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Whitebait fishery of Mangalore - Malpe, Karnataka during 1997-2002

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ABSTRACT

Whitebaits, with an annual average of 5,152 t formed 4.2% of the total fish catch of Mangalore-Malpe region during 1997-2002. Trawls, purseseine and *ranibale* contributed to the fishery with peak abundance during October-February. The fishery has registered a steady decline over the years with the lowest catch being observed in 2001-02. Three species dominated the fishery of the region. Growth parameters estimated were $L\alpha$ = 109 mm and K = 1.5 yr^{-1} for *Encrasicholina devisi*, $L\alpha$ = 122 mm and K = 1.1 yr^{-1} for *Stolephorus waitei* and $L\alpha$ = 118 mm and K = 1.6 yr^{-1} for *Encrasicholina punctifer*. Total mortality estimated was 8.19, 6.18 and 8.97 respectively for the above species and natural mortality was 3.11, 2.46 and 3.18 respectively. The study indicated that the stock is under greater fishing pressure than desired. Biology of *E. punctifer* and *S. insularis* is being reported for the first time from this area.

Introduction

Anchovies are small sized shoaling pelagic fishes found abundantly along the Indian coast. They form an important animal protein source for the coastal fisherfolk and are an important link in the food chain of larger marine fishes. Anchovies popularly known as whitebaits along the Mangalore-Malpe coast are represented by two genera and several species and together form an important marine pelagic fishery resource. Like any other shoaling pelagic tropical resource, the fishery of whitebaits exhibit annual and seasonal fluctuations. The Mangalore-Malpe coast plays an important role in the marine capture fishery of Karnataka and the whitebaits caught along this region comprise around 57% of the whitebait catch of Karnataka. Earlier studies on whitebaits include those by Luther (1972, 1981, 1990), Menon and George (1975), Rao *et al*. (1982), Rao (1988 a, b), Luther *et al*. (1992) and Gopakumar and Pillai (2000). The present paper is a detailed analysis of the whitebait fishery of Mangalore-Malpe region with biology and stock structure of dominant species during 1997-98 to 2001-02 periods.

Materials and methods

Weekly visits were made to Mangalore and Malpe fishing harbours and data on the effort expended by different gears and whitebait catch by weight were collected. Monthly estimates were obtained by raising the estimated daily catch to the number of fishing days in the month.

Total length (mm) and wet weight (g) were taken and fishes were cut open to identify the sex as well as stage of gonad maturation. The gonads were classified into five groups and seven stages as follows: immature (stages I and II), developing (stages III and IV), mature or gravid (stages (V and VI), spent (stage VII) and resting (stage IIb). Fishes in stage III and above were considered for the purpose of estimating length at first maturity.

Length frequency data grouped into 5 mm intervals were used to estimate the growth parameters of the von Bertalanffy growth equation. $L\alpha$ and K were estimated using the ELEFAN module of FiSAT (FAO-ICLARM stock assessment Tools Ver. 1.1, 1990) and t_o was calculated using Pauly's (1979) empirical equation. The total instantaneous mortality coefficient (Z) was estimated using the length converted catch curve method (Pauly, 1983) and natural mortality coefficient (M) using Pauly's (1980) empirical formula (T = 28.5°C in the present study). The exploitation rate (E) was estimated from the equation E = F/Z. Average standing stock (Y/F), total annual stock of biomass (Y/U) and MSY (Z*0.5*(Y/F) was estimated for the five-year period.

Results

Fishery

The whitebait catch declined from 7,196 t in 1997-98 to 2,323 t in 2001-02 and formed 7.48 and 2.38% respectively of the total fish catch of Mangalore-Malpe region. Whitebaits are amenable to different kinds of fishing. Purseseines landed 53.6%, trawls 46.3% and ringseines less than 0.1% (Fig.1). The whitebaits occurred in large shoals during November-March period and

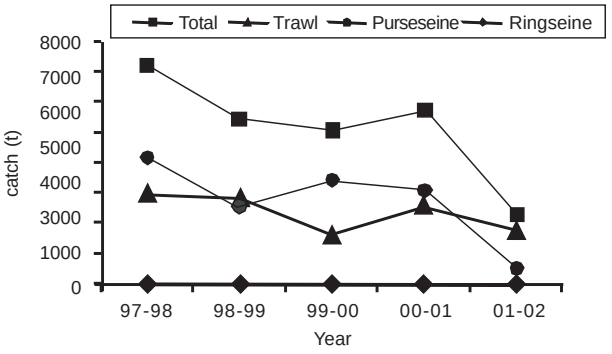

Fig.1. Contribution of different gears to the whitebait fishery of Mangalore-Malpe during 1997-'98 to 2001-'02

purseseines operated small meshed nets (12 mm) during this period to trap these shoals. Peak landings were observed during November which coincided with the peak spawning period of the fish. In trawls, whitebaits were landed almost throughout the fishing season with peak during February-April (Fig. 2).

