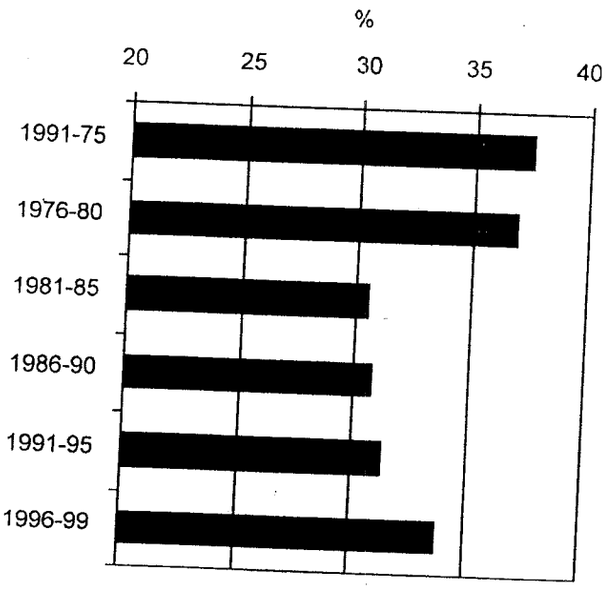
Scientific name	Common name (English)	Gujarati name
Elasmobranchs		
Sharks		
Carcharhinus limbatus	Black tip shark	*Patari*
C. dussumieri	White cheek shark	*Patari*
C. macloti	Hardnose shark	*Patari*
C. hemiodion	Pondicherry shark	*Patari*
C. sorrah	Spot tail shark	*Patari*
Rhizoprionodon acutus	Milk shark	*Sandhy; Pisori*
R. oligolinx	Grey sharpnose shark	*Sandhy; Pisori*
Scoliodon laticaudus	Spadenose shark	*Sandhy*
Eusphyra blochii	Winghead shark	*Julio*
Sphyrna lewini	Scalloped hammerhead	*Julio*
S. mokaran	Great hammerhead	*Julio*
Mustelus mosis	Arabian smoothhound	*Bokha*
Guitar-fishes		
Rhina ancylostoma	Bowmouth guitar fish	*Dhons*
Rhinibatos granulatus	Granulated shovelnose guitar fish	*Dhons*
Rhyncobatus djiddensis	White-spotted shovelnose guitar fish	*Dhons; Kharaj*

Rays		
Aetobatus narinari	Spotted eagle ray	*Wagali*
Aetomylaeus maculatus	Mottled eagle ray	*Lala; Kagadi*
Rhinoptera javanica	Flapnose ray	*Boor*
Manta biorostris	Giant devil ray	*Kagda; Timdi; Kharaj*
Mobula diabolis	Laser devil ray	*Timdi; Kharaj*
Dasyatis imbricata	Scaly sting ray	*Patara*
D. zugei	Pale-edged sting ray	*Varala*
Gymnura poecilura	Long-tailed butterfly ray	*Boor*
Himantura bleekeri	Whip-tailed sting ray	*Varala*
H. uarnak	Marble/Honeycomb sting ray	*Varala*
Narcine brunnea	Brown electric ray	*Jangeru*
N. indica	Spotted electric ray	*Jangeru*
Catfishes		
Arius arius	Threadfin sea catfish	*Khagada; Khaga*
A. caelatus	Engraved catfish	*Khagada; Khaga*
A. dussumieri	Blacktip sea catfish	*Khagada; Khaga*
A. sona	Sona sea catfish	*Khagada; Khaga*
A. thalassinus	Giant catfish	*Khagada; Khaga*
A. tenuispinis	Thin-spine sea catfish	*Khagada; Khaga*
Osteogeneosis militaris	Soldier catfish	*Gozi Khagadi*
Croakers		
Atrobucca nibe	Longfin kob	*Kala Dhoma*
Johnieops sina	Sin croaker	*Dhoma; Thuri*
J. vogleri	Sharptooth hammer croaker	*Dhoma; Thuri*
J. aneus	Greyfin croaker	*Dhoma; Thuri*
J. dussumieri	Dussumier's croaker	*Dhoma; Thuri*
J. macrorhynus	Bigsnout croaker	*Dhoma; Thuri*
Johnius belangerii	Belanger's croaker	*Dhoma; Thuri*
J. glaucus	Pale spotfin croaker	*Dhoma; Thuri*
J. carouna	Caroun croaker	*Dhoma; Thuri*
J. dussumieri	Bearded croaker	*Dhoma; Thuri*
J. macropterus	Largefin croaker	*Dhoma; Thuri*
Otolithes cuvieri	Lesser tigertooth croaker	*Dhoma*
O. ruber	Tigertooth croaker	*Dhoma; Mosambi gumla*
Otolithoides biauritus	Bronze croaker	*Koth; Goyni*
Paranibea semiluctosa	Half-mourning croaker	*Dhoma*
Pennahia macrophthalmus	Bigeye croaker	*Dhoma*
Protonibea diacanthus	Spotted croaker	*Ghol; Babar*
Umbrina canariensis	Canary drum	*Dhoma*
Threadfins		
Eleutheronema tetradactylum	Fourfinger threadfin	*Sheri; Rawas*
Polynemus indicus	Indian threadfin	*Dara; Bawa*
P. heptadactylus	Sevenfinger threadfin	*Bawa*
P. plebius	Striped threadfin	*Bawa*
P. sextarius	Blackspot threadfin	*Bawa*
Pomfrets		
Pampus argenteus	Silver pomfret	*Vichudo; Paplet*
P. chinensis	Chinese pomfret	*Kafri Vichudo*
Parastromateus niger	Black pomfret	*Halva; Addadio*

