Proceedings of the Second Workshop on Scientific Results of *FORV Sagar Sampada*

Editors

V.K. Pillai
S.A.H. Abidi
V. Ravindran
K.K. Balachandran
Vikram V. Agadi

Department of Ocean Development
Government of India
New Delhi
1996

Department of Ocean Development (DOD)
Government of India
Mahasagar Bhavan, Block No-12
C.G.O. Complex, Lodi Road
New Delhi-110 003
India

ISBN : 81-900656-0-2

Citation Styles

For entire volume

Pillai, V.K. Abidi, S.A.H., Ravindran, V., Balachandran, K.K. & Agadi, V.V. (Eds.) 1996. *Proceedings of the Second Workshop on Scientific Results of FORV Sagar Sampada*, (Department of Ocean Development, New Delhi), pp. 564.

For individual article

Goswamy, S.C. & Shrivastava, Y. 1996. Zooplankton standing stock, community structure and diversity in the northern Arabian Sea, In: *Proceedings of the Second Workshop on Scientific Results of FORV Sagar Sampada*, edited by V.K. Pillai, S.A.H. Abidi, V. Ravindran, K. K. Balachandran & V.V. Agadi, (Department of Ocean Development, New Delhi), pp. 127-137.

Designed and Printed by:

Publications & Information Directorate
Council of Scientific & Industrial Research
Pusa Campus, New Delhi-110 012
India

Proc. Second Workshop Scient. Resul. FORV Sagar Sampada, 1996, pp. 305–314

Catfish resource in the Indian shelf waters

N.G. Menon, K. Balachandran. S.G. Raje, P.U. Zachariah, M.Feroz Khan,
Y. Appanna Sastry & P. Jayasankar

Central Marine Fisheries Research Institute, P.B.No.-1603,
Cochin- 682014

ABSTRACT

At attempt is made to analyse the bottom trawl fishing data collected by 91 cruises of *FORV Sagar Sampada* (1985 - '91). The vessel trawled in 544 stations spread over both the coasts up to a depth of 100 m and catfishes appeared in 54 stations with catch 3 -2401 kg/hr. The dominant species occurred beyond 50 m depth belt was invariably *Tachysurus thalassinus* whereas shoaling species like *T. tenuispinis* and *T.dussumieri* are reported from grounds less than 50 m. The resource has better abundance in 51 -100 m depth belt along northwest and northeast region.

INTRODUCTION

The estimated potential marine catfish available for exploitation in the Indian EEZ is 123000 tonne out of which 60000 tonne is from depths below 50 m and 63000 tonne from above 50 m depth (Anon, 1991). The annual average production of catfishes during 1988 -1992 period was 44167 tonne showing a general declining trend. This production was achieved chiefly from coastal waters preferably below 50 m depth. The decline in the landing is more marked in the southwest region. In the maritime states of Kerala, Karnataka and Goa the catfish landings have declined drastically from 9960 tonne (1988) to 1029 tonne (1992); 8817 (1988) to 294 tonne (1992); and 3925 (1988) to 123 tonne (1992) respectively. Although the earlier exploratory surveys, acoustic surveys and experimental fishing surveys have located potentially rich catfish fishing grounds along the coasts, the present landings from the shallow grounds registered a continuously dwindling trend. Investigations conducted so far on this important group of demersal fish clearly reveal that the major reasons for the depletion of stocks are brooder/spawner destruction from spawning grounds during a restricted spawning season by a mass harvesting device, the purse seine and irrational removal of juveniles and destruction of their feeding grounds by incesscent coastal bottom trawl operations (Silas *et al.* 1980; Anon, 1987; James *et al.* 1989; Bensam & Menon, 1994). Further the stock assessment studies conducted on this group also reveal that

most of the shoaling and migrating species are over exploited from the presently fished grounds of <50 m depth (Anon, 1987; Menon *et al.* 1994).

