



# Sagara Sangamam

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## SOUVENIR - 2009

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**IFCOS - INDIAN FISHERMEN & FISHERIES WORKERS CO-OPERATIVE SOCIETY LTD.**

**SAGARA SANGAMAM  
NATIONAL SEMINAR**

**SOUVENIR  
2009**



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# STATUS, PROSPECTS AND MANAGEMENT OF PELAGIC FISHERIES IN INDIA

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## **Introduction**

India has been one among the top ten fish producing countries of the world since 1960 with its position oscillating between the third and the sixth rank. Currently India occupies the third position contributing about 5% (6.5 million tonnes, including inland and marine fish production) to the world fish production of about 128.8 million tonnes. The marine fish production in India reached a record of 3.15 million tonnes in 2008 due to mechanisation of the crafts, motorisation of the country crafts, commencement of stay over fishing at deeper areas, improvements in gears and related infrastructure facilities which were introduced at

different periods since the late 1950s. Almost 90% of the production were obtained from within 70 m depth covering an estimated area of about 1,00,000 km<sup>2</sup>.

## **Pelagic Fishery Resources**

The pelagic fishes live most part of their life in the surface or subsurface waters. This group exhibits rich species diversity and abundance in the Indian EEZ. Out of the 250 odd species available, only about 60 species belonging to 7 major groups support major and minor fisheries (Table 1). The Indian oil sardine, Indian mackerel and Bombay duck play dominant role in the Indian marine fisheries and together

form about 26% of the total marine fish landings (1999-2008).

**Unique biological characteristics:** The pelagics (except pelagic sharks) are characterized by certain unique combination of biological features, which include formation of large schools, feeding

on plankton or nekton, fast growth rate and short life span (1-4 years). Most of them are either continuous spawners or have prolonged spawning periods with high fecundity. Many of them are migratory and generally show shoaling behaviour.

**Table 1. Details of major families of pelagic fishes and species/groups**

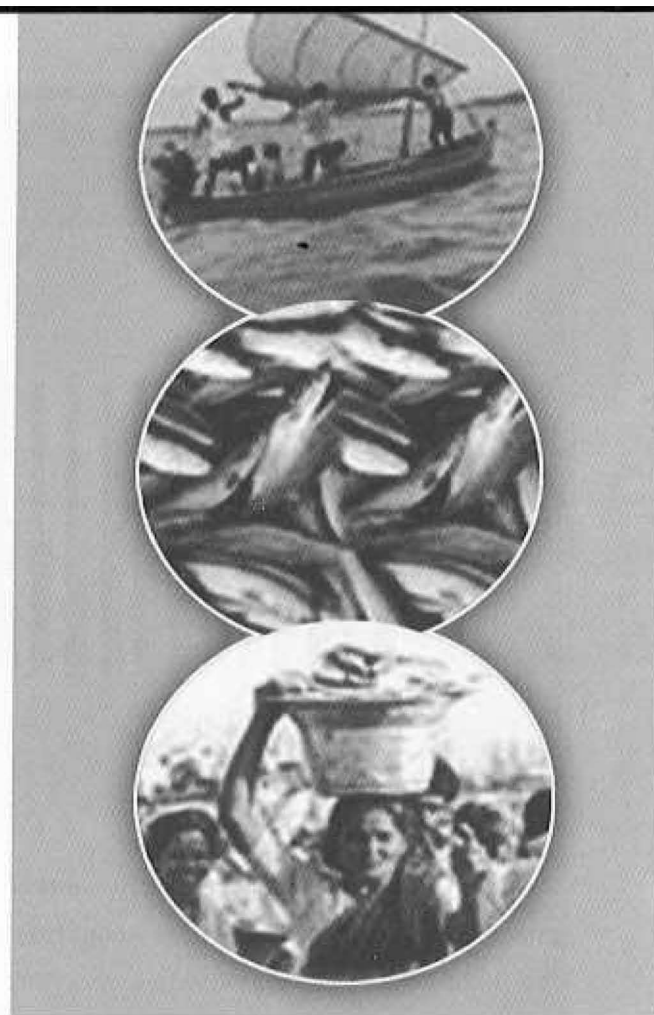
| Family          | Group/species                                    | Species Number |
|-----------------|--|----------------|
| Clupeidae       | Oil sardine*                                     | 1              |
|                 | Lesser sardines*<br>(including rainbow sardines) | 14             |
|                 | <i>Hilsa</i> spp. & other shad                   | 15             |
|                 | Whitebaits*                                      | 24             |
|                 | <i>Thryssa</i> and <i>Thrissocles</i> spp.       | 10             |
|                 | Wolf herrings                                    | 2              |
|                 | Other clupeids                                   | 40             |
| Scombridae      | Coastal tunas                                    | 5              |
|                 | Oceanic tunas                                    | 4              |
|                 | Seerfishes & wahoo                               | 5              |
|                 | Mackerels*                                       | 3              |
| Trichiuridae    | Ribbonfishes*                                    | 8              |
| Carangidae      | Seads*   | 12             |
|                 | Jacks  | 4              |
|                 | Black pomfret                                    | 1              |
|                 | Trevallies                                       | 25             |
|                 | Runners  | 1              |
|                 | Pilot fishes                                     | 1              |
|                 | Leather jackets                                  | 4              |
|                 | Pompanos and darts                               | 6              |
| Harpodontidae   | Bombay-duck*                                     | 1              |
| Stromateidae    | Pomfrets   | 2              |
| Coryphaenidae   | Dolphinfishes                                    | 2              |
| Rachycentridae  | Cobia  | 1              |
| Mugilidae       | Mulletts   | 22             |
| Sphyraenidae    | Barracudas                                       | 7              |
| Exocoetidae     | Flying fishes                                    | 10             |
| Bregmacerotidae | Unicorn cod                                      | 1              |
|                 | Others   | 19             |

