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Tamilnadu, with a coast line of about 1000 km and continental shelf area of 41,412 sq. km., gives excellent scope for fishing throughout the year. During the past three decades fishing activity has increased throughout the state. The resources are presently exploited by traditional crafts and mechanized fishing boats. Continued technological advances in fishing fleet has increased fishing efficiency and fishing intensity. Changes in the pattern and mode of fishing operations such as multiday fishing has necessitated an appraisal of the trawl fishery of Tamilnadu during the last fifteen years. Data on catch and effort of trawlnet during 1985-2000 are analyzed for interpretation and to suggest management options.

Trend of fish landings in Tamilnadu

Tamilnadu ranks fourth among the maritime states of India with respect to total marine fish landings. The annual average estimated marine fish production during 1985-2000 amounted to 3.51 lakh tones, representing 15.8% of total all India landings. There was a gradual increase in the landings during 1985-1992 from 2.0 lakh t to 3.7 lakh t (Fig.1). The landings were slightly low in 1993, descending to 3.3 lakh t. Since then there was a recovery and landings reached record level of 4.7 lakh t in 1997. The landings again decreased to 3.9 lakh t in 2000. The average landing and its percentage to the total all India landings is given in table 1.

Table 1 : Average landing of Tamilnadu and its percentage to the total all India landings

Period	1986-1990	1991-1995	1996-2000
Average (x '000 t)	285	378	420
Percentage	14.9	16.5	16.2
Minimum & Maximum (x '000 t)		200 (1985)	472 (1997)

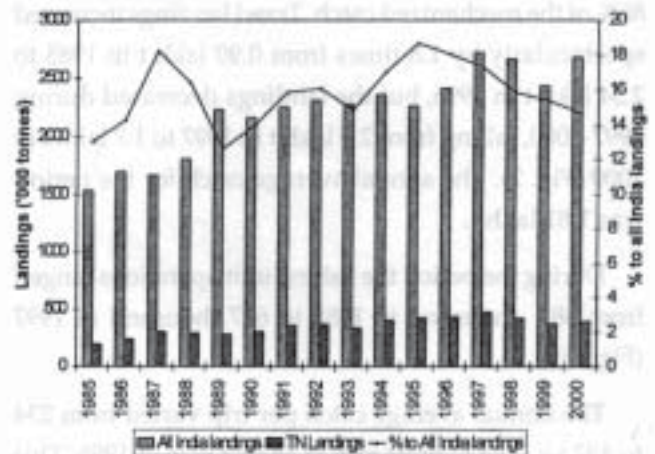


Fig. 1. Trend in marine fish landings in Tamilnadu along with all India landings 1985-2000

