DIVERSITY AND EXPLOITATION STATUS OF DEMERSAL FISHERY RESOURCES OF INDIA

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Introduction

Fisheries are an important source of income and means of livelihood in developing countries, particularly in rural areas. Estimates by the Food and Agricultural Organisation indicates that capture fisheries employ over 27 million people worldwide, of which 85% live in Asia. Marine fisheries play an important role in food security and nutrition in developing countries. There is serious concern about the state of marine fisheries worldwide. While over-fishing is likely to have been the major cause of the serious setbacks, these have probably been exacerbated by habitat degradation. Fisheries sector plays an important role in the overall socio-economic development of India. The fisheries sector contributed 76,913 crores to the GDP during 2009-10 which is 0.96 per cent of the total GDP at factor cost and 5.4 per cent of the GDP at factor cost from agriculture forestry and fishing (Zacharia and Najmudeen, 2013). During 2015-16, the export of marine products from India reached over 9.45 lakh tonnes valued at Rs.30,421 crores and US$ 4.688 billion (MPEDA, 2017). India is one of major fish producing countries in the world contributing over 3 per cent of both marine and freshwater fishes to the world production (Srinath and Pillai, 2006) with third position in capture fisheries and second in aquaculture. India has an Exclusive Economic Zone (EEZ) covering a total area of 2.02 million sq. km, i.e., 0.86 million sq. km on the west coast including the Lakshadweep Islands and 1.16 million sq. km on the east coast, including the Andaman and Nicobar Islands and a continental shelf of half a million sq. km (Vivekananadan *et al.,* 2003).

The marine fishes, based on their depth-wise distribution may be grouped mainly as pelagic and demersal, the former occupying surface and subsurface waters and the latter the neretic areas in the continental shelf. Demersal fishes can be divided into two main types: Strictly benthic fish which can rest on the sea floor, and bentho pelagic fish which can float in the water column just above the sea floor. Benthic fish, sometimes called groundfish, are denser than water, so they can rest on the sea floor. Benthic fish which can bury themselves include dragonets, flatfish and stingrays. Demersal finfishes are one of the major components in the marine fish landings along the Indian coast. The major gear which exploit the demersal finfish resources in India are bottom trawlnets. Demersal fish though generally occupy the seafloor; feeding on the benthic organisms and detritus, perform vertical and horizontal migration in search of their feeding and breeding grounds. Hence, the day and night catches in bottom trawl show differences, eg. catfish, rays, eels etc. In the in shore fishing activities below 50 m depth, occurrence of pelagics in bottom trawl and catfish, perches and penaeid prawns in pelagic net is common. Trawl catch consists of 76% demersal (finfish 38% and inveretebares-38%) remaining pelagic or column water fishes.

When compared to the pelagic resources, proper exploitation of the demersal finfishes in India has been a initiated only three decades ago (Bensam, 1992). With the introduction of mechanized bottom trawling from the late fifties, the exploitation of demersal finfishes attained a 2.7- fold increase during late eighties. With the large-scale introduction of mechanized trawling, several environmental problems and stock-recruitment hazards to inshore fisheries have come up. Demersal fish groups such as the sharks, groupers, snappers, threadfins, pomfrets and Indian halibut are commercially valuable and contribute substantially to the economy of Indian marine fisheries. Some of these groups, especially of large-size, are targeted by the fishermen by using different craft and gear combinations. However, several other demersal finfishes are not targeted, but are landed as by catch by shrimp trawlers (Vivekanandan, 2011).

