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PRESENT STATUS OF EXPLOITATION OF FISH AND SHELLFISH RESOURCES : WHITEBAITS

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Abstract

On the basis of data from Vizhinjam, Cochin and Mangalore, the trends in fishery, species composition, biology of different species and distribution in space and time of whitebait are presented with reference to premonsoon, monsoon and postmonsoon seasons. Of the three centres, the fishing grounds off Mangalore are found to be most productive for whitebaits. In the inshore fishing grounds at Cochin and Mangalore, the whitebaits seem to be absent during monsoon months. At Vizhinjam, however, the main whitebait fishery season coincides with the monsoon period. In the light of the data presented, the rational exploitation of whitebait resources during monsoon, postmonsoon and premonsoon seasons is discussed.

Introduction

The present whitebait production in the country is around 85,000 tonnes, accounting for about 8% of the pelagic fish catch or about 4% of the total marine fish production. Most of the catch (97%) is obtained along the southern maritime States : Karnataka (17%), Kerala (45%), Tamil Nadu (20%), Pondicherry (1%) and Andhra Pradesh (14%). Further, the southern stretch of the west coast extending from Kanyakumari to north Karnataka accounting for about 70% of the total whitebait catch is the most productive region for whitebait in the country.

Data Base

Data on effort, catch, species composition, length composition and distribution of maturity stages of gonads collected at Vizhinjam, Cochin and Mangalore during the period 1984-88 have been analysed with special reference to the premonsoon (February- May), monsoon (June-August) and postmonsoon (September-January) seasons. Observation centres at Vizhinjam, Cochin and Mangalore are taken to represent the southern, central and northern sectors of the southwest coast. A fishing trip of a gear is taken as a unit of effort and the catch per unit of effort is expressed as catch rate. Values given in brackets following ranges of catches and catch rates are their averages. Fishes of 60-64 mm and above of *S. devisi*, 80-84 mm and above of *S. bataviensis* and 45-49 mm and above of *S. buccaneeri* are considered as adults. Fish with gonads in maturity stages V-VII are taken as mature. Whitebait is exclusively caught by *Netholi vala* which is specially designed to catched this resource. They are also caught in appreciable quantities in purse seines; in other gears they form the by-catch.

Observations

Trends in the whitebait fishery : Gearwise effort, catch, catch rate and species composition of the whitebait in the three seasons as well as over the three seasons; species composition, gearwise, and in the catch pooled from all gears over the period (1984-88) for the three observation centres Vizhinjam, Cochin and Mangalore are given in Tables 1 to 3. Monthly trends of whitebait landings as also the effort and catch rates in the different gears at the three centres are shown in Figs. 1 - 4.

Vizhinjam : At Vizhinjam the annual whitebait landings ranged between 311 t and 555 t (427 t). Though whitebait were caught by one or more gears almost throughout the year, significant quantities were obtained only during May-October period. Monsoon period witnessed the bulk (78%) of the annual catch followed by postmonsoon (15%) and premonsoon (7%) periods. Boat seines landed greater portion of the catch (86%) followed by gillnet (12%) and shore seine (2%) at catch rates of 12 kg, 32 kg and 14 kg respectively.

TABLE 1. *Gearwise and seasonwise effort, catch (kg) and catch rate (in parenthesis) for whitebait and the component species, as well as the species composition over the period 1984-88 at* Vizhinjam

Season	Effort	Sd	Sbt	Sbc	San	Sin	Total
Boat seine							
Premonsoon	1856	625 (0.34)	521 (0.28)	-	-	246 (0.13)	1,392 (0.75)
Monsoon	21,267	105,807 (4.98)	118,533 (5.57)	91,026 (4.28)	11,954 (0.56)	3242 (0.15)	330,562 (15.54)
Postmonsoon	6,645	18,757 (2.82)	16,456 (2.48)	-	-	1445 (0.22)	36,658 (5.52)
Over the period	29,768	125,189 (4.21)	135,510 (4.55)	91,026 (3.06)	11,954 (0.40)	4933 (0.17)	368,612 (12.38)
% species composition	-	33.96	36.76	24.69	3.24	1.34	
Shore-seine							
Premonsoon	171	1,925 (11.26)	275 (1.61)	256 (1.50)	-	179 (1.05)	2,635 (15.41)
Monsoon	15	62 (4.13)	61 (4.07)	-	-	-	123 (8.2)
Postmonsoon	256	2,384 (9.31)	315 (1.23)	77 (0.30)	25 (0.10)	649 (2.54)	3,450 (13.48)
Over the period	442	4,371 (9.89)	651 (1.48)	333 (0.75)	25 (0.06)	828 (1.88)	6,208 (14.05)
% Species compositon	-	70.41	10.49	5.36	0.40	13.34	
Gillnet							
Premonsoon	891	20,452 (22.95)	5,192 (5.83)	-	-	-	25,644 (28.78)
Monsoon	49	649 (13.24)	113 (2.31)	-	-	-	762 (15.55)
Postmonsoon	674	23,293 (34.56)	2,342 (3.47)	13	-	-	25,648 (38.05)
Over the period	1614	44,394 (27.51)	7,647 (4.74)	13 (.008)			52,054 (32.25)
% species composition		85.28	14.69	0.02			
Annual average catch		173,954	143,808	91,372	11,979	5761	426,874
% Species composition (All gear)		40.75	33.69	21.40	2.81	1.35	

