Available online at: www.mbai.org.in doi: 10.6024/jmbai.2012.54.2.01727-08

Quantitative changes in bottom trawl landings at Kasimedu, Chennai during 1998-2007

G. Mohanraj, Shoba Joe Kizhakudan*, E. Vivekanandan, H.M. Kasim, S. Lakshmi Pillai, Joe K. Kizhakudan, S.N. Sethi, S. Mohan, P. Thirumilu, S. Rajapackiam, S. Gomathy, P. Poovannan, G. Srinivasan, K.S.S.M. Yousuf and P. Vasu

Madras Research Centre of CMFRI, 75, Santhome High Road, R.A. Puram, Chennai, Tamil Nadu - 600 028.

*Correspondence e-mail: shobajoe@rediffmail.com

Received: 09 Jan 2012, Accepted: 19 Dec 2012, Published: 28 Dec 2012

Original Article

Abstract

During the period 1998-2007, an annual average of 20,898 t of marine resources was landed by trawlers at Kasimedu, Chennai, by expending a mean annual effort of 35,608 units. The annual catch during 1998-2007 showed fluctuations between 12182 t in 2005 and 35,838 t in 2002. The mean annual effort of 13.21 lakh h in 1998 dropped down to 5.08 lakh h in 2007; mean annual catch declined from 36,364 t in 1998 to 17,293 in 2007. Catch per hour (CPH) increased from 27.51 kg in 1998 to 33.98 kg in 2007, in spite of reduction in both. Multiday trawl units which formed only about 8% of the annual operational units during 1989-'91, accounted for 39% and 31% of the operational units in 1998 and 2006, respectively. Seasonal abundance of catch indicated that maximum catch was landed during the third and fourth quarters of the year, which contributed to 34.2% and 25.1% of the annual average catch during 1998-2007. Demersal finfish resources contributed maximum (38.1%) to the annual average catch during the period 1998-2007 followed by pelagic finfish resources (25.4%), crustacean resources (15.1%) and cephalopods (5.6%). Miscellaneous finfishes and shellfishes accounted for about 15.8% of the catch. The resources that regularly contributed to the bulk of the catch were elasmobranchs, carangids, threadfin breams, silverbellies, ribbonfishes, tunas, goatfishes, lizardfishes, croakers, barracudas, clupeids, whitebaits, snappers, shrimps, crabs and cephalopods.

Keywords: *Chennai, trawl fishery, quantitative changes, catch, effort, MSY.*

Introduction

Chennai in Tamil Nadu, is one of the most important fish landing centres along the east coast of India. Although exploratory surveys conducted by the Department of Fisheries of the Madras Presidency in the early period of the twentieth century indicated the existence of trawling grounds off this coast, commercial trawling activities began in the late 1960s and trawling became an active mode of exploitation from 1970s (Rao and Pillai, 1992). While several forms of indigenous craft and gear were prevalent then, there has been a marked transition of the fishing industry into a mechanised sector towards the 1990s. The total fish production of trawlers based at Chennai increased from 1,416 t in 1980 to 17,293 t in 2007. At present, trawlers from Chennai operate between Ongole and Nagapattinam moving up to offshore waters of 60-70 m depth. Trawl activities include single-day fishing and multiday fishing. Some trawlers also engage in gill net and hook and line operations for seerfishes and tunas. Dharmaraja *et al.* (1987) described the status of the trawl fishery during 1981-84. Ramamurthy *et al.* (1988) have given a detailed account of the fishes landed by trawl and other gear at Kasimedu Fisheries Harbour during the period 1981-'85. Vivekanandan *et al.* (1991) have presented a detailed analysis of the catch and effort data of mechanized

and indigenous gear for the years 1980-'86. Devaraj *et al*. (1996), in an analysis of the coastal fisheries and aquaculture management in the east coast of India, described the trawling areas exploited by Chennai-based vessels. Vivekanandan (1992) gave a detailed account of the catch trend and estimate of Maximum Sustainable Yield of demersal fishes off Chennai, based on data collected from exploratory trawlers based at Madras, and from commercial trawlers, for the period from 1973 to 1982. Rao and Pillai (1992) have described the commercial trawl fishery off Madras coast during the period 1980-'89. The present study attempts to throw light on the changes in the profile of bottom trawl fishing activities and catch trend during the 10-year period from 1998 to 2007.