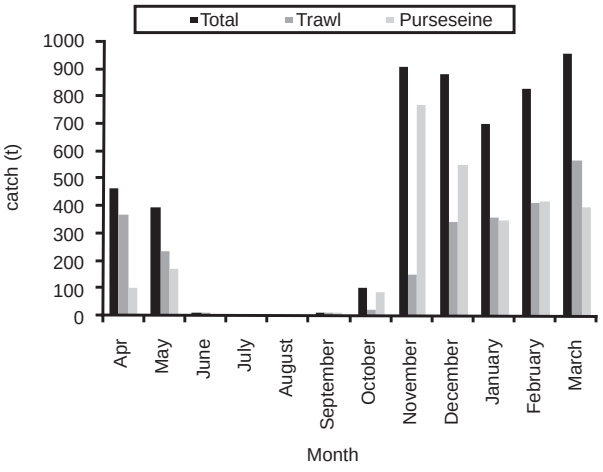

Fig. 2. Average monthly trends in whitebait landings at Mangalore-Malpe

Species composition

The different species of whitebaits occurring along this coast belonged to two genera *viz., Encrasicholina* and *Stolephorus* (Whitehead *et al*., 1988; Luther, 1990). Of these, *E. devisi* and *S. waitei* were dominant species and formed 80.83 and 9.97% respectively in both gears combined. *E. devisi* contributed 83.93 and 78.63% respectively to purseseine and trawl catch and *S. waitei* formed 4.59 and 15.78 % respectively in the purseseine and trawl. The other species that contributed to the total whitebait catch were *E. punctifer* (8%), *S. insularis* (1%), *S. commersonii* (0.1%) and *S. indicus* (0.1%). *Ranibale* landed only *S. insularis* (96%) and *S. indicus* (3%).

Fishery and biology of Encrasicholina devisi

E. devisi was the dominant species both in the purseseine and trawl. The annual catch ranged between 2,043 and 6,744 t. Purseseine was the dominant gear and contributed 55.3% and the trawl landed the remaining 44.7%. The catch recorded a steady declining trend over the years.

The size distribution of *E. devisi* was 40-100 mm with major mode at 80 mm. The catch comprised mainly of adults (92.5%) followed by pre-adults (7.5%) and indeterminate fishes (0.5%). Sex-ratio (male:female) among pre-adults and adults was 1:1 and 1:0.9 respectively. Fishes with partially spent stage (VIIa) comprised the dominant group (43.3%), followed by developing (35.3%), gravid (19.7%), fully spent (1.4 %) and resting stages (0.3 %).

Fishery and biology of Stolephorus waitei

S. waitei was observed in the trawl catch every year and formed a fishery during all fishing months. Purseseine landed this species only during October to February. The total annual catch of *S. waitei* ranged between 183 t (1998) and 837 t (2001). Lower catches observed during 1999 and 2001 may be due to the absence of this species in the purseseine catch.

Total length of *S. waitei* ranged between 40 and 110 mm with major mode at 90 mm. Adults formed the bulk of the fishery (86.8%) followed by pre-adults (11.2%) and indeterminates (1.3%). Sex-ratio (male : female) was 1:0.87 and 1:0.99 among pre-adults and adults respectively. Partially spent stage comprised the dominant group (45 %), followed by gravid (19.8%), developing (25 %), fully spent (1.2 %) and resting (1.02%).

Fishery and biology of Encrasicholina punctifer

The total annual catch of *E. punctifer* ranged between 17 (1998-99) and 1,235 t (2000-01). Purseseine landed the bulk (76.15%) of the catch though it formed a fishery only during March-May. Trawls landed this species throughout the year.

The total length of *E. punctifer* ranged between 50 and 105 mm with major mode at 85 mm. Adults formed the bulk (98%) followed by pre-adults. Sex ratio (male:female) among adults of this species was 1:0.9. Partially spent stage comprised the dominant group (44.4%), followed by gravid (32.5%), developing (21.6%), resting (1%) and fully spent (0.5%) stages.

Fishery and biology of Stolephorus insularis

S. insularis was caught by trawl (58%), purseseine (41%) and the *ranibale* (1%). Annual catch ranged between 41 and 148 t. The fishery is highly seasonal; caught by purseseine in October, by *ranibale* in July and by trawls during September-November and January-February.

The total length ranged between 45 and 90 mm with major mode at 70 mm. Adults formed the bulk (84%) followed by pre-adults. Males were dominant in the fishery with the sex ratios (male:female) of 1:0.2 among pre-adults and 1:0.7 among adults. Among adults, developing stage comprised the dominant group (57.9%) followed by partially spent (28.3%), gravid (12.1%), fully spent (1.2%) and resting (0.5%) stages.

