Asian Fisheries Science **22** (2009): 285-296
ISSN: 0116-6514
E-ISSN: 2073-3720
https://doi.org/10.33997/j.afs.2009.22.1.027

Asian Fisheries Society, Manila, Philippines

Status of marine fisheries in Gujarat with strategies for sustainable and responsible fisheries

G. MOHANRAJ*, K.V. SOMASEKHARAN NAIR, P.K. ASOKAN and SHUBHADEEP GHOSH
Veraval Regional Centre of CMFRI
Central Marine Fisheries Research Institute, Kochi-682014, India

Abstract

Gujarat with about 20% (1600 km) of the country's coastline, 33% of the continental shelf area (1,64,000 sq. km) and over 2,00,000 sq. km of EEZ ranks second among the maritime states in marine fish production. The marine fish production in the state has shown a declining trend from 2002 (4.68 lakh tons) to 2005 (3.56 lakh tons) with promising increase by 42.7 % to 5.08 lakh tons during 2006. There is a conspicuous change in the resource composition over the years with quality fishes like pomfrets, larger sciaenids, threadfins and penaeid prawns being replaced by low value fishes such as ribbonfishes, threadfin breams, carangids, nonpenaeid prawns and smaller crabs. During the five year period, pelagic resources contributed (40%), followed by the demersal resources (30%), crustacean resources (22%) and cephalopod resources (8%). Among the pelagic resources, the contribution of Bombay duck *Harpadon nehereus* (Synodontidae) decreased from 34.8% in 2003 to 24.6% in 2006, while the contribution of *Trichiurus lepturus* (Trichiuridae) increased from 33.5% in 2003 to 46.6% in 2006. The demersal resources were dominated by croakers (30%) and the crustacean resources by non-penaeid prawns (60%). The substantial component of the catches was landed by trawlers (59%), followed by dolnetters (26%) and gillnetters (14%). The last quarter (46%) recorded the highest landings with the poor catches in the second (14%) and third quarters (15%). There was a distinct change in species composition of sciaenids caught by dolnetters over the years with smaller sciaenids (*Otolithes cuvieri*, Sciaenidae and *Johnius glaucus*, Sciaenidae) completely replacing commercially important larger sciaenids like koth (*Otolithoides biauritus*, Sciaenidae) and ghol (*Protonibea diacanthus*, Sciaenidae). The mean length for *Harpadon nehereus* increased from 159 mm in 2003 to 216 mm in 2006, whereas for *Otolithes cuvieri* and *Nemipterus japonicus* (Nemipteridae) the mean length decreased from 202 mm and 223 mm in 2003 to 163 mm and 193 mm in 2005. The emergence of mackerel fishery in 2006 coupled with increased landings of high export value cephalopods and tunas provide scope for the sustenance of marine fishery of Gujarat. Strategies for sustainable responsible fisheries are outlined.

*Corresponding Author :
E-mail address: gmohanraj@hotmail.com

Asian Fisheries Science **22** (2009): 285-296

Introduction

Gujarat with about 20% of the country's coastline, 33% of the continental shelf area (1,64,000 sq. km) and over 2,00,000 sq. km of EEZ ranks second among the maritime states in marine fish production. The annual marine fishery potential of the state is estimated at 0.57 million tons, which is about 17% of the all-India potential. The width of the Indian continental shelf is greatest off Gujarat offering scope for exploitation of several types of finfish and shellfish resources by both traditional and mechanized fishing. However, the intensive and uncontrolled fishing pressure in the coastal waters of the state fishing has resulted in major shifts in the marine ecosystem of the state. It was therefore a necessity to investigate the resource characteristics of all major resource contributing to the fishery of the state over a period of five years for their judicious exploitation, management and conservation.

Materials & Methods

Data on catch of major resources and effort expended were collected weekly from the trawl net landing centres of Bhidiya (Veraval) and Mangrol, gill net landing centres of Old Light House (Veraval) and Muldwarka and the dol net landing centres of Nawabunder, Rajapara and Jaffrabad for the five year study period from 2002 to 2006. The monthly and annual estimates of catches were made following the Stratified Multistage Random Sampling Design (Srinath et al. 2005) adopted by the Fishery Resource Assessment Division of Central Marine Fisheries Research Institute.

Results

During the five year study period (2002 to 2006), the annual average marine fish production in Gujarat was 4.37 lakh tons (Fig 1).

