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Trawl Fisheries off Visakhapatnam

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Visakhapatnam is one of the major trawl fishery centres along the east coast of India. About 500 small mechanized fishing units including small trawlers and *sona* boats were in active operation, conducting fishing from Sand Heads in the North to Pentakota in the South. The data were collected from small trawlers during 1994-2003 and from *sona* boats during 1997-2003 and analyzed for changes in the trend of fishery, fishing patterns, craft and gear, species composition and possible impact of trawl ban on the fishery. Demersal resources (43%) were the major component of trawl landings, followed by pelagic (35%), crustacean (20%) and molluscan resources (2%). The total catch and catch rate were higher during September - December. The CPUE ranged from 11 $kg.h^{-1}$ (1991) to 25 $kg.h^{-1}$ (2003) with an average of 25 $kg.h^{-1}$ in small trawlers. In the case of *sona* boats, CPUE ranged from 7 $kg.h^{-1}$ (1999) to 33 $kg.h^{-1}$ (2003) with an average of 23 $kg.h^{-1}$. Though the magnitude of catch is higher in *sona* boats, the catch composition is almost similar to that of small trawlers. After the introduction of fishing ban during the month of May from 1999 onwards, the total landings increased during June – August; however, the CPUE has declined indicating increased effort.

Key words : Trawl fisheries, Visakhapatnam, small trawler, *sona* boat, trawl ban

Visakhapatnam is one of the major fishing harbours along the east coast of India. Only country crafts using indigenous gears were engaged in fishing operations along the Visakhapatnam coast, until 1960s. Since 1964, mechanized fishing started with the introduction of small mechanized boats in Visakhapatnam. Single day fishing used to be in operation up to 1980. Night fishing for 2 days restricting to 4 months during winter season, i.e., October-January was started during 1980 and continued till 1984. The introduction of *sona* boats in 1987 started a new era in the fishing history of Andhra Pradesh leading to increased

fish production and better economic returns to the industry. Voyage fishing lasting for 8-10 days started with the introduction of *sona* boats. During the period from 1987 to 1990, voyage fishing used to be conducted in October-March, whereas single day fishing was conducted in other months. From 1990 onwards, voyage fishing was extended to 9 months except in April, May and June and gradually by 1995, it was conducted throughout the year.

At present, there are about 300 small trawlers, 250 *sona* boats and 60 large trawlers, operating off Visakhapatnam. The trawlers operate in a wide area from Sand Heads in the north to Pentakota in the south covering an area of about 6200 sq. km in the Bay of Bengal. The fishery, composition of landings and seasonal abundance of different resources along the Visakhapatnam coast were studied earlier by Sastry and Chandrasekhar (1996), Luther *et al.* (1988), Rao (1987,1988, 1990, 1999a and 1999b), Philip and Mathew (1996) and Reuben *et al.* (1996). The present study deals with the trend in fishery, composition of landings, species composition and possible impact of fishing ban on the fishery.

Materials and Methods

Data collected from small trawlers for the period 1994-2003 and from *sona* boats during 1997-2003 were used for the present study. Data on catch and effort, total landings and group-wise catch distribution were collected as per the standard procedure adopted by Fishery Resource Assessment Division of CMFRI (Kutty *et al.*, 1973). The catches were raised to monthly catches by a factor based on observation days and total fishing days in the month. The number of fishing days, hours, depth of operation and fishing grounds were recorded on enquiry from the crew. The landings were tabulated into 25 major groups and the remaining miscellaneous groups with lesser landings were included in the category "other groups".

Results and Discussion

Trawl net is the major gear operated along the northeast coast of India. The trawlers operating off Visakhapatnam use four-seam shrimp trawl with a codend mesh size of 10-25 mm. The mechanized and indigenous crafts are in active operation at Visakhapatnam. Under mechanized sector, there are small-mechanized units that are engaged in regular trawl fishing and large trawlers engaged in deep-sea fishing concentrating mainly on shrimps. The small trawlers fish in the depth range 10-100 m while *sona* boats operate in the range of 40-100 m.