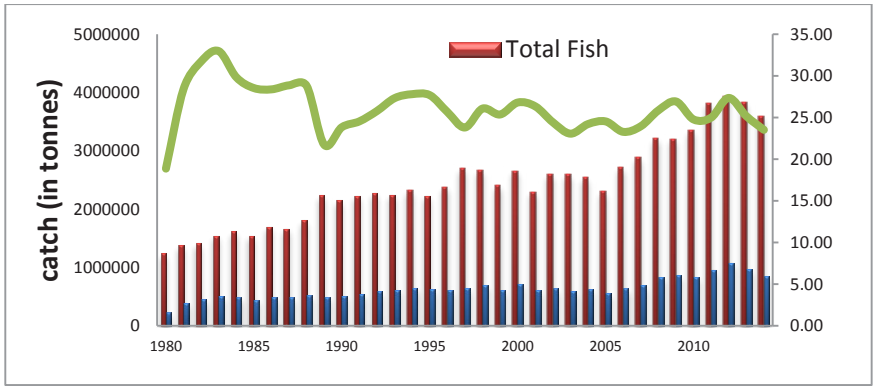

Fig.1. Trends in the landings of demersal finfishes in India during 1980-2014

The landings of demersal finfishes India during 1980-2014 period shows that the catch is increasing steadily over the years from a meagre of 2,34,408 tonnes to nearly 10,76,789 tonnes in 2012, and thereafter declined to 8,42,199 tonnes in 2014. However, the catch share of demersal finfishes during the last 35 years indicate that the contribution of demersal finfishes to the total Indian marine landings are decreasing over the years. The maximum share was reported in 1983 with 33% contribution and the lowest share (21.7%) was in 1989. The region-wise average share of demersal finfishes along the Indian coast shows that the northwest region comprising of Gujarat and Maharashtra contributes the highest share, followed by southwest coast comprising Kerala and Karnataka and southeast coast comprising Tamil Nadu and Andhra Pradesh. The share of demersal finfishes to all India marine landings of India in 2016 was 29%.

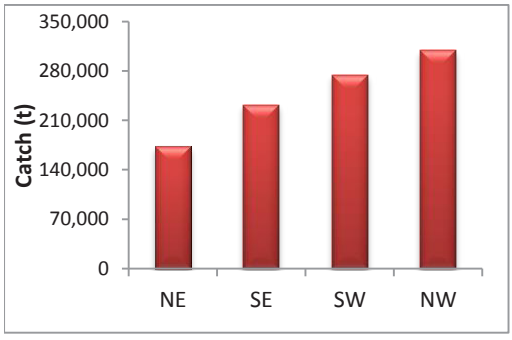

Fig. 2. Region-wise landings of demersal finfishes for the period
2007– 2012

The group wise composition of demersal finfish assemblages in Indian marine fish landings during 2016 indicate that the major contributors are the perches (37%), followed by the croakers (18%), silverbellies (11%), lizardifishes and catfishes each contributed 9%, elasmobranchs (6%) and flatfishes and promfrets (5% each). The exploitation status of the important groups of demersal finfishes along the coast of India are briefly mentioned below.

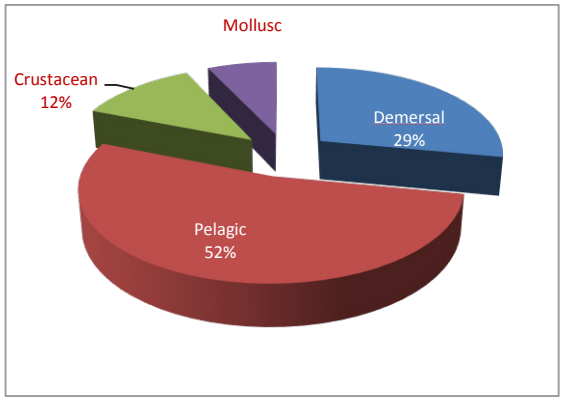

Fig. 3. Share of demersal finfishes to the all India Marine Capture fisheries during 2016

ELASMOBRANCHS

In India, there are about110 species of elasmobranchs, of which 66 species of sharks, 4 sawfishes, 8 guitarfishes and 32 species of rays are landed in the commercial catches. Among these, 34 species are commercially important. Some species of elasmobranchs are protected under the Wildlife Protection Act (10 species), which include, *Pristis microdon, Rhynchobatus djiddensis, Pristis zijsron Carcharhinus hemiodon* (Pondicherry shark), *Glyphis glyphis, Rhincodon typus* (whale shark), *Urogymnus asperrimus* (Porcupine

