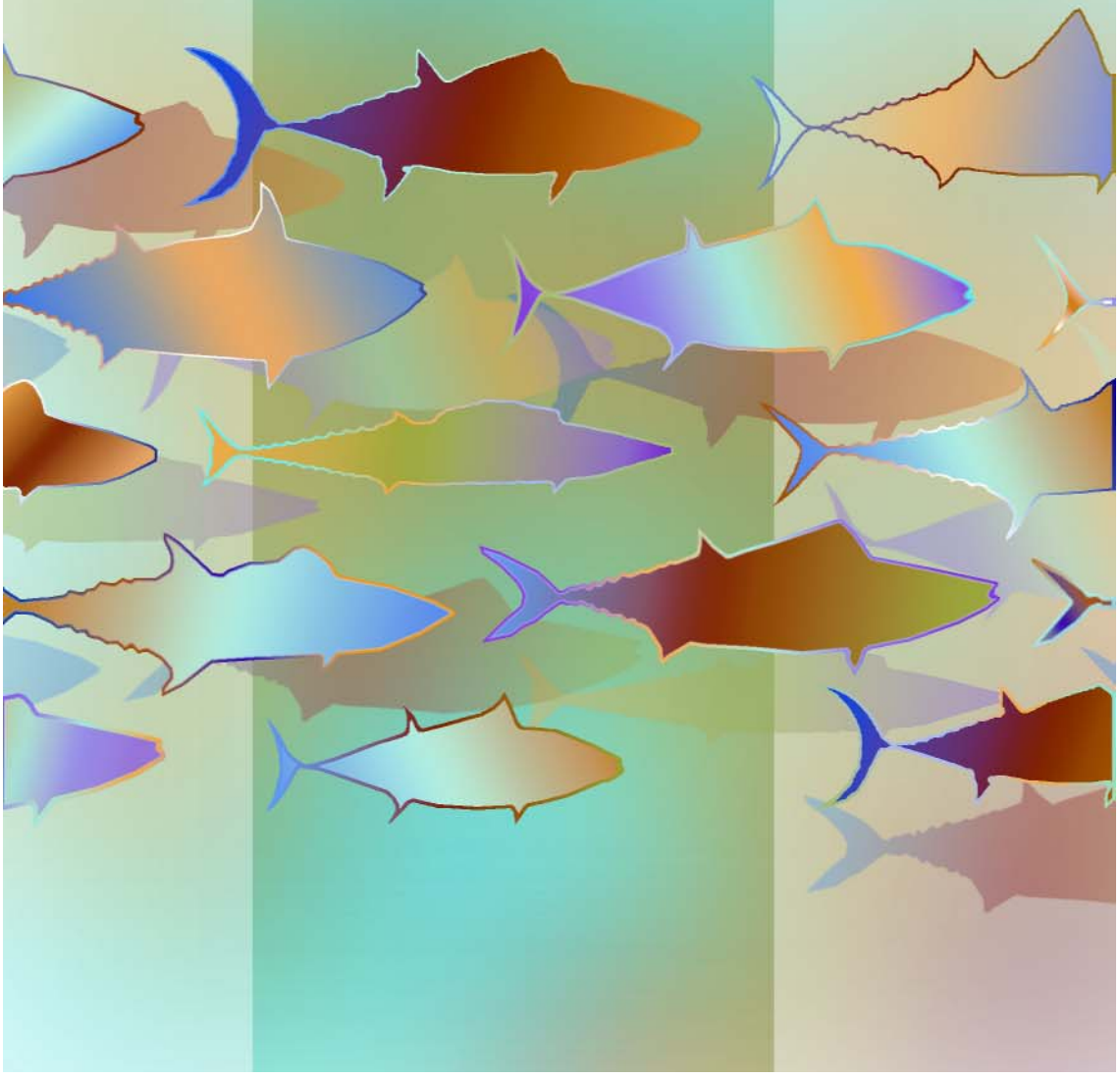
Status of Exploited Marine Fishery Resources of India



STATUS OF EXPLOITED MARINE FISHERY RESOURCES OF INDIA

Editors
M. Mohan Joseph
and
A.A. Jayaprakash

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
Post Box No. 1603, Tatapuram P.O.
Kochi – 682 014, India

