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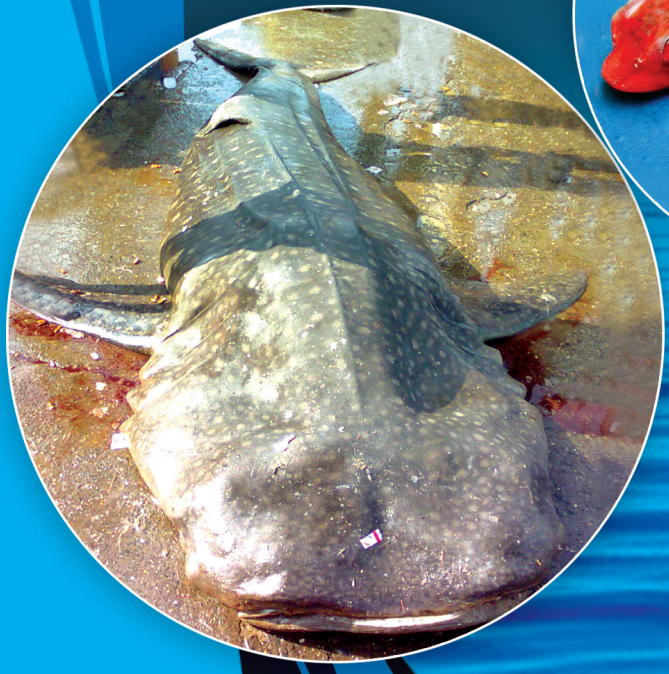

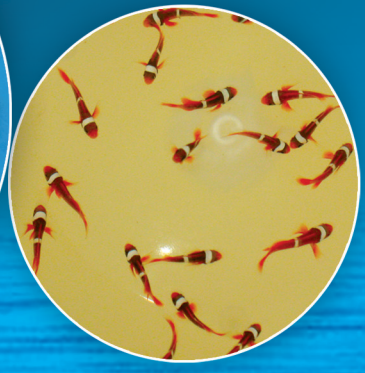

Technical and Extension Series

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Rhincodon typus landed at New Ferry Wharf

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Juveniles of *Amphiprion frenatus*

The Marine Fisheries Information Service : Technical and Extension Series envisages dissemination of information on marine fishery resources based on research results to the planners, industry and fish farmers, and transfer of technology from laboratory to field.

Successful captive breeding and juvenile production of the tomato anemonefish, *Amphiprion frenatus*

K. Madhu and Rema Madhu
Central Marine Fisheries Research Institute, Kochi

The tomato anemonefish *Amphiprion frenatus* belonging to the family Pomacentridae and subfamily Amphiprioninae has very high demand in the marine aquarium industry due to their attractive bright red colouration. The adult *A. frenatus* is bright orange-red in colour, with one white vertical stripe just behind the eyes, joined over the head, whereas the juveniles are dark red, with three vertical white bands and black pectoral fins. They are very hardy and easy to feed as they accept a variety of food, making them a great choice for aquarists. Usually they grow upto 14 cm in length. However, the females grow significantly larger than the males. In nature, they live in association with sea anemone species *viz*., *Heteractis magnifica, Entacmaea quadriolour, Heteractis aurora* and *Macrodactyla dorensis.* They have wide distribution in waters of the Western Pacific from the Ryukyu Islands, Japan to Malaysia and Indonesia, Indo-Pacific to Oceania. Being a protandric hermaphrodite, males are much smaller than females. Considering the importance of this species in marine aquarium trade, captive breeding of the species was attempted. Under captivity, pair formation, broodstock development and breeding of *A. frenatus* have been successfully obtained and its juveniles were produced in the Marine Hatchery of the Central Marine Fisheries Research Institute, Kochi. This is the first report on the captive breeding and spawing of *A. frenatus* in India.

Pairing

The breeding pairs were developed through pair formation experiments. For this, 5-6 numbers of juveniles of different age groups brought from the Andaman & Nicobar Islands were reared in 500 l FRP tanks along with one host sea anemone *H. magnifica*. The fishes and anemones were fed twice daily with wet feeds such as meat of shrimps, mussels and clams at the rate of 10% of their body weight and live feeds like *Brachionus plicatilis* and newly hatched *Artemia* nauplii. In all the tanks, the range of environmental parameters were maintained at optimum level *i.e.*, temperature: 27 to 29 °C, salinity: 32 to 34 ppt, dissolved oxygen: 4.6 to 6.2 ml/l and pH: 8.1 to 8.8. After 3-5 months of rearing, one pair grew ahead of others (Fig. 1) and the pair thus formed were then transferred to broodstock tanks.

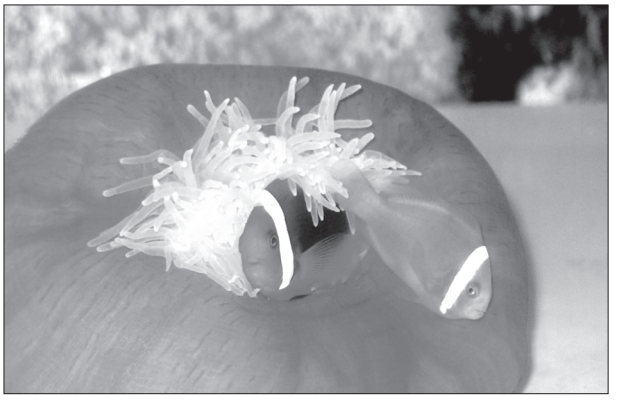

Fig. 1. Adult pair of *Amphiprion frenatus* developed through pair formation

Broodstock development

In the broodstock rearing tanks, the fishes were fed with wet feeds such as cooked mussel meat, shrimps, clam meat, fish egg mass and also provided formulated feeds enriched with vitamins, minerals and algal powder, at the rate of 10% of their body weight supplied at an interval of 3 h during day time whereas at night, they were fed with live feeds such as rotifers and *Artemia* nauplii at the rate of 3 to 5 no./ml after enriching the same with a mixed culture of micro-algae *Nannochloropsis oculata, Cholrella marina* and *Isochrysis galbana*. The environmental parameters were maintained as in the case of pair formation tanks. The water was recirculated to ensure water movement and provided good water quality with the aid of a specially devised filter system during

the period of rearing and once in a week, 25% of the water was exchanged. Broodstock tanks were provided with tiles or earthen pots for egg deposition which also enabled the transfer of egg clutches to hatching tank without mechanical injury.

Breeding behaviour and spawning

Few days prior to spawning, the male selected a suitable site near to the sea anemone for laying the eggs and cleared off the algae and debris with its mouth. On the day of spawing, both the parents spent considerable time for the celaning of site which indicated that spawning may occur within few hours. The spawning was noticed between 0600 hrs and 1530 hrs during day time and the spawning lasted for one hour to one and a half hour. In each spawning, approximately 200 to 600 capsule shaped eggs were laid at an interval of 15 to 30 days, depending on the size of fish. The egg size ranged between 1.2 to 3.0 mm in length with a width of 0.8 to 1 mm. The eggs adhered to the sides of the earthen pot with stalk.

Parental care

As parental care is inevitable for hatching of the larvae, the parents were allowed to remain in the parental tank itself until hatching. During incubation period, both the parents carefully looked after the eggs during day time which involved two basic activities *viz.,* fanning by fluttering the pectoral fins and mouthing to remove the dead or weakened eggs and dirt. No nocturnal care was noticed (Fig. 2).

The newly spawned eggs were red or reddish brown in colour for the initial two days and as the embryo developed, it turned to black from 3rd to 5th day and later turned to silvery on 6th and 7th day of incubation (Fig. 3).

Fig. 2. Male and female *A. frenatus* guarding the eggs

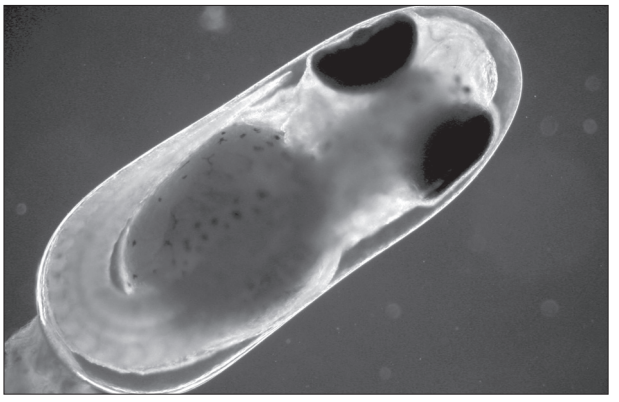

Fig. 3. Embryo inside the egg capsule on 5th day of incubation

At this stage, the glowing eyes of the developing larvae inside the egg capsule were clearly visible when viewed from a short distance. Male assumed nearly all responsibility of caring for the eggs and spent a higher percentage of time at the nest than the females, which increased gradually upto 70% of time as the day of hatching approached. When incubated at a water temperature range of 27 - 29 °C, the hatchlings emerged on completion of 7th day of incubation. Hatching was initiated shortly after sunset.