Mechanized fishing was initiated in Andhra Pradesh in 1964, with the introduction of *Pablo* boat (9.14 m LOA) and subsequently within a short period

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of three years, *Royya* or *Pomfret* (9.75-10.0 m LOA) and *Sorrah* boats (11.41 m LOA) were introduced. *Sona* boats (13.1 m LOA) which has higher fish hold capacity and capability for voyage fishing, was introduced in 1981. At present, only small trawlers and *sona* boats are engaged in active fishing. The description of the small trawlers and *sona* boats is given Table 1.

Table 1. Details of small trawlers and *sona* boats operating off Visakhapatnam

Details	Small trawler	*Sona* boat
Length Overall	9.14-11.41 m	13.1 m
Engine power	65-83 hp	102 hp
Crew strength	6	9
Fishing gear	Shrimp trawl	Shrimp trawl
Codend mesh size	10-20 mm	15-25 mm
Depth of operation	10-70 m	Up to 100 m
Fish hold capacity	2-3 t	5 t
Duration of fishing trip	3-4 days	10-15 days

Fishery by small trawlers

The annual average estimated landings by small trawlers were 6,163 t during the period from 1994 to 2003. The annual landings ranged from 2,563 t in 1999 to 17,538 t in 2003. The small trawlers accounted for 32% of the trawl landings. The landings were comparatively better from 2000 onwards with a steady and sharp increase compared to the previous years (Fig. 1). There was only marginal variation in the fishing units during this period. But the effort in terms of fishing hours increased from 2000 onwards with highest effort of 7,12,660 h in 2003.

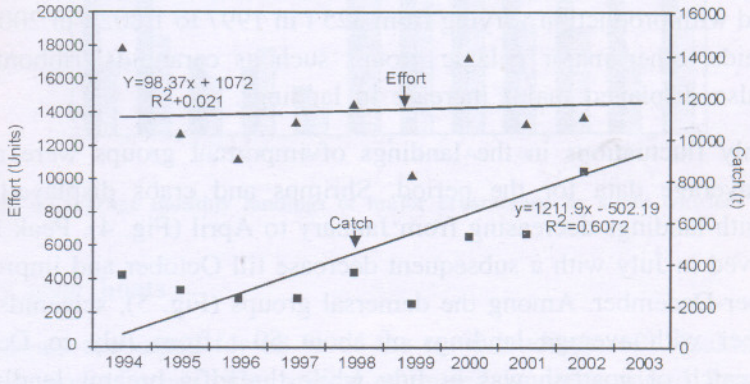

Fig. 1. Trend in effort and catch by small trawlers off Visakhapatnam

The results indicated that the small trawlers were also used for voyage fishing lasting for 5-10 days though the endurance of this class of vessels at sea is only 5-6 days. Landings showed an increasing trend while the catch per hour did not deviate from the average of 19 kg except in 1999 and 2000 (Fig. 2).

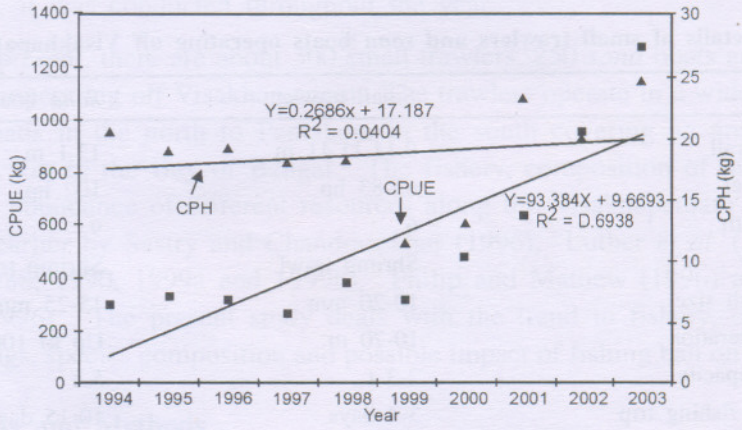

Fig. 2. Trends in catch per unit (CPU) and catch per hour (CPH) by small trawlers off Visakhapatnam