Whitefish		
Lactarius lactarius	Whitefish	*Kitali*
Perches		
Diagramma pictum	Painted sweetlip	*Ander*
Epinephelus tauvina	Greasy grouper	*Vekhali; Vekhala*
E. diacanthus	Thorny-cheek grouper	*Vekhali; Vekhala*
E. malabaricus	Malabar grouper	*Vekhali; Vekhala*
E. merra	Honey-comb grouper	*Vekhali; Vekhala*
E. rivulatus	Halfmoon grouper	*Vekhali; Vekhala*
Lethrinus lentjan	Redspot emperor	*Dhamil; Gurkha; Pakhri*
L. elongatus	Longface emperor	*Dhamil; Gurkha; Pakhri*
L. nebulosus	Yellow-branded emperor	*Dhamil; Gurkha; Pakhri*
Lutjanus johni	John's snapper	*Raja*
L. lutjanus	Bigeye snapper	*Raja; Gulalio*
L. malabaricus	Malabar blood snapper	*Gulalio*
L. vitta	Brownstripe snapper	*Gulalio*
Nemipterus delagoae	Delagoa threadfin bream	*Rata machala*
N. japonicus	Japanese threadfin bream	*Rata machala*
N. mesoprion	Redfilament threadfin bream	*Rata machala*
Plectorhincus pictus	Trout sweetlip	*Ander*
Pomadasys maculatum	Saddle grunt	*Ghurkho*
Priacanthus hamrur	Moontail bulleye	*Ratado; Dorali*
Therapon jarbua	Jarbua terapon	*Kadva*
T. theraps	Large-scaled terapon	*Kadva*
Lizardfishes		
Saurida tumbil	Greater lizardfish	*Bhunger*
S. undosquamis	Brushtooth lizardfish	*Bhunger*
Flatfishes		
Cynoglossus bilineatus	Fourlined tongue sole	*Jib*
C. arel	Largescale tongue sole	*Jib*
Euryglossa orientalis	Oriental sole	*Jib*
Psettodes erumei	Indian spiny turbot	*Jib*
Apogon spp.	Cardinal fish	*Kutamachi*

Pomfrets

Pomfrets were an important commodity supporting the fishing industry of Gujarat since the establishment of the industry in the state. The abundance of pomfrets in the coastal waters of Gujarat has been recorded in several studies based on exploratory and commercial trawling in these grounds. Exploitation of this resource was mainly done by the traditional sector, using gill nets made of cotton yarn. With the introduction of trawling and mechanization of fishing activities, there was an increase in the intensity of fishing and a subsequent increase in landings. However, the demand for pomfrets far exceeded the supply. This resource too has joined the list of many other important fish resources which were once abundant in the fish landings of the state and are now dwindling. With