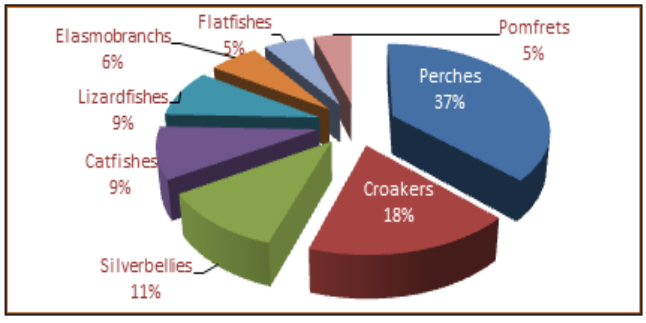

Fig. 4. Share of demersal finfishes to the all India Marine Capture fisheries during 2016

Fig. 5. Heavy landings of sharks at Cochin Fisheries Harbour, Kerala

ray). Majority of the species of elasmobranchs in the Indian seas are viviparous, some are oviparous and few are ovo-viviparous with very low fecundity. All India landings of elasmobranchs during 2016 was 52,424 tonnes, forms 5.6% of demersal catch. Trawl nets accounting for 48.8%, gillnets 35.6% and hook & line units 6% of the total elasmobranch landings of the country.

Sharks : Shark landings in India during 2016 was 23,002 tonnes, which formed 45% of the total elasmobranch landings of the country. The major families appeared in the landings were Carcharhinidae, Triakidae, Sphyrnidae, Echinorhinidae, Hemiscylliidae, Alopiidae, Lamnidae, Centrophoridae, Squalidae and Stegostomatidae. The dominant species in the landings were *Carcharhinus falciformis*(37.25%), *Alopias superciliosus (11.85%), Sphyrna lewini(11.53%), Alopias pelagicus*(8.53%).

Rays: The landing of rays in India during 2016 was 26,211 tonnes, which formed 51% of the total elasmobranch landings of the country. The major families in the landings were Dasyatidae, Mobulidae, Myliobatidae, Gymnuridae and Rhinopteridae

Fig. 6. Landings of rays at Cochin Fisheries Harbour along Kerala coast

Skates/guitar fishes: All India landings of guitarfishes were estimated at 3627 tonnes, which constituted 4% of the total elasmobranch landings of the country.

Fig. 7. Landings of guitarfishes along the Kerala coast

The major families of guitarfishes landed along the coast are Rhinidae and Rhinobatidae.

There are significant changes in the share of sharks and rays to total elasmobranch landings recent years. The all India Production Elasmobranchs during 1999-2010, shows that sharks were dominant in the catch with 49.7% share and that of the rays was 44.5%. However, the landings during 2006 indicate that the rays has emerged as the dominant group with 51% followed by sharks with 45% share.

PERCHES

This group was abundant in the rocky grounds off Kerala and Tamil Nadu and was exploited by drift nets, hooks and lines and traps. All India landings of Perches is 4.07 lakh tonnes and forms 40% of total demersal finfish landings. Among the different groups of perches landed along the Indian coast, threadfin breams were the dominant group with 42% of the total perch landings, followed by bullseyes belonging to the family priacanthidae with 32% share, rock codes/groupers 10%, snappers and pigface breams 3% each and other minor perch groups contributed 10%.

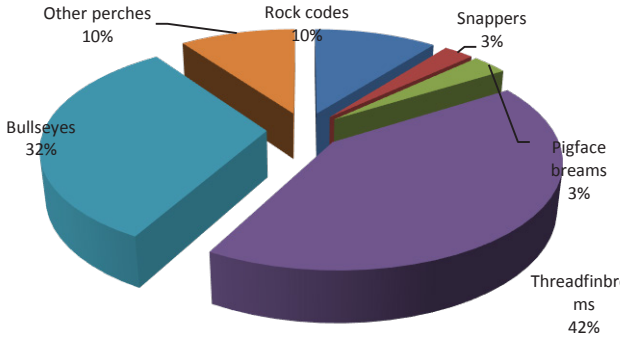

Fig. 8. Composition of different groups to the total perch landings in India

THREADFIN BREAMS

Six species of thredfin breams are known from the seas around India. *Nemipterus japonicus, N. randalli, N. bipunctatus, N. metopias, N. zysron, N. nematophorus, N. tolu.* Among these, *Nemipterus japonicus,*