Sd = *Stolephorus devisi*; Sbt = *S. bataviensis*; San = *S. andhraensis*; Sin = *S. indicus*; Sbc = *S. buccaneeri*.

Though boat seines were operated throughout the year, 72% of their effort was expended during the monsoon period followed by postmonsoon (22%) and premonsoon (6%) periods. Nearly 90% of the boat seine whitebait catch was obtained during the monsoon period with catch rates of 6 - 24 kg (16 kg) followed by postmonsoon period (10%) with the catch rates of <1-27 kg (5.5 kg). Only stray and insignificant amounts of whitebait were obtained during the premonsoon period in this gear.

Much of the gillnet effort was expended during the premonsooon period (55%) followed by postmonsoon period (42%) with more of less equal contribution (49% each) to the annual landings. Catch rates of 17-32 kg (29 kg) were obtained during premonsoon period and 33-78 kg (38 kg) during the postmonsoon period. Early part of the monsoon period (June) accounting for about 3% of the annual effort contributed to 2% of the annual catch at catch rate of 10-20 kg (16 kg).

TABLE 2. *Gearwise and seasonwise effort, catch (kg) and catch rate (in parenthesis) for whitebait and the component species, as well as the species composition over the period 1984-88 at Cochin*

Season	Effort	Sd	Sbt	Sbc	Sc	Sm/Sh*	Si	Total
Trawlnet								
Premonsoon	17,110	70,692 (4.13)	103,173 (6.03)	21,345 (1.25)	2,185 (0.13)	494 (0.03)	12 (0.0007)	197,901 (11.57)
Monsoon	11,765	37,435 (3.18)	67,817 (5.76)	15,837 (1.35)	-	-	-	121,089 (10.29)
Postmonsoon	10,010	222,757 (22.25)	148,578 (14.84)	1949 (0.19)	11,628 (1.16)	1187* (0.12)	347 (0.03)	386,446 (38.61)
Over the period	38,885	330,884 (8.51)	319,568 (8.22)	39,131 (1.01)	13,813 (0.36)	494 (0.01)	359 (0.01)	705,436 (18.14)
*S. *heterolobus* (over the period 1187/(0.03) (0.17%)								
% species composition		46.90	45.30	5.55	1.96	0.07	0.05	
Purse seine (1984-85 & 85-86)								
Premonsoon	1718	125,942 (73.31)	-	-	-	-	-	125,942 (73.31)
Monsoon	-	-	-	-	-	-	-	-
Postmonsoon	1344	38,978 (29.00)	1031 (0.77)	16,832 (12.52)	-	-	-	56,841 (42.29)
Over the period	3062	164,920 (53.86)	1031 (0.34)	16,832 (5.50)	-	-	-	182,783 (59.69)
% species composition		90.23	0.56	9.21	-	-	-	-
annual average catch		495,804	320,599	55,963	13,813	494	359	888,219
*S. *heterolobus* (annual average catch) = 1187 (0.13%)								
% Specis composition (All Gear)		55.82	36.09	6.30	1.56	0.06	0.04	

Sd = *Stolephorus devisi*; Sbt = *S. bataviensis*; San = *S. andhraensis*; Si = *S. indicus*; Sbc = *S. buccaneeri*; Sc = *S. commersonii*; Sm = *S. macrops*; Sh = *S. heterolobus*.

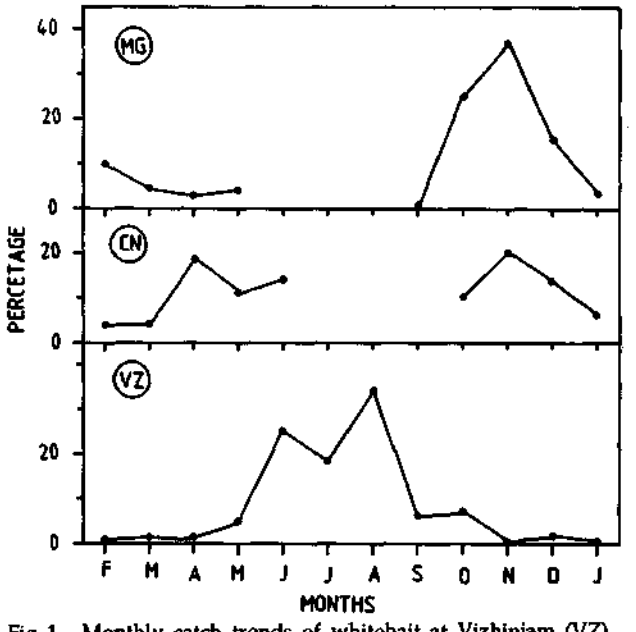

Fig. 1. Monthly catch trends of whitebait at Vizhinjam (VZ), Cochin (CN) and Mangalore (MG).