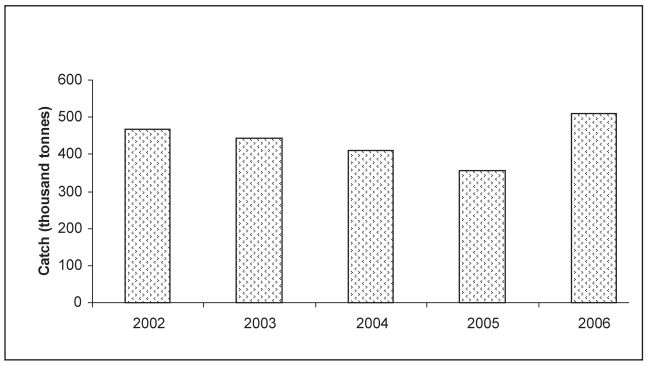

Figure 1. Change in annual catch of marine fishery resources of Gujarat during 2002 - 2006

Trawlers contributed substantially (60%) followed by dolnetters (26%) and gillnetters (14%). The last quarter (46%) for all the five years recorded the highest landings and the lowest landings were recorded in the second (14%) and third quarter (15%). Amongst the contribution by trawlers, multiday's and singleday's proportion were 47% and 13%, respectively. Maximum landings by the trawlers were recorded in the last quarter (48%) during all the five years. Dolnetters and gillnetters also landed good catch during the fourth quarter (48% and 39% respectively).

Catch and Catch Rates of Different Gears

There was an increase in total production by multiday trawlers over the years with a concomitant considerable increase in the catch rate. The total catch and catch rate for multiday trawlers increased from 1.87 lakh tons and 36 $kg.h^{-1}$ in 2003 to 2.49 lakh tons and 74.57 $kg.h^{-1}$ in 2006. There was however a decrease of catch by singleday trawlers from 0.72 lakh tons in 2003 to 0.38 lakh tons in 2006. The decrease in catch could be the result of a drastic reduction in effort from 18.4 lakh fishing hours in 2003 to 7.5 lakh fishing hours in 2006. Nevertheless, the catch rate increased from 39 $kg.h^{-1}$ to 50 $kg.h^{-1}$ (Fig. 2).

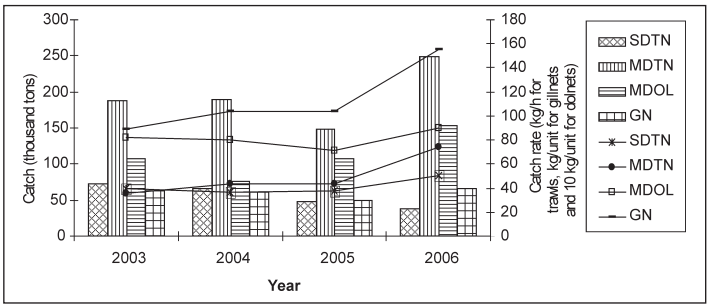

Figure 2. Change in annual catch and catch rate of major gears operated along the coast of Gujarat during 2003 - 2006.

The total production by gill netters in Gujarat increased from 0.61 lakh tons in 2003 to 0.65 lakh tons in 2006. This was accompanied by an increase in catch rate from 89 $kg.unit^{-1}$ to 156 $kg.unit^{-1}$ (Fig. 2). The dol net fishery over the years exhibited a significant increase in production due to increased fishing effort and mechanization with simultaneous increase in catch rate. The total catch and catch rate by mechanized dol nets in the state was 1.53 lakh tons and 899.1 $kg.unit^{-1}$ for 2006 and 1.07 lakh tons and 816.6 $kg.unit^{-1}$ for 2003 (Fig. 2).

Resource-wise Production in Gujarat

The major contributors to the marine fishery of Gujarat were the pelagic finfishes with 40%. The demersal resources contributed 30%. Crustaceans with 22% and cephalopods with 8% were the other significant contributors to the marine fishery of