Fig. 9. Landings of threadfin breams along southwest of India

*N. randalli*are commercially important. Their abundance is influenced by upwelling and are known to move to inshore waters during monsoon period along the west coast. They are Fractional spawners with protracted spawning periods. Spawning in *N. japonicas takes* place during October-April with a peak during October - December along Gujarat. In Kerala, *N. japonicus* and *N. randalli* spawn during monsoon and post monsoon periods with peaks during monsoon in the former and during post monsoon in the latter species. All India landings of threadfin breams in 2016is 1.63 lakh tonnes, forms 17.3% of the total demersal finfish catch in India.

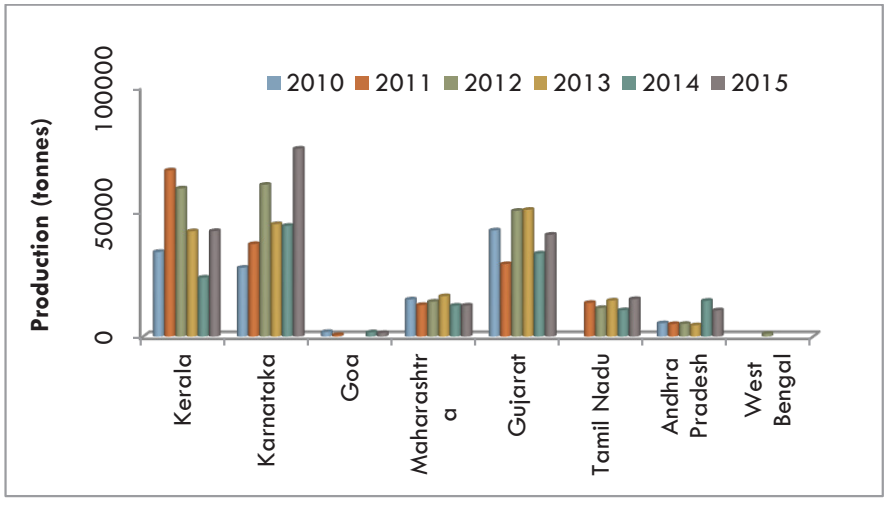

Fig. 10. State-wise trend of threadfin breams during 2012-2016

GROUPERS

Rock cods or groupers are protogynous hermaphrodites, initially maturing as females then reverting to males as they grow in age and size. The major species observed in the landings are *Epinephelus chlorostigma, E. diacanthus, E. areolatus, E. tauvina, E. morrhua, E. bleekeri,*

Fig. 11. Landings of groupers along southwest coast of India

E. longispinnis, Cephalopholis argus, Aetheloperca rogaa, Variola louti. The total landings of groupers during 2016 in India was 42781 tonnes, which formed 10% of the perch landings of India.

SNAPPERS

The major species observed in the all India landings of snappers were *Pristipomoides typus, L. argentimaculatus, Lutjanus gibbus, L. rivulatus, L. bohar*, and *L. lutjanus*. The

Fig. 12. Landings of Snappers at Cochin Fisheries Harbour, Kerala

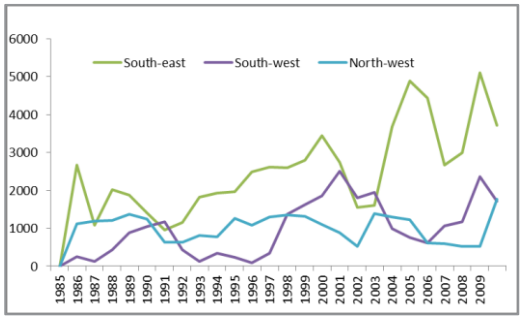

Fig. 13. Region wise distribution of snappers along the Indian coast

catch of snappers during 2016 in India was 10,533 tonnes. Southeast coast of India contributed the majority of landings of snappers in India followed by southwest coast of India.