### **Mode of exploitation**

Canoes, Pablo type boats, catamarans, trawlers and purse seiners are used in the exploitation of pelagic resources. The gears used are purse seine, shore seine, boat seine, gillnet, drift gillnet, hooks & line, pole & line and *dol* net. Considerable quantities of pelagic fishes are also landed by pair trawlers and high-opening trawl nets operated from the shrimp trawlers as well as gillnets of various mesh sizes operated from motorized/mechanized crafts.

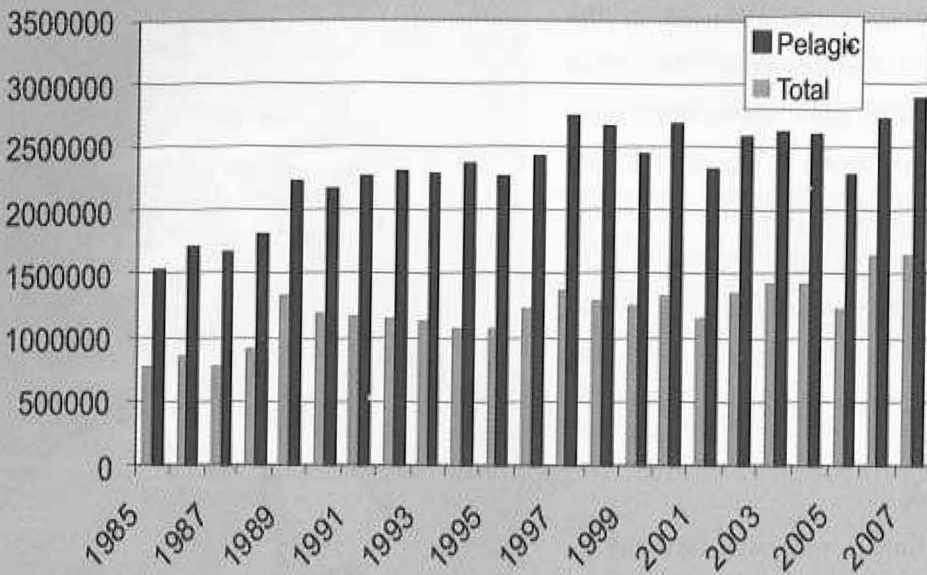
### **Production trends**

Pelagic finfish production during 1985-2008 fluctuated from 0.78 million tonnes (mt) in 1985 to 1.69 mt in 2008 forming 53% of the total marine fish production (Fig.1). Mechanised sector contributed about 53.8% to the total pelagics followed by motorized (38.9%) and traditional (7.3%). 64% of the production of pelagics in 2008 was obtained from the west coast and 36% from the east coast. Out of 250 species that contribute to pelagic fisheries along the Indian coast, only 60 species belonging to 7 groups, oil sardine, lesser sardines, anchovies, Bombay-duck, ribbonfishes, carangids and Indian mackerel form major fisheries. Annual average production of these during 1990-2008 was 1.05 million tonnes; forming 82.6% of pelagics and 42% of total marine fish landings. The other pelagic groups, which include the wolffherrings, shads, barracudas, mullets, seerfishes and