Material and methods

Data on catch, effort and species composition were collected based on weekly observations of the trawl landings at Kasimedu Fisheries Harbour, Chennai during 1998-2007. Data on discards at sea have not been included in the present study. From the year 2001, trawl operations along the coast remain closed for a period of 45 to 50 days annually, from mid-April to the first week of June, and there is no trawl landing during the month of May. Trends in the catch, effort and species composition during 1998-2007 were compared with results published for earlier periods (Vivekanandan *et al*., 1991; Rao and Pillai, 1992). Estimates of Maximum Sustainable Yield (MSY) and optimum effort were arrived at by fitting Schaeffer's Surplus Production Model (Sparre and Venema, 1998) to the catch and effort data for all-fish, major pelagics, major demersals, major crustaceans and cephalopods landed by trawl at Kasimedu during 1998-2007. The model was also applied to the catch and effort data pertaining to some important pelagic, demerasl and crustacean resources which showed a perceptible change over the decade.

Results and discussion

Fishing area and fishing operations

The Fisheries Harbour at Kasimedu, commissioned in 1984, is situated in north Chennai, with a ground area of 24 ha and water spread area of 48 ha. The jetty is 495 m long. The tidal amplitude within the harbour is 1 m and the water depth at low tide is about 6 m. Periodical dredging is done to keep the bar mouth always open to facilitate movement of fishing crafts. The rivers, Cooum and Adyar flow into the sea at distances of about 10 and 15 km south of the harbour while the river Koutalaiyar flows into the sea at Ennore, about 15 km north of the harbour. The second-largest brackishwater lake in India, Pulicat Lake opens into the sea at about 35 km north of the harbour. The continental shelf south of the harbour, up to a depth of 30 m, is sandy. Further south, there are intermittent rocky patches which hinder free trawling operations.

About 500 trawlers operate from the Fisheries harbour at Kasimedu. Of this, about 200 are small trawlers of 10-11 m OAL (65 hp) and the rest are large trawlers of 13-15 m OAL (100-120 hp). The small trawlers are used for daily fishing operations in the vicinity of the Chennai coast while the large trawlers are operated for multi-day fishing voyages (5-7 days) mostly along the northern stretch up to Nizampatnam. Trawl operations were carried out mostly within the 50 m depth range in the early 1990s, and Devaraj *et al*. (1996) reported maximum trawling intensity in inshore waters (up to 50 m depth) along the Pulicat and the Nizampatnam stretches. The area of intensive trawling activities now extends beyond this, up to 60 m depth (Fig. 1). Some of the larger trawlers have started deep sea trawling operations in waters beyond 100 m depth since 2004, targeting deep sea shrimps and lobsters.

Fishery: Catch and effort

During the period 1998-2007, an annual average catch of 20,898 t of marine resources was landed by trawlers by

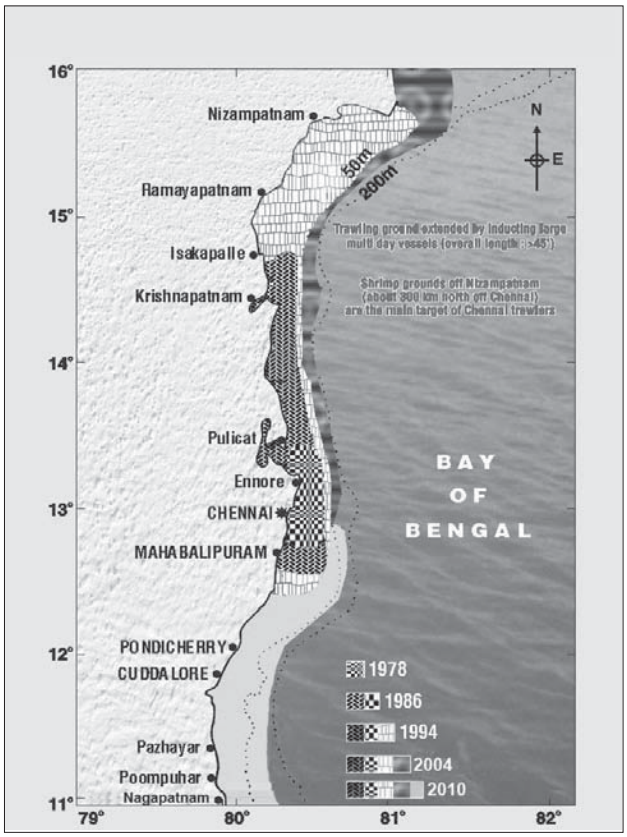

Fig. 1. Map showing extent of trawling grounds along Nagapattinam-Ongole stretch, Tamil Nadu.