1. Percentage contribution of demersal finfish resources to total marine fish production in Gujarat, during 1971-75 to 1996-99

the sharp decline in pomfret landings, there is no targeted fishery now for pomfrets by trawlers along this coast. The major species contributing to the catches of pomfrets are the silver pomfret, (*Pampus argenteus*) and the black pomfrets (*Parastromateus niger*). The Chinese pomfrets (*Pampus chinensis*), which was once a major contributor to the pomfrets landings in the state, is no longer landed in mentionable quantities.

Threadfins

While Gujarat was once famous for its threadfin fishery, this resource has now dwindled to a mere 1% of the average annual fish catch. The *dara* fishery in the waters off the Gulf of Kutch has now become practically non-existant. This local name refers to large-sized breeding adults of *Polynemus indicus* and *Eleutheronema tetradactylum*. The fishing was mainly done by bottom-set gill nets and trawl nets. Bottom-set gill nets were predominantly used during the period May-September. Each fish would measure up to 1.5 m in total length. However, the effects of incessant fishing for this resource in the coastal waters is now reflected on the present-day landings. While such large adults are now obtained occasionally in stray numbers at some of the gill net centres, trawl net catches of this resource form only a very meagre percentage of the total trawl catches. Nearly 80% of the trawl net catches of threadfins are now comprised of the lesser-valued *P. heptadactylus*. The catches of *P. indicus* are almost always comprised of younger age-classes of about 30-40 cm total length.