The groups that contributed more than 5% of the total fishery were: shrimps (11.9%), crabs (6.4%), goatfish (7.2%), threadfin breams (5.1%), sciaenids (7.5%), clupeids (10.1%), ribbonfish (7.2%), carangids (7.8%) and other groups (7.0%). The trend in the landings of all the groups were analyzed and ranked on the basis of **b** values (Fig. 3). The groups that did not show significant increase in landings over the years were cephalopods, elasmobranchs, lizardfish, threadfin breams and bull's eye. Clupeids exhibited the maximum increase with landings of 2,452 t in 2003 from 181 t in 1995. Shrimps, the target group of trawlers ranked third with production varying from 325 t in 1997 to 1,802 t in 2003. Apart from clupeids, other major pelagic groups such as carangids, ribbonfish and mackerel also displayed major increase in landings.

Monthly fluctuations in the landings of important groups were analysed based on average data for the period. Shrimps and crabs displayed similar variation with landings decreasing from January to April (Fig. 4). Peak landings were observed in July with a subsequent decrease till October and improvement in November-December. Among the demersal groups (Fig. 5), sciaenids peaked in September with average landings of about 50 t from July to December. Maximum catch of goatfish was in July while threadfin breams landings was maximum in September. Clupeid landings were maximum in February and

November with landings of about 80 t (Fig. 6). Surprisingly, carangids peaked in May, which may be due to heavy landings in this month before the imposition of trawling ban. Catches of ribbonfish steadily increased from June and reached a maximum in September.

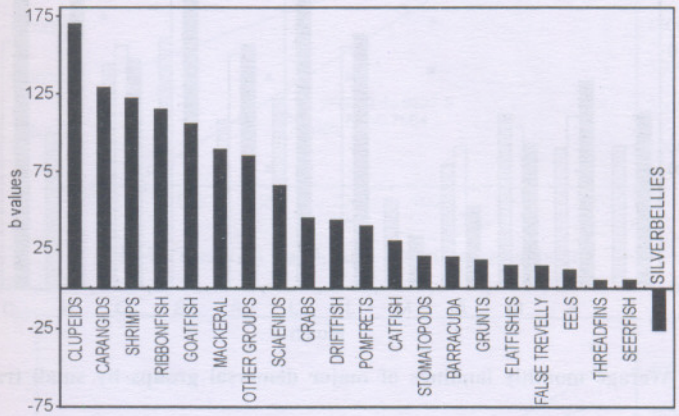

Fig. 3. Relative increase in landings of different species groups by small trawlers off Visakhapatnam, based on b values

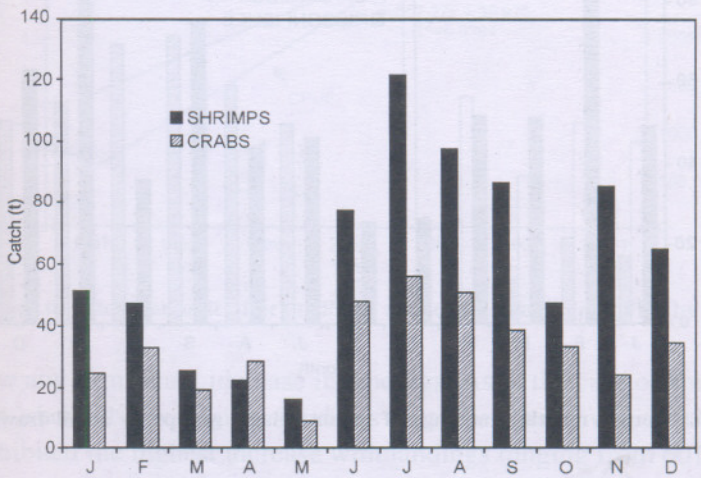

Fig. 4. Average monthly landings of major crustaceans by small trawlers

Fishery by *sona* boats

Sona boats accounted for 68 % of the trawl landings, off Visakhapatnam, during the period of study. The annual estimated landings varied from 1880 t in 1999 to 33,061 t in 2003 with an annual average of 13,250 t off Visakhapatnam