Bulk of the shore seine effort (58%) was expended during postmonsoon period with its contribution of 56% to the annual catch, at a catch rate of 2-33 kg (13 kg). The premonsoon season effort of 39% accounted for 42% of the annual catch at catch rates of 1-29 kg (15 kg). The monsoon period accounted for only 3% of the annual effort with its contribution of 2% to the annual catch at catch rate of 7-20 kg (8 kg).

Cochin : At Cochin the annual whitebait landings ranged between 306 t and 1725 t (888 t) in the mechanised sector. Nearly half the annual catch was landed in postmonsoon period followed by 36% in premonsoon period and 14% in early monsoon period. Trawl net landed the bulk (80%) of the catch and the rest by purse seine at catch rates of 18 kg and 60 kg respectively. Whitebait occurred in the catches during October-June period, good catches being obtained around November-December and April-May. The trawling effort was

TABLE 3. *Gearwise and seasonwise effort, catch (kg) and catch rate (in parenthesis) for whitebait and the component species, as well as the species composition over the period 1984-88 at Mangalore*

Season	Effort	Sd	Sbt	Sbc	Sc	Sm	Total
Trawlnet							
Premonsoon	25,472	59,702 (2.34)	110,194 (4.33)	-	-	21,349 (0.84)	191,245 (7.51)
Monsoon	-	-	-	-	-	-	-
Postmonsoon	20,258	29,619 (1.46)	96,926 (4.78)	15 (0.001)	42 (0.002)	3373 (0.17)	129,975 (6.42)
Over the period	45,730	89,321 (1.95)	207,120 (4.62)	15 (0.0003)	42 (0.0009)	24,722 (0.54)	321,220 (7.02)
% Species composition	-	27.81	64.48	0.005	0.01	7.70	
Purse seine							
Premonsoon	2721	496,199 (182.36)	-	312 (0.11)	-	353 (0.13)	496,864 (182.60)
Monsoon	-	-	-	-	-	-	-
Postmonsoon	8875	2684,691 (302.50)	4520 (0.51)	14,456 (1.63)	-	8148 (0.92)	2,711,815 (305.56)
Over the period	11,596	3180,890 (274.3)	4520 (0.39)	14,768 (1.27)	-	8501 (0.73)	3208,679 (276.71)
% Species composition	-	99.13	0.14	0.46	-	0.26	-
Annual average catch	-	3270,211	211,640	14,783	42	33,223	3529,899
% Species composition	-	92.64	6.00	0.42	0.001	0.94	
(All Gear)							

Sd = Stolephorus devisi; Sbt = S. bataviensis; Sc = S. commersonii; Sm = S. macrops.

observed almost throughout the year, the share of the premonsoon, monsoon and postmonsoon periods being respectively 43%, 31% and 26% and the share of the whitebait catch being 28%, 17% and 55% with catch rates at 12 kg, 10 kg and 39 kg respectively. Whitebait was absent in the trawl catch during July - September throughout the period. Purse seine effort was observed throughout the year excepting the monsoon period. Premonsoon and postmonsoon periods shared it in the order of 57% and 43% respectively with the catches and catch rate at 69% and 31%, and 73 kg and 42 kg respectively. In trawlnet good catches with catch rates of 40-72 kg were obtained during November-December followed by May-June with catch rates at 20-22 kg. It would appear that the whitebait school nearer to the bottom during postmonsoon period at Cochin. In purse seines good catches as well as catch rates were obtained in April (410 kg/net) and November (268 kg/net).

Mangalore : At Mangalore the annual whitebait landings ranged between 1640 t and 8835 t (3530 t) in the mechanised fishing sector. Mechanised fishing operations in this area remain suspended from 1st June to 31st August as per restriction imposed by the Government of Karnataka. Whitebait landings were obtained during the rest of the period, very good catches being obtained around November. Purse seine landed the bulk (90%) of the annual whitebait catch and trawlnet landed the rest at catch rates of 277 kg and 7 kg respectively. In the case of tralwing, premonsoon period witnessed intense fishing activity as well as good catches with their share of 56% and 60% of the annual trawling effort and whitebait catch respectively with catch rate of 1-16 kg (8 kg). Postmonsoon period accounted for 44% of the annual effort and 40% of the annual catch at an average catch rate of 7 kg. Better catch rates of 9-16 kg were obtained during April-May and of 10 - 13 kg during November-December.