Gujarat. The pelagic resources were dominated by ribbonfish *Trichiurus lepturus*, which formed 37% and Bombay duck *Harpadon nehereus*, which formed 31% of the pelagic catches over the five years. The contribution of *Harpadon nehereus* decreased from 34.8% (57.5 thousand tons) in 2003 to 24.6% (47.5 thousand tons) in 2006, while the contribution of *Trichiurus lepturus* increased from 33.5% (55.5 thousand tons) in 2003 to 46.6% (90 thousand tons) in 2006. Carangids, Seer fishes and tunas were the other commercially significant and highly valuable pelagic resources landed along the coast of Gujarat. The major demersal resource for the five years was croakers forming 30% of the total demersal fish catch. Croakers were followed by threadfin breams (17%), catfishes (15%), elasmobranchs (8%) and lizardfishes (6%). The nonpenaeid prawns formed on an average 61% of the total crustacean landings in the state. *Acetes* spp. (Sergestidae) contributed more than 70% of the total non-penaeid catches, followed by *Nematopalaemon tenuipes* (Palaemonidae) and *Exhippolysmata ensirostris* (Hippolytidae). Penaeid prawns formed 25% of the total crustacean catch. Crabs contributed a significant 12% to the total crustacean catch in the state. The total cephalopod production for the state increased from 0.23 lakh tons in 2002 to 0.49 lakh tons in 2006 and was constituted mainly by *Loligo duvaucelli* (Loliginidae), *Sepia pharaonis* (Sepiidae) and *S. aculeata* (Sepiidae).

Bombay duck

Bombay duck formed on an average 12.68% of the total marine landings of the state. The Bombay duck production at the dol net landings centres of Gujarat decreased from 0.65 lakh tons (13.96% of total marine production) in 2002 to 0.475 lakh tons in 2006 (9.58% of total marine production) (Fig. 3).

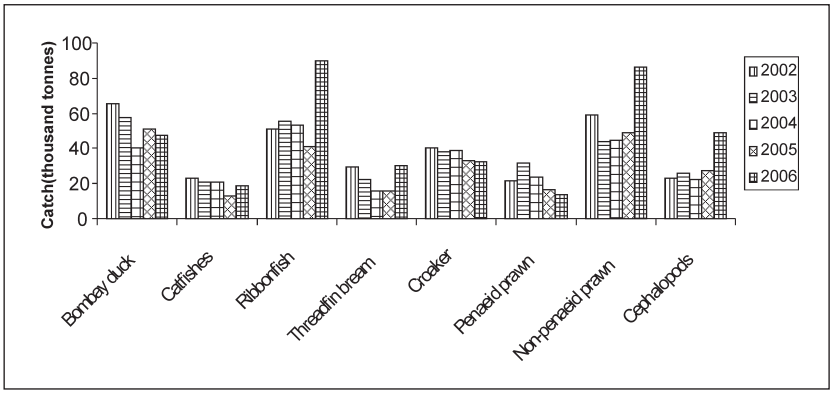

Figure 3. Change in annual catch of major resources contributing to the marine fishery of Gujarat during 2002 - 2006.

Fourth quarter was more productive followed by the first quarter (Fig. 4).

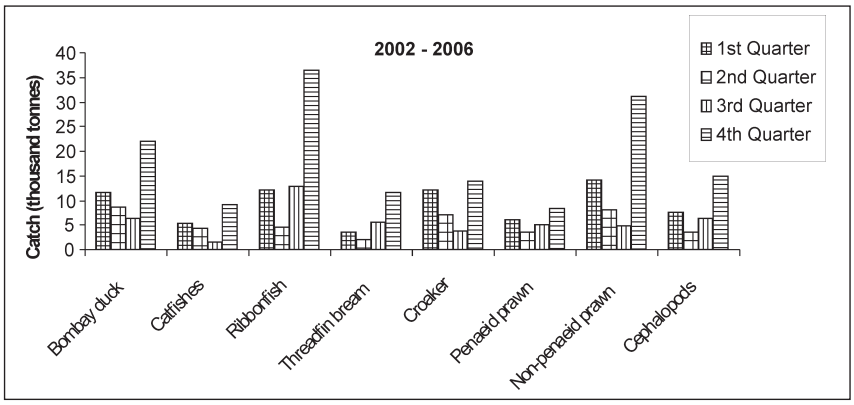

Fig 4. Seasonal abundance in catch of major marine fishery resources of Gujarat during 2002 - 2006

The catch rate also decreased similarly from 438 kg.unit^{-1} in 2003 to 280 kg.unit^{-1} in 2006. The mean size increased from 15.9 cm in 2003 to 21.6 cm in 2006.

Ribbonfish

The ribbonfish landings registered a tremendous increase of 75% in 2006 as compared to that of 2002. The resource formed on an average 13.79% of the total marine landings. The catch was 0.9 lakh tons in 2006 and 0.51 lakh tons in 2002 (Fig. 3). The catch rate showed an increase from 10.65 kg.h^{-1} in 2003 to 27 kg.h^{-1} in 2006. The contribution of this resource was major to the trawl net catches in all the years. Post monsoon months recorded heavy landings of ribbonfish (Fig. 5). The mean length of the catch decreased from 69 cm in 2002 to 67.6 cm in 2006.