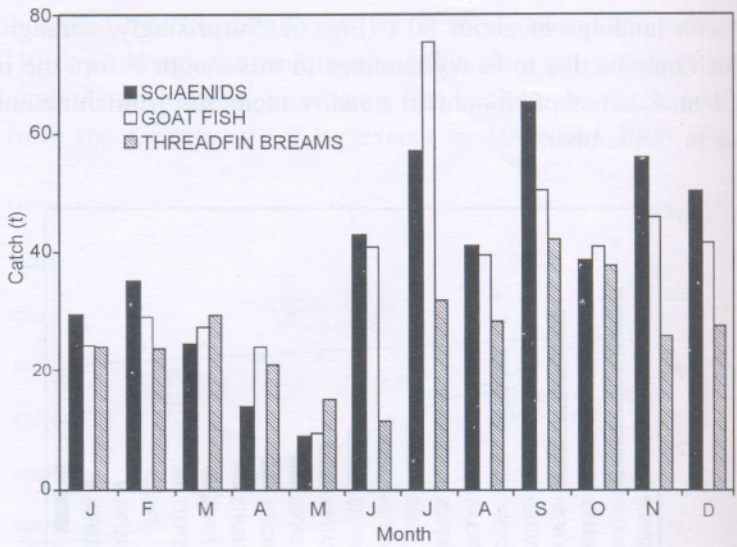

Fig. 5. Average monthly landings of major demersal groups by small trawlers

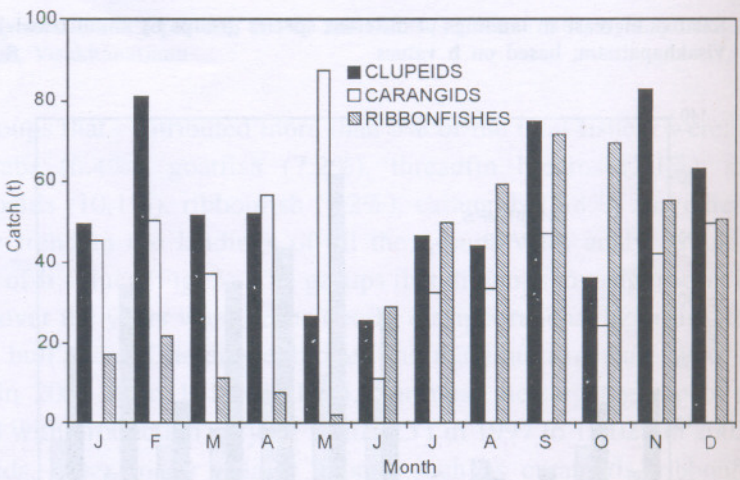

Fig. 6. Average monthly landings of major pelagic groups by small trawlers

during the period 1997-03. The effort in units, unlike small trawlers showed an increasing trend as is the case with increased catches (Fig. 7). The catch per hour ranged from 1.0 kg (1999) to 4.7 kg (2003) with an average of 3.2 kg. Both CPH and CPU exhibited upward trend as the years progressed (Fig. 8).

Major groups that formed the fishery were shrimps (18.4%), goatfishes (7.1%), sciaenids (8.8%), clupeids (9.8%), ribbonfish (10.2%), carangids (6.7%) and other groups (7.2%). Stomatopods, elasmobranchs, bull's eye and other groups