Table 1. Catch and effort of trawlers based at Chennai during the period 1998-2007

Year	Effort (units)	Effort ('00000 hours)	Catch (t)	CPUE (kg/unit)	CPH (kg/h)
1998	53596	13.21	36364	678.49	27.51
1999	43767	10.47	20267	463.05	19.35
2000	42575	9.88	18219	427.93	18.45
2001	33750	7.43	20806	616.47	27.58
2002	53002	10.74	35838	676.16	33.36
2003	38510	8.01	19330	501.97	24.13
2004	17555	3.47	12776	727.77	36.86
2005	21890	4.96	12182	556.52	24.55
2006	27395	5.07	15906	580.62	31.39
2007	24036	5.09	17293	719.46	33.98
Average (1998-2007)	35608	7.84	20898	586.90	26.64
Average (1998-2002)	45338	10.37	26299	580.06	25.36
Average (2003-2007)	25877	5.32	15498	598.89	29.14

expending a mean annual effort of 35608 units in 7,84,466 actual fishing hours (Table 1). Both effort and catch has declined over the years while the catch per hour (CPH) had increased (Fig. 2). It is interesting to note that the CPH increased from 27.51 kg in 1998 to 33.98 kg in 2007, in spite of reduction in both, effort and catch. Maximum decline (46.1%) in the annual total catch was observed during the years 2002 and 2003 while maximum increase (72%) was observed during the years 2001 and 2002. The first five-year period (1998-2002) was found to be more productive than the succeeding one. The annual average number of units operated and actual fishing hours during 2003-'07 reduced to almost half to that of 1998-2002 (Table 1).

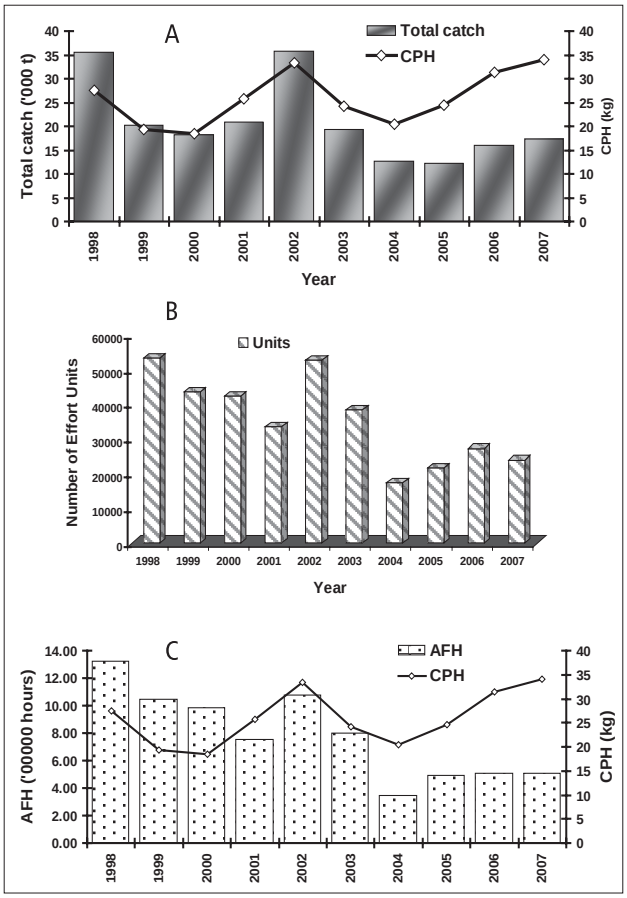

Fig. 2. Catch (A), effort (B) and catch rates (C) for trawlers based at Kasimedu, Chennai, during 1998-2007.