Seerfish

The total production showed a decrease of 10.5% in 2006 (0.063 lakh tons) when compared to 2002 (0.07 lakh tons) (Fig. 5). Nevertheless, the catch rate for the resource increased from 71.43 kg.unit-1 in 2003 to 117.67 kg.unit-1 in 2006. It formed about 1.6% of the total marine fish landings. The last quarter in all the years recorded the highest values for catch and catch rate (Fig. 6). The main species contributing to the fishery was *Scomberomorus guttatus* (Scombridae), which formed 81.13% of the total seer fish production in gill nets and 87.97% in trawl nets, the rest being constituted by *S. commerson* (Scombridae). There was a marginal decrease in mean size of *S. guttatus* from 43.9 cm in 2002 to 42.4 cm in 2006.

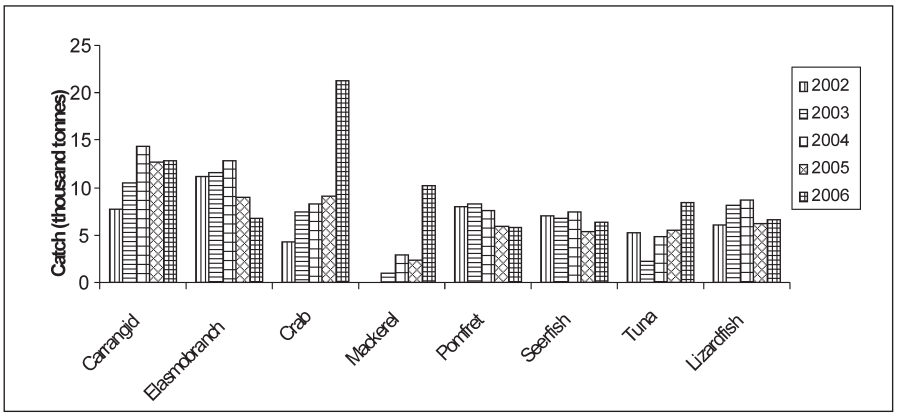

Fig 5. Change in annual catch of minor resources contributing to the marine fishery of Gujarat during 2002 - 2006

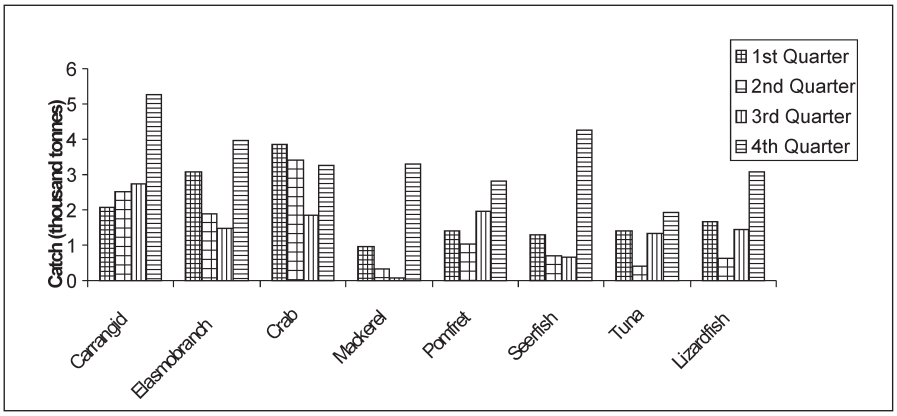

Fig 6. Seasonal abundance in catch of minor marine fishery resources of Gujarat during 2002 - 2006

Tunas and Billfishes

There was a substantial increase in both catch (62%) and catch rate (590%) of tunas in 2006 from that of 2002. The catch in 2002 was 0.052 lakh tons at a catch rate of 22.77 kg.unit^{-1} and in 2006 it was 0.085 lakh tons at a catch rate of 157.11 kg.unit^{-1} (Fig. 4). The catch and catch rates were better during October – December (Fig. 6). Tunas and billfishes formed on an average 1.25% of the total marine fish landings of Gujarat. The main species of tunas landed were *Thunnus tonggol* (Scombridae) (50.67%), *Katsuwonus pelamis* (Scombridae) (13.36%), *Euthynnus affinis* (Scombridae) (19.56%), *Auxis thazard* (Scombridae) (11.85%), *Thunnus albacares* (Scombridae) (3.48%) and *Sarda orientalis* (Scombridae) (1.09%). The main species which supported the billfish

fishery were *Istiophorus platypterus* (Istiophoridae) and *Makaira indica* (Istiophoridae). In *T. tonggol*, *E. affinis* and *A. thazard*, the mean lengths increased from 57.8 cm, 43.9 cm and 32.5 cm respectively in 2002 to 60.8 cm, 46.5 cm and 35.8 cm respectively in 2006.