tunas, formed only 17.4% of pelagic fish landings. The groups, which exceeded an average production of one lakh tonne per year (1990-2008) were oil sardine (2.6), mackerel (1.6), carangids (1.6), anchovies (1.3), ribbonfishes (1.3) and Bombay-duck (1.1). The contributions of major pelagic finfish groups in the total marine fish landings were oil sardine (14.5%), mackerel (5.0%), carangids (5.5%), ribbonfish (6.2%), lesser sardine (3.4%), Bombayduck (4.2%), tunas(2.0%) whitebait (2.1%) and seerfish(1.8%) of the total production(Fig.2).

**Pelagic Finfish production in India during 1985-2008**



A comparison of the average annual production of major pelagic finfish groups from the initial stages of mechanization in 1960s through the 80s to 1994 shows an increasing trend with respect to all the groups. Compared to 1960s, the production almost doubled or even trebled with respect to many groups in the 1980s, but since late 1990s catches have stabilized. The increased production in the early eighties could be attributed mainly to the introduction of purse seine fishing, while that of the late eighties and nineties to the motorisation of country crafts, introduction of innovative gears like ringseine and commencement of stay-over fishing. Substantial increase was noticed in the case of anchovies, Bombay-duck, tunas and billfishes till 1992 and that of ribbonfishes and mackerel

till 1993-94 while oil sardine showed tremendous increase in production during the last one decade.

The average annual pelagic fish landings and their percentage contribution (1990 –2008) are given in Table 2. Region wise, the southwest coast (Goa, Karnataka and Kerala) is most productive (41%) followed by the northwest (Gujarat and Maharashtra 25%), southeast (Tamil Nadu, Pondicherry and Andhra Pradesh 23%) and northeast (West Bengal and Orissa 11%). The trend of exploitation of pelagic stocks by the non-mechanised (traditional), motorised traditional and mechanised sectors is given in Table 3.

**Table 2.** Average landings of pelagic finfishes (in t) and their percentage contribution during 1990 – 2008.

| Groups                | Catch(tonnes)    | %    |
|-----------------------|------------------|------|
| Oil sardine           | 262,098          | 20.6 |
| Mackerel              | 164,844          | 13.0 |
| Carangids             | 155,573          | 12.2 |
| Ribbonfishes          | 134,304          | 10.6 |
| Anchovies             | 127,749          | 10.0 |
| Bombay-duck           | 111,067          | 8.7  |
| Lesser sardines       | 94,422           | 7.4  |
| Other clupeids        | 49,248           | 3.9  |
| Tunas and Billfishes  | 46,452           | 3.7  |
| Seerfishes            | 45,246           | 3.5  |
| Hilsa shad            | 28,669           | 2.3  |
| Wolf herring          | 15,572           | 1.2  |
| Barracudas            | 14,891           | 1.2  |
| Other pelagics        | 21,419           | 1.7  |
| <b>Total pelagics</b> | <b>1,271,554</b> |      |

Source: CMFRI

**Table 3.** Sector- wise effort, catch & catch/hr of pelagic groups in respect of non-motorized (traditional), motorized and mechanised units in India during 1999-2008

**Table 2.** Average landings of pelagic finfishes (in t) and their percentage contribution during 1990 – 2008.

|                      | Mechanized | Motorized  | Non-motorized (traditional) |
|----------------------|------------|------------|-----------------------------|
| Catch/hour (kg)      | 37.93      | 25.59      | 10.16                       |
| Total catch (tonne)  | 748,144    | 540,518    | 101,965                     |
| Effort (AFH)(hr)     | 19,722,666 | 21,123,780 | 10,039,011                  |
| Effort(Units number) | 1,059,184  | 4,417,079  | 2,451,107                   |
| Contribution (%)     | 53.8       | 38.9       | 7.3                         |