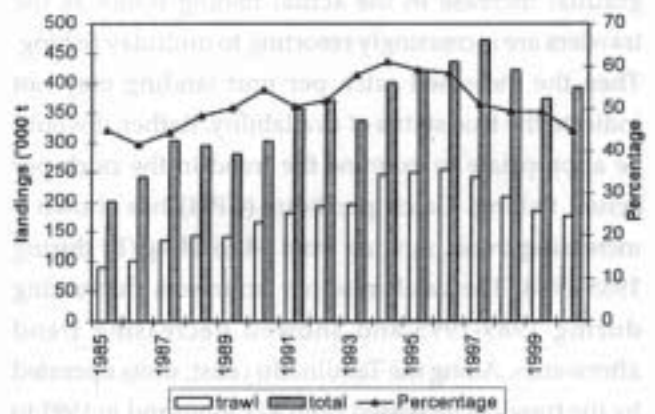


Fig. 2. Trend in the total trawl landings and its contribution to state landings

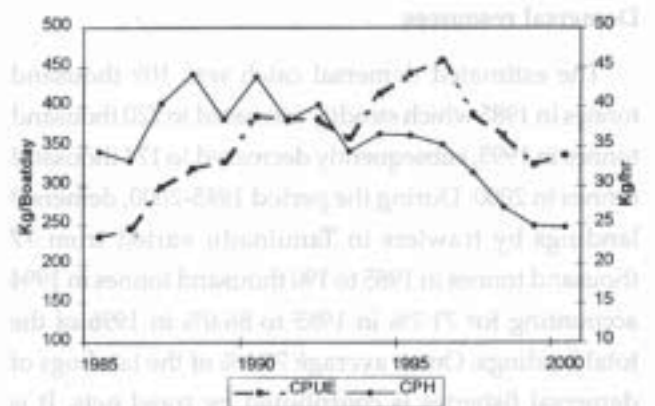


Fig. 3. Trend in the CPUE and CPH of trawl catch in Tamilnadu

Trawl Fishery

The landing of the trawlers alone accounted for 51% of the total landings of Tamilnadu, which was about 88% of the mechanized catch. Trawl landings increased spectacularly by 1.8 times from 0.90 lakh t in 1985 to 2.54 lakh t in 1996, but the landings decreased during 1997-2000, falling from 2.0 lakh t in 1997 to 1.7 lakh t in 2000 (Fig. 2). The annual average catch for the period was 1.81 lakh t.

During the period the fishing unit operations ranged from 385 thousand in 1985 to 617 thousand in 1997 (Fig. 3).

The annual average catch per trip varied from 234 to 457 kg. The highest rate of 457 kg was in 1996. This may be due to increased number of trawlers and extension of the fishing ground. Also, there has been gradual increase in the actual fishing hours as the trawlers are increasingly resorting to multiday fishing. Then the increased catch per unit landing may not indicate the true status of availability. Rather, it would be appropriate to examine the trend in the catch per actual fishing. Catch per hour (CPH) has shown an increasing trend, ranging from 34 to 44 kg/hr during 1985-1988. The catch rate per hour was fluctuating during 1989-1995 and showed decreasing trend afterwards. Along the Tamilnadu coast, units operated by the trawlers increased from 471 thousand in 1991 to 518 thousand in 2000. The fishing time spent per unit operation increased from 10 to 14 hours.

Demersal resources

The estimated demersal catch was 109 thousand tonnes in 1985 which steadily increased to 220 thousand tonnes in 1995, subsequently decreased to 174 thousand tonnes in 2000. During the period 1985-2000, demersal landings by trawlers in Tamilnadu varied from 77 thousand tonnes in 1985 to 190 thousand tonnes in 1994 accounting for 71.1% in 1985 to 86.6% in 1996 of the total landings. On an average 78.1% of the landings of demersal fisheries is contributed by trawl nets. It is noticed that in the total trawl landings, an average of 75.2% is demersal resources.

Catch composition

Eventhough different groups dominated during the years of observation, on an average silverbellies was the most abundant constituent (23.2%) followed by cluepids (14.2%), penaeid prawns (10.5%), croakers (4.8%), carangids (4.3%), rays (3.9%), threadfin-breems (3.9%), cephalopods (3.8%), other perches (3.3%), goatfishes (3.1%), crabs (2.8%), lizard fishes (2.6%), ribbonfishes (1.1%) and pigface breems (1.0%). On an average these together contributed 68.5% the total trawl landings.

Silverbellies

The fishes of the family *Leiognathidae*, popularly known as silverbellies registered steep and steady rise in their catches constituting a cheap source of food, fish meal and fertilizer. Earlier these fishes were mainly caught by indigenous craft and gears like catamarans and bagnets. Trawl nets appears to be quiet effective since the fishes habitually live at or nearer the bottom in large schools and do not seem to migrate long distance. It is observed that silverbellies is the major component of the total trawl catch. It however, fluctuated between 30 thousand tonnes and 52 thousand tonnes with an average of 39 thousand tonnes. On an average around 93% of the total silverbellies landings is by trawl catch. CPUE ranged from 57 kg in 2000 to 101 kg in 1986. It has shown a decreasing trend during 1987-2000, except 1990 and 1994. The average CPUE during 1985-2000 was 78 Kg. The CPH for the period 1985 to 2000 showed a minimum of 4 kg/hr in 2000 and a maximum of 14 kg/hr in 1986, with an average of 8 kg/hr.