While multiday fishing operations contributed to only 20-25% of the total trawl landings at Chennai in the early 1990s, more than 75% of the catch is now accounted for by multiday trawl operations. Rao and Pillai (1992) reported a three-fold increase in the annual fish production during 1985-89 as compared to the previous five year period due to the starting of long trip shrimp trawling operations off Sriharikota-Nellore coast. Multiday trawl units, which formed only about 8% of the annual operational units during 1989-91 (Rao and Pillai,

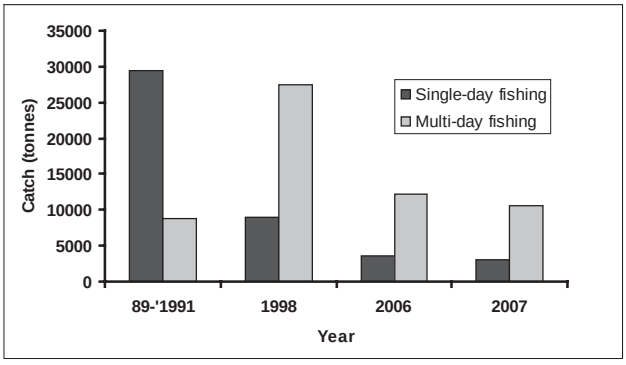

Fig. 3. Fish catch landed from single-day and multi-day operations by trawlers based at Kasimedu, Chennai

1992), accounted for 39% of the operational units in 1998, 31% in 2006, and 30% in 2007 (Fig. 3).

During the period 2003-'07, the fishery was affected by several external factors like hike in diesel prices and natural calamities like rough sea conditions during the rainy season and the tsunami that hit the Tamil Nadu coast on 26 December, 2004.

Seasonal abundance

Seasonal abundance of catch indicated that maximum catch was landed during the third and fourth quarters of the year, which contributed to 34.2% and 25.1% of the average annual catch during 1998-2007 (Fig. 4). Minimum catch was always recorded during the second quarter, except in the year 2005. The catch performance in the I quarter was better during 1998-2002 while catch performance in the II quarter was better during 2003-'07 (Fig. 5). Vivekanandan *et al*. (1983) reported heavy landings of several resources, especially threadfin breams, along the Madras coast during September and suggested that this may possibly be due to upwelling along the coast in this month.

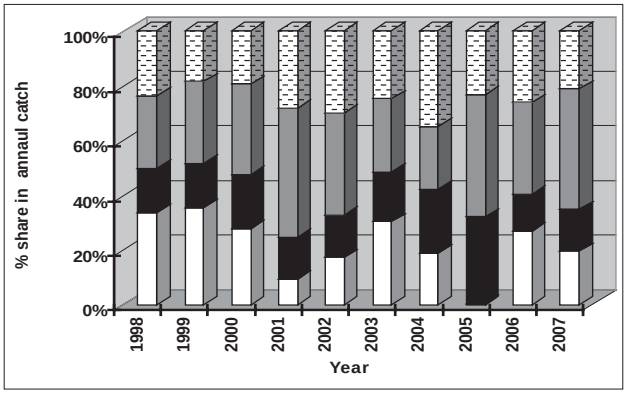

Fig. 4. Quarter-wise trawl landings of marine fish at Kasimedu, Chennai for the period 1998-2007.

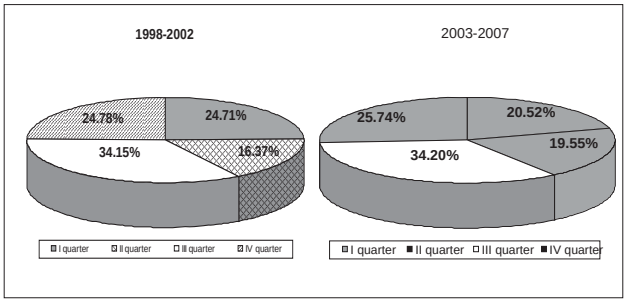

Fig. 5. Comparison of quarter-wise trawl landings at Kasimedu, Chennai for the periods 1998-2002 and 2003-2007