Hatching and larval rearing

The peak hatching took place after sunset between 1830 and 1930 hrs at a water temperature range of 27 - 29 °C. The newly hatched larvae measured 1.5 - 3.5 mm in length and each had a transparent body, large eyes, visible mouth, and a small yolk sac. The mouth gape of the newly hatched larvae ranged from 300 to 365 µ. The larvae were fed with mixed culture of micro-algae *Chlorella marina* and *Nannochloropsis oculata* (1.5 x10^6 cells/ml) in 1:1 proportion and the rotifer *Brachionus plicatilis* (6 to 8 no./ml) upto 10th day (Fig. 4).

From 11th to 14th day post-hatch, larvae were weaned on to newly hatched *Artemia* nauplii (4 to 6 no./ml) along with rotifer (6 to 8 no./ml) and mixed culture of micro-algae (1.5 x10^6 cells/ml) and on 15th day to 17th day of post-hatch, the larvae were fed with newly hatched *Artemia* nauplii (4 to 6 no./ml). From 15th to 17th day of post-hatch, the size of the juveniles ranged between 10-12 mm and all attained bright reddish colour. Most of the fry resembled

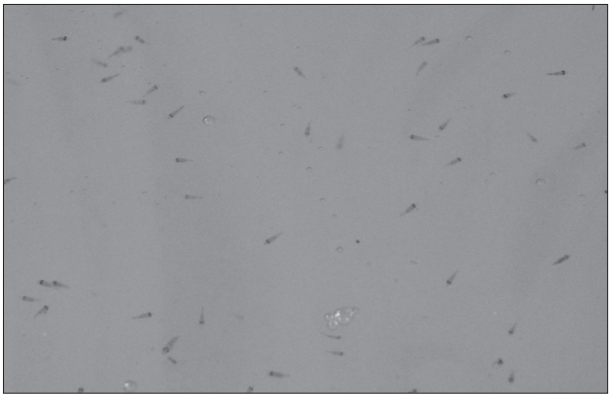

Fig. 4. Ten day old larvae of *A. frenatus* in green water system

Fig. 5. Thrity days old juveniles of *A. frenatus*

juvenile fish and began to shift from partially pelagic to epibenthic, eating minced shrimp, fish flesh, mussel meat, clam meat and formulated diets. Daily 25% of water was replaced with filtered seawater.

Juvenile rearing

Most of the hatchery produced juveniles attained adult colouration and banding pattern at 30 days of post-hatch (Fig. 5).

Under hatchery conditions, with management of water quality and feeding, 85 to 90 % larval and juvenile survival were obtained. Three types of banding patterns were recorded in *A. frenatus* during its different life stages. All the juveniles exhibited three white bands (opercular, middle and tail band). In the sub-adult stage, the tail band completely disappeared and the mid body bar appeared feeble and subsequently disappeared. In the adult stage, all the fishes possessed only single broad white cross bar on head which was found just behind the eyes and it persisted throughout the life cycle. The body is usually black on sides with reddish snout, belly, dorsal fin and tail. The size of the female varied between 90 and 140 mm and that of male between 60 and 70 mm in total length. The growth studies of the hatchery produced juveniles, as well as the standardisation of larval rearing techniques are in progress. The juveniles produced under captivity will be made available to the farmers and traders through seed sale counter at CMFRI, Kochi.

Marine fisheries of the south-west coast of India during 2008

Somy Kuriakose, J. Srinivasan, P. L. Ammini, Haja Najeemudeen, K. P. George, M. R. Beena, M. B. Seynudeen, G. Subbaraman and Sindhu K. Augustine
Central Marine Fisheries Research Institute, Kochi

The south-west region comprising the states of Kerala, Karnataka and Goa with a coastline of 994 km and 7.83 lakh fishermen population, had been the most productive and the largest contributor to the country's total marine fish landings. Marine fish production in this region during the year 2008 has been estimated as 11.11 lakh t, contributing about 34.5% to the all India landings (Fig. 1). Among the different states in the region, the maximum contribution was from Kerala 6,70,100 t (60%), followed by Karnataka 3,30,060 t (30%) and the rest 1,10,508 t (10%) from Goa. Compared to the estimate of 2007, an increase of about 1,02,438 t in landings was noticed in the south-west region.

Major resources

In the south-west region, the pelagic fishes contributed 67%, demersal fishes 19%, crustaceans 8% and molluscs 6.5% of the total landings during 2008 (Fig. 2). The pelagic finfish production in this

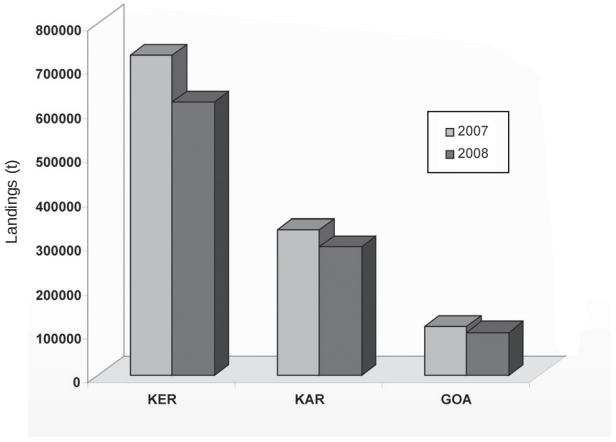

Fig. 1. Estimated marine fish landings in different states of south-west region during 2007 - '08

region increased from about 7.26 lakh t in 2007 to 7.44 lakh t in 2008. Oilsardine (49%), mackerel (15%), *Stolephorus* spp. (9.6%), carangids (7.3%), tunnies (3.4%), and ribbonfishes (4.3%) were the major components of the pelagic finfish production. The landings of the demersal resources have increased from 1.6 lakh t in 2007 to 2.07 lakh t in 2008, the major contributing resources being threadfin breams (35%), lizardfishes (13.7%), croakers (7.9%), soles (9.8%) and silverbellies (5.6%) (Fig. 3). The contribution by crustaceans did not vary much during 2007-'08 in this region, whereas the landings of molluscan resources registered an increase of 37,493 t because of the increased contribution from squids, cuttle fishes and bivalves.

The major resources which contributed to the landings were oilsardine (32.6%), mackerels (9.9%),

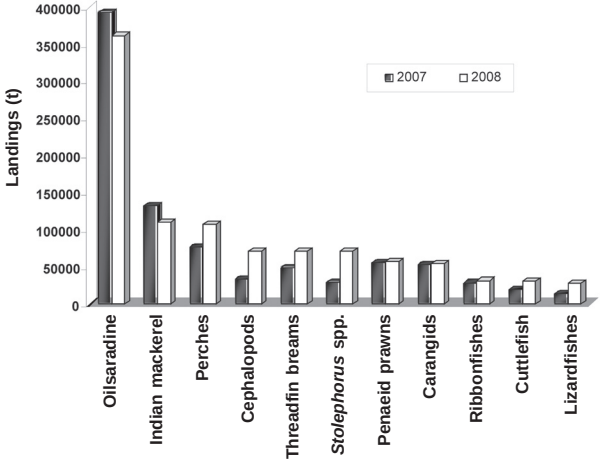

Fig. 3. Landings of major resources along the south-west coast during 2007 and 2008

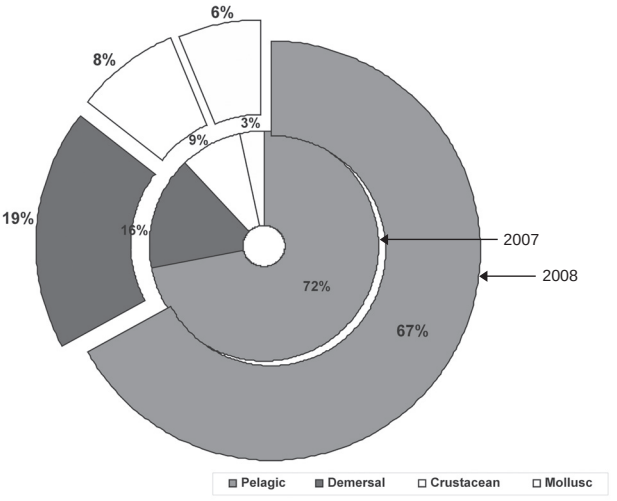

Fig. 2. Components of marine fish landings in south-west region during 2007 and 2008

perches (9.7%), cephalopods (6.4%), threadfin breams (6.4%), *Stolephorus* spp. (6.4%) penaeid prawns (5.2%) and ribbonfishes (2.8%). Considering the diversity of the resources, a total of 270 species were landed in Kerala, 138 in Karnataka and 66 in Goa during 2008.

- Oilsardine being the major resource along the south-west coast contributed 3,61,757 t of which 64% was from Kerala and 22% from Karnataka and the rest from Goa. The landings registered a marginal decline of 31,273 t (8%) compared to 2007. Ringseine was the major gear (63%) of exploitation, followed by purseseine (25%), gillnet (5%) and non-mechanised gears (5%).
- Indian mackerel, another major pelagic resource also showed a decrease during 2008 (1,10,164 t) compared to 2007 (1,32,437 t). Purseseine (35%), ringseine (29%) and gillnets (24%) were the major gears which contributed to the landings.
- An increase of 31,611 t was observed in the landings of perches, the estimate being 1,07,716 t during 2008. The major contribution was from multiday trawlers (87%).
- Cephalopod fishery almost doubled during the year 2008 with an estimate of 71,441 t, Kerala (65%) and Karnataka (33%) being the major contributors.
- The landings of threadfin breams showed an increase of 46% (22,319 t) with an estimate of

71,139 t during 2008, trawlnet being the major gear (97%).