BULLSEYES

The landings of Bullseyes during 2016 in India was 130740 tonnes, which formed 32% of the total perch landings of the country. They belongs to a single family Priacanthidae. The major species observed in the landings are *Priacanthus hamrur*, *Oookeolus japonicas* and *Priacanthus sagittarius*. From a mere 43,576 tonnes in 2015 its landings of bullseye has been escalated to a three- times-high of 1.3 lakh tonnes during 2016.

Fig. 14. Catch of Bullseye, *Priacanthus* sp

PIGFACE BREAMS

The major species observed in the landings of pigface breams/ emperor breams in India are *Lethrinus mahsena, L. lentjan, L. conchyliatus, L. nebulosus, L. ramak, L. elongatus* and *Lethrinus miniatus*. The landings of Pigface breams in India during 2016 was 12519 t, which formed about 3% of the total perch landings of the country. Southeast coast of India contributed the major share of landings of pigface breams in India.

Fig. 15. Emperor bream/ pigface bream landings along the Kerala

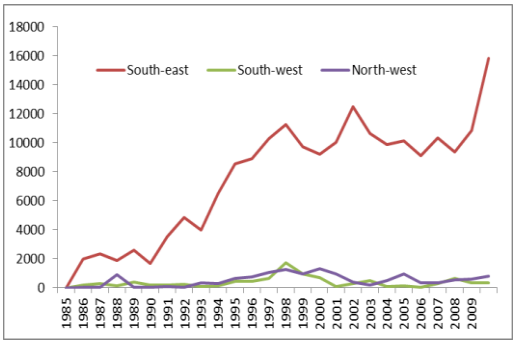

Fig. 16. Region wise distribution of pigface breams in India

LIZARDFISHES

All India landings of lizardfishes is 94, 817 tonnes, forms 8.3% of demersal catch20 - 40 m depth up to 150-200 m depth. The species of lizardfishes landed along the west coast of India are *Saurida tumbil, S. undosquamis, Trachinocephalus myops, Synodus englemani* and that of East coast are *Saurida undosquamis, S. longimanus* and *S. micropectoralis, Saurida tumbil, Trachinocephalus myops, Synodus englemani*. Spawning in *S. tumbil* occurs during September to March off Veraval and Bombay along North west coast; August to November off Cochin.

Fig. 17. Lizardfish landings along the west coast of India

CATFISHES

Catfishes are important demersal resources which have wide distributional range in the Indo-Pacific region. They are distributed all along the Indian coastal waters up to the middle shelf with preferential concentration on muddy grounds of 30-70 m depths. Catfishes migrate both vertically (diurnal migration) and horizontally (seasonal) in small schools to large shoals in response to seasonal climatic / hydrographic variations. Marine catfishes belong to the family Ariidae, of which 11 species appear in the commercial fisheries.

Fig. 18. Catfish landings along the west coast of India

West coast of India landed 70% of the total catfish catch and the east coast 30%, northwest coast landed 90% of the west coast catch. All species of catfishes exhibit parental care - the male carrying the brood (25-120 eggs) in the oro-buccal cavity for 1 to 2 months' time until the juveniles (4-7 cm) are released. After spawning the brooding males segregate into shoals and move along the surface and prefer shallow water. The newly released juveniles of all species of tachysurids live in the shallow muddy grounds feeding on the bottom epi-and in-fauna – become easy target in fishing. The all India landings of catfishes is during 2016 was estimated at 80559 tonnes, which formed 8.9% of demersal finfish catch of India.