It is relevant to recall here the results of ground fish resource surveys of FSI, FAO/UNDP and *FORV Sagar Sampada*, all of which have located fairly high productive grounds for catfishes in depths above 50 m preferably along southwest during monsoon season (Rao *et al.* 1977; Philip, 1986; Joseph & John 1987; Sudarsan *et al.* 1988; James & Pillai, 1990; Vijayakumar & Naik, 1991). In order to sort out this anomaly between the high potentials and low production, the results of the experimental fishing surveys (bottom trawl) conducted on board *FORV Sagar Sampada* during cruises 1-91 (1985 - 1991) are analysed critically to evaluate the present trend of catfish potential in different geographic and bathymetric realm of the shelf waters, preferably within 50 - 100 m depth belt, where the maximum trawling was undertaken. Short biological account of major species caught in the bottom trawl is also included in this report.

MATERIALS AND METHODS

Catch particulars of bottom trawl nets (Chalut, Star model, Granton, Kalute, HSDT I, II, III) operated from *FORV Sagar Sampada* during cruises 1 -91 along the EEZ during February 1985 - June 1991 are utilised for this study. The data were analysed for different regions, northwest, southwest, southeast and northeast. The data were also pooled for different bathymetric zones, 0-50m 51-100m and above 100m to estimate the bathymetric abundance in the above 4 regions. The species composition was estimated for each region and the samples were analysed for the size composition and maturity conditions. The standing stocks and potential yields are estimated (Gulland, 1969) and 60% of the standing stock (B) is reckoned as the potential yield. The biomass was estimated for each 1° square grid (343 km^2) by averaging the catch per hour of the different stations coming within the 1° grid and using the head rope length of the bottom trawl net operated and speed of tow in the respective stations.

RESULTS

Since the potential yield of catfishes within below 50 m depth zone is well-known from the commercial trawl data records of earlier studies, the present attempt is mainly restricted to estimate the potential yield of catfishes within the depth zone of 51 - 100m. Out of 414 trawling stations covered catfishes were reported from 54 stations preferably in the depth belt 30 - 100 m. In the middle shelf waters (51-100m) the vessel trawled along 234 stations and catfish occurred in 34 stations.

Experimental fishing

In order to estimate the relative availability and abundance of ground fish resources in different geographic and bathymetric areas of middle and outer shelf waters of the EEZ, bottom trawling was made in 414 stations within the depth belt 30-200 m and in

a few stations beyond 200 m also. The total catch (Table 1) from the surveyed areas in the EEZ was 262.6 tonne at a catch rate of 634 kg/haul and catfish formed only 2.2% of the total catch. The vessel occupied 234 stations within 51 - 100 m depth belt with an yield of 200.1 tonne (76% of total catch) and catfish has accounted for 1.2% of the total catch of this depth zone. In the total catfish landings the 51-100 m depth zone contributed only <40%.

Along the northwest region the vessel trawled in 55 stations, out of which 41 stations were within the depth belt 51-100 m and the average fish catch rate in this depth zone was 517 kg/hr. Catfish was caught in 7 stations within the depth belt 36-64 m with a production range of 10-597 kg/ haul. In this region catfish has accounted for 20% of the total positive trawl catch with a mean catch rate of 79.6 kg/hr. In the southwest region the vessel trawled at 198 stations, out of which 109 stations were within 51-100 m depth with a mean catch rate of 1094 kg/hr. Only 9 stations yielded catfish and the catch ranged from 5 to 2401 kg/haul. It formed 47.8% of the total positive trawl catch of this region. The mean catfish catch rate was 269.2 kg/hr. Along the west coast catfish has accounted for 37.8% of the total bottom trawl productions by the positive stations in the total 253 stations occupied by the vessel. The mean catch was 185 kg/hr in the west coast.

Although the vessel trawled in 57 stations along the southeast coast with a fish production of 338 kg/hr, catfish was never encountered from the trawl catch of this region in appreciable quantities either from shallow grounds or from deeper areas. During the cruises the vessel covered 104 stations for bottom trawling operations along the northeast region. The region yielded a catch rate of 389 kg/hr of fish. Catfish was recorded in 38 stations within the depth belt 33 - 100 m (Fig.1). The catch ranged from 3-1500 kg/haul and has accounted for 9.8% of the total trawl catch of 38 stations. The mean catfish catch from this region was 73.7 kg/hr.