- Penaeid prawn fishery recorded an estimate of 57,391 t, which showed a slight increase of about 1600 t.
- The fishery of *Stolephorus* spp. showed two fold increase during 2008 with an estimate of 70,629 t, the landings during 2007 being 28,764 t.
- Carangid landings was about 54,000 t and not much variation noticed in this fishery compared to 2007.
- The ribbonfish landings was to the tune of 31,228 t and an increase of 2,681 t was noticed.
- A marginal decrease of 4,296 t was noticed in the landings of tunnies during 2008.
- The landings of other sardines also witnessed an increase of 11,674 t with an estimate of 25,758 t for 2008.

Fishing season

Fishing is carried out throughout the year along the south-west coast with an exception of 45 days ban for mechanised vessels during June -July. During 2008, July-September period was the most productive season (32%) followed by October - December period (30%). Compared to 2007, there was a quantum jump in the landings during July-September, in all the maritime states of this region. There was a decline of about 57,000 t during the January-March period as compared to 2007 (Fig. 4).

Sectorwise contribution

The contribution from mechanised sector increased from 58% in 2007 to 65% in 2008, whereas

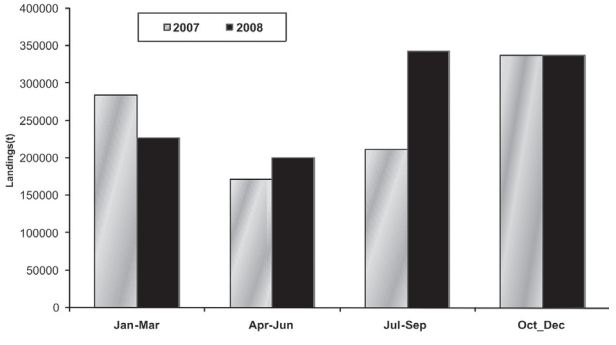

Fig. 4. Estimated marine fish landings in different seasons

contribution from motorised sector was to the tune of 33% and artisanal 2% (Fig. 5). Among the mechanised sector, trawlers (53%), purseseines (23%) and ringseines (20%) were the major contributors. The major gears contributing to the landings in motorised sector were ringseines and gillnets.

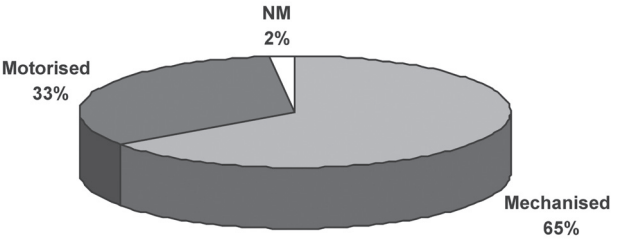

Fig. 5. Sectorwise landings in south-west region during 2008

Major gears

In the south-west region, the major gears which contributed to the landings were trawlnet (34%), ringseine (32.6%), purseseine (15%) and gillnets (8%) during 2008.

The unit operations of the single day trawlers increased from 3,08,834 in 2007 to 3,30,075 during 2008. However, the catch per unit effort (CPUE) had shown a slight decline from 239 kg/unit to 223 kg/unit. In case of multiday trawlers, there was increase both in the CPUE and catch per hour (CPH) during 2008. The major resources caught in trawlnets were threadfinbreams (18%), cephalopods(14.7%), penaeid pawns (10%) ribbonfishes (7.4%) and lizardfishes (7.1%).

Ringseine units mainly focusing on the pelagic shoals were operated from both motorised and mechanised crafts. Oilsardine was the major contributor in both the sectors, followed by mackerels in the mechanised sector and *Stolephorus* spp. in the motorised sector. Though the unit operations of mechanised ringseine had shown an increase from 34,588 in 2007 to 58,959 during 2008, the CPUE registered a slight decrease from 2,843 kg to 2444 kg. Similarly, the unit operations of the motorised ringseines also increased from 1,81,161 in 2007 to 2,17,763 in 2008. However, the CPUE showed a decrease of 295 kg. The CPUE of purseseiners registered a slight increase when compared to 2007, though there was a reduction of 12,298 in the number of units operated.

Marine fisheries of the south-east coast of India during 2008

T. V. Sathianandan, Wilson T. Mathew, P. L. Ammini, K. Ramani, D. Pugazhendi, Sindhu K. Augustine, Lata Khambadkar, S. Sankaralingam, S. Seetharaman and S. Subramani
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The south-east coast of India comprising the states of Andhra Pradesh, Tamil Nadu and Pondicherry have a total coastline of 2050 km which is 34% of the total coastline of the country. This region is more diverse with respect to the number of species that are landed. In 2007, it was observed that 499 species were landed in Tamil Nadu, 294 in Andhra Pradesh and 115 in Pondicherry. The estimate of marine fish landings for the south-east region for 2008 was 6,63,790 t which accounted for 21% of the total landings in the country. Compared to the landings in 2007, there was a marginal increase of about 2% in 2008. The percentage contributions from Andhra Pradesh, Tamil Nadu and Pondicherry were 64%, 34% and 2% respectively. Contribution from the mechanised sector was 3,90,974 t (59%), that from outboard sector was 2,13,891 t (32%) and from non-mechanised sector was 58,925 t (9%).

Major resources

Important groups according to their landings in the region were oilsardine 74,118 t (11%), lesser sardines 72,710 t (11%), silverbellies 53,734 t (8%), penaeid prawns 43,982 t (7%), Indian mackerel 31,067 t (5%), other carangids 26,244 t (4%), ribbonfishes 23,005 t (3%), other perches 18,910 t (3%), other clupeids 18,738 t (3%), croakers 18,312 t (3%), crabs 17,945 t (3%), *Stolephorus* spp. 13,358 t (2%) and goatfishes 13,300 t (2%). The important species/groups that showed significant increase in landings compared to the landings in 2007 were lesser sardines 18%, Indian mackerel 15%, ribbonfishes 70%, lizardfishes 172%, squids 145% and wolf herring 53%. Those that showed decrease in landings were other clupeids 31%, *Stolephorus* spp. 34% and *Scomberomorus commerson* 45%. Contribution by the major groups towards total marine fish landings in the region for 2008 is shown in Fig.1.

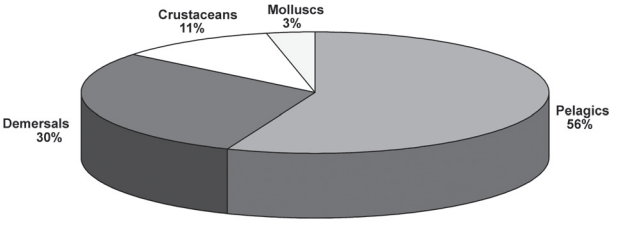

Fig. 1. Groupwise contribution towards total marine fish landings in south-east region for 2008

Major gears

Important gears operated in the region with their contribution were, mechanised trawlnets 1,51,725 t (22.86%), mechanised multiday trawlnets 1,40,563 t (21.18%), outboard gillnets 1,26,079 t (18.99%), multiday sona trawlnets 53,461 t (8.05%), mechanised gillnets 42,423 t (6.39%), outboard purseseines 37,118 t (5.59%) and non-mechanised gillnets 30,101 t (4.53%). Among the mechanised gears, major contributions were from trawlnets, multiday trawlnets and gillnets. Among outboard gears, the important contributions were from gillnets, purseseines, hooks and lines and ringseines. Important gears among non-mechanised sector were gillnets and shoreseines. The overall catch per unit effort (CPUE) for the three sectors were 796 kg $unit^{-1}$ for mechanised sector, 80 kg $unit^{-1}$ for outboard sector and 55 kg $unit^{-1}$ for the non-mechanised sector. In terms of hours of operations, the catch per hour (CPH) for the three sectors were 40 kg h^{-1} for the mechanised sector, 14 kg h^{-1} for the outboard sector and 12 kg h^{-1} for the non-mechanised sector.

Among the mechanised gears, the multiday sona trawlnets had the maximum CPUE per boat which is 2,798 kg unit^{-1} followed by purseseines (2,383 kg unit^{-1}), gillnets (1,617 kg unit^{-1}), multiday gillnets (1,450 kg unit^{-1}), multiday trawlnets (777 kg unit^{-1}) and singleday trawlnets (593 kg unit^{-1}). Among the outboard gears, ringseines had the maximum CPUE of 1213 kg unit^{-1} followed by purseseines (743 kg unit^{-1}) and bagnets (354 kg unit^{-1}). Among the non-mechanised sector the shoreseines had maximum CPUE of 727 kg unit^{-1} followed by boatseines (129 kg unit^{-1}). With respect to catch per hour, among mechanised gear, purseseines had the maximum of 638 kg h^{-1} followed by gillnets (161 kg h^{-1}) and sona trawlnets (62 kg h^{-1}). Among outboard gears the maximum catch per hour was 730 kg h^{-1} for ringseines followed by purseseines (283 kg h^{-1}) and shoreseines (156 kg h^{-1}). Non-mechanised shore seine had maximum CPH of 215 kg h^{-1} followed by non-mechanised boatseine (39 kg h^{-1}) among the non-mechanised sector.