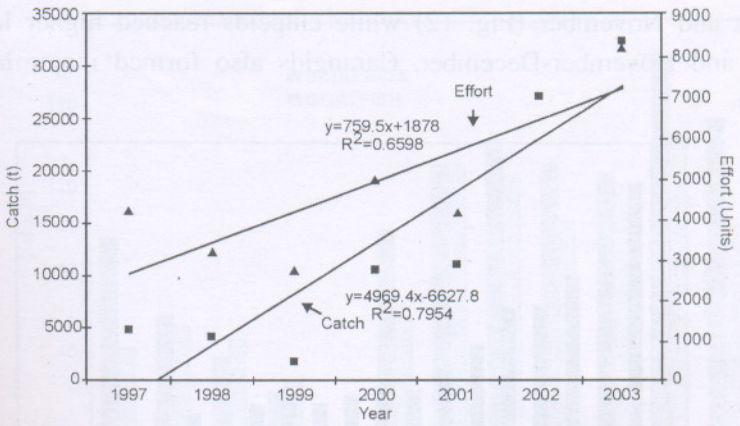

Fig. 7. Trend in catch and effort of *sona* boats

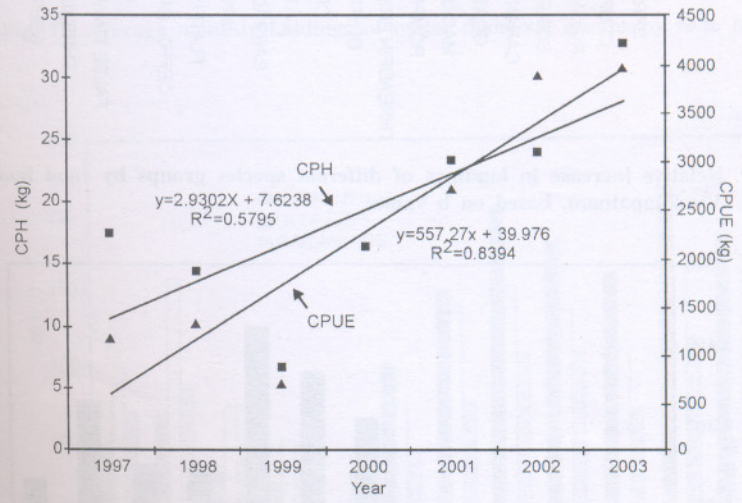

Fig. 8. Trends in catch per unit effort (CPUE) and catch per hour (CPH) by *sona* boats

did not show any significant increase in landings. As in the case of small trawlers, silverbellies showed decreasing landings but the trend was not significant. Shrimps exhibited the highest increase with landings ranging from 601 t to 5,851 t (Fig. 9). Prominent pelagic groups were clupeids, ribbonfish and carangids. Economically important groups such as cephalopods, crabs and seerfishes exhibited only minor increase in the landings during the period. Sciaenids and goatfishes were the major demersal groups displaying increased landings.

August was the peak month of shrimp landings by *sona* boats (Fig. 10). Sciaenids and goatfishes peaked in November with average landing of more than 120 t in a month from July to December (Fig. 11). Ribbonfish catches were highest

in August and November (Fig. 12) while clupeids reached higher landings in February and November-December. Carangids also formed major landings in December.

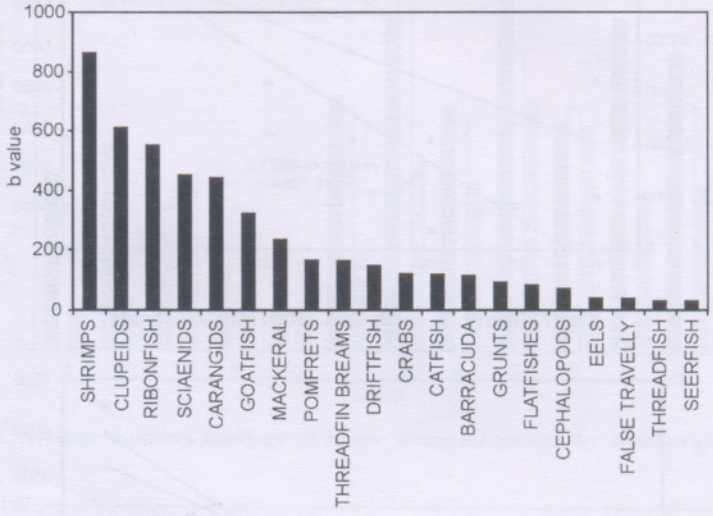

Fig. 9. Relative increase in landings of different species groups by *sona* boats off Visakhapatnam, based on b values