Table 1 - Regionwise bottom trawling results of *FORV Sagar Sampada*

Region	Total stations trawled	No. of stations with catfish catch	Depth range (m)	Total catch (kg)	Catfish catch (kg)	Catfish in total catch (%)	Average total catch (kg/hr)	Average catfish catch (kg/hr)
Northwest	55	7	36-235	25573	597	2.3	465	11
Southwest	198	9	40-400	155287	2557	1.6	784	13
Northeast	104	38	33-263	48191	2725	5.7	463	26
Southeast	57	-	23-221	33595	-	-	589	-

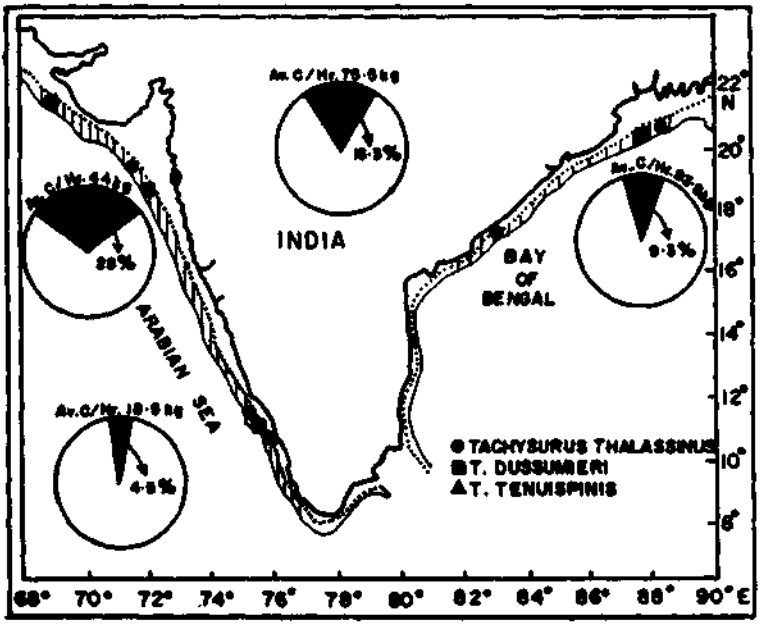

Fig. 1 - Regionwise average catfish catch (kg/hr) in 50-100 m depth zone

Production from different latitudes

The rate of catfish production in the northwest region has varied from 20 kg/hr in 16°N to 195 kg/hr in 18° N latitude (Table 2). In the southwest region the catfish yield has ranged from 11 kg/hr in 12° N to 808 kg/hr in 10° N latitude. The latitude-wise production rate was within 4.5 kg/hr (16° N) and 35 kg/hr in 20° N in the northeast region.

Bathymetric abundance

Latitude-wise catfish catch/hour from the two depth zones 0-50m and 51-100m is given in Table 2. The catfish catch by bottom trawl from depth below 50m was 120.3 kg/hr along the northwest region. Whereas the production rate was 44 kg in the depth zone 51-100 m. It has accounted for 17.8 % in shallow grounds of less than 50 m and 27.8% in middle shelf areas of 51- 100m. The shallow grounds of <50 m depth zone in the southwest zone landed catfishes at a catch rate of 613.8 kg/hr and it has accounted for about 80% of the trawl catch. In the depth belt 51-100m the catch rate was only 18.5 kg/hr and catfish formed 4.5% of the total catch. The catfish production rate from 0-50 m depth belt along the northeast region was 73.7 kg/hr and it formed 13.3% of the total yield of bottom trawl operations. Higher production rates of about 94 kg/hr was recorded from 51- 100m depth zone and catfish has accounted for 9.3%.

Table 2 - Latitudewise and depthwise catfish abundance

Latitude	Total catch (kg)	Catfish catch (kg)	Catfish (%)	Catfish catch (kg/hr)	0-50 m depth			51-100 m depth		
					Total catch (kg)	Catfish catch (kg)	Catfish (%)	Total catch (kg)	Catfish catch (kg)	Catfish (%)
West coast										
18°N	1772	195	11	194	1772	195	11	-	-	-
17°N	524	150	29	75	189	96	51	335	54	16
16°N	100	20	20	20	-	-	-	100	20	20
15°N	599	232	39	66	599	232	39	-	-	-
14°N	58	13	22	13	-	-	-	58	13	22
13°N	480	50	10	50	-	-	-	480	50	10
12°N	1710	27	2	11	1635	12	1	75	15	33
10°N	2456	2418	98	808	2434	2413	99	22	12	55
9°N	116	12	10	12	116	12	10	-	-	-
7°N	526	37	7	37	526	37	7	-	-	-
East coast										
20°N	3576	316	12	35	2495	300	12	81	13	16
19°N	23706	2297	10	119	1075	237	22	22631	2060	9
18°N	1174	90	8	17	288	16	6	886	74	8
17°N	291	16	6	11	-	-	-	291	16	6
16°N	97	9	9	5	49	4	8	48	5	10