Carangids

The estimated landings of carangid increased from 0.077 lakh tons in 2002 to 0.129 lakh tons in 2006 (Fig. 4), with catch rate increasing simultaneously from 2.02 $kg.h^{-1}$ in 2002 to 3.86 $kg.h^{-1}$ in 2006. The highest values of catch and catch rates were observed in the last quarter for all the five years (Fig. 6). This resource formed 2.87% of the total marine landings of Gujarat. Among carangids, *Megalaspis cordyla* (Carangidae) (46.8%) dominated the gill net catches while *Decapterus russeli* (Carangidae) (69.5%) dominated the trawl landings.

Mackerel

There was an emergence of mackerel (*Rastrelliger kanagurta*, Scombridae) fishery in 2006 in which 0.1 lakh tons were landed forming 2.07% of the total marine fish catch in Gujarat (Fig. 4). The catch rate in gillnet recorded for the resource in this year was 190.4 $kg.unit^{-1}$. 70% of the catch was landed in the fourth quarter (Fig. 6).

Threadfin breams

Threadfin breams formed about 5.35% of the total marine fish catch. The threadfin breams production in 2006 (0.303 lakh tons) showed a marginal increase as compared to 2005 (0.297 lakh tons) (Fig. 3). Good catch was recorded during the post monsoon months of September – December (Fig. 5). However, the catch rate increased by more than two folds from 4.28 $kg.h^{-1}$ in 2003 to 9.09 $kg.h^{-1}$ in 2006. The fishery was supported predominantly by *Nemipterus mesoprion* (Nemipteridae) (55.63%) and *N. japonicus* (41.2%) along with small quantities of *N. delagoae* (Nemipteridae) (3.18%). The mean size of *Nemipterus mesoprion* increased from 13.58 cm in 2003 to 15.79 cm in 2005 but in *N. japonicus*, it decreased from 22.31 cm in 2003 to 19.27 cm in 2005.

Sciaenids

The landing of sciaenids has decreased over the years from 0.4 lakh tons landed in 2002 to 0.33 lakh tons landed in 2006 (Fig. 3). Sciaenids contributed on an average 8.94% to the total marine fish landings in Gujarat. The catch rate of croakers in the trawl fishery showed an uptrend (33%), but in the dolnet fishery it decreased (34%) during the five year period. Heavy catches of sciaenids were landed by trawlers during October – December where as dolnetters recorded good catch during January and November (Fig. 5). The proportion of koth in sciaenids landed by dolnetters has decreased

from 60.3% in 2003 to 17.5% in 2006, while the contribution of *Otolithes cuvieri* and *Johnius glaucus* has increased in the same period by more than two folds. The dominant species in the trawl fishery was *Otolithes cuvieri* (54.4%). *Johnius glaucus* (30.9%), *Johnieops sina* (Sciaenidae) (9.7%) and *Otolithoides biauritus* (4.33%) were the other major species constituting the fishery. The gillnet fishery was supported predominantly by *Otolithes cuvieri* (47.37%) and *Johnius glaucus* (28.39%) along with small quantities of *Protonibea diacanthus* (9.17%), *Johnieops sina* (7.55%) and *Otolithoides biauritus* (7.55%). The mean length of *O. cuvieri* decreased over the years from 20.24 cm in 2003 to 16.31 cm in 2005 but in *J. glaucus* the mean length was more or less uniform during the period.

Lizardfish

The lizardfish production had come down marginally from 0.067 lakh tons in 2002 to 0.063 lakh tons in 2006 (Fig. 4). The catch rate however, exhibited an increasing trend from 1.17 $kg.h^{-1}$ in 2003 to 1.88 $kg.h^{-1}$ in 2006. The peak catch and catch rates were observed in October, with good production during the last quarter (Fig. 6). Lizardfishes formed about 1.78% of the total marine fish catch in Gujarat. The main species which contributed to the fishery was *Saurida tumbil* (Synodontidae) (81.1%), followed by *S. undosquamis* (Synodontidae) (18.9%). The mean lengths for both *S. tumbil* and *S. undosquamis* increased from 28.41 cm and 25.31 cm in 2003 to 31.34 cm and 30.98 cm in 2005.