Important species caught by the mechanised sector were silverbellies (12%), oilsardine (11%), penaeid prawns (9%), ribbonfishes (5%) and other carangids (4%). Species mainly caught by the outboard sector were lesser sardines (21%), oil sardine (12%), Indian mackerel (7%), *Euthynnus affinis* (5%) and other carangids (4%). About 26% of the catch by the non-mechanised sector were lesser sardines, 9% Indian mackerel and 7% oilsardine.

Single day trawlnets, multiday trawlnets and outboard gillnets were the gears contributing maximum towards total landings in the south-east region. These gears together accounted for 63% of the total landings. Important species caught in singleday trawlnets were silverbellies (15%), penaeid prawns (6%) and other carangids (5%). In multiday trawlnets, the important species caught were silverbellies (16%), penaeid prawns (12%), oilsardine (8%), croakers (5%), ribbonfishes (4%), lesser sardines (4%) and other perches (4%). Major groups caught in outboard gillnets were lesser sardines (21%), Indian mackerel (9%), oilsardine (6%), other clupeids (5%), crabs (5%) and *Euthynnus affinis* (4%).

Among the important species, oilsardines were mainly caught by gears such as mechanised gillnet (40%), multiday trawlnets (14%), outboard gillnets (10%), outboard ringseines (10%) and outboard purseseines (9%). Lesser sardines were caught in outboard gillnet (36%), outboard purseseines (19%), non-mechanised gillnets (15%), multiday trawlnets (8%), single day trawlnets (7%) and outboard ringseines (5%). Silverbellies were mainly caught by single day trawlnets (41%), multiday trawlnets (41%) and outboard gillnets (9%). Penaeid prawns were caught in multiday trawlnets (38%), multiday sona trawlnets (24%), single day trawlnets (22%) and outboard gillnets (6%). Indian mackerels were caught mainly by outboard gillnets (35%), multiday sona trawlnets (13%), outboard purseseines (13%), multiday trawlnets (10%) and non-mechanised gillnets (8%).

Seasonal variations

In the south-east region, the peak season was July-September and the estimate of marine fish landings during this season was almost the same for both 2007 and 2008 (Fig. 2). Landings were comparatively poor during April-June period and in 2008, the estimate was slightly less than that in 2007 of this period. During January-March and October-December, the landings in 2008 were higher than that in 2007.

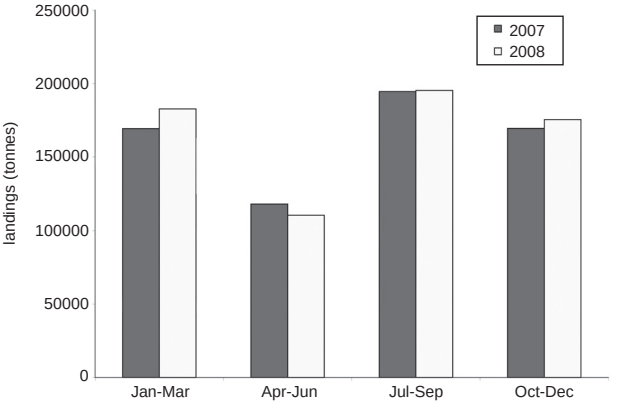

Fig. 2. Total marine fish landings (season-wise), in the south-east region during 2007 and 2008

Marine fisheries of the north-west coast of India during 2008

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The north-west coast hitherto referred as NWC consists of two major coastal states of India *viz*., Gujarat and Maharashtra and the Union Territory, Daman and Diu. Gujarat has the longest coastline amongst Indian states and Maharashtra is known for its major harbours like Sassoon Docks and New Ferry Wharf which make the position and status of this region unique and interesting. Having a long history of mechanised efforts, this region is also well known for its resources like Bombayduck, non-penaeid prawns and pomfrets. Although the coastal stretch is very long, the fishery is conspicuous by its fluctuating intensity with most of the activities centred on big harbours like Sassoon Docks, New Ferry Wharf, Versova, Porbander/Okha, Jhakau and Veraval. Stretches like the southern Gujarat comprising Navsari, Valsad and Surat as well as the coasts of Raigarh and Sindhudurg of Maharashtra are mostly peppered with low intensity landing centres most of which are seasonal too. At the same time the specialised dolnet fishery of Thane and purseseine fishery of Ratnagiri and Bombayduck fishery of Jafrabad, Rajpara and Nawabunder have an aura of uniqueness around them, which is equally fascinating to study.

The estimated marine fish landings of the NWC was 9.5 lakh t in 2008 as against 8.4 lakh t in the previous year. Around two thirds of this quantity is attributable to Gujarat state including Daman and Diu whose tally touched almost 6 lakh t in 2008. The corresponding increase in total unit efforts in the interregnum was 7.6%. Of these, the contribution of the five major harbours are 46% which is a clear indication of the skewed pattern of landings.

Assemblage profile

The extent of contribution attributable to major assemblages to the landings of NWC is depicted in Fig. 1.

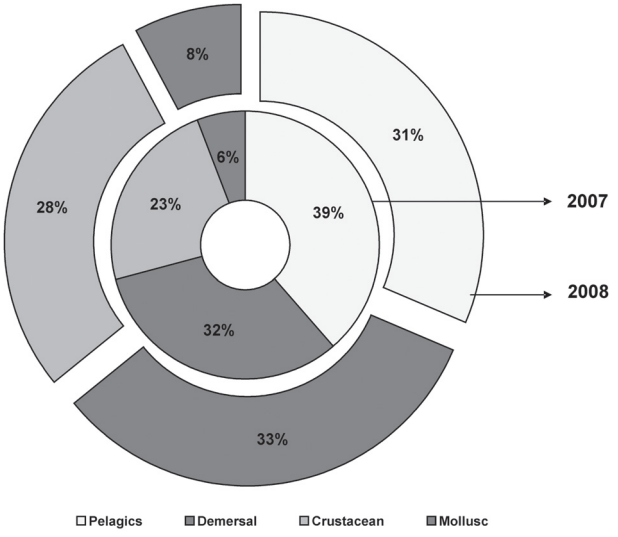

Fig. 1. Groupwise contribution to marine fish landings in the north-west region of India

As is evident from the chart, in 2008 demersal and pelagic resources accounted for more than 60% of the total estimated landings and between them they had equal share. The important crustacean group was slightly behind with 28%. There was a marked dip in the contribution of pelagic resources as compared to 2007. The loss of pelagic contribution had been taken up by crustacean resources which had 5% more stake in 2008 landing spectrum.

Gearwise scenario

Among the most dominant gears, mechanised trawlnet and mechanised dolnet were the standout gears which accounted for more than 80% of NWC landings. Their domination was so complete that none of the eight other gears could make it to the cut. This is one unique feature of NWC which cannot be seen in other zones. Detailed breakup of percentage contribution of various gears for the years 2007 and 2008 attributed to NWC is given in Table 1. Another interesting feature was the persistence of

outboard gears which are very late entrants albeit on a subdued scale. Mechanised trawling predominantly consisted of multiday effort whose catch per hour increased from 36 kg in 2007 to 49 kg in 2008 which amply buttresses the increased contribution by this gear discussed above. The other major gear, mechanised dolnet, however had a different trend. The per unit return of this gear came down by more than 10% from its 2007 estimate of 505 kg per unit to 444 kg per unit in 2008.

Table 1. Gearwise contribution to the landings of north-west region (in percentage)

Gear	2007	2008
Mechanised trawlnet	51.12	54.29
Mechanised dolnet	31.09	26.41
Mechanised gillnet	6.64	5.95
Mechanised purseseine	1.53	1.76
Mechanised bagnet	0.23	0.79
Mechanised hooks and lines	0.11	0.08
Outboard gillnet	7.43	7.36
Outboard bagnet	0.09	1.75
Outboard hooks and lines	0.31	0.27
Non-mechanised gears	1.43	1.21

Seasonal scenario

Traditionally, NWC has two quarters which are virtually undisturbed by fishing regulations and the rest two coming under the influence of seasonal regulations. Fig. 2 showcases the performances of four quarters in the years 2007 and 2008.

As is evident from Fig. 2, the first and fourth quarters had a mixed trend when compared to 2007. While the fourth quarter showed a marginal decline, the first showed some increment. The third season remained undisturbed in the two year period whereas the second quarter landings of 2008 showed notable increase over the corresponding figures of the previous year.

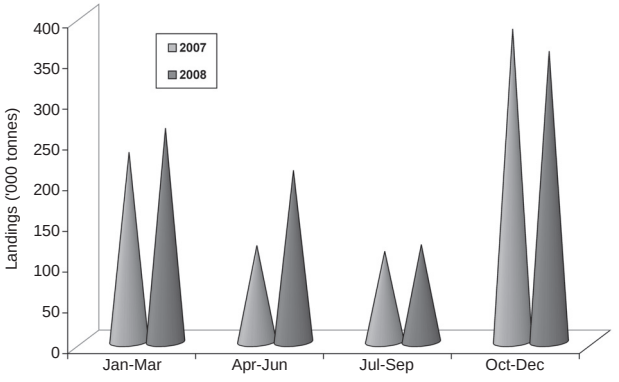

Fig. 2. Seasonwise landings in north-west region

Resource spectrum

The spectrum of resourcewise landing in NWC is depicted in Fig. 3. For comparison, the corresponding landing estimates for the previous year is also given along with.