Carangids

The annual average catch of carangids (1985-2000) is 8.2 thousand tonnes forming 4.3% of the total trawl catch. Carangid landings showed an increasing trend during 1985-1995. The landings in the region reached the highest level of 13 thousand tonnes (5.2%) in 1995, just over 1.8 thousand tonnes than it had been in 1985 (or 6 times increase), declined to 10.8 thousand tonnes in 1998 and again down to 7.2 thousand tonnes in 2000.

The CPUE showed an increasing trend during 1985-1990 reaching 22.1 kg/unit in 1990 from 6.0 kg/unit in 1985. CPUE stabilized until 1996, despite a decline in 1992 and 1994. But CPUE dropped to 13.8 kg/unit in 2000. CPH also showed the same trend as that of CPUE during 1985-2000.

Goatfishes

Goatfish catches increased by four times from 1.7 thousand tonnes in 1985 to 8.4 thousand tonnes in 1990. Catches showed a declining trend during 1991-1998, reaching 4.5 thousand tonnes in 1998. Since then the stock has recovered and landings reached 8.3 thousand tonnes in 1999, but again decreased to 5.3 thousand tonnes in 2000. During 1985-2000 period, the annual average landings of the goatfish has been 5.5 thousand tonnes forming 3.1% of the total trawl catch.

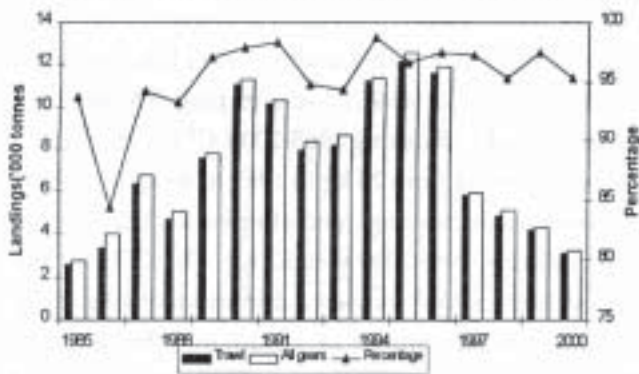


Fig. 4. Trend in the landings of threadfin breams and contribution of trawl to the resource landings by all gears

Ribbonfishes

Ribbonfishes or hair-tails of the family, Trichiuridae are important, low priced fishes. The annual average landing of ribbonfishes in the 1985-2000 period was 2 thousand tonnes which formed 1.1% of the total trawl catch. The catches have been found to vary widely from 444 tonnes in 1985 to 5.3 thousand tonnes in 1991. It collapsed in 1993 to 1.8 thousand tonnes. Since then the stock has recovered and landings reached 2.6 thousand tonnes in 1995 and showed a fluctuating trend during 1997-2000.

Other Perches

The annual average catch of the other perches for

1985-2000 was 6.2 thousand tonnes forming 3.3% of the total trawl landings, the catch rate being 1.1 kg/hr. The lowest yield of other perches was 2.4 thousand tonnes (2.6%) in 1985 and the highest yield 10.9 thousand tonnes (4.3%) in 1995. Maximum catch of 10.9 thousand t at 1.5 kg/hr was landed in 1996. Landings were good in 1994 (10 thousand tonnes) and 1997 (10.2 thousand tonnes) the catch rate being 1.5 and 1.3 kg/hr respectively. A decreasing trend in the landings has been noticed after 1997, only 6.1 thousand tonnes of croakers were landed in 2000.

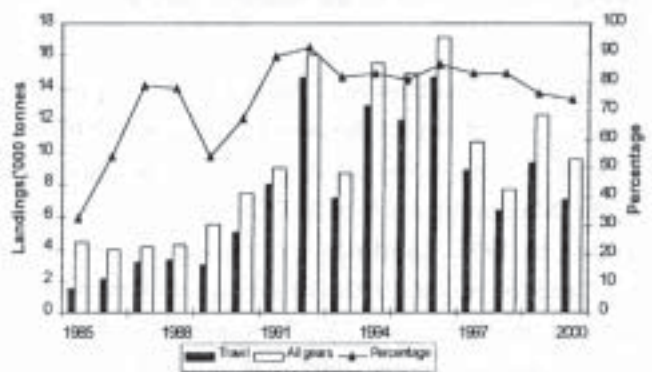


Fig. 5. Trend in the landings of cephalopods and contribution of trawl to the resource landings by all gears.