In the case of purse seining, on the other hand, postmonsoon period witnessed intense fishing activity as well as whitebait catches with their

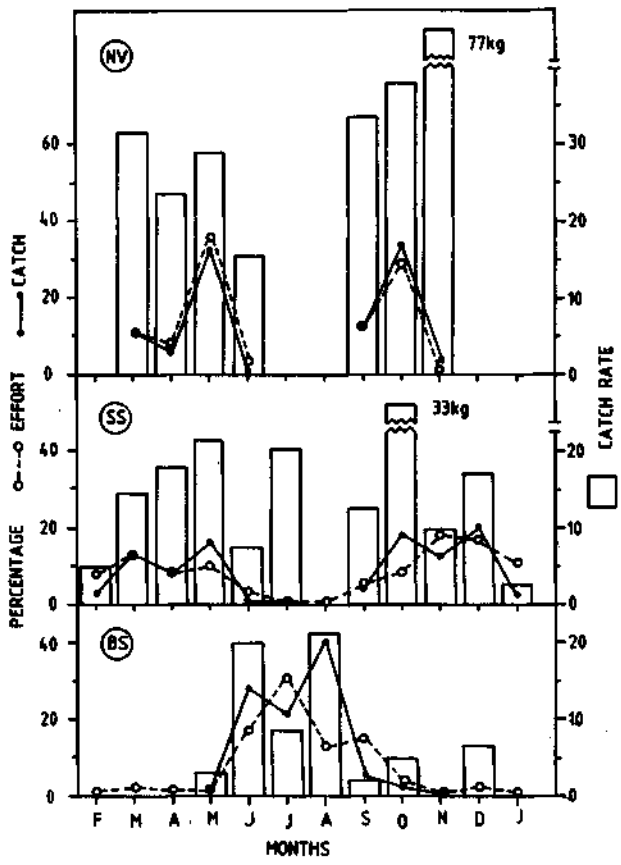

Fig. 2. Gearwise monthly trends in effort, catch and catch rate (kg) at Vizhinjam (NV=Netholi vala, SS=Shore seine and BS=Boat seine).

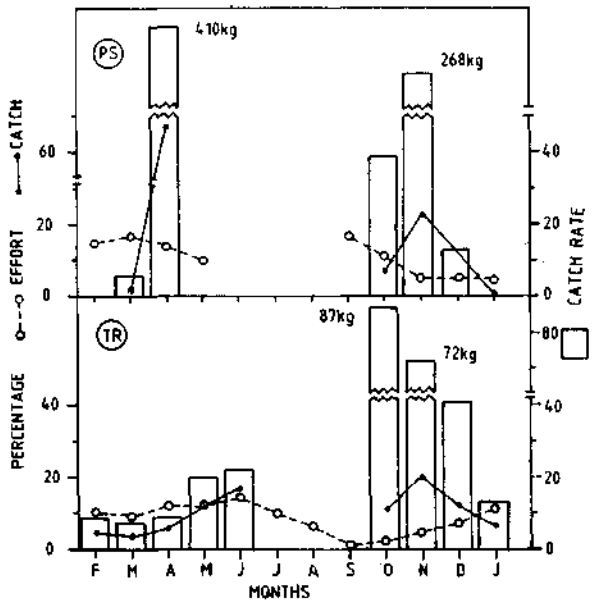

Fig. 3. Gearwise monthly trends in effort, catch and catch rate (kg) at Cochin (PS=Purse seine and TR=Trawl).

share of 77% and 85% respectively of their annual estimated values. The catch rate being 7-614 kg (306 kg). The premonsoon period accounted for only 23% of the annual effort and 15% of the annual catch at catch rate of 83-417 kg (183 kg). Better catches of 300-614 kg were obtained during October-December and of 132-417 kg during February-March. Thus October-March may be considered as the good whitebait fishery season for purse seine at Mangalore.

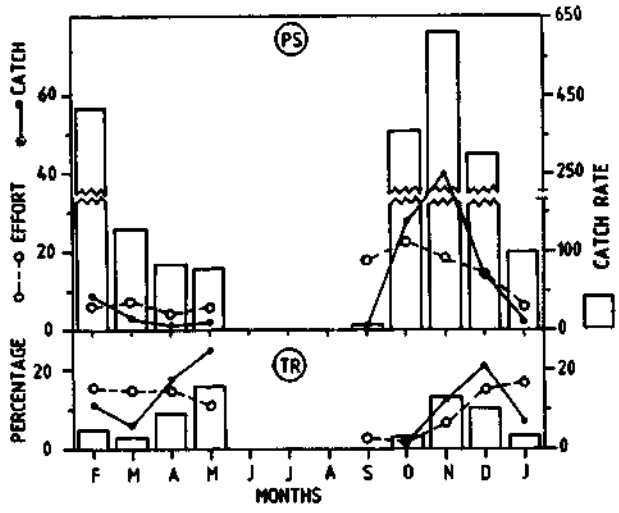

Fig. 4. Gearwise monthly trends in effort, catch and catch rate (kg) at Mangalore.