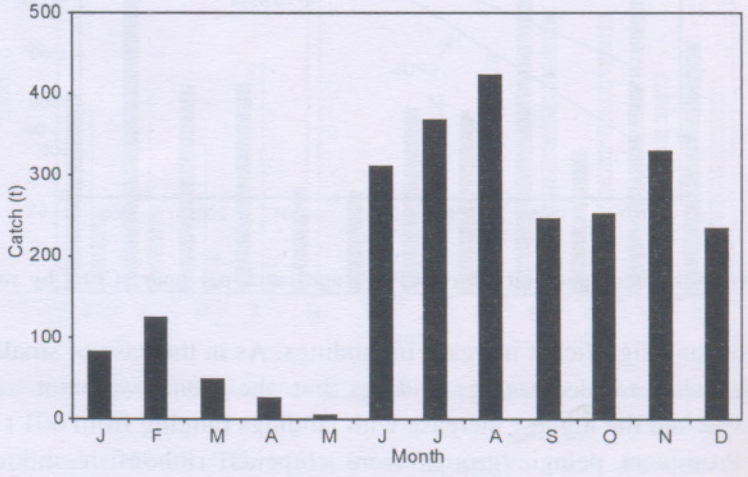

Fig. 10. Average monthly landings of major crustaceans by *sona* boats

Species composition

About 34 marine fish species were represented in the fishery. There was no significant difference in the composition of the fishery between small trawlers and *sona* boats, though the magnitude of catch was more in *sona* boat. Demersal

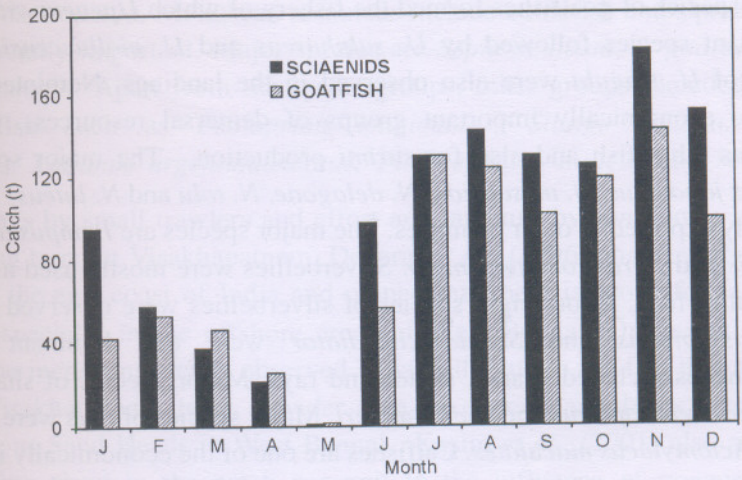

Fig. 11. Average monthly landings of major demersal groups by *sona* boats

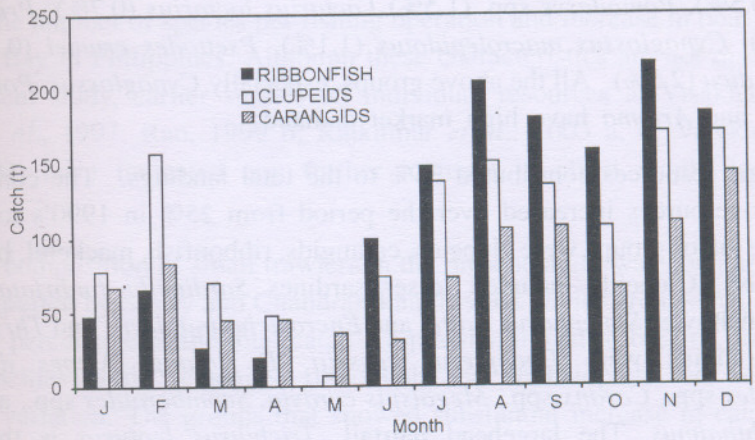

Fig. 12. Average monthly landings of major pelagic groups by *sona* boats

resources were the major group contributing 43% of the total trawl landings, off Visakhapatnam, which shows a reduction from the earlier landings of 55%. Among lizardfishes, five species represented the fishery over the period of which *Saurida undosquamis* and *S. tumbil* contributed more than 80% of the fishery. Other species in the landings were *S. micropectaralis, S. longimanus* and *Trachinocephalus myops.* About 13 species of sciaenids were represented in the fishery of which *Nibea maculata, Johnius carutta* and *Pennahia macrophthalmus* dominated the landings.