Threadfin breams

The annual average catch of threadfin breams for 1985-2000 has been 7.2 thousand tonnes forming 3.9% of the total trawl catch. During 1985-'88 and 1997-2000, the landings were below the average of 7.2 thousand tonnes (Fig. 4). From 1989-1996, landings improved. The landings showed a gradual increase over the years totalling 12.1 thousand tonnes in 1995, compared with 2.6 thousand tonnes in 1985. Moreover, the catch rate of threadfin breams spectacularly increased from 6.8 kg/unit in 1985 to 25.9 kg/unit in 1990, while it declined to 5.9 kg/unit in 2000.

Croakers

Fishes belonging to the family *Sciaenidae*, popularly called "jewfishes" or "croakers" live in the bottom areas of the nearshore waters. The yield from this fishery ranged from 4.5 thousand tonnes in 1985 to 17.8 thousand tonnes in 1995. Catch has generally decreased

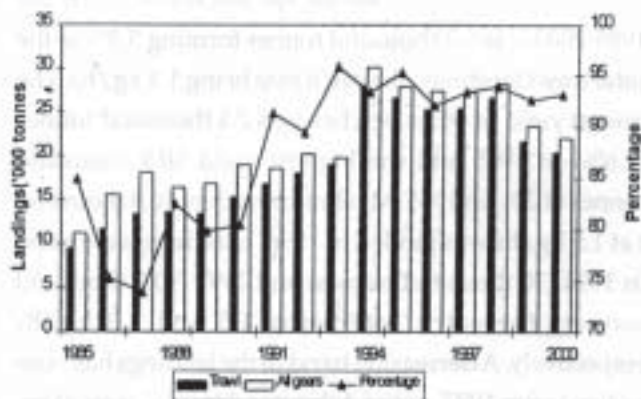


Fig. 6. Trend in the landings of penaeid prawns and contribution of trawl to the resource landings by all gears

despite an increase between 1995 and 1996. The average landings was about 8.4 thousand tonnes, which forms 4.8% of the total trawl catch, the catch rate being 1.7 kg/hr. Maximum catch of 11,792 t at 1.7 kg/hr was landed in 1995. Landings were good in 1991 (1.4 thousand tonnes) and 1994 (10.1 thousand tonnes); the catch rate being 2.2 and 1.5 kg/hr respectively. A steady decline in catch since 1997 was noticed, only 7.4 thousand tonnes of croakers were landed in 2000.

Cephalopods

Cephalopods comprise 3.8% of the total trawl landings in Tamilnadu. After rapid increase in landings until 1992, the cephalopods catch topped 14.7 thousand tonnes, declined to 7.2 thousand tonnes in 1992, the stock has recovered afterwards during 1994-1996 (Fig. 5). Landings has gone down again and reached 7.1 thousand tonnes in 2000. The CPUE and CPH over the years is showing similar type of trend over years. Both reached a highest value of 29.3 kg/unit and 3.1 kg/hr respectively in 1993. The CPUE and CPH is declining afterwards despite an increase during 1994-1996, reaching 13.5 kg/unit and 1.0 kg/hr respectively in 2000.

Crabs

Total catch of crabs during the period 1985-2000 ranged from 3.1 thousand tonnes to 8 thousand tonnes contributing 3.5 to 4.6% of the total trawl landings. The catch was maximum in 2000 and minimum in 1986 (2.4 thousand tonnes, 2.9% of the trawl catch) but the

percentage contribution was lowest in 1989 (1.8%, 2.5 thousand tonnes). The average catch for the 16 year period was 5.1 thousand tonnes forming 2.8% of the total trawl catch.

Penaeid prawns

This group formed the second most abundant component of the trawl fishery contributing to 11% (19.1 thousand tonnes) of the average yearly trawl landings. On an average around 88% of the total penaeid prawn landings is by trawl catch. During 1985-2000, the fluctuations in the annual trawl landings have been very marked. In 1985, the landings amounted to 9.6 thousand tonnes and increased gradually to 28.2 thousand tonnes in 1994 (Fig. 6).