Pomfrets

Pomfrets contributed on an average 1.74% to the total marine fish landings. The pomfret landing in Gujarat decreased by 27% from 0.08 lakh tons in 2002 to 0.058 lakh tons in 2006 (Fig. 4). The catch rate of this resource in gillnets however, increased from 87.4 $kg.unit^{-1}$ in 2003 to 108.5 $kg.unit^{-1}$ in 2006. Fairly good catches (39%) were landed in the last quarter by the gillnetters (Fig. 6). The average mean length of 22.62 cm recorded in 2004 increased to 24.55 cm in 2005.

Elasmobranchs

The elasmobranch production decreased by 40% in 2006 from that of 2002, while the catch rate remained more or less the same. The total landing of 0.112 lakh tons recorded in 2002 decreased to 0.068 lakh tons in 2006 (Fig. 4). Elasmobranchs contributed on an average 2.53% to the total marine landings in Gujarat. The fishery was at its peak during the last and the first quarters (Fig. 6). Among elasmobranchs, the dominant species was spade nose shark *Scoliodon laticaudus* (Carcharhinidae) (31.9%) followed by *Carcharinus* spp. (Carcharhinidae) (23%), *Dasyatis* spp. (Dasyatidae) (9.8%), *Rhinobatus* spp. (Rhinobatidae) (20.4%) and *Rhincobatus* spp. (Rhinobatidae) (14.5%).

Catfishes

Catfishes formed about 4.65% of the total marine fish catch in Gujarat. The landing of catfish decreased by 18% from 0.223 lakh tons in 2002 to that of 0.118 lakh tons in 2002 (Fig. 3) and the catch rate decreased from 160.9 kg.unit^{-1} in 2003 to 110.6 kg.unit^{-1} in 2006. The average landings were highest in the last quarter (Fig. 5).

Prawns

The total penaeid prawn landings in Gujarat decreased by 38.6% in 2006 from that of 2002, while the catch rate decreased by 34.1% in 2006 from that of 2003. The catch was 0.218 lakh tons in 2002 and 0.134 lakh tons in 2006 and the catch rate 6.08 kg.h^{-1} in 2003 and 4 kg.h^{-1} in 2006 (Fig. 3). The catch and catch rate were the highest in the final quarter (Fig. 5). Penaeid prawns formed 5.27% of the total marine resources landed in Gujarat. There was a distinct shift in species composition of penaeid prawns in 2006 from that in 2005. *Parapenaeopsis stylifera* (Penaeidae) was the dominant species in 2005 contributing to half of the catch landed by trawlers, followed by *Solenocera choprai* (Solenoceridae) (21%) and *S. crassicornis* (Solenoceridae) (19%). However in 2006, *S. crassicornis* (65.4%) was the major contributor to the penaeid shrimp fishery, followed by *P. stylifera* (18%) and *S. choprai* (8%).

The nonpenaeid shrimps formed about 13.38% of the total marine catch in Gujarat. There has been a tremendous increase in both catch (47%) and catch rate (206%) of nonpenaeid prawns over the years. An estimated catch of 0.587 lakh tons of non-penaeid shrimps landed during 2002 increased to 0.863 lakh tons in 2006 (Fig. 3). The final quarter recorded the maximum in terms of catch and catch rate (Fig. 5). *Acetes* spp (70.33%), *Nematopalaemon tenuipes* (17.34%) and *Exhippolysmata ensirostris* (12.05%) were the constituent species in all the years.

Crabs

Crabs contributed on an average 2.38% to the total marine landings in Gujarat. There has been a huge increase in the landings of crab from 0.043 lakh tons landed in 2002 to 0.213 lakh tons landed in 2006 (Fig. 4). The catch rate also increased similarly from 1.44 kg.h^{-1} in 2003 to 6.38 kg.h^{-1} in 2006. Crab catches were chiefly composed of low value species such as *Charybdis* sp. (Portunidae) and *Thalamita crenata* (Portunidae). Crabs of commercial significance such *as Charybdis ferriatus* formed only an insignificant portion (5.62%) of the catch.