Species composition : Seven species of whitebait occurred along the west coast (Table 4). However only two species namely, *Stolephorus devisi* and *S. bataviensis* constituted the bulk of the whitebait landings together accounting for 74% at Vizhinjam, 92% at Cochin and 99% at Mangalore. *S. buccaneeri* occurring in increasing abundance from south to north constituting 21%, 6% and <1% respectively at the above three centres is yet another species of some regional importance. These three species together accounted for 95-99% of the whitebait landings along south-west coast (Tables 1-3).

Fishery and biology of the important species : Monthly trends of the landings of each of the three important species pooled from all gears are given in Fig. 5. Size ranges and the dominant size groups of the three species in each season at the three centres are given in Table 4. Seasonal abundance

(in percent) of the fish with gonads in advanced stages of maturity for each of the three species at the three centres are given in Fig. 6. Specieswise catch and the salient features of their biology at the three centres are discussed here.

S. DEVISI

Annual catch trend

At Vizhinjam the annual landings of this species ranged from 117 t to 297 t (174 t). The three seasons accounted for 13%, 61% and 26% respectively of the annual catch. Boat seine accounted for the bulk (72%) of this catch followed by gillnet (26%) and shore seine (2%) the average catch rates being 4.2 kg, 27.5 kg and 9.9 kg respectively.

At Cochin the annual landings were 120 t - 1100 t (495 t). The three seasons accounted for 39%, 8% and 53% respectively of the annual catch. Shrimp trawls landed the bulk (67%) of the catch and purse seine landed the rest (33%) at the average catch rates of 8.5 kg in trawlnet and 54 kg in purse seine.

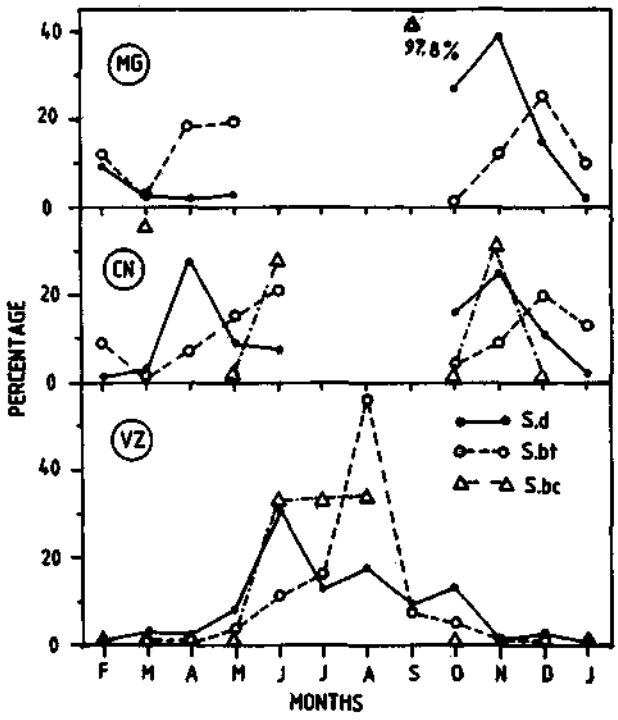

Fig. 5. Monthly trends in the landings of the three important species of whitebait at Vizhinjam, Cochin and Mangalore (S. d =*S. devisi*, S. bt =*S. bataviensis*, S. bc =*S. buccaneeri*).

At Mangalore the annual landings ranged between 1251 t and 8470 t (3270 t). The three seasons accounted for 17%, nil and 83% of the annual catch. Purse seine landed most of this catch (97%), shrimp trawl contributing the rest at catch rates of 71-794 kg (174 kg) in purse seine and upto 158 kg (2 kg) in shrimp trawl.

TABLE 4. *Size range (mm) and dominant size (in parenthesis) of the three dominant species of Stolephorus in the three seasons at Vizhinjam, Cochin and Mangalore (1984-88)*

Centre	*S. devisi*	*S. bataviensis*	*S. buccaneeri*
Premonsoon			
Vizhinjam	30-99 (30-39 & 60-84)	35-94 (45-49 & 75-85)	30-54 & 60-94 (35-49)
Cochin	50-104 (65-89)	35-109 (60-89)	50-94 (75-79)
Mangalore	45-99 (65-84)	55-104 (70-94)	-
Monsoon			
Vizhinjam	30-94 (55-75)	40-104 (45-49 & 65-80)	45-105 (60-84)
Cochin	45-74 (50-54)	55-109 (70-74)	65-94 (70-79)
Mangalore	-	-	-
Postmonsoon			
Vizhinjam	30-44 & 60-99 (30-34 & 65-89)	60-104 (70-90)	35-54 & 70-99 (40-44 & 85-89)
Cochin	55-99 (70-84)	60-104 (70-94)	70-99 (85-94)
Mangalore	65-99 (70-84)	75-104 (85-94)	-