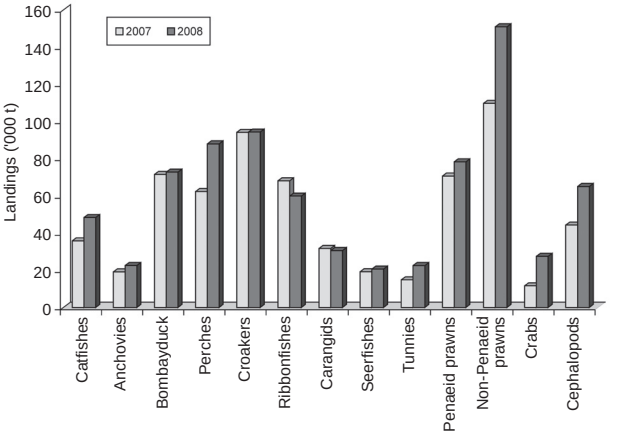

Fig. 3. Major groups landed in north-west region

Non-penaeid prawns have shown a quantum jump in terms of landings in 2008. They not only dominate the inter-resource contribution, but also top the list of those resources which showed an increase corresponding to their 2007 performance. The landings of catfishes, anchovies, perches, seerfishes, tunnies, penaeid prawns, crabs and cephalopods recorded hike of varying degrees in 2008 as compared to 2007. Carangids and ribbonfishes showed decline in the one year period under focus with the latter's fall being more significant. Croakers were landed at the same level in 2008 as they were in 2007.

During 2008, in Maharashtra, there were about 210 species landed of which 70 came under pelagic and 140 under demersal. In the case of Gujarat, about 155 species were landed of which 50 were pelagic and 105 demersal. In the year 2007, the total number of species landed in Maharashtra and Gujarat were 208 and 160 respectively. Another interesting feature is the contribution of independent species in the major groups to which they belong to. Table 2 indicates the major groups and the most dominant species landed under each group in the case of Maharashtra during 2008. The percentage

contribution indicates the proportion in weight of the respective species towards the total weight attributable to the group to which the species is attached. As is evident *Acetes indicus* dominated the non-penaeid prawn group by accounting for about 80%.

Table 2. Major species contributing to their respective groups of importance in Maharashtra

Group	Species	Percentage contribution
Perches	*Nemipterus japonicus*	52.01
Carangids	*Megalaspis cordyla*	42.54
Pomfrets	*Pampus argenteus*	49.66
Seerfishes	*Scomberomorus guttatus*	69.38
Penaeid prawns	*Parapenaeopsis stylifera*	32.38
Non-penaeid prawns	*Acetes indicus*	79.64

A similar analysis carried out for the Gujarat State indicated that among the pomfret species, the silver pomfret contributed overwhelmingly to the tune of 84%, whereas *Acetes* dominated the non-penaeid prawn landings (Table 3). Carangid group also peppered with quite a few species contributing almost equally with *M. cordyla* leading the pack.

Contribution from major harbours

As mentioned earlier, NWC is so dominated by mechanised gears that it can be termed as a trawling hot bed. Naturally, crafts using such gears with higher cost of operation, target fertile and receptive markets. Mumbai being a megapolis fits the bill perfectly.

Table 3. Major species contributing to their respective groups of importance in Gujarat

Group	Species	Percentage contribution
Perches	*Priacanthus cruentatus*	47.05
Carangids	*Megalaspis cordyla*	27.64
Pomfrets	*Pampus argenteus*	83.57
Seerfishes	*Scomberomorus guttatus*	53.60
Penaeid prawns	*Parapenaeopsis stylifera*	32.08
Non-penaeid prawns	*Acetes indicus*	83.42

Three major harbours dot the Mumbai coastline and naturally they show the lion's share in Maharashtra landings. Similarly Gujarat has been served by harbours located at Okha, Veraval and Jakhau. The following table shows the relative contribution of major harbours in 2008.

In Gujarat, Veraval old and new harbours account for about one third of the annual total landings of the state whereas New Ferry Wharf in Mumbai matches it in the context of Maharashtra.

Table 4. Contribution from major harbours in north-west region

State	Harbour	Percentage
Gujarat	Veraval	27.67
	Porbander	17.24
Maharashtra	Sassoon Docks	12.47
	New Ferry Wharf	28.59
	Versova	6.31

Marine fisheries of the north-east coast of India during 2008

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Central Marine Fisheries Research Institute, Kochi

The north-east region of India comprises of the states of West Bengal and Orissa. There are about 100 landing centres distributed in these two coastal states, of which most of them record seasonal fishing. The estimated marine fish landings in this region was 4.83 lakh t in 2008, which formed about 15% of the total 'all India landings'. There was a sharp increase of about 27% in the fish landings in 2008 as compared to 2007. This is mainly due to the significant increase in the number of crafts and gears operated in this region. The state of West Bengal accounted for the largest share in the landings (62%)

and the remainder (38%) was from Orissa. The major harbour in the region is the Paradeep Fishing Harbour. This is situated in the state of Orissa and it accounted for 76% of the state's total landings in 2008.

The proportion in weight of the total marine fish landings accounted by pelagic fish has risen from about 53% in 2007 to over 56% in 2008 (Fig. 1). Demersal fish production also showed an increase from 30% in 2007 to 32% in 2008. Crustaceans accounted for 14%, while molluscs accounted for 1% of the total marine fish landings during 2008. The relative proportions of these two groups have remained more or less similar over the previous year.

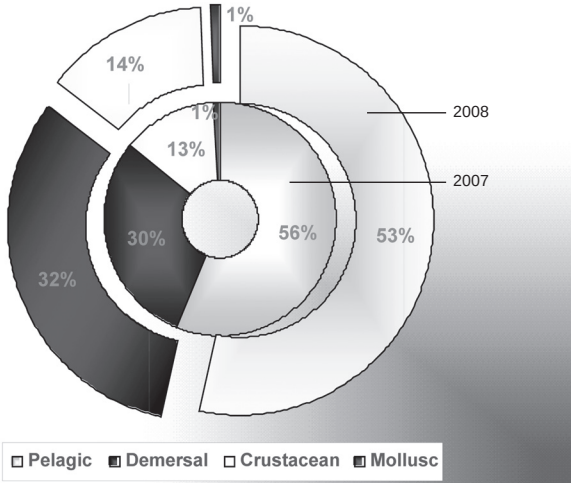

Fig. 1. Groupwise contribution to marine fish landings in the north-east region of India during 2007 & 2008

During 2008, in West Bengal, about 111 species were landed of which 43 species come under pelagic and 44 species under demersal. In the case of Orissa, about 169 species were landed of which 60 are pelagic and 72 demersal. In the year 2007, the total number of species landed at West Bengal and Orissa were 105 and 166 respectively.

Fishing season

The seasonwise marine fish landings showed considerable variations in this region. The fishing season begins by July and extends upto February. The most productive season was October-December and the lean season was from April to June. During January-March, landings increased from 18% in 2007 to 22% in 2008 (Fig. 2). The landings increased from 48% in 2007 to 55% in 2008 during October - December, while from April to June and July to September it decreased from 8% to 4% and from 26% to 19% respectively.

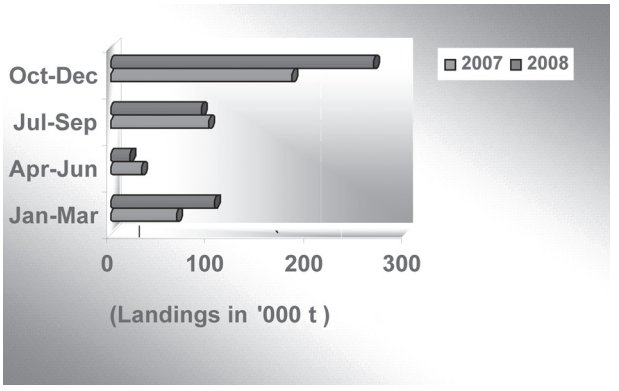

Fig. 2. Seasonwise landings in the north-east region during 2007 & 2008

The north-east region is cyclone prone and is worst affected by cyclones and floods during the south-west monsoon. Cyclones may also occur in May in the inter-monsoonal period. During every year, the cyclones and strong southern winds disrupt the fishing operations in this region.

Sectorwise contribution

During 2008, the mechanised and motorised sectors contributed 80% and 15% respectively, while the non-mechanised sector accounted for the rest 5% of the total landings. The types of crafts commonly used by the fishermen in the mechanised sector are trawlers, gillnetters and bagnetters. Trawlers and gillnetters conducted multiday fishing. Plank-built boats, canoes and catamarans are used in the artisanal sector. The major gears used in the mechanised sector are trawlnet, gillnet, fixed bagnet and hooks and lines. Gillnets, bagnets and hooks and lines were the important gears in the motorised sector. Shoreseine and ringseine operations were also reported from this region.