Catch composition

Demersal finfish resources contributed maximum (38.1%) to the annual average catch during the period 1998-2007, followed by pelagic finfishes (25.4%), crustaceans (15.1%) and cephalopods (5.6%). Miscellaneous finfishes and shellfishes that were either landed in low quantities or were of

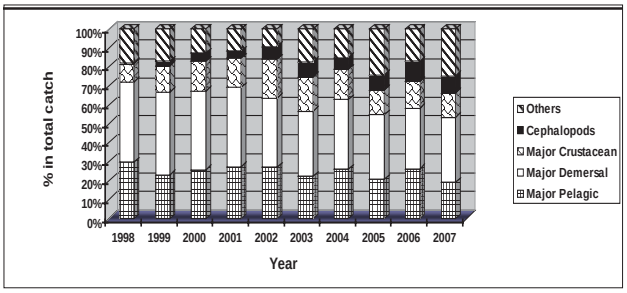

Fig.6. Share of major resources in annual trawl landings at Kasimedu, Chennai during 1998-2007

low economic value, along with juveniles of various species, and other marine resources like echinoderms, seaweeds etc., together accounted for about 15.8% of the catch (Fig. 6). The contributions of demersal and pelagic finfishes revealed a declining trend over the ten-year period. Crustacean resources showed an increasing trend from 1998 to 2002, after which the trend was negative. Cephalopods, on the other hand, showed an increasing trend from 1998 to 2007. The share of the miscellaneous catch decreased from 17.7% in 1998 to 9.4% in 2002, and thereafter increased to 24.2% in 2005. Major demersal fishes showed a decrease from the first five-year period by about 7% while major pelagic resources decreased by about 3%. The catch of miscellaneous, non-conventional and low-value resources showed an increase by about 5% (Fig. 7).

The annual contribution of major resources to the total catch is shown in Table 2. During 1998-2007, shrimps contributed maximum, forming 10.5% of the average annual catch, while sharks contributed the least (0.6%). There is a perceptible

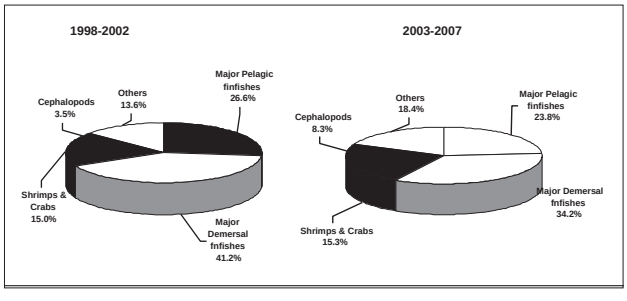

Fig.7. Comparison of contribution (in %) of major resources to average annual trawl landings at Kasimedu, Chennai, for the period 1998-2002 and 2003-2007

Table 2. Percentage contribution of major resources to annual trawl landing at Kasimedu (1998 - 2007)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
Sharks	0.87	1.06	0.35	0.43	0.52	0.70	0.46	0.49	0.56	0.62	0.60
Rays & Skates	5.44	5.06	3.99	3.82	3.89	3.08	2.89	2.66	2.57	3.40	3.68
Threadfin breams	6.85	6.62	7.03	7.69	8.50	7.68	8.02	7.70	8.59	6.95	7.56
Silverbellies	12.33	10.89	10.8	11.22	8.58	7.68	7.77	7.17	7.71	8.15	9.23
Ribbon fish	6.37	5.19	5.88	3.77	4.29	5.92	7.27	6.51	8.12	6.93	6.03
Carangids	7.22	8.81	7.33	9.53	8.71	6.06	8.79	6.16	8.25	1.06	7.19
Goat fish	4.74	10.22	6.52	5.37	3.61	2.95	3.59	5.58	3.72	4.14	5.04
Lizard fish	2.09	2.32	2.76	3.09	4.41	4.50	4.87	4.00	3.17	3.44	3.47
Croakers	6.76	5.75	8.12	6.47	3.91	4.81	4.07	3.93	3.16	4.82	5.18
Silverbiddies	0.16	0.20	1.03	1.40	1.51	1.03	2.62	1.26	1.01	0.01	1.02
Barracuda	1.70	1.39	1.55	1.84	2.13	2.36	1.81	2.11	1.60	2.05	1.85
Whitebaits	3.69	1.89	1.81	1.77	2.14	1.82	2.66	2.45	4.03	3.74	2.60
Clupeids	11.97	5.72	8.42	9.87	9.36	5.59	4.44	3.03	4.02	5.35	6.78
Perches	0.86	1.71	2.67	3.72	2.79	3.48	4.98	2.59	2.27	2.77	2.78
Shrimps	3.18	11.10	11.84	11.50	15.72	12.63	9.86	9.57	11.16	8.86	10.54
Crabs	6.65	2.65	3.49	3.47	4.45	4.99	5.37	3.27	2.83	3.85	4.10
Cephalopods	0.70	2.44	4.13	3.77	6.33	7.91	6.07	7.74	10.55	9.09	5.87
Others	18.42	16.96	12.30	11.27	9.17	16.81	14.46	23.79	16.69	24.77	16.46