Monthly catch trend

At Cochin *S. devisi* was landed during October-June, catches being better during April-June and October-December. At Mangalore this fish was landed during October-May, main fishery season being October-December. When mechanized fishing was resumed in September after the monsoon season, this species was not available to both the mechanized gears. Same was the case at Cochin also. This indicates that *S. devisi* enters the present fishing ground of the central and northern sections of the southwest coast about a month after the close of the southwest monsoon. In the southern sector (Vizhinjam), on the other hand, June-October was the main fishery season although the fish was landed throughout the year.

Fishery and biology

In the postmonsoon period, bulk of the catch of *S. devisi* was obtained during October-December both at the northern and central sectors accounting for 81% and 51% of the annual catch respectively. January accounted for only 2% in each sector and nil during September at both the centres in spite of fishing effort. During this season purse seine landed the bulk of the catch both at Mangalore (89%) and Cochin (64%) and shrimp trawl landed the rest. In the southern sector (Vizhinjam), however, September-October period yielded good catches accounting for 22% and the remaining three months accounting for only 4% of the annual catch. In the southern sector both juveniles (30-34 mm length) and adults (65-89 mm length) formed the dominant catch during the postmonsoon period. Fish in advanced stages of maturity formed 80%. Gillnet (52%) and boat seine (42%) landed bulk of the catch during this period, shore seine landing the rest (6%). At Cochin adult fish of the size range 70-84 mm formed the dominant catch. Fish in advanced stages of maturity formed only 12%. Bulk of the catch (85%) was landed by shrimp trawl and the rest by purse seine. At Mangalore also adult fish of the size range 70-85 mm length formed the dominant size. Fish in advanced stages of maturity formed 80%. Most of the catch (99%) during this period was landed by purse seine and the rest by shrimp trawl.

During the succeeding period (premonsoon), February witnessed good catches at Mangalore accounting for 9% and rest of the three months together accounting for only 8% of the annual catch. At Cochin April-May accounted for 37% and the rest of the three months for only 3% of the annual catch. At Vizhinjam 8% of the annual catch was obtained in May and the remaining three months of the season (February-April) together accounted for only 5%. Both juveniles and adults with dominant sizes at 30-39 mm and 60-84 mm occurred in the catches. Bulk of the adult fish (84.5%) was with gonads in advanced stages of maturity. Gillnet landed bulk (89%) of the catch of this season followed by shore seine (8%) and boat seine (3%). At Cochin and Mangalore adult fish of the size range 65-89 mm and 65-84 mm respectively formed the dominant component of the catch, fish with gonads in advanced stages of maturity being 9% and 59% at Cochin and Mangalore respectively.

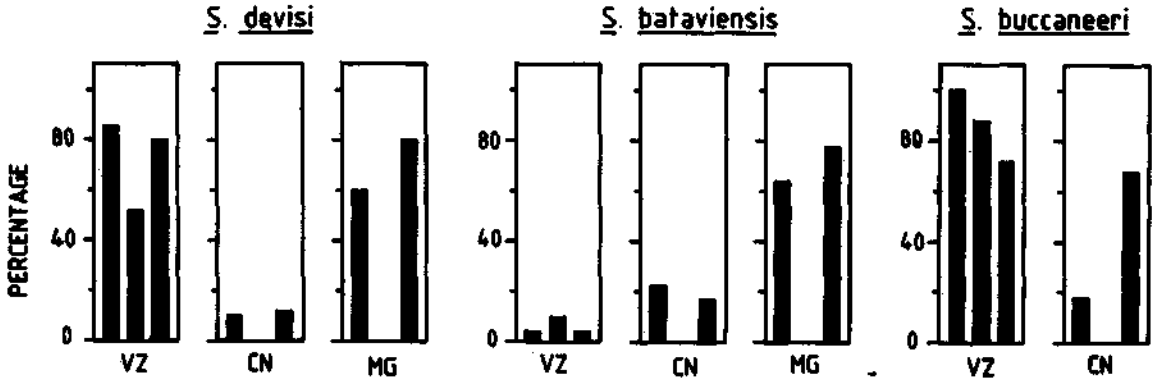

Fig. 6. Percentage composition of fish in advanced stages of maturity (Stages V-VII) in the premonsoon, monsoon and postmonsoon periods respectively (shown as bars).