In the mechanised/motorised sector, among the various gears employed, gillnet contributed 39%, trawlnet 35% and bagnet 11% of the landings. The other mechanised and motorised gears contributed about 6% and 4% respectively (Fig. 3).

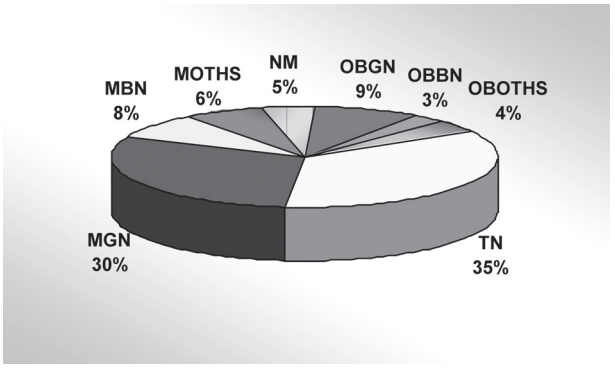

Fig. 3. Sectorwise landings in the north-east region

TN - Trawl net, MGN - Mechanised gillnet, MBN - Mechanised bagnet, MOTHS - Mechanised others, NM - Non-mechanised, OBGN - Outboard gillnet, OBBN - Outboard bagnet, OBOTHS - Outboard others

Most of the trawlers conducted multiday fishing and accounted for 89% of the total trawl landings. The trawl landings showed a 5% increase in 2008 as compared to 2007. The catch per unit effort (CPUE) for trawlers decreased from 3468 kg in 2007 to 3455 kg in 2008. Similarly the catch per hour (CPH) also decreased from 61 kg to 57 kg in 2008. The CPUE of mechanised gillnetters showed an increase of 471 kg in 2008 compared to that of 2007. In the case of artisanal units, CPUE increased from 61 kg in 2007 to 69 kg in 2008.

The trawl landings were dominated by croakers (18%), penaeid prawns (15%), ribbonfishes (11%), other carangids (5%), other clupeids (5%) and goatfishes (4%). Gillnet units were operated from mechanised and motorised crafts and the landings were constituted mainly by hilsa shad (29%), other clupeids (9%), catfishes (7%), Bombayduck (7%) and ribbonfishes (5%). The contribution from gillnet towards total landings was about 1.51 lakh t in 2007 and it increased to 1.88 lakh t in 2008. As compared to the year 2007, all the gears showed marginal improvement in landings during 2008. The bagnet landings from the mechanised boats experienced a reduction of nearly 2000 t during 2008 and the same gear in the motorised sector, showed an increase of 3500 t. Contribution from the artisanal sector remained more or less equal to 5%. The landings by hooks and line were about 15,829 t in 2008 which showed 1% increase as compared to 2007.

Major resources

Among the important groups, hilsa shad was the major component of landings during 2008 and it accounted for 0.54 lakh t forming 11.3% of the total north-east region landings. The other important groups from this region were croakers (11%), penaeid prawns (7%), Bombayduck (6.5%), ribbonfishes (6.4%), other clupeids (6.1%), non-penaeid prawns (6%), catfishes (5.7%), carangids (4.9%) and pomfrets (4.7%). Among the major resources landed, except Bombayduck, all others showed an improvement in the landings during 2008 as compared to 2007 (Fig. 4).

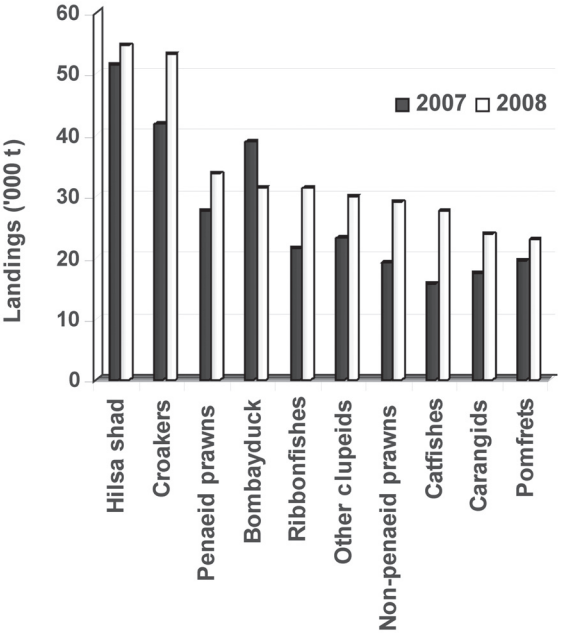

Fig. 4. Major groups landed in the north-east region

Hilsa shad was caught mainly by multiday gillnetters (95%). Croakers were landed by multiday trawlers (67%), bagnetters (14%), gillnetters (13%) and about 3% by non-mechanised units. Penaeid prawns were mainly caught by trawlnets (89%) and about 7% by bagnets. In the case of ribbonfishes, the landings were by trawlers (64%) and by gillnetters (32%). Other carangids were abundant in trawl landings. Goldspotted granadier anchovy and hairfin anchovy are common anchovies of this region and are landed by trawlers. Non-penaeid prawns were mainly caught in bagnets along with their predators, *Harpadon nehereus*. Catfishes, pomfrets and horse mackerel were landed by gillnets.

Unusual heavy landing of rays and skates at Tuticorin Fisheries Harbour

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Tuticorin Research Centre of CMFRI, Tuticorin

Tuticorin coast is known for the rich elasmobranch resources consisting of sharks, rays and skates. However, the landing of the resource was declining over the years. Elasmobranchs are mainly caught by trawlers, hooks and line and gillnets. At Tuticorin Fisheries Harbour (TFH), which is one of the major landing centre along the Gulf of Mannar (GOM) coast, the trawl fishery was excellent when fishing resumed on 30th May 2009 after the 45 day monsoon ban. On 15th of July 2009, unusual heavy landing of rays and skates was noticed (Fig. 1). The landing of rays and skates on this day alone was estimated as 33.3 t consisting of nine species of rays and four species of skates.

Fig. 1. A view of Tuticorin Fisheries Harbour on 15-7-2009

Landing of rays

The fishery was composed of *Himantura bleekeri* (45%), *H. uarnak* (10%), *H. marginatus* (3%), *Dasyatis centroura* (4%), *Pastinachus sephen* (9%), *Aetobatus narinari* (10%), *Mobula mobular* (11%), *Rhinoptera javanica* (7%) and *Gymnura poecilura* (1%). On enquiry, it was understood that, fishing was carried out at 29 fathom (52 m) depth, off Tuticorin. The fishing voyage started at 0500 hrs reaching the fishing area after 3-4 h of voyage. The boats carried out 4-6 hauls, each lasting for 1.5-2 h and returned to the landing centre by 2200 hrs and continued till 0300 hrs on the following day. The total fish landing during the observation day at TFH was estimated as 340 t by 207 boats and the rays constituted 6.6% of the total landings (Table 1).

Landing of skates

Nearly 10.7 t of skates (wedgefishes and guitarfishes) were landed on the same day by few trawlers and four species were identified in the

Table 1. Landings, length range and sex ratio of rays landed at Tuticorin Fisheries Harbour

Species	% in catch	Nos. landed	Total quantity (kg)	Length range (cm)	Sex ratio (M:F)
Family Dasyatidae (Sting rays)					
Himantura bleekeri	45	198	10168	59-106	73-27
Himantura uarnak	10	33	2260	67-109	64-36
Himantura marginatus	3	12	678	42-69.6	69-31
Dasyatis centroura	4	12	904	67.9-97	68-32
Pastinachus sephen	9	27	2033	94-125	91-9
Family Myliobatidae (Eagle rays)					
Aetobatus narinari	10	34	2260	113-172	78-22
Family Mobulidae (Devil rays)					
Mobula mobular	11	36	2486	162-220	81-19
Family Rhinopetridae (Cownose rays)					
Rhinoptera javanica	7	19	1582	141-166	83-17
Family Gymnuridae (Butterfly rays)					
Gymnura poecilura	1	30	226	36-47	69-31

landings. The percentage composition and other details are given in Table 2.

Table 2. Landings, length range and sex ratio of skates landed at Tuticorin Fisheries Harbour

Species	% in catch	Nos. landed	Total quantity (kg)	Length range (cm)	Sex ratio (M:F)
Family Rhinidae (Wedgefishes)					
Rhina ancylostoma	27.1	65	2900	117-136	90-10
Family Rhinobatidae (Guitarfishes)					
Rhinobatos granulatus	43.2	506	4620	52-79	86-14
Rhinobatos obtusus	19.2	118	2050	49-72	79-21
Rhinobatos annandalei	10.5	210	1125	53-82	84-16

Price structure and marketing

The fishes were sold at the landing centre at Rs. 25-60 /kg for rays, Rs 10-15/ kg for guitarfishes and Rs. 40-50 /kg for wedgefishes. The fins of *Rhina ancylostoma* was sold for Rs.500-1000 /kg. On enquiry, it was understood that the fishes would be taken to Kayalapattinam, salt cured for 2-3 days after removing the head and later sundried. The processed meat is transported to Kerala where its flesh has good demand in dried condition. The dried fish will be sold for Rs. 80-100/kg. The main use of the fins is as raw material for medicinal purpose.