decrease in the contribution of clupeids and silverbellies, while resources like threadfin breams, rays and skates, barracudas, croakers, lizardfish, goatfish and crabs have remained more or less steady over the years. While there has been an increase in the contribution of ribbonfish and whitebaits, cephalopods have shown maximum improvement, with the percentage in the total catch increasing from $<1\%$ in 1998 to $>10\%$ in 2006 (Table 2).

A comparison of the average annual percentage share of different resources during 1998-2007 with the information available for the period 1980-'86 (Vivekanandan *et al.*, 1991) and 1989-'91 (Rao and Pillai, 1992) reveals a marked decline in the contribution of threadfin breams, silverbellies, ribbonfish, goatfish, lizardfish and silverbiddies (Table 3).

Table 3. Composition of trawl landing at Kasimedu (%) – a comparison between three study periods

	1980-86 Vivekanandan *et al.*, 1991	1989-91 Rao & Pillai, 1992	1998-2007 Present study
Sharks	2.9	0.2	0.6
Rays & Skates		1.0	3.7
Threadfin breams	11.7	14.0	7.7
Silverbellies	10.1	16.0	9.3
Ribbon fish	2.6	8.2	6.1
Carangids	5.0	5.4	7.3
Goat fish	2.5	14.7	5.1
Lizard fish	5.8	5.7	3.5
Croakers	4.0	4.3	5.2
Silverbiddies		3.5	1.0
Barracuda		1.9	1.9
Whitebaits	1.3	0.4	2.6
Clupeids			6.8
Perches			1.5
Shrimps	9.9	5.7	10.7
Crabs		2.0	4.2
Cephalopods	3.3	7.0	6.0
Others	31.5	10.1	16.5

Maximum Sustainable Yield

The present average annual effort and average annual catch are much less than the estimated fmsy and MSY values (Table 4). The estimated MSY is 38,232 t for an estimated effort of 29.4 lakh hours. The maximum effort employed along the coast was 13.2 lakh hours in 1998, when the annual catch obtained was 36,364 t, which is the highest recorded for the period 1998-2007. The present average effort of 7.8 lakh hours can be increased by 3.7 times, to obtain 83% more yield. Estimates of MSY made for major pelagics, major demersal and major crustaceans revealed that although there

Table 4. Estimates of Maximum Sustainable Yield (MSY) and Optimum effort for resources exploited by trawl along Chennai coast

Resource	Annual optimum effort ('00000 hours)	MSY (tonnes)	Annual average effort ('00000 hours)	Annual average yield (t)
All Fish	29.41	38232	7.84	20898
Major Pelagics	76.49	21122	7.84	5451
Ribbonfish	13.53	1462	7.84	1248
Carangids	23.27	2651	7.84	1610
Barracudas	19.15	544	7.84	402
Whitebaits	15.63	657	7.84	555
Major demersals	99.30	40933	7.84	8166
Threadfin breams	19.75	2278	7.84	1634
Silverbiddies	3.97	273	7.84	236
Large Perches	7.02	563	7.84	566
Major Crustaceans	22.62	4741	7.84	3214
Shrimps	12.15	2357	7.84	2280
Crabs	66.27	3027	7.84	934
Cephalopods	4.27	1313	7.84	1156

is scope for increasing the present yield, the rate of increase required for optimum effort varies considerably, ranging from about 1.5 times the present effort for crustaceans to almost 5 times the present effort for major demersals.