During the monsoon season, as mentioned earlier, mechanized fishing is suspended at Mangalore. But at Cochin, despite fishing effort (entirely by shrimp trawl) this species was not met with in the catches during July-August, the month of June accounting for only 8% of the annual catch.

In the southern sector, about 61% of the annual catch was obtained during this season about half of this catch being obtained during June alone. Boat seines landed 99% of the catch of this species. Pre-adults and adults formed the catch during this period at Vizhinjam with the dominant size at 55-75 mm. Fish with gonads in advanced stages of maturity formed only 52%. At Cochin, mostly juveniles of 50-54 mm length formed the dominant catch. Only fish with resting and developing gonads were met with at this centre.

S. BATAVIENSIS

Annual catch trend

At Vizhinjam the annual landings of this species ranged between 66 t and 394 t (144 t). The three seasons accounted for 4%, 83% and 13% respectively of the annual catch. Boat seine accounted for most of the catch (94%) followed by gillnet (5%) and shore seine (1%), the average catch rates in the three gears being 4.6 kg, 4.7 kg and 1.5 kg respectively. At Cochin annual landings of this species ranged between 22 t and 789 t (321 t). The three seasons accounted for 32%, 21% and 47% respectively of the annual catch. Nearly the entire catch (99.7%) was landed by trawlnet and a small quantity by purse seine at catch rates of 8 kg and 0.8 kg respectively. At Mangalore the annual landings of this species ranged between 92 t and 380 t (212 t). The three seasons accounted for 52%, nil and 48% respectively of the annual catch. Most of the catch (98%) was landed by shrimp trawl and the rest by purse seine at the catch rates of 4.6 kg and 0.4 kg respectively.

Monthly catch trend

The main fishery season of this species at Vizhinjam occurred during June-August coinciding with the monsoon season although the fish was available during March-December. Despite fishing effort this fish was not available in catches during January-February. At Cochin it occurred during October-June, good catches being obtained during November-February and May-June. Although fishing was carried out in July-September, fish was not available in the catches. At Mangalore *S. bataviensis* supported the fishery, during October-May with better catches during November-February and April-May, as at Cochin. However, this fish was not available in September.

Fishery and biology

During the postmonsoon period bulk of the catch of *S. bataviensis* was obtained during November-January both at northern and southern sectors accounting for 47% and 43% of the annual catch respectively. October contributed to only 1% at the northern sector and 5% in central sector, and nil during September in both the sectors. In the southern sector, however, September-October period yielded catches accounting for 12.8% of the annual catch and November-December for 0.5% and nil catch during January. Shrimp trawl yielded most of the catch of this species at Cochin (99.7%) and Mangalore (97.8%) and the rest was by purse seine. At Vizhinjam boat seine landed the bulk (94%) followed by gillnet (5%) and shore seine (1%). In the northern and central sectors pre-adults and adults in the length range of 85-94 mm and 70-94 mm were dominant. Fish in advanced stages of maturity were dominant (77%) in the northern sector, but such fish formed only 17% in the central sector. Most of the catch was landed by trawlnet both at Mangalore (98%) and at Cochin (99.7%) and the rest by purse seine.

During the succeeding period (premonsoon) at the northern and central sectors, April and May together accounted for 36% and 22% of the annual catch respectively followed by February 12% and 9% . The month of March witnessed poor catches amounting to 4% and 1% respectively at these two centres. At the southern sector (Vizhinjam) poor catches were obtained during most of the period, only May witnessing relatively better catches accounting for 4% of the annual catch. Bulk of the catches comprised pre-adults and adults of the size 70-94 mm and 60-89 mm at Mangalore and Cochin respectively. Fish in advanced stages of maturity formed 64% and 22% respectively at these two centres. The entire catch of the season was landed by shrimp trawl at both the centres. At Vizhinjam, however, early juveniles, pre-adults and adults with dominant sizes at 45-49 mm and 75-85 mm formed the fishery. Bulk of the catch of this species was landed by gillnet (86.7%) followed by boat seine (8.7%) and shore seine (4.6%).

During the monsoon season this fish was landed only in June at Cochin entirely by trawlnet accounting for 21% of the annual catch. At Vizhinjam abount 83% of the annual catch was obtained during this season, the month of August alone accounting for 56% of the annual catch. Most of the catch (99.8%) was landed by boat seine, stray catches occurring in the other two gears. Early juveniles and pre-adults of 45-49 mm and 65-80 mm length at Vizhinjam, pre-adults of 70-74 mm length at Cochin formed the dominant catch. Fish in advanced stages of maturity formed only 9% at Vizhinjam, but such fish was absent at Cochin during this period.

From what has been stated above, this species appears to make periodical movements in

and out of the regular fishing grounds. It is more abundant off Mangalore and cochin during pre-monsoon period, and during the monsoon period off Vizhinjam. Again, it is more abundant in the central and northern sectors during the post-monsoon period.