Potential yield

The potential yield of catfish for each 10' square grid for areas upto 100 m depth belt was estimated by utilising the catch per hour data derived from the bottom trawling results. Although the stations were few, the estimate for the northwest region (15° N-23° 30'N) shows a potential of 26500 tonne from 51-100 m depth belt. The estimated potential for the southwest region (7° 30'N -15°N) is only 3540 tonne from 51-100 m depth zone. The northeast region (15°N- 21° 45' N) within the depth belt 51-100 m has an estimated potential of 10100 tonne. The potential yield /km within 51-100 m has ranged from 0.12 tonne/km in the southwest coast, 0.27 tonne/ km in the northwest region to 0.58 tonne/km in the northwest region. The shallower grounds of 0-50 m depth has an estimated potential of 57000 tonne which is very close to the revalidated potential from this depth belt, in the northwest, southwest and northeast regions with the maximum contribution of 64% from the northeast region alone.

Seasonal abundance

The monthly catfish catch rates from three regions, northwest, southwest and northeast is shown in Table 3. The coverage is not sufficient enough to give seasonal abundance of catfish in the surveyed areas. However from the available data it is found that the resource has better abundance during postmonsoon months of September - December with catch rate ranging from 46-195 kg/hr preferably in 51-100 m depth zone. This resource is abundant in depths below 50 m during monsoon season with

Table 3 - Seasonal abundance of catfishes

Months	Northwest catch (kg/hr)	Southwest catch (kg/hr)	Northeast catch (kg/hr)
January	-	12	15
February	-	-	-
March	-	-	18
April	-	-	49
May	-	-	140
June	-	495	-
July	20	50	26
August	-	-	-
September	96	-	55
October	195	-	29
November	46	-	46
December	92	12	-

monthly values of 50 -496 kg/hr in July and June respectively. In the northeast region, with a better seasonal coverage, it is found that the average monthly catch rate varied from 15 kg/hr (January) to 140 kg/hr (May). No definite seasonal abundance of catfish is discernible in this region.

Species composition

The species composition of catfish in the coastal commercial fisheries and their biology have been well presented (Anon, 1987; Dan, 1977, 1980; Menon, 1979, 1984 a,b ; Menon *et al.* 1992; Majumdar, 1971, 1977, 1978). Along the northwest coast species such as *Tachysurus dussumieri, T. cealatus, T. tenuispinis* and *O. militaris* dominated the coastal fishery although more than 8 species occurred in this region. On the contrary, the survey results showed that the most abundant component of catfish from 51-100 m depth is *T. thalassinus.* In the southwest region the nearshore commercial catch composed chiefly of *T. tenuispinis, T. thalassinus,* and *T. dussumieri* in their order of abundance. Several species appeared in the commercial catches of southeast coast with particular dominance of *T.thalassinus, T. dussumieri, T. caelatus* and *T. platystomus.* Although many species were caught from the shallow grounds of northeast coast. The experimental bottom trawling in 51-100 m depth netted only *T. thalassinus* and *T. dussumieri.*

Biology

Biological investigations conducted based on data and samples derived from bottom trawl landings preferably from depths above 50 m on three species such as *T. thalassinus, T. tenuispinis* and *T. dussumieri* revealed that the entire exploited stocks belong to adult populations in the age classes II - V years. The length range of *T.thalassinus* was from 20-60 cm and the dominant size classes were within 35-50 cm. The size of *T. tenuispinis* varied from 30 -50 cm and dominated by 45-50 cm fishes. The catch of *T. dussumieri* was low and represented by sizes 30-70 cm. Invariably females of *T. thalassinus* (F:M = 1:0.7) dominated the catch and belonged to maturity stages III - V in June, July months. It fed mainly on *Nemipterus* spp. *Squilla* spp and other ground fishes and prawns. *T. tenuispinis* catch was predominated by maturity stages II - IV and the sex ratio was F:M = 1:0.9.