Four species of goatfishes formed the fishery of which *Upeneus vittatus* was the dominant species followed by *U. sulphureus* and *U. molluccensis*. Small quantities of *U. tragula* were also observed in the landings. Nemipterids were one of the economically important groups of demersal resources, which are preferred as table fish and also for *surimi* production. The major species are *Nemipterus japonicus, N. mesoprion, N. delagoae, N. tolu* and *N. luteus*. Pomfrets were mainly exported to other countries. The major species are *Pampus argenteus, P. chinensis* and *Parastromateus niger*. Silverbellies were mostly used as dry fish and as poultry feed. About eight species of silverbellies were observed of which *Leiognathus bindus* and *Secutor insidiator* were the dominant species. Elasmobranches included sharks, skates and rays. Major species of sharks were *Carcharinus mealnopterus* and *C.dussumieri*. Major species of rays were *Dasyatis zugei* and *Actomylacus maculates*. Catfishes are one of the economically important table fishes along the Andhra coast. *Arius thalassinus, A. tenuispinis* and *A. dussumieri* were the major species.

Apart from the above resources, seasonal species landed included *Polynemus indicus* (0.5%), *Pomadasys* spp. (1.5%) *Lactarius lactarius* (0.7%), *Priacanthus* spp. (1%), *Cynoglossus macrolepidotus* (1.1%), *Psettodes erumei* (0.4%) and *Arioma indica* (2.5%). All the above groups, especially *Cynoglossus, Pomadasys, Lactarius* and *Arioma* have high market demand.

Pelagic resources contributed 35% to the total landings. The contribution of pelagic resources increased over the period from 25% in 1990's to 35% in 2000. The major groups were clupeids, carangids, ribbonfish, mackerel, barracuda and seerfish. Clupeids included lesser sardines *Sardinella fimbriata* and *S. gibbosa*, anchovies *Stolephorus waitei* and *Encrasicholina devisi* and *Thryssa* spp. Major carangids were *Decapterus russelii, D. lajang, Alepes djeddaba, Carangoides* spp., *Caranx* spp., *Megalspis cordyla, Scomberoides* spp., and *Selar crumenophthalmus*. The largehead hairtail, *Trichiurus lepturus* is the major species in the ribbonfish group. The catch is landed mainly in dry condition and fetches a high price. *Scomberomorus guttatus, S. commerson* are the major species of seerfish. Mackerel landings consisted of the single species *Rastrelliger kanagurta* and *Sphyraena jello* and *S. obtusata* represented barracudas.

Crustacean resources contributed 20% to the total trawl landings. The major prawn resources landed during the period were *Metapenaeus monoceros, M. dobsoni, M. affinis, Penaeus indicus, P. monodon, P. semisulcatus* and *P. japonicus* which are of high economic value. Besides these species, there were about 15 other penaeids, which are small in size supporting the fishery regularly. The major crab resources were *Portunus pelagicus, P. sanguinolentus*

and *Charybdis cruciata*. Molluscan resources include cuttlefish and squids, which are commercially important. Major species are *Sepia aculeata*, *S. pharaonis* and *Loligo duvaucelli*. Apart from the major groups, other groups included mostly demersal fish such as *Pentaprion longimanus, Sillago sihama, Gerres filamentosus, Lutjanus argentimaculatus, Platycephalus indicus* and serranids.

Landings by small trawlers and effort and landings by *sona* boats indicated an increasing trend at Visakhapatnam. Devaraj *et al.,* (1996) analyzed the coastal fisheries in the east coast of India and opined that there is scope for increasing the catch especially in the offshore areas of West Bengal, Orissa and Andhra Pradesh. The increasing trends observed is partially due to the fact that the boats based at Visakhapatnam have a wider area to operate and lands catch made as far away as Sand Heads in West Bengal. Kasim *et al.*, (2001) also attributed the increasing trend in the catch per unit to the influence of voyage fishing by trawlers at Kakinada. Munoz (1991) listed the characteristics of an overfished fishing ground as fluctuations in annual production, decreasing trend in CPUE, decreasing trend of the average size of fish, succession of species composition, decline in the number of species per fishing operation and increase in boat density off Manila Bay in Philippines. Although these characteristics are not discernible in the present study, earlier studies on individual resources at Visakhapatnam (Reuben *et al.*, 1997; Rao, 1999 b; Rajkumar *et al.*, 2003 a, b; Vivekanandan *et al.*, 2003) have indicated any further increase in effort would harm the fishery.