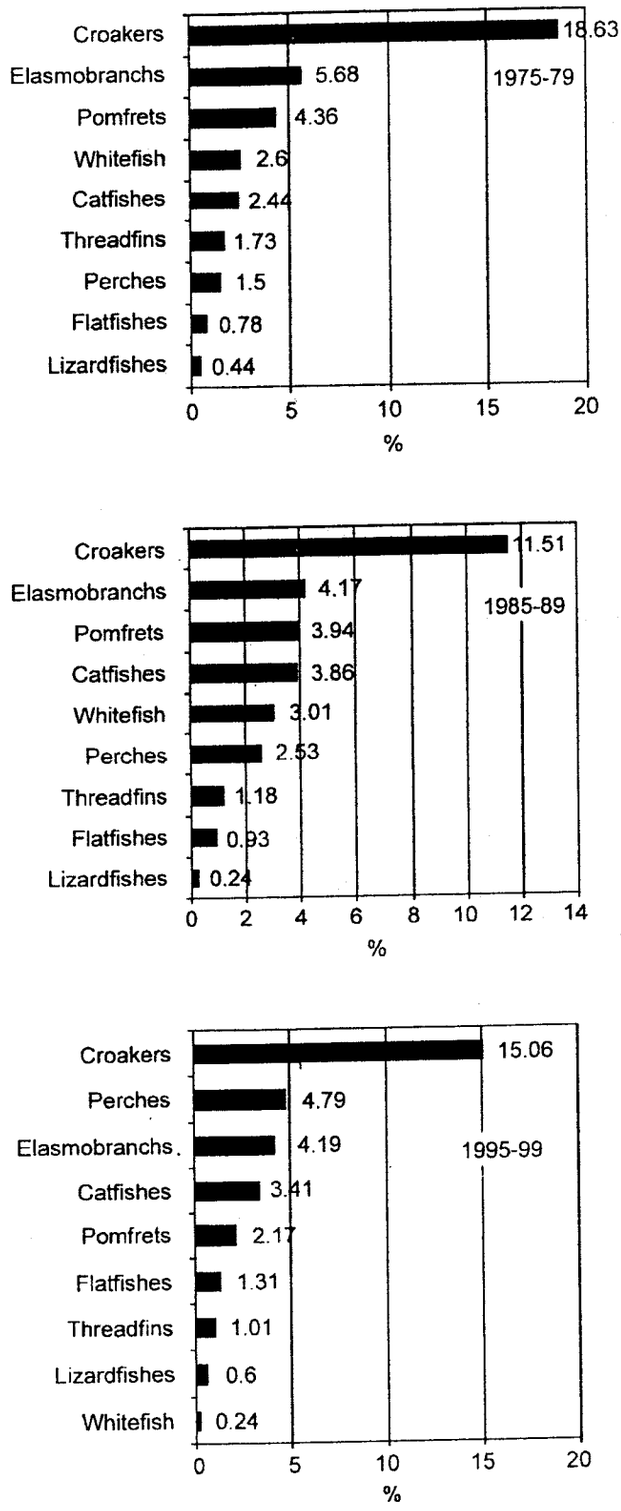


Fig. 2. Percentage contribution of major resources to demersal finfish production in Gujarat, during 1975-79, 1985-89 and 1995-99

Whitefish

The whitefish, *Lactarius lactarius* formed about 2.5-3% of the average annual fish catch of the state during the period 1975-89. Since then, this resource has shown a sharp downward trend, forming only about 0.3% of the average annual fish catch of the state during the period 1990-99. In the subsequent year, it has decreased to less than 0.1%.

Lizardfishes

The lizardfish fishery is comprised of two species – *Saurida tumbil* and *S. undosquamis*. The landings of lizardfishes increased from an annual average of about 3,500 t in 1975-89 to about 15,000 t in 1990-99. The percentage contribution of this resource to the annual average fish catch has increased from 0.2% in 1975-89 to 0.6% in 1990-99.

Flatfishes

The catch of flatfishes increased from about 7,000 t in 1975-89 to about 33,000 t in 1990-99, with the percentage contribution of this resource to the average annual fish catch during these periods increasing from 0.9% to 1.2%.

Perches

Perches are an important group contributing to the fishery in Gujarat. The perch fishery was earlier supported by the larger perches like groupers and snappers. However, in the past decade, the perch fishery has undergone several changes and the mainstay of the fishery has been taken over by lesser perches, especially threadfin breams. The catch of perches showed a ten-fold increase from an annual average of about 14,000 t in 1975-79 to about 140,000 t in 1995-99, with the percentage contribution of these resources to the average annual fish catch during these periods increasing from 1.5% to 5%.

Croakers

Croakers are one of the most important groups that form the mainstay of the marine fishery of Gujarat. The annual average catch of croakers increased from about 177,000 t in 1975-79 to 441,000 t in 1995-99. However, the percentage contribution of croakers to the total fish catch between these periods fluctuated between 19% and 15%. While the quantum of croaker landings has been increasing, the quality of the catch has undergone many changes. In the early years of commercialization of fishing activities in the state, there was a good fishery for the large-sized croakers, *Otolithoides biauritus* and *Protonibea diacanthus*, locally called as *koth* and *ghol*. The exploited resources were usually large-sized breeding adults, growing to more than 1.5 m in length. These resources

were highly valued then, especially for their air-bladders. However, the present day catches of croakers are by and large comprised of the smaller fishes - *Otolithes cuvieri*, *Johnius* spp. and *Johnieops* spp. *O. biauritus* and *Protonibea diacanthus* are caught mainly by gill net and *dol* net operations, but the landing of large-sized fishes have become a rare occurrence. There is a consistent fishing for these fishes from March to May, by gill net operators of certain centres like Diu and Veraval. Since 1990 onwards, croakers have been the largest contributor to the annual average marine fish catch of Gujarat.

Catfishes

Catfishes are another major resource that have occupied a significant position in the marine fishery of Gujarat. The annual average catch of catfishes has steadily increased from about 23,000 t in 1975-79 to 100,000 t in 1995-99. However, the percentage contribution of this group to the total fish catch fluctuated between 2.4% and 3.4%, during this period.

Elasmobranchs

Elasmobranchs, comprising of sharks, rays and guitar fishes, form an important fishery along the Gujarat coast. The annual average catch of elasmobranchs increased from about 53,000 t in 1975-79 to 123,000 t in 1995-99. However, the percentage contribution of this group to the total fish catch during the periods decreased from 6% to 4.2%.