Length at first maturity

The length at first maturity was 69 mm for both *E. devisi* and *E. punctifer* and was 79 mm for *S. waitei*. *S. insularis* matured at a smaller total length of 60 mm.

Spawning season

As observed in most pelagic fishes of the tropics, spawning in whitebaits is prolonged and spread over several months. Fishes with gravid and partially spent gonads were observed during all fishing months. However, the percentage of gravid and partially spent *E. devisi* was more during October-January and April, indicating peak spawning during these months. In the case of *S. waitei*, peak spawning could be discerned during October-February and April. In *E. punctifer*, spawning was observed during November-February and May.

Length-Weight relationship

The length-weight relationships (cm and g) for the different species of whitebaits were as follows :

E. devisi	a = 0.004145	b = 3.221
S. waitei	a = 0.005241	b = 3.156
E. punctifer	a = 0.00926	b = 2.874

Growth and stock structure

The growth as well as the stock position of *E. devisi*, *S. waitei* and *E. punctifer* were studied and the values obtained are given in Table 1. The study showed that the present exploitation rates of all the three species were much higher than the desired (>0.5), with the present yield being more than MSY.

Discussion

Whitebaits are popular along the coastal districts of Karnataka both in the fresh and dried form. Vertical migration (Anon, 1974, 1976; Menon and George, 1975) with annual and seasonal fluctuations in catch is common to the fishery and may be mainly the result of the changes in physico-chemical environment (Luther, 1981). The purseseines continued to land bulk of the catch and introduction of multi-day trawlers did not seem to have an apparent impact on the species composition of whitebait fishery. Earlier studies on the biology of *E. devisi* and *S. waitei* (Luther 1972, 1990; Luther *et al*., 1992; Rao, 1988 a, b) have indicated that whitebaits are multiple spawners with a prolonged spawning period. A similar pattern was observed in the present study with spawning spread over several months. Length at first maturity and the length-weight relationships estimated for different whitebait species in the present study is comparable to the earlier studies as reported by Rao (1988 a, b) and Luther *et al*. (1992).

The estimates of Lα and K obtained for *E. devisi* and *S. waitei* in the present study is comparable to the values obtained by Luther (1990) and Luther *et al*. (1992) for the same species along the west coast. However, the K values are lower when compared to the values obtained by Rao (1988 a, b), but higher to those observed for the same species by Tiroba *et al.* (1990) and Dalzell (1990). The annual K value of 1.0 and more is indicative of fast growth rate in whitebaits in this region. Earlier studies on the status of whitebait stocks have always indicated high abundance of the dominant species (*E. devisi* and *S. waitei*) along the south-west coast (Luther, 1981, 1989; Rao, 1988; Luther *et al*., 1992) and scope of increasing production by increasing effort. However, the present study revealed that the exploitation rate of above species and of *E. punctifer* is higher than optimum (E >0.5). The Y/R and B/R analysis showed that E_{max} in all the three species is slightly more, but further increase in effort will not result in profitably higher catch. Earlier reports by Luther (1990), Dalzell (1990), Tiroba *et al*. (1990) and Luther *et al.* (1992) have indicated higher values for natural mortality as compared to the fishing mortality. Over the years, the number of units operating along this coast has increased by several folds and the fishing efficiency too has increased. Several resources are under great fishing pressure and the present study has revealed that exploitation levels of whitebaits are also higher than desirable. The fishing mortality rates for the three species were high, though whitebaits are known to be prey for several carnivores. It is also observed that the present yield is higher than the MSY (Table 1) indicating that the fishery is under great pressure. Whitebaits are an

Table 1. Estimates of growth and stock parameters of *E. devisi*, *S. waitei* and *E. punctifer* at Mangalore-Malpe

Species	Lα (mm)	K/yr.	Z	M	F	E	Y(t)	Y/U	Y/F	MSY
E.devisi	109	1.5	8.19	3.11	5.08	0.62	4197	6768	826	3382
S.waitei	122	1.1	6.18	2.46	3.72	0.60	504	839	135	417
E.punctifer	118	1.6	8.97	3.18	5.79	0.65	384	595	66	296

important food item for most of the larger pelagic fishes higher up in the food chain. Exploitation of this resource beyond desirable levels will therefore not only affect the stock of whitebaits but will also have a negative impact on the stocks of those fishes which directly feed on whitebaits. In a multispecies fishery scenario as present in Karnataka coast, the growth and survival of different species in a given region is inter-related and a balance is maintained between the different trophic levels. Under these circumstances, it is imperative that certain fishery management steps (like increase in mesh size to permit escape of the small-sized whitebaits, catch quota, limiting operation of purseseines engaged in fishing exclusively for whitebaits) are implemented to limit the fishing pressure and prevent further damage to the whitebait fishery of the region.

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