Cephalopods

The cephalopod landings in Gujarat increased by more than two folds during the

five year period from 0.234 lakh tons in 2002 to 0.49 lakh tons in 2006 (Fig. 3), with a concomitant increase in catch rate from 5.05 $kg.h^{-1}$ in 2003 to 14.74 $kg.h^{-1}$ in 2006. Fourth quarter was more productive followed by the first quarter (Fig. 5). The cephalopod resource was constituted mainly by *Loligo duvaucelli*, *Sepia pharaonis* and *S. aculeata.* The cephalopod landing in the pre monsoon period was dominated by *L. duvaucelli* but in the post monsoon period it was dominated by *S. aculeata*.

Discussion

The total marine fish catch has increased from less than one lakh tonne in 1971 to more than five lakh tons in 2006. The increase of catch in the last quarter could be attributed to the resumption of fishing activities after ban during the monsoon period. The reduction in the catches of high value penaeid shrimps and increased demand for cephalopods and demersal finfish resources like threadfin breams and other perches has resulted in trawlers extending their operation to deeper waters and increasing the number of fishing days per trip.

Nair *et al*. (2003) reported decreasing contribution of Bombay duck from 30% of the total marine catch in 1975-1979 to 15% in 1995-1999 which is similar to the observations recorded in the present study. Similarly, Nair *et al*. (2003) reported increasing contribution of ribbonfish from 5% of the total marine catch in 1975-1979 to 11% in 1995-1999. Kasim *et al*. (2002) recorded an average seerfish catch of 0.129 lakh tons during 1995-1999, contributing 2.2% to the total fish catch of Gujarat. Similar landings of tuna (0.08 lakh tons) from the coastal waters of Gujarat were reported by Pillai *et al*. (2002) during 1985-1999. *Thunnus tonggol* is a species widely distributed in the shelf edge and slope waters and the expansion of the fishing grounds with enhanced exploitation of large pelagics from deeper waters is the causative factor for the increased representation of this species in the total tuna landing. The emergence of a fishery in 2006 for *T. albacares* and *S. orientalis* is an important change recorded in the tuna fishery over the years.

The demersal resources accounted for 35 – 37% of the annual average marine fish catch during 1971-2000 (Kizhakudan *et al*., 2003), but recently there has been a shift in resource composition with the virtual disappearance of whitefish (*Lactarius lactarius*, Lactariidae), threadfins and larger sciaenids (Ghol and Koth) and the dominance of lesser valued croakers. Continued indiscriminate fishing of aggregations of large sized gravid females in the coastal waters has resulted in the virtual disappearance of ghol and koth from the fishery. The contribution of croakers to the demersal fish catch has decreased from 45% (Nair *et al*., 2003) in 1975-1999 to the present level. Sciaenids contributed on an average 24% to the total fish catch during 1975-1979 (Nair *et al*., 2003). The landing of lizardfishes was an increase when compared to the negligible

0.2% (Kizhakudan *et al*., 2003) contribution in 1975-1979. The proportion of *S. undosquamis* in the lizardfish catch has shown a gradual increase over the years at the expense of *S. tumbil*. In recent years, the catch of pomfrets has reduced drastically from the 5 - 6% contribution during 1975-1989 (Nair *et al*., 2003). The fishery of elasmobranchs has also registered a decrease when compared to 5 – 7% contribution in the period from 1975-1999 (Nair *et al*., 2003).

Crustaceans formed about 17% of the average annual marine fish catch of Gujarat during 1971-2000 (Kizhakudan & Thumber, 2003), but their increasing contribution in the last half decade could be attributed to the huge amount of nonpenaeid landings by dolnetters. The operation of multiday trawlers (5 - 8 days) in deeper waters (80 - 100 m) for cephalopods and the increase in the landings of nonpenaeid prawns by both trawl and dol nets has resulted in decline of penaeid prawn fishery over the years. Moreover, this increase in the number of long-trip operations has also effected a change in the composition of penaeid shrimp landings, with decline in the contribution of *Parapenaeopsis* spp. and *Metapenaeus* spp. (Penaeidae) and a corresponding increase in the contribution of *Solenocera* spp. Similar results on the contribution of *Acetes* spp. to the total nonpenaeid catch was reported by Kizhakudan & Thumber (2003). The contribution of crabs was an increase from the 7% contribution to the crustacean catch during 1975-1999 (Nair *et al*., 2003). Similar to the present study, Kizhakudan & Thumber (2003) reported that in the coastal waters of Gujarat commercially important crabs formed less than 10% of the total crab landings. The contribution of lobsters to the crustacean landings was marginal and has decreased from 8.2% in 1971-1975 to less than 1% in 2002-2006.