DISCUSSION

The revalidated catfish potential from the Indian EEZ is 123000 tonne, to be shared by 0-50 m depth and above 50 m depth at the rate of 60000 tonnes and 63000 tonnes respectively (Anon, 1991). The production from presently exploited grounds below 50 m depth showed a gradual decline from 54219 tonne (1988) to 34100 tonne (1991). In this catch the northwest region contributed 57% and the northeast region 23%, whereas the southwest and southeast regions together landed only 20% of the total yield. On the contrary during 1978 - '82 the average catfish catch was 51734 tonne

which is shared by northwest (37.6%), southwest (34.6%), southeast (9.8%) and northeast (18%). This drastic decline in production along the southwest and southeast regions especially in depths below 50 m is due to irrational destruction of spawners and brooders, juvenile overharvest by mechanised trawlers from coastal fishing ground and destruction of prey diversity from the feeding grounds (James *et al.* 1989; Lakshmi & Srinivasa Rao, 1992; Menon *et.al* 1992; Bensam *et.al* 1994). Further the stock assessment of catfishes from depths below 50 m also showed that the present fishing pressure has surpassed the optimum for a sustainable yield (Anon 1987 ; Menon *et al.* 1994). In this circumstance it is felt necessary to analyse the bottom trawl data collected by *FORV Sagar Sampada* especially from the middle shelf water (above 50 m) for a meaningful estimate of the catfish biomass and potential yield available in the middle shelf waters for exploitation, which could be of immense help for managing this resource.

The earlier resource surveys conducted by FSI showed the highest catch rate (40.2 kg/hr) for catfish from the northeast region forming 17.4% of the total catch. The survey also indicated that the depth zone 50-100 m is highly productive for catfish with 53.2 kg/hr, whereas fairly high catches (45.7 kg/hr) were recorded in depths below 50 m in the southwest coast (Joseph & John, 1987). Ruben *et al.* (1987) estimated the potential yield of catfishes in the northeast coast as 30000 tonne; whereas the present estimate from 51-100 m depth of above region is only 10000 tonne. James & Pillai (1990) also reported that higher concentration of catfish exist off southwest, centralwest and northeast coasts. Vijayakumaran & Naik (1991) also reported on the high abundance (55 kg/hr) of catfishes along the northeast coast within 51-100 m depth belt. The rate of production based on the present analysis from the same region shows still higher value (94 kg/hr) and catfish formed 9% of the total catch. From the stagnating or declining production in the coastal waters, it is evident that the resource within 50 m depth is being tapped either to the optimum level or beyond the sustainable yield. The commercial coastal fishery was mainly supported by juvenile or sub-adult stages (30-80% of catfish catch or trawl net) from the mechanised trawlers and spawner/brooder from the purse seine fishery (about 60% of the total catfish catch by the gear). Mass exploitation at both the stages are detrimental to sustainable yield. Therefore, efforts should be made to exploit the stocks available in the deeper waters of 51-100 m.

The results of the present investigation very clearly showed that the potential available in the deeper grounds belong to higher age classes and mature fishes, spawned atleast once, therefore, their exploitation does not pose recruitment overfishing.

REFERENCES

Anon. 1987. Marine catfish resources of India, *Bull. Cent. Mar. Fish. Res. Inst.* 40:1-94.

Anon. 1991. *Report on working group on revalidation of the potential marine fisheries resources of the Exclusive Economic Zone,* (MPEDA, Cochin) pp.57.

Bensam, P & Menon N.G. 1994. The endangered, vulnerable and rare demersal marine finfishes of India, In : *Threatened fishes of India,* (NATCON, Allahabad): pp.297-305.

Bensam, P. Menon.N.G, Balachandran.K, Andrews, J. 1994. Need for protecting the non-edible benthic biota of the in-shore waters for the benefit of the coastal resources and the fishing industry. *Mar. Fish. Infor. Serv. T & E Serv.* No 128 : 1 - 5.

Dan, S.S. 1977. Maturity, spawning and fecundity in the catfish, Tachysurus tenuispinis (Day), *Indian J. Fish.* 24: 96-106.

Dan, S.S. 1980. Age and growth in the catfish, *Tachysurus tenuispinis* (Day), *Indian J. Fish.* 27 (1&2): 220-235.