Dharmaraja *et al*. (1987) observed that there was very little scope for increasing the yield from the conventional fishing grounds off Madras based on data from commercial trawl operations during 1981-84. Analysing the data collected from exploratory trawling operations between Velanganni and Nizampatnam during 1973 to 1982, Vivekanadan (1992) concluded that the fishing intensity off Chennai may be stepped up by 4.5 times to obtain 33% more demersal fish yield. However, from a depth-wise analysis within the surveyed area, he concluded that there was only marginal scope for increasing the yield from the inshore area of <30 m depth while there was good scope for increasing the fishing effort and obtaining about 2.5 times more catch from the area between 31 and 60 m depth. The values of optimum effort obtained in the present study for the all-fish catch and for different resources indicate that the scope for increasing the effort is not much. Even though trawl operations are carried out in waters up to 60-70 m depth, the bulk of the activity occurs in the 15-50 m depth range. Hence, considering the extent of fishing pressure being exerted on several important resources, there is a need to reorient the focus of trawl operations along the coast to deeper waters. Deep sea operations by some trawlers during December-February since 2004 have shown promise and the scope for increasing effort in this direction must be explored. The results of the present study indicate the potential of certain resources like carangids and cephalopods for fishing intensification. The MSY estimates obtained also indicate scope for improving the marine fish yield from this coast, with a multi-species fishery management approach. The spatial and seasonal availability of non-conventional resources which will find demand in the market, particularly as value-added products, is another possibility that could help revive the marine fish yield from this coast.

Acknowledgements

The authors are thankful to Dr. G. Syda Rao, Director, CMFRI, for the encouragement given and for permission to present this paper at MECOS 2009.

References

Devaraj, M., R. Paul Raj, E. Vivekanandan, K. Balan, R. Sathiadas and M. Srinath. 1996. Coastal fisheries and aquaculture management in the east coast of India. *Mar. Fish. Infor. Serv., T & E Ser.*, 141:1-9.

Dharmaraja, S.K., K. Vijayalakshmi, S.H. Najeemudeen, C.J. Prasad, M.B. Seymeudeen, K. Anandan, M. Kartikeyan and G. Balakrishnan. 1987. An appraisal of the marine fisheries of Tamil Nadu and Pondicherry. *CMFRI Spl. Publ*, 34 : 1-63.

Sparre, P. and S.C Venema, 1998. Introduction to tropical fish stock assessmentPart 1: Manual. FAO fisheries technical paper 306/1 Rev. 2. Food and Agriculture Organization of the United Nations. Rome. http://www.fao.org/docrep/w5449e/w5449e00.htm

Ramamurthy, S., J.C. Gnanamuthu, E. Vivekanandan, P. Ramadoss and S. Chandrasekhar. 1988. Marine Fish Calendar. VII. Madras. *Mar. Fish. Infor. Serv., T & E Ser.*, 85 : 1-9.

Rao, K. Satyanarayana and P.K. Mahadevan Pillai. 1992. Commercial trawl fishery off Madras coast during 1980-'89 with a comparative account of the catch trend of shrimp and fish trawlers during 1989-'91. *Mar. Fish. Infor. Serv., T & E Ser.*, 113 : 1-6.

Vivekanandan, E. 1992. Catch trend and Maximum Sustainable Yield of demersal fishes off Madras. *J. Mar. Biol. Ass. India,* 34 (1&2) : 10-13.

Vivekananadan, E., J. C. Gnanamuthu, S. Srinivasarengan, P. Devadoss, M.D.K. Kuthalingam, S. K. Balakumar, S. Chandrasekar and S. Mohan. 1991. Exploited marine fishery resources of Madras. *J. Mar. Biol. Ass. India*, 33 (1&2) : 40-48.

Vivekanandan, E., M. Kathirvel, V. Selvaraj, K.G. Girijavallabhan, M. Rajagopalan and L. Chidambaram. 1983. Spurt in landings along north Tamil Nadu coast. *Mar. Fish. Infor. Serv., T & E Ser.*, 70 : 18-19.