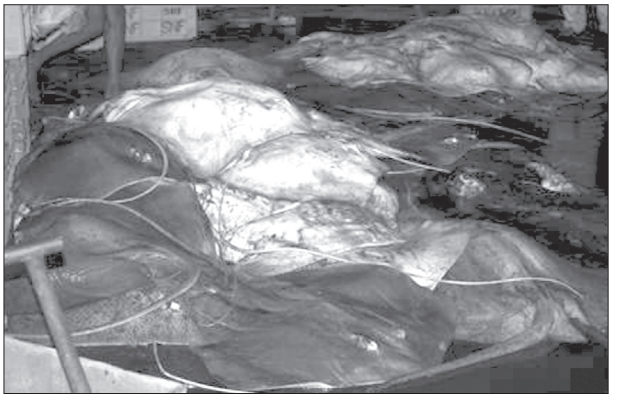

Fig. 3. Rays being taken for auctioning

Fig. 2. Skates kept onboard the trawl boats on 15-7-2009

Fig. 4. Removing the skin of ray for manufacture of leather chappal

The present landing of nine species of rays belonging to four families and skates belonging to two families indicate that the Tuticorin coast is rich in batoid fish diversity. On an average 1,334 t of rays are caught annually by trawlers, hooks and line, bottom-set gillnet and driftnet at Tuticorin (Arumugham and Balsubramanian, 2007). They have stated that all the body parts of rays are processed for value added products like ladies' bags, belts and fancy items. The rays and skates are bottom dwelling fishes and are important part of the marine ecosystem. They are facing overexploitation in several parts of the world. They are mainly predators with slow growth rate, late onset of sexual maturation and produce less number of offsprings. Rays and skates are similar to sharks in having life history strategy that make them vulnerable to overexploitation. A few targeted or by-catch batoid fisheries had been impaired by overexploitation of the breeding stocks (Compagno, 1999). Only in the past few years,

there has been widespread concern about the catch trend in batoid fishes worldwide. The skate *Rhynchobatus djiddensis* is included in the IUCN red list under endangered species and is banned from catching. Concern about the vulnerability to overexploitation have lead to Western Australian commercial fishing boats being prohibited from catching rays and skates except very few boats that have license for fishing these animals. The ban will help to reduce the capture of on-at risk species and assist the recovery of a range of other species that are likely to be overfished. The unregulated landing of batoid fishes at Tuticorin may lead to a situation like this, which points to the need for regulation of the fishery in the Gulf of Mannar.

Occurrence of *Octopus dollfusi* Robson 1928 in Maharashtra waters

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Octopus fishery is gaining momentum in India especially along the north-west coast. The major centres in Mumbai where octopi are landed by trawlers are New Ferry Wharf, Sassoon docks and Versova. Cephalopods comprise about 10.5% of trawl landings of Maharashtra with octopus contributing 7.1% (CMFRI, 2006). *Cistopus indicus* dominates the octopus fishery in Mumbai waters (Sujit Sundaram and Sarang, 2004).

Apart from *C. indicus* and *Octopus membranaceus*, *Octopus dollfusi* (Fig. 1) commonly called as 'marbled octopus' is also observed regularly at New Ferry Wharf. This octopus is a benthic species living in shallow waters. It is distributed along Indo-China and Hong Kong (Roper *et al.*, 1984).

The important distinguishing characters of *O. dollfusi* are elongated oval mantle and inconspicuous eyes. The arms are moderately long and stout with the dorsal arms being the shortest.

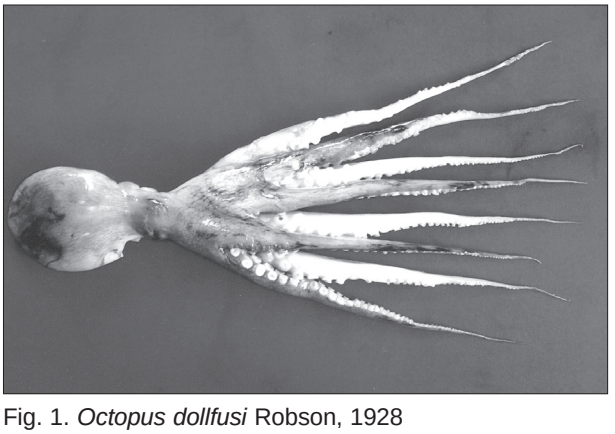

Fig. 1. *Octopus dollfusi* Robson, 1928

The mantle, head and arms are covered dorsally with numerous large reticulate warts, with each unit bordered by a darkly pigmented line. Some of the larger suckers at the base of the arms are bluish in colour.

In Mumbai, the species occurred among other species of octopus during December-May. The depth of fishing operation was about 30-40 m, 70-80 km off the north-west coast. The mantle length of the species landed at New Ferry Wharf ranged from 50 to 90 mm during December - March while larger specimens upto 120 mm were observed during April - May. According to Roper *et al*. (1984), the maximum mantle length of this species is 90 mm. Among the 18 specimens analysed, only two were females. Majority had guts with 'trace' and 'empty' condition and the food was in finely macerated condition. The species was found to mainly feed on 'prawns' followed by 'fish'.

Sarvesan (1969) made some observations on the brooding behavior of this species. Meiyappan and Mohamed (2003) recorded occurrence of this species along Chennai and Cochin coasts. According to Kripa *et al*. (2000), *O. dollfusi* contributed to about 3% of the octopus fishery in Cochin while in Mumbai waters it contributed only 1%.

Earlier, octopus resources were exported. However, due to the opening of many Chinese restaurants in Mumbai recently, local demand for octopus has emerged, fetching moderately high price. The cost of *C. indicus* is Rs. 60/kg while *O. dollfusi* fetches Rs. 40/kg at the landing centres.

Record landings of cephalopods by trawlers at Veraval during first quarter of 2009

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Veraval Regional Centre of CMFRI, Veraval

Cephalopods represent one of the most important exploited marine fishery resources at Veraval. The cephalopod landings in Gujarat increased by more than two folds from 0.234 lakh t in 2002 to 0.49 lakh t in 2006 (Mohanraj *et al*., 2009), with a concomitant increase in catch rate from 5.05 kg h^{-1} in 2003 to 14.74 kg h^{-1} in 2006. The cephalopod resource was constituted mainly by *Loligo duvauceli*, *Sepia pharaonis* and *S. aculeata.* The cephalopod landing in the pre-monsoon period was dominated by *L. duvauceli* but during the post-monsoon period it was dominated by *S. aculeata*. The dominance of *L. duvauceli* in the pre-monsoon period and that of *S. aculeata* in the post-monsoon period was because of the shift in fishing grounds by trawlers from near shore to off shore areas in the post-monsoon period. An alarming nature of the fishery was the large scale capture and export of juvenile squids mostly measuring less than 5 cm, commercially called nipple squids, which is a threat to the sustenance of the fishery.

During the first quarter of 2009, record landings of cephalopods to the tune of 5,692 t by trawlers at Veraval were recorded (Fig. 1). There was an increase by 41% when compared to 4,038 t landed in the first quarter of 2008. The catch in the month of January increased by more than two fold from 794 t in the previous year to 1945 t in the present year (Table 1). During the month of February, the catch increased by almost three fold from 679 t in 2008 to 1,843 t in 2009 (Table 1). The species dominating were *Octopus* sp., *Sepia pharaonis*, *Sepiella inermis* and *Loligo* sp. (Fig. 2 and 3). However in the month of March, the catch decreased when compared to the previous year. The catch in the month of March was 2,565 t during 2008 and 1,904 t during 2009 (Table 1). This decrease in catch in the month of March was mainly attributed to the decreased landings of *L. duvauceli* in the present year.

Fig. 1. Bulk landings of cephalopods by trawlers at Veraval

Similar scenario was observed in catch rates too. The catch per effort of *Loligo* sp. in the month of January and February increased from 3.6 kg h^{-1} and 6.4 kg h^{-1} in 2008 to 5.2 kg h^{-1} and 7.9 kgh^{-1} in 2009. However in the month of March, it decreased from 13 kgh^{-1} in 2008 to 8.3 kgh^{-1} in 2009. The catch per effort of other cephalopods during January-March

Table 1. A comparison of the cephalopod landings by trawlers at Veraval during the first quarter of 2008 and 2009

Species	January				February				March			
	2008	2009	Difference	%	2008	2009	Difference	%	2008	2009	Difference	%
Loligo sp.	580860	882107	448753	85.86	580475	1272269	691994	119.18	2312576	1218117	1094459	-47.33
Sepia pharaonis	44089	107034	62945	142.77	7080	33683	26603	375.75	9038	41811	32773	362.61
Sepiella inermis	8154	62040	53886	660.85	14919	73388	58478	392.21	200928	484684	283756	141.22
Octopus sp.	666	236640	235974	35531.53	1250	102830	101580	8126.4	15204	120350	105146	691.57
Other species	160104	657643	497539	310.76	75110	360869	285759	380.45	27491	39255	11764	42.79

Fig. 2. Specieswise segregation of cephalopods at Veraval Fisheries Harbour

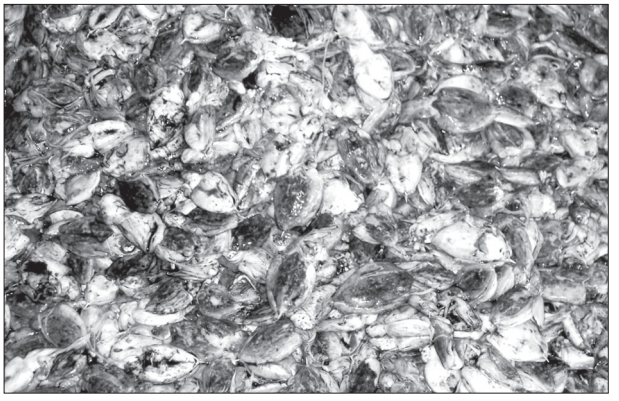

Fig. 3. Landings of *Sepia aculeata* by trawlers in February '09 at Veraval

also increased tremendously in the current year as compared to previous year (Table 2).