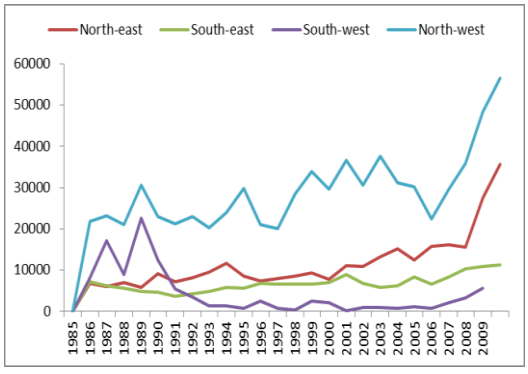

Fig. 18. Catfish landings along the west coast of India

FLATFISHES

These were abundant in muddy and/or sandy bottom up to about 80 m depth belonging to genera such as *Cynoglossus, Psettodes, Pseudorhombus, Bothus, Paraplagusia,* etc. and exploited by trawl nets, gill nets and other artisanal gears. The Commercial exploitation of flatfishes along the Indian coast varies widely with *Cynoglossus macrostomus* dominating in the West Coast and *Cynoglossus macrolepidotus* along the East coast. The Fishery of *Psettodes erumei* showed a decline in recent years. The all India landings of flatfishes during 216 was 43,828 tonnes, which formed 4.7% of demersal finfish catch of India.

Fig. 20. Landings of flatfishes along the southwest coast of India

SCIAENIDS

Sciaenids include high value demersal resources like croakers, which are landed mainly from Gujarat and Maharashtra. The important gears used are trawls and gill nets. These fishes are caught mainly during October - December and January - March. They mainly consist of the species like *Pseudosciaena diacanthus, Otolithes* spp. and *Johneiops* spp. *Protonibea diacanthus, Johniops macrorhynus, Otolithe scuvieri, J. dussumieri, J. glaucus,* and *O. ruber.* All India landings of Sciaenids during 2016 is 1, 57, 793 tonnes, which forms 16.5% of demersal finfish catch of the country.

Fig. 21. Sciaenid landings along the southwest coast of India

POMFRETS

Pomfrets belong to two families, the black pomfret *Parastromateus niger* is coming under the family Carangidae and the silver pomfret *Pampus argenteus* belongs to the family Stromateidae. They are landed abundantly in Gujarat and Maharashtra. The blackpomfret landings in India during 2016 was 13,924 tonnes, and that of silver pomfret was 26,012 tonnes, which formed 3.3% of demersal finfish catch of the country

Fig. 22. Black pomfret (*Parastromateus niger)*

Fig. 23. Silver pomfret *(Pampus argenteus)*

SILVERBELLIES

Silverbellies belonging to the family Leiognathidae. Exploited by trawl nets and artisanal gears, this group formed about 12% of demersal finfishes production.The major species landed along the coast of India are *Leiognathus splendens, L. equlus, Gazzaminuta, L. bindus, L. dussumieri, L. jonesi, Secutor insidiator.*

Table.1. Changes in the scientific names of the silverbellies exploited in India

Previous name	Present name
Leiognathus bindus	*Photopectoralis bindus*
L. blochi	*Nuchequula blochii*
L. edwardsi	*Equulites elongatus*
L. insidiator	*Secutor insidiator*
L. jonesi	*Eubleekeria jonesi*
L. splendens	*Eubleekeria splendens*
L. ruconius	*Secutor ruconius*
L. daura	*L. daura*
L. dussumieri	*L. dussumieri*
L. longispinis	*L. longispinis*

All India landings of silverbellies is 92764 tonnes, which forms 10.4% of demersal finfish catch of India.

WHITEFISH

Fig. 24. Whitefish *Lactarius lactarius* landed along the Kerala coast

This resource is also called butterfish and known to be depleted/overexploited by the mechanised trawl operations along the near-shore waters of west coast of India. Although distributed all along the coastline, it has been supporting notable fisheries along the southwest and southeast regions. All India landings of whitefish is 6,312 tonnes, forms 0.8% of demersal catch *Lactarius lactarius*is the only species available in this family. Whitefish production in India shows wide fluctuation. Shows steady fall except spurt in 1983 and 1985. In Karnataka it fluctuated between a lowest of 37t in 1964 and highest of 2,930 t in 1988. East coast shows a steady decline from 4,738 t in 1960-69 to 888 t in 1990-99. West coast showed an increase from 2,901 t in 1960-69 to 12,354 t in 1980-89 then steep decline to 6,109 in 1990-99.