Almost 80% of the total marine fish landings in Gujarat is obtained by the operation of trawl nets. Therefore, any major changes in the operation of this gear and the resources exploited by it will have an immediate and visible impact on the total fish landings in the state. The most significant change that took place in trawl operations towards the nineties was a change in fishing depths to 80-100 m, primarily for the exploitation of cephalopods, and a subsequent increase in multi-day fishing operations. This resulted in better catches of demersal finfishes like threadfin breams and lizardfishes, which began to gain market demand, for *surimi* processing. Major changes that took place with the change in trawl fishing operations include the virtual disappearance of whitefish, threadfins and pomfrets from the first fifteen ranks and the dominance of croakers, especially the lesser-valued species. Another important development was the increase in landings of the non-penaeid shrimps, especially *Acetes* spp. From occupying the eleventh position among the first fifteen resources contributing to the total marine fish catch of Gujarat, this resource jumped to the position of second largest position in the state's marine fish catch in 1995-99. This, and the growing prominence of some pelagic finfish resources

like ribbonfishes, clupeids and carangids, has been the primary reason why resources like elasmobranchs and catfishes have displayed a decrease in their percentage contribution to the total marine fish catch, in spite of an increase in the quantity landed.

The contribution to the fishery by gill net and *dol* net operations is also significant. The *ghol-koth-dara* fishery which was supported by large-sized sciaenids and threadfins, has now become practically non-existent. The existence of a special bottom-set gill net fishery for larger threadfins and croakers during March-May off Bedi Port in the Gulf of Kutch has been reported by earlier workers (Jayaraman *et al.*, 1959; Bhatt *et al.*, 1964; Kutty, 1967). Kizhakudan & Kizhakudan (2000) reported a similar fishery in the grounds off Jaffrabad for large-sized croakers, catfishes, perches and eels during late March and early April. These grounds are well-known for their excellent resources of small non-penaeid and caridean shrimps and other small fish groups which form the diet of these fishes (Kutty, 1967). Aggregations of such large-sized adult breeding fishes in coastal waters thus may well be for the dual purpose of breeding and intensive feeding. Kutty (1967) has also observed the predominance of males in the aggregations and suggest the segregation sexes during breeding. Continued indiscriminate fishing of such breeding aggregations in the past is now reflected in the virtual disappearance of such large-sized fishes from the fishery. A similar fishery of catfishes in the grounds off Madhavpur has been reported by Polera *et al.* (2002). Such targeted fishing practices can prove to be devastating to the resource and the state's fishery over a period of time.

Commercially important demersal resources like perches, threadfin breams, bull's eye, lizardfishes and cephalopods are exploited from the continental shelf region mainly by trawlers operating up to a depth of 100 m. With the introduction of multi-day fishing operations lasting 7-9 days at a stretch in the late eighties by trawlers of 15-17 m L_{OA}, these resources in the continental shelf area of the state up to 100 m depth began to be optimally exploited. However, better returns induced increase in the number of fishing units and the number of small and medium trawlers increased from less than 1800 in the early eighties to more than 6300 in the late nineties. Along with the increase in the number of trawlers, the fishing capacity and efficiency of the vessels too underwent a lot of change, following the acquisition of larger vessels and the induction of modern fish finding and harvesting technologies. However, the annual catch per unit (CPU) has been showing a gradual declining trend, which indicates that the exploited stocks in the coastal waters of the state are now at a critical point of exploitation, and the problem faced is largely one of regulation and conservation of the resource.

Mesh size regulation of trawl codends is another factor of serious concern. In spite of the order issued by the Commissioner of Fisheries, Gujarat, in 2000, to increase the codend mesh sizes, only a very small fraction of the trawl operators have adopted 35 mm mesh size for the codend. Thus, the bulk of the trawl bycatch is made up of juveniles of a wide variety of finfishes and shellfishes, which, if exploited at the right size will offer better benefits towards sustenance of the fishery and conservation of the resource.

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