The reduction in the catches of high value penaeid shrimps and increased demand for cephalopods has resulted in trawlers extending their operation to deeper waters and increasing the number of fishing days per trip. The operation of multiday trawlers (5 - 8 days) in deeper unexploited waters (80 - 100 m) for cephalopods has resulted in this huge increase in catch for the first quarter of 2009. GPS (Garmin, USA) data collected from multiday trawlers revealed that fishing for cephalopods was carried out between Lat. 20° 57' to 21° 30' N and Long. 57° 49' to 69° 03' E. The high incidence of berried cephalopod females in the catch could give an indication that the fishing ground would be a probable breeding ground for cephalopods.

Table 2. Catch rates of cephalopods landed by trawlers at Veraval during the first quarter of 2008 and 2009

Species	January				February				March			
	2008		2009		2008		2009		2008		2009	
	C/U	C/hour	C/U	C/hour	C/U	C/hour	C/U	C/hour	C/U	C/hour	C/U	C/hour
Loligo sp.	120.49	3.57	155.11	5.19	196.77	6.43	213.83	7.91	402.89	13.01	234.43	8.34
Sepia pharaonis	9.15	0.27	18.82	0.63	2.4	0.08	5.66	0.21	1.57	0.05	8.05	0.29
Sepiella inermis	1.69	0.05	10.91	0.37	5.05	0.17	12.33	0.46	4.79	0.16	7.55	0.27
Octopus sp.	0.14	0.004	41.61	1.39	0.42	0.01	17.28	2.24	2.65	0.09	23.16	0.82
Other species	33.21	0.98	115.64	3.87	25.46	0.83	60.65	0.64	35	1.13	93.28	3.32

Accidental capture and landing of whale shark, *Rhincodon typus* (Smith, 1828) and tiger shark, *Galeocerdo cuvier* (Peron and Le Sueur, 1822) by trawlers at New Ferry Wharf, Mumbai

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Rhincodon typus commonly known as whale shark is a pelagic species. Though whale shark is the largest fish, it mainly feeds on plankton. They are locally called as 'dev mushi' or 'bhari' in Maharashtra. Whale shark is listed as an endangered species by the International Union for Conservation of Nature and Natural Resources (IUCN Red List, 2000) and is also included in the Appendix II of CITES since 2003. There is no regular fishery for this species in India except in Gujarat. They are

occasionally trapped in different gears such as trawlnet and gillnet.

A female whale shark measuring 3.1 m and weighing approximately 0.4 t was caught by a trawler from a depth of 45-65 m and was landed at New Ferry Wharf on 23-03-09 (Fig. 1 and 2). The present report is probably the smallest recorded specimen of whale shark from Maharashtra waters. The auction that followed realised an amount of Rs. 10,000/-. The liver was removed for extracting oil and the rest of the body was utilised for salt curing.

Fig. 1. Lateral view of whale shark, *Rhincodon typus* landed at New Ferry Wharf

Fig. 2. Front view of *R. typus* landed at New Ferry Wharf

A female *Galeocerdo cuvier* commonly called as tiger shark and locally known as 'waghbeer' in Maharashtra was landed by a trawler at New Ferry Wharf on 17-01-09 (Fig. 3 and 4). It was caught from a depth of 45-65 m. Usually they occur upto depths of 140 m.

Fig. 3. Dorsal view of the tiger shark, *Galeocerdo cuvier* landed at New Ferry Wharf

Fig. 4. Ventral view of *G. cuvier* landed at New Ferry Wharf

The tiger shark which measured 4.2 m in total length, is probably the largest record from Maharashtra waters and weighed approximately 1.1 t. The auction realised an amount of Rs.26,000/-. The fins fetched a very high value.

Earlier records of landings of whale sharks and tiger sharks from Maharashtra waters are given in Tables 1 and 2.

Table 1. Records of landings of whale shark from Maharashtra waters

Date of capture	Landing centre	Gear	Depth of capture (m)	Total length (m)	Weight (t)	Reference
08-01-80	Cuffe parade, Mumbai	Gillnet (Tarti jal)	13	7.6	--	Karbhari (1986)
21-11-83	Cuffe parade, Mumbai	Gillnet (Wagra jal)	33	12.2	11.0	Karbhari and Josekutty (1986)
10-11-85	Cuffe parade, Mumbai	Gillnet	30	5.0	5.0	Shriram (1986)
21-02-92	Makarabagh, Malvan	Trawlnet	40	5.0	0.5	Maikar (1992)
16-03-93	Cooperage, Mumbai	Gillnet	--	6.7	3.7	Shriram *et al*. (1994)
30-09-95	Madaban, Ratnagiri	Stranded	--	20.8	--	Katkar (1996)
21-12-99	Dakti, Dhanu	Gillnet (Wagra jal)	40	6.3	1.8	Kamble and Rane (2001)
23-12-04	Versova, Mumbai	Trawlnet	45-65	10.6	2.0	Jadhav *et al.* (2005)
23-03-09	New Ferry Wharf, Mumbai	Trawlnet	45-65	3.1	0.4	Present report

Table 2. Records of landings of tiger shark from Maharashtra waters

Date of capture	Landing centre	Gear	Depth of capture (m)	Total length (m)	Weight (t)	Reference
20-04-85	Cruise trip off Maharashtra (6 specimens caught)	Hook and line	300	2.0-3.8	up to 0.1	Arvindakshan (1988)
25-02-03	Sasoon Docks, Mumbai	Gillnet	30-35	4.1	1.1	Katkar and Kamble (2003)
13-09-03	New Ferry Wharf, Mumbai	Trawlnet	40-45	3.9	--	Shriram and Katkar (2004)
16-09-03	New Ferry Wharf, Mumbai	Trawlnet	40-45	4.1	--	Shriram and Katkar (2004)
04-03-04	Sasoon Docks, Mumbai	Gillnet	25-30	3.7	0.2	Josekutty *et al.* (2004)
16-03-04	New Ferry Wharf, Mumbai	Gillnet	30-35	3.4	0.3	Josekutty *et al.* (2004)
23-03-09	New Ferry Wharf, Mumbai	Trawlnet	45-65	4.2	1.2	Present report

Unusual landing of *Protonibea diacanthus* at Okha, Gujarat

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Protonibea diacanthus locally known as 'ghol' were landed by multiday trawlers operating 50 - 60 km away from Okha (Jakhau) at depths of 60 - 70 m for 5 - 6 days. On 14.10.08, 210 nos. (4165 kg) and on 15.10.08, 165 nos. (2500 kg) were landed. Their length ranged from 75 - 150 cm. Majority of the catch (80%) had length of 120 cm. The average weight was 20 kg fetching a price of Rs. 500/kg. The total value of the catch on the first day was approximately Rs. 20 lakhs and on the second day Rs. 12.5 lakhs.

Fig. 1. *Protonibea diacanthus*

Landing of 'flying gurnard' in Mumbai

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On 8th May 2009, about 20 fishes with striking colour pattern were landed at Sassoon Docks in Mumbai. They were caught by a trawler operating at 70-100 m depth off Mumbai. Four specimens were brought for identification at the Mumbai Research Centre of CMFRI. The species was identified as *Dactyloptena peterseni* (Nystrom, 1887). The species belonging to the genus *Dactyloptena* have no fishery importance. If caught incidentally, they are marketed as fresh but rarely used as food. They are mostly used in marine aquarium, especially *Dactyloptena orientalis*.

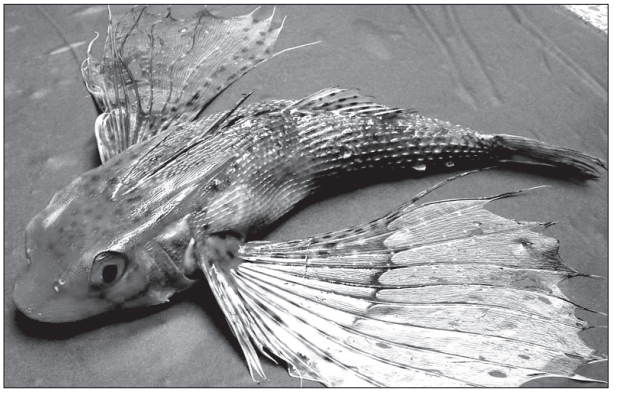

Fig. 1. Flying gurnard *Dactyloptena peterseni* (Nystrom, 1887) landed at Mumbai