GOATFISHES

Fig. 25. Goatfish landings along southeast coast of India

This group has three important genera in India, *Upeneus, Parupeneus* and *Mulloidichthys*. These were exploited by trawls and traditional gears mostly in Tamil Nadu, Andhra Pradesh, Kerala, Karnataka and Maharashtra. Dominant species along the east coast of India include *Upneus taenipterus, Upeneus bensasi, Upenues sulphureus, Upeneus sundaicus,*

Parupenus indicus and *U. molluccensis*. All India landings of goatfishes during 2016 was 30,276 tonnes, which formed 3.2% of demersal finfish catch of the country.

EELS

Eels are long-bodied, snake like fishes, having a crevice dwelling or sediment-burrowing mode of life, though some live in the pelagic realm of the open oceans.

Fig. 26. Eels belonging to the family Muraenesocidae landed along the Kerala coast

Traditionally marketable species of eels are caught from conventional fishing grounds of northwest and northeast coasts of India and are largely a by-catch. Pike congers belonging to the family Muraenesocidae occur in tropical waters in the soft bottoms upto 100 m depth and in estuaries. Four species are recorded in Indian waters and they grow to a maximum length of 80 cm (*Congresox talabon*) (Cuvier, 1829), 250 cm (*C. talabonoidies*) (Sleeker, 1853), 180 cm (*Muraenesox bagio*) (Hamilton-Buchanan) and of 80 cm (*M. cinereus*) (Forsskal, 1775).

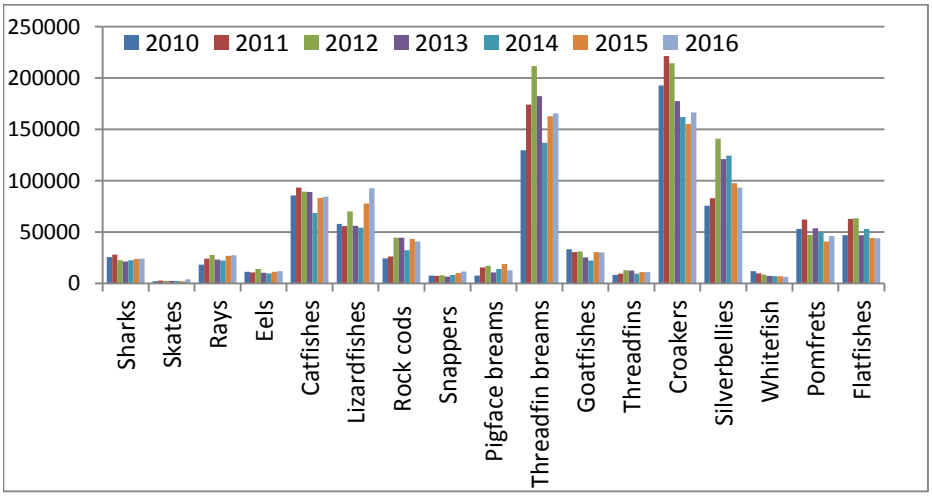

Fig. 27. Trends in the landings of major demersal finfish species during 2010-2016

Regionwise Distribution of Species

Finfishes exploited by trawls belong to 21 major fish groups, which are mostly demersal groups. Each maritime region of India is characterized by dominance of specific demersal finfish groups. Along the northeast (NE) coast, sciaenids, catfishes and pomfrets (74.0% to the demersal landings) are dominant. The southeast coast is characterised by the abundant landings of silverbellies and pigface breams. Along the southwest coast of India, threadfin breams and other perches are the major demersal resources and the northwest coast is characterised by the dominance of sciaenids, catfish, pomfrets and threadfin breams.