The dominance of *L. duvaucelli* in the premonsoon period and that of *S. aculeata* in the postmonsoon 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 would threaten the sustenance of the fishery.

Conclusion

There was a shift of trawling operations over the years from single day trawling to multi day trawling. Multiday trawl operations aimed at exploitation of valuable target species with specific gears and in specific fishing grounds. The present annual catch is nearing the potential yield of 5.7 lakh tons estimated for Gujarat. However, bulk of the fish catch of the state is composed of low value species, which are sundried, or block frozen and exported to China and Southeast Asian countries. The production of larger sciaenids, larger perches, pomfrets, threadfins, penaeid prawns, lobsters, eels, clupeids

and mullets are declining very fast and have reached a critical level. Some of the valuable fishes like larger sharks and whitefish had completely vanished from the fishery of the state. The fishery at present is dominated by low value fin and shell fishes like smaller croakers, carangids, Bombay duck, ribbonfishes, threadfin breams, lizardfishes, flatfishes and nonpenaeid prawns. The management options suggested for revitalizing the dwindling fishery of the state, are regulation of fishing effort, operational ban on gill netters during monsoon as they are actively engaged in fishing of gravid females of ghol, koth, dara and lobsters, regulation of cod end mesh size for trawls since they exploit juveniles and sub adults of commercial species in large quantities and also regulation of mesh size for dol nets as smaller mesh leads to destructive fishing of juveniles of white pomfrets.

Acknowledgement

The authors wish to express their gratitude to Dr. Mohan Joseph Modayil, Director, and CMFRI for his keen interest and Dr. E. Vivekanandan, Principal Scientist and Head, Demersal Fisheries Division for the encouragement and suggestions.

References

Kasim, H.M., C. Muthiah, N.G.K. Pillai, T.M. Yohannan, B. Manojkumar, K.P. Said Koya, T.S.

Balasubramaniam, U.S. Bhat, M.N.K. Elayathu, C. Manimaran and H.K. Dhokia. 2002. Stock

assessment of seerfishes in the Indian seas. In: Management of Scombroid Fisheries (ed. N.G.K. Pillai, N.G. Menon, P.P. Pillai and U. Ganga), pp. 108-124, CMFRI, Kochi, India.

Kizhakudan, J.K. and B.P. Thumber. 2003. Fishery of Marine Crustaceans in Gujarat. In: Proceedings of

Fishing and Fish Processing Industries in Gujarat – Present status and future needs, pp. 47-56, The Society of Fisheries Technologists, Research Centre of CIFT, Veraval, India.

Kizhakudan, S.J., K.V.S. Nair and M.S. Zala. 2003. Demersal Finfish resources of Gujarat. In:

Proceedings of Fishing and Fish Processing Industries in Gujarat – Present status and future needs, pp. 57-66, The Society of Fisheries Technologists, Research Centre of CIFT, Veraval, India.

Pillai, P.P., N.G.K. Pillai, C. Muthiah, T.M. Yohannan, H.M. Kasim, G. Gopakumar, K.P. Said Koya, B.

Manojkumar, M. Sivadas, A.K.V. Nasser, U. Ganga, H.K. Dhokia, S. Kemparaju, M.M. Bhaskaran, M.N.K. Elayathu, T.S. Balasubramaniam, C. Manimaran, V.A. Kunhikoya and T.T. Ajith Kumar. 2002. Status of exploitation of coastal tunas in the Indian seas. In: Management of Scombroid Fisheries (ed. N.G.K. Pillai, N.G. Menon, P.P. Pillai and U. Ganga), pp. 56-61, CMFRI, Kochi, India.

Nair, K.V.S., J.K. Kizhakudan and S.J. Kizhakudan. 2003. Marine fisheries of Gujarat – An Overview.

In: Proceedings of Fishing and Fish Processing Industries in Gujarat – Present status and future needs, pp. 1-10, The Society of Fisheries Technologists, Research Centre of CIFT, Veraval, India.

Srinath, M., Somy Kuriakose and K. G. Mini. 2005. Methodology for estimation of marine fish landings in India. CMFRI Special Publication 86: 57 pp.

Received: 23 November 2007; Accepted: 6 November 2008