## Indian oil sardine

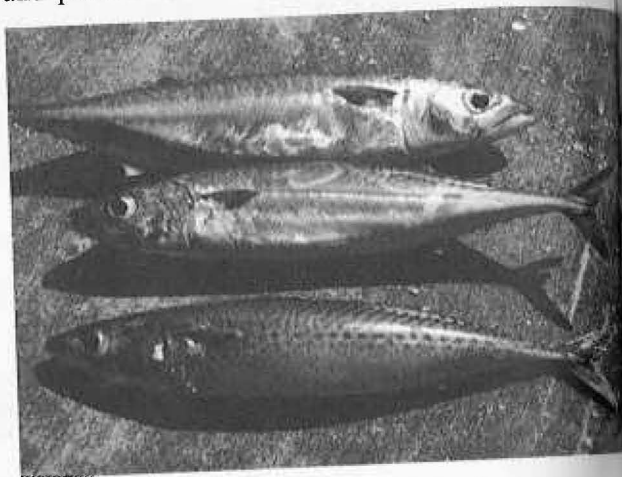


During the last fifty years, all-India production of oil sardine ranged from 14,000 tonnes in 1952 to an all-time high of 4.97 lakh tonnes in 2007; contributing 0.1% to 17.3% to the total marine fish landings in India. The oil sardine catch increased from 78,000 tonnes in 1986 to 279,000 tonnes in 1989 declined to 47,000 tonnes in 1994. The resuscitation of the oil sardine stock after an ever-lowest landing in 1994 manifested from heavy recruitment that followed, which culminated in a highest production of 4.97 lakh tonnes in 2007. The average (1999 to 2003) annual landings of the oil sardine along the west coast were 147,989 tonnes (73 %) and were 53,984 tonnes (27%) along the east coast. However during 2008, oil sardine landings along the west coast were 369,847 tonnes (83%) and were 71,844 tonnes (16%) along the east coast. The success of oil sardine fishery depends on rainfall, food availability, migratory pattern, survival of eggs and larvae, intensity of upwelling and availability and accessibility of shoal to the gear in operation.

### The Indian mackerel

The mackerel fishery comprises a single species viz., *R. kanagurta*. However, *R. brachysoma* and *R. faughni* also are reported to occur in the catches along the east coast. The Indian mackerel showed signs of recovery from

the progressive decline in catches experienced since 2001 when landings were at 88,288 t. Compared to the annual average decadal landings of 1.9 lakh t, the catches in 2008 were 1.77lakh t. Till the 1980s exploitation of the resource in the upwelling areas of the southwest coast of India was mainly restricted to the post-monsoon period by traditional crafts using small surface gears like shore-seine, boat-seine and gillnets made of cotton or hemp up to 20-m depth. With the introduction of motorization and purse seine and ring seines in the early



eighties, the indigenous fishery has undergone a major upheaval with heavy catches of juveniles even during the monsoon period. This large scale exploitation of the juveniles is the key factor which limits the yield from the mackerel stock. Under the present length at first capture (140 mm), maximum sustainable yield from the resource is 2.2 lakh tonnes.

### Anchovies

The average annual catch of anchovies during 1990-2008 was 1.30 lakh tonnes, constituting 10% of the total pelagic fish



production in India. The annual landings ranged from 1.05 lakh tonnes in 1987 to 1.66 lakh tonnes in 1991. Among anchovies, whitebaits were the most important with current (1990-2008) average annual landings of 55,415 tonnes forming 43% of the overall anchovy production of 1.27 lakh tonnes, grenadier anchovy *Coilia dussumieri* and *Thryssa* formed 27% each and *Settipinna* 3%. The whitebaits formed 60% of the southeast coast and 80% of the southwest coast anchovy production. The grenadier anchovy dominated anchovy fishery in the northwest and the northeast regions with an average landings of 34,107 tonnes during 1990-2008.