In the years that followed there has been a decrease upto 19.1 thousand tonnes in 2000. However, the percent contribution of penaeid prawns to total trawl catch were almost stable and it varied between 9.3% (1990) to 11.8% (1999), accounting an average percentage of 10.5 during 1985-2000. CPUE showed an increasing trend from 25 kg in 1985 to 48 kg in 1994. It has shown a decreasing trend afterwards. The average CPUE during 1985-2000 was 37 Kg. The CPH for the period 1985 to 2000 showed a minimum of 4 kg/hr in 2000 and maximum of 14 kg/hr in 1986, with an average of 8 kg/hr. CPH showed a decreasing trend from 1989 to 2000. The annual average catch rate in the said period was 3.7 kg/hr.

Analysis of production peaks

The sequence of production peaks reached by each species or species group can be used to identify the different phases of the development of each fishery (FAO, 1996). The results of this analysis for trawl fishery are summarized in Table 2. This table shows the sequence of attainment of peak landings in a smoothed time series by three-year running-means. The procedure for smoothing the original time series has the effect of reducing, but not completely eliminating, the potential impact of interannual environmental changes on natural populations. The sequence of peaks is generally as would be expected, based on knowledge of fisheries development in Tamilnadu. The last column of Table 2

lists the ratio between recent landings (2000) and maximum landings. Ray landings has fallen by around 22 percent during 2000. Penaeid prawn landings is about 76 percent of the maximum landings. Silverbellies and croakers landing were around 64 and 70 percent respectively of the maximum landings. Cephalopod landings was less than 36 percent, but lizard fishes and threadfin breams have fallen by around 66 percent, or even more. Only crabs showed that recent landings are above the peak landings on a three-year running mean. The difference between peak and current landings should be interpreted with caution. Peaks in smoothed production, probably give an indication of the average long-term yield (ALTY) that the species assemblage in

the raw data should have reduced the potential impact of these problems. In this regard, however, it is acknowledged that historical trends are also the result of environmental changes and biological interactions, and declines may sometimes reflect potentially irreversible situations created by fishing and climatic changes in the exploited ecosystem.

The sum of the differences between the observed historical peak landings of each species or species group, smoothed by a 3-year running-mean and recent landings, amounts to about 20,000 tonnes. This observation implies that, if these individual species or species groups were all restored to their historical maximum levels, a gain of some 20,000 tonnes of

Table 2. Comparison of peak landings and recent landings (2000) of demersal fish species (three-year running means)

Sl. No.	Species group	2000 landings (t)	Maximum landings (t) (3 year means)	Period of maximum landings	Ratio of 2000 to maximum landings
1.	Goatfishes	5,296	6,601	1991-1993	0.90
2.	Rays	7,316	0,365	1997-2000	0.78
3.	Penaeid prawns	20,496	26,761	1994-1996	0.76
4.	Pigface breams	2,665	3,891	1994-1996	0.76
5.	Other perches	6,062	9,552	1994-1996	0.71
6.	Croakers	7,379	10,472	1994-1996	0.70
7.	Carangids	7,204	12,510	1994-1996	0.70
8.	Silver bellies	29,878	46,864	1994-1996	0.64
9.	Clupeids	23,754	42,307	1997-1999	0.56
10.	Cephalopods	7,051	13,221	1994-1996	0.53
11.	Lizard fish	3,187	9,282	1994-1996	0.34
12.	Threadfin breams	3,096	11,647	1994-1996	0.27
13.	Ribbon fishes	2,444	3,735	1991-1993	1.43
14.	Crabs	8,028	6,866	1997-1999	1.16

a given area may be helpful for sustainable production in the future, with proper management. However, in the case of demersal stocks, which are sensitive to natural fluctuations of climatic conditions on a decadal scale, peak harvests resulting from transient favourable environmental situations may bear little relation to the ALTY, although the smoothing procedure applied to

landings could be expected. However, some declines may reflect potentially irreversible situations created by habitat losses in the coastal zone caused, in turn, by the impact of human activities or by other environmental changes.

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