Gulland, J.A. 1969. Manual of methods for fish stock assessment, Part 1. Fishery population analysis. *FAO Mar. Fish. Sic. A,* pp.154.

James, P.S.B.R., Bande, V.N., Menon.N.G., & Balachandran K. 1989. The catfish resources of southwest coast of India: Prospects and management problems, *Bull. Cent. Mar. Fish. Res. Inst.* 44 (1):78-94.

James, P.S.B.R. & Pillai V.N. 1990. Fishable concentrations of fishes and crustaceans in the offshore and deep sea areas of the Indian Exclusive Economic Zone based on observations made on board *FORV Sagar Sampada,* In: *Proc. First Workshop Sci. Result FORV Sagar Sampada,* edited by K.J. Mathew, (CMFRI, Cochin) pp.201-213.

Joseph, K.M. & John M.E. 1987. Potential marine fishery resources, *CMFRI Special Publication* No 30 : 18-43.

Lakshmi, K. & Srinivasa Rao, K. 1992. Trends in catfish catches at Visakhapatnam showing disappearance of *Arius tenuispinis. J. Mar. Biol. Ass. India,* 34 (1 & 2): 26 -37.

Menon, N.G. 1979. *Studies on the biology and fishery of the giant marine catfish, Tachysurus thalassinus (Ruppell),* Ph.D. thesis, University of Cochin, Cochin.

Menon, N.G. 1984 a. Observation on the intraovarian ova of a few tachysurids from Indian waters, *Indian J. Fish.* 31 (2):250-256.

Menon, N.G. 1984 b. On the biology of the flat-mouthed catfish, *Tachysurus platystomus* (Day) from Mandapam *Indian J. Fish.* 31 (2): 293 -308.

Menon, N.G. Bande, V.N. Muthiah, Raje, S.G. Zachariah, P.U. & Balachandran K. 1992. Present status of exploitation of fish and shellfish resources : Catfishes. *Bull. Cent. Mar. Fish. Res. Inst.* 45: 133-153.

Menon, N.G., Srinath, M. Zachariah, P.U. Raje, S.G. & Appanna Sastry, Y. 1994. Stock assessment of catfishes of India, *Indian J. Fish.* 39 (1 & 2):65-84.

Mojumder, P. 1971. Length-weight relationship in catfish *Tachysurus thalassinus* (Ruppell), *Indian J. Fish.* 18: 179-182.

Mojumder, P. 1977. Length frequency studies in the catfish, *Tachysurus thalassinus* (Ruppell) at Waltair during the years 1964-65 to 1969-70, *Indian J. Fish.* 25 (1 &2) : 109 - 121.

Philip, K.P. 1986. Fishery resources off the offshore and deep sea waters of Karnataka and the fishing effort suggested for exploitation, In: *Proc. Sem. on problems and prospects of marine fishing and fish processing in Karnataka,* (Forum of Fishery Professionals, Mangalore) pp.28-35.

Rao, K.V. N., Kumaran, M. & Sankara Subramanian J. 1977. Resources of ribbonfishes and catfishes of the soutwest coast of India, *Seafood Export J.* 9 (11):9 -26.

Reuben, S. Sudhakara Rao. G., Luther, G., Appa Rao, T., Radhakrishna, K., Appanna Sastry, Y. & Radhakrishnan, G. 1989. An assessment of the bottom trawl fishery resources of the northeast coast of India, *Bull. Cent. Mar. Fish. Res. Inst.* 44 (1):59-77.

Silas, E.G., Parameshwaran Pillai, P., Dhulkhed M.H. Muthiah C . & Syda Rao, G. 1980. Purse seine fishery - Imperative need for regulations, *Mar. Fish. Infor. Serv. T & E Ser.* 24 : 1 -9.

Sudarsan, D., Sivaprakasam, T.E., Somavanshi, V.S., John, M.E., Nair, K.N.V. & Joseph, A. 1988. An appraisal of the marine fishery resources of the Indian Exclusive Economic Zone, *Bull. Fish. Surv. India.* 18: pp.85.

Vijayakumaran, K. & Naik, S.K. 1991. Demersal finfish resources of the inter-continental shelf of the EEZ, In: *Proc. Nat. Workshop Fish. Resour. Data Fish Indus,* (FSI, Bombay) pp. 71-79.

* * *