### Tunas and bill fishes



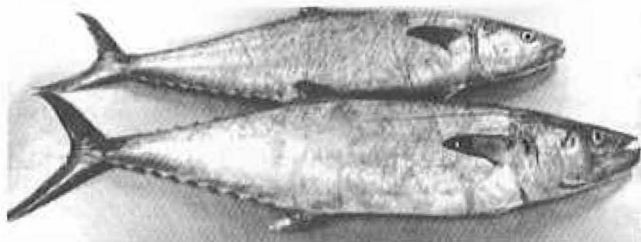
Of the 8 major species of tunas occurring along the Indian coast, five are coastal/neretic and three are oceanic and migratory. The commonly occurring coastal tuna species are *Euthynnus affinis* (little tuna), *Auxis thazard* (frigate tuna), *A. rochei* (bullet tuna), *Sarda orientalis* (oriental bonito), *Thunnus tonggol* (long tail tuna) while oceanic species include *Katsuwonus pelamis* (skipjack tuna), *T. albacares* (yellowfin tuna) and *T. obesus* (bigeye). The drift gill net is operated all along the Indian coast while the purseseine and

the hooks and line are popular off southwest coast. The pole and line and troll lines are operated in Lakshadweep seas targeting skipjack and yellowfin tuna. Tuna production along the mainland coast fluctuated between 30,285 t (1987) and 87,000 t (2008) with an annual average production of 46,450t forming 3.6% of the total pelagic fish production.

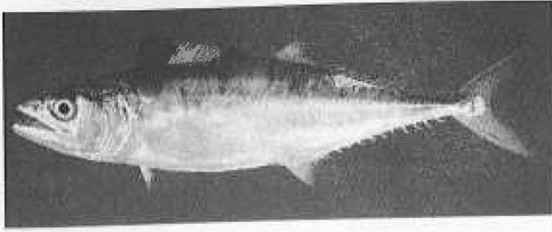
Four genera of billfishes *Istiophorus*, *Makaira* and *Tetrapturus* (family Istiophoridae) and *Xiphias* (family Xiphilidae) occur in the Indian seas.

### Seerfishes

The annual seerfish catch showed an increasing trend during the past five decades with fluctuations ranging from a mere 4505 t in 1953 to an all time peak of 60,000 t in 2007 with the increase along the west coast being remarkable. They contribute just 1.85% of the marine fish production but owing to high unit value are major sources of income for gill net and hooks and line fishermen. Out of the four species viz., the king seer (*Scomberomorus commerson*), the spotted seer (*S.guttatus*), streaked seer (*S.lineolatus*) and the wahoo (*Acanthocybium solandri*), the fishery is sustained by the first two species.



## Carangids



Carangids have emerged as one of the important pelagic fish groups landed by the mechanized sector and the average annual production (1985-2008) was 133,000 t which constituted 4% of the total marine fish production. There are 54 species of carangids occurring along the Indian coast but commercial fisheries comprise mainly of horse mackerel (*Megalaspis cordyla*), round scads (*Decapterus dayi*, *D. macrosoma*), selar scads (*Selar crumenophthalmus*), queenfishes (*Carangoides* spp.), trevallies (*Caranx para*, *C. carangus*, *Selaroides leptolepis*), leatherjackets (*Scomberoides* spp.) and pompanos (*Trachinotus* spp.). The fisheries are mostly seasonal coinciding with the monsoon and largely from 60 - 80 m depths along the mainland coast and 20 - 40 m in Andaman seas. Exploitation is done by a variety of gears such as trawl nets, drift and bottom-set gill nets, hooks and line, shore seines, ringseines and purseseines.

### Ribbonfishes

The ribbonfishes, (hair-tail or cutlass) are widely distributed along the Indian coast and form major pelagic fishery resources of the Indian seas. The average ribbonfish production

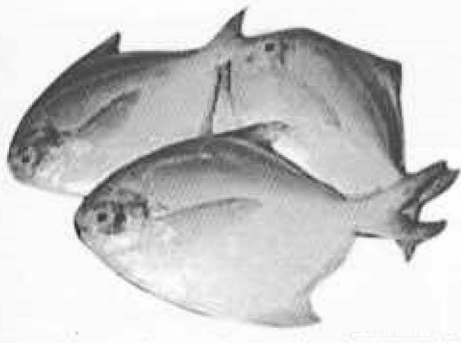
in the 60s was 28,171 t, which increased to 65,360 t during the 80s to 120,461 t during 1990s. The average production during 2001-2008 was 159,352 t. *Trichiurus lepturus* is the dominant species (>95%) in the fishery. Species such as *T. russelli*, *Lepturacanthus savala*, *L. gangeticus*, *Eupleurogrammus muticus* and *E. glossodon* have also been recorded in the Indian waters. The major gears are trawls (70%) followed by the bagnets, gillnets and the purseseines. Nearly 64% of the ribbonfish landed annually in India are exported in frozen form to China, Japan and other southeast Asian countries, the remaining being either routed for the domestic fresh fish market or sun-dried. The development of export market has led to targeted fishing for ribbonfishes and to a certain degree of unsustainable exploitation especially on the east coast, as evidenced from increasing component of juvenile ribbonfishes in trawl landings.