Catch composition of small trawlers in the present study was compared with the catch reported by Sastry and Chandrasekhar (1986). Major groups that showed decrease in percentage of the total catch are prawns, threadfin breams, lizardfish and silverbellies while sciaenids, ribbonfish and cephalopods did not show significant variation. The groups that showed substantial increase in catch were clupeids, crabs and carangids. At Visakhapatnam, silverbellies was the only group that showed a negative catch trend during 1994-2003. Silverbellies tend to diminish faster than the total stock because they occur in very shallow waters and are therefore more accessible and secondly they occur in waters generally also yielding prawns, so they are subjected to a disproportionately high fishing intensity when compared with species in other parts of the area (Pauly, 1977). The decrease in landings of silverbellies by both the trawlers, therefore, must be viewed seriously as any further increase in effort will lead to a rapid decline of its stock. Pauly (1979) further cautions that reduction in a particular group will have repercussion higher up in the food chain leading to decline in total stocks.

Bycatch-shrimp ratio ranged from 4.6 to 8.7 in small trawlers and from 2.1 to 6.9 in *sona* boats. Pelagic groups have become major bycatch in the trawl landings over the period. Mackerel and ribbonfish (either fresh or dried) fetch good price. In spite of this, most pelagic and undersized demersal finfish are discarded for want of storage space when shrimp catches are good. This is due to the difference in value between prawn and non-shrimp catches. However, the increase in demand for fish in other coastal states where catch have declined and in interior areas of Madhya Pradesh, Chattisgarh and Bihar has resulted in better utilization of the bycatch. Devaraj *et al.*, (1996) suggested that the bycatch could be landed at Diamond Harbour, Roy Chowk and Paradeep, which are nearer to Sand Heads to reduce the discard of bycatch. They also suggested that the storage capacity of the vessels could be increased in accordance with their length to accommodate the entire bycatch. Clucas (1997) concluded that discards can be reduced by identifying new ways to utilize the resource through research and development in areas of fish processing technology, market intelligence and access to market information between different groups and regions. Minimising catches of non-target groups will reduce the impact on the community and will help to sustain the resource in the long term. Semi-pelagic trawls (Brewer *et al.*, 1996) and mid-water trawls may be operated to target commercially important groups such as mackerel, if economics are encouraging.

It is observed that codend mesh size of trawlers at Visakhapatnam is as low as 10-15 mm in certain cases. Alagaraja *et al.*, (1986) emphasized the urgent need for maintaining the codend mesh size of trawlers at 30 mm. Studies on codend mesh size and individual resources conducted in other countries (Silvestre *et al.*, 1987; Ochavillo and Silvestre, 1991; Tokai, 1993; Perez-Comas *et al.*, 1998) and in India (Murty, 1985; Kasim 1993; Mohamed, 1996) conclusively prove that mesh size below 30 mm is inappropriate and leads to considerable economic losses. Along with the increase in mesh size, the use of square mesh codend has to be encouraged as it allows the smaller size groups of finfish and shellfish to escape (Kunjipalu *et al.*, 1998).

In 1999, government of Andhra Pradesh imposed a fishing ban for 45 days from April 16 to May 31 as a conservation measure and it is in practice till date. A cursory analysis of data indicate that there is an increase in catch after the ban period when compared to pre-ban period. However, it is difficult to assess whether this increase is due to the impact of ban alone as the fishery has undergone changes with the efficiency of trawlers, duration of fishing and range of exploited area. Ban on trawling for 45 days uninterrupted for the last 16 years has had a positive impact on the fish landing in Kerala (Yohannan *et al.*, 1999; Ghosh, 2004). Closure of the fishery for a short period or for longer periods of

time has shown an increase in landings by allowing the stocks to rebuild (Ye and Beddington, 1996; Bailey, 1997; Dinmore *et al.*, 2003; Pipitone *et al.*, 2003). Rao (2001), however, cautions that it is not possible to revive depleting resources by imposing closed season without a restriction on the number of vessels operating in the fishery. The trawl fishery at Visakhapatnam, therefore, needs to be regulated by reducing the effort, increasing the codend mesh size and by continuing the seasonal closure of the fishery.

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