S. BUCCANEERI

Annual catch trend

At Vizhinjam the annual landings of this species ranged between 22 t and 235 t (91 t). The three seasons accounted for 0.3%, 99.6% and 0.1% respectively of the annual catch. Boat seines landed most of the catch (99.6%) followed by shore seine (0.4%). Very rarely, it is caught in gillnet also. Average catch rates of 0-3 kg and 0-0.75 kg were obtained in boat seine and shore seine respectively. At Cochin the annual landings of this species ranged between nil and 100 t (56 t). The three seasons accounted for 38%, 28% and 34% respectively of the annual catch. Bulk of the catch (70%) was landed by trawl net and the rest (30%) by purse seine at the average catch rate of 1 kg and 9 kg respectively in the two gears. At Mangalore this species was rare. Over the period of this study it occurred in the catches in four months and the total catch was 59 t at this centre.

Monthly catch trend

This species is highly sporadic and occurred in spurts along the west coast. At Vizhinjam, however, it occurred in boat seine almost regularly during June-August. Throughout the period of study it was rare in the gillnet and in shore seine it was caught only occasionally in very small quantities. These three gears accounted for 99.62%, 0.01% and 0.36% respectively of the annual catch. At Cochin this species was encountered only during 1987 and 1988. Bulk of the catch (70%) was caught in trawlnet and the rest by purse seine. Three months - March (36%), June (28%) and November (31%) accounted for 95% of the annual catch. At Mangalore this species was met with only during 1987 and 1988 as at Cochin, but September accounted for the bulk of the catch (97.8%). However most of the catch was by purse seine (99.9%) and only a very little by trawlnet.

Fishery and biology

Generally, adult fish and fish in advanced stages of maturity formed the bulk of the catch whenever it occurred at the three centres. At Vizhinjam, however, juveniles formed bulk of the landings during the premonsoon period and fish with resting and developing gonads formed most of the catch in the premonsoon period at Cochin.

Distribution of whitebait in time and space : Examination of the seasonal trends of the catch and catch rate of whitebait as well as the fishing effort expended by the different types of gears at the three centres (Figs. 1-4) brings to the fore the seasonal distribution pattern of the whitebait in time and space. To determine the status of the fishery in a month, comparison was made of the monthly percentage of the effort in relation to the catch and catch rate. For example, at Cochin in the trend line of the trawl catch the monthly percentages of catches during February-April is below the effort, whereas the trend line of the effort during October-December is much below the catch and the monthly catch rates are also high indicating the former period (February-April) to be poor fishery season for whitebait by shrimp trawl. And during July-August, although very high trawling effort was expended, there was no catch indicating that whitebait was absent in the fishing grounds. Similar approach was made to elucidate the seasonal trend for the whitebait fishery by the other gears at the other centres.

In the Vizhinjam area the whitebait keep moving into the inshore fishing grounds during March-December. During this period they seem to school close to surface and shoreward during March-May and September-December and get caught in surface gillnets. During June-August, whitebait seem to school in deeper waters and get caught in boat seine operated at mid depths. At Cochin these fishes seem to be distributed nearest the bottom during May-June and October-December than during January-April and move away from the inshore fishing grounds during July-September. In this connection it may be pointed out that boat seines at Vizhinjam obtained good catches of whitebait during this period (July-September). Further, the whitebait in the Vizhinjam area is distributed over the entire column of inshore water during the postmonsoon period and closer to the surface during March-April, and thus get caught by surface gillnets. At Mangalore the distribution pattern of whitebait during the monsoon period remains unknown as operations of both purse seine

and trawlnet were suspended during the period. However, from the very poor returns by purse seine and nil catches in trawl nets during September it is clear that whitebait abandon the inshore fishing ground off Mangalore area during monsoon period and enter the fishing ground about a month after the close of the monsoon. Here, the whitebait seem to school more towards the bottom during January and April-May, but towards the surface during February and October-November and over the entire column of inshore waters during December. In March the catch was relatively less as related to the effort put in by both the gears.

General Remarks

From the foregoing account it is evident that the fishing ground off Mangalore is more productive for whitebait than at Cochin. Vizhinjam, where indigenous units fitted with out-board motor for propulsion are operated, ranks third among the three centres. During the monsoon months the fishing activity by the trawlers and purse seines is suspended at Mangalore whereas only the latter gear is not employed at Cochin. And the whitebait itself seems to be absent in the inshore fishing grounds of these two centres during the monsoon months. Thus the question of enforcing any regulatory measures in fishing for whitebait during monsoon period for conservation of this fishery resource off Mangalore and Cochin does not arise. At Vizhinjam, however, the main whitebait fishery season coincides with the monsoon period. Neither the magnitude of the whitebait fishery nor the biological characteristics of the two primary species at this centre attract any fishery regulation measures.

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