## Bombay-duck

**Bombay-duck** constitutes a fishery of high magnitude along the northwest coast and are conspicuously absent on the southwest and southeast coasts. They form a seasonal fishery on the northeast coast (West Bengal, Orissa and the northern part of Andhra Pradesh). Annual Bombay-duck production ranged from 67,392 t in 1988 to 136,442 t in 1991 with an average of 105,087t. The *dol* nets, gillnets, boatseines and trawls are employed in this fishery. Though *Harpadon nehereus* was the sole contributor along the northwest coast, another species *H. squamosus* (195-214 mm) has been recently recorded off Kakinada on the northeast coast. The Bombay-duck is highly perishable because of its high water content, and hence needs speedy disposal. The bulk of the catch is sun-dried and sold in the interior markets while a small portion is converted into manure. Laminated Bombay-duck are in good demand in some foreign markets.

## Pomfrets



Pomfrets belonging to the family Stromateidae, comprises silver pomfret (*Pampus argenteus*) and the Chinese pomfret (*P.chinensis*) which

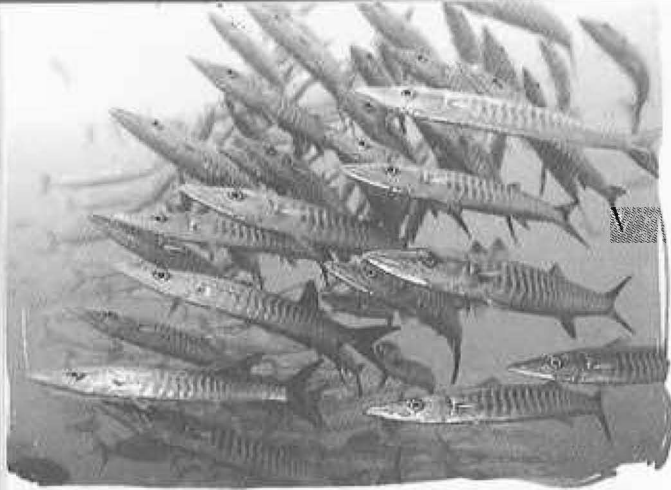
form about 2% of all India marine fish landings(38,000 t). They are highly relished table fishes and command high unit value in internal and export markets. Landings are mainly from Gujarat and Maharashtra on the northwest and Orissa on the northeast coasts. On the northwest coast the principal gear exploiting the adult pomfrets are drift gillnets (140-155 mm mesh size) while the *dol* net essentially exploits the juveniles. As the fishery on the northwest coast collapsed during the 1990s, restriction of *dol* net operations to minimise recruitment overfishing and regulation of gillnets to minimise growth overfishing were recommended as management measures to be urgently implemented. Recently, the CMFRI recommended minimum legal weight (MLW) of 300 g for export of pomfrets have been implemented by the Marine Products Export Development Authority (MPEDA), which can go a long way in ensuring the sustainability of the fishery.

## Hilsa shad and other clupeids

The Hilsa shad (*Hilsa ilisha*) forms a prominent fishery in the northeast coast. During 1999-2008, the annual catch of shad increased from 21,086 t in 1999 to 64,180 t in 2008.

## Barracudas

The barracudas, otherwise known as seapikes are important food and sport fishes of the tropical and subtropical waters. The annual



catch improved remarkably from a meager 4,000t in 1986 to 21,049t in 2008. Four species, *Sphyraena obtusata*, *S.barracuda*, *S.jello* and *S.forsteri* constitute the barracuda fishery in India.

#### Other pelagics

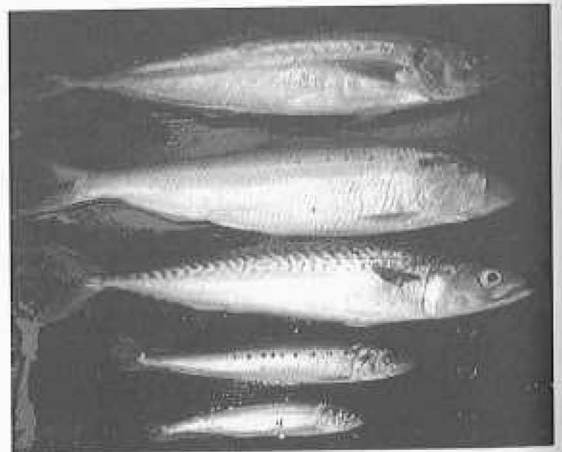
Clupeids such as the wolfherring (*Chirocentrus dorab*), Rainbow sardine (*Dussumiera spp.*), *Escualosa*, *Ilisha*, *Nematalosa*, *Opisthopterus*, *Pellona*, *Reconda*, *Dorosoma*, *Chanos* etc. together form about 1.6 % of the total all India landings. The mullets (*Mugil spp.*) form a fishery mainly in the northwest region, which contributed an annual average of 6056 t during 1999-2008.

#### Research priorities in the management of pelagic fisheries

##### *Impact of environment on pelagic fisheries*

There is strong evidence that annual variations in the year class strength of pelagic fishes in upwelling areas are governed mainly by oceanographic factors such as upwelling intensity, offshore water transport and water column stability and each year the success of pelagic fisheries is a delicate balance between

physical oceanographic factors and effects of fishing on the stock. Seawater temperature, dissolved oxygen levels, salinity, phytoplankton and zooplankton concentrations play a vital role in controlling the distribution and abundance of pelagic fishery resources. Thus, fishery environment data has become crucial to addressing productivity of fishing grounds, annual/long term fluctuations in fish catches and making fishery forecasts. Today, parameters like Sea Surface Temperature (SST) and phytoplankton pigments (Chlorophyll *a*) obtained from satellites are available with agencies like the Indian National Centre for Ocean Information Services (INCOIS) and are used in prediction of Potential Fishing Zones (PFZ).



##### *Fish recruitment dynamics and modelling*

Fluctuations in pelagic fish landings are partly due to recruitment variations. Many of the world's greatest fisheries particularly for pelagics like the sardines have collapsed owing to recruitment failure caused by high fishing pressure on the spawning stock. There is also a

significant influence of environment in determining the recruitment success of pelagic species every year.

### **Future prospects of pelagic fisheries**

As regards pelagic resources, though a progressive trend is noticeable in production of some groups, many of them, especially the oil sardine, mackerel, Bombay-duck, seerfishes, ribbonfishes and coastal tunas have reached the optimum level of exploitation in the conventional inshore fishing grounds. The stock assessment studies conducted for 19 species of exploited pelagic finfishes have shown that the present effort expended is close to or in some cases even exceeded the level of MSY and further increase in effort in the coastal sector would be detrimental to sustain the yield. There are also certain imbalances in pelagic fish landings *vis-a-vis* their potential, especially on the north east coast of India where demersal fisheries especially shrimp trawling is given more importance. There is not much scope of further increase in production from this inshore zone, and hence, the need to bring the outer shelf and oceanic waters into increasing levels of exploitation. The groups, which are expected to contribute significantly to the additional yield from beyond the conventional fishery

zone (outer shelf and oceanic waters), are the whitebaits, carangids, ribbonfishes, barracudas, oceanic tunas, billfishes and pelagic sharks. Besides the above groups, the deeper areas of the oceans contain non-conventional mesopelagic resources, such as file fishes and lantern fishes that can be converted into fish meal. According to a recent observation, the mesopelagic fish fauna in the Arabian Sea is dominated by myctophid fishes. Among them, one species *Benthoosema pterotum* is arguably the largest single species population of fish in the world, with stock estimates ranging upto 100 million tonnes per year. Economically viable technologies could be developed for their commercial exploitation, handling, processing and utilization. However, the fishing activities in the offshore and in the high seas are at present limited since such activities are capital-intensive and require offshore fishing vessels (longliners, purseseiners, midwater trawlers), infrastructures, shore facilities, expertise and skilled manpower. Development of the above facilities for offshore fishing operations, coupled with value added product development, marketing and export would provide the necessary impetus for further development of pelagic fisheries in the country.