4

Whitebaits

A. A. Jayaprakash

1. Introduction

The Whitebaits that comprise a group of small pelagic fishes belonging to the genera Stolephorus and Encrasicholina are widely distributed in the Indo-Pacific region (Figs. 1&2). Altogether ten species have been found to occur in our seas. In India, this resource contributes on an average to 64,000 t (1991-2000) forming 1.7-5.8% of the total marine fish landings in the country and unlike other anchovies (genera: Thryssa, Setipinna, Coilia and Thrissina), is mostly exploited from the southern maritime states. The landings of whitebaits from the southern states like Andhra Pradesh, Tamil Nadu, Kerala and Karnataka accounted for 75-97% of the total production of whitebait. The studies conducted on this resource by the UNDP/FAO Pelagic Fishery Project along the southwest coast of India from Ratnagiri to Tuticorin; and the investigations carried out by the Central Marine Fisheries Research Institute at various centres along the east and west coasts have indicated its fishery potential and provided valuable information on various biological aspects of the constituent species.

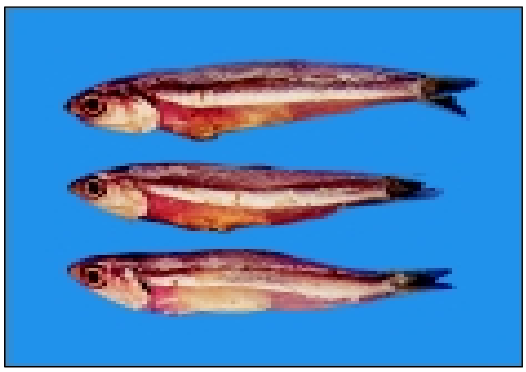


Fig. 1. Encrasicholina devisi

2. Production trends

Fig. 2. Stolephorus waitei

Craft and gear

Boat seine (cod end mesh 10 mm) and shore seine (cod end mesh 10-20 mm) are employed to exploit the resource in Andhra Pradesh, Tamil Nadu and Kerala coasts. Along the west coast, at south off Quilon, gill net (Netholi vala) of 15 mm mesh is specially engaged to net the whitebaits. These gears are operated from Catamarans and small country crafts, many of them fitted with outboard motors in Kerala. In the shrimp trawls, (cod mesh 15 mm) anchovies constitute a by-catch. The purse seine (cod end mesh 14-20 mm) introduced during the seventies in Goa, Karnataka, Kerala and Maharashtra; and the ring seines especially the Choodavalai (cod mesh 8 mm) operated from plank built boats fitted with outboard motors along Kerala and Karnataka coasts since 1985 have been exploiting the resource from 15-50 m depth range.

Status of fishery

The annual production of whitebaits, like any other pelagic fishery resource, showed wide annual fluctuations. The production varied from 33,680 t in 1980 to 1 lakh t in 1988 (Fig. 3). During the years 2000 and 2001 the resource accounted for 45,000 each. The average landings during the last three decades 1971-80, 1981-90 and 1991-2000 were 30,000 t; 64,000t; and 66,254t respectively indicating a growth rate of 113% in the eighties and a stabilization thereafter in the nineties.

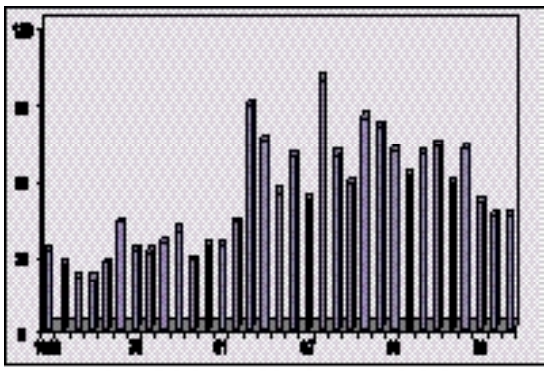


Fig. 3. All India landings of whitebaits (x000 tonnes) during 1969-2000

Statewise contribution

During the seventies the production from the east coast accounted for 56% and west coast 44%. Subsequently, from eighties and in the nineties the trend reversed wherein the west coast production accounted for 64% and 67% respectively. Southern states like Kerala, Tamil Nadu, Karnataka and Andhra Pradesh together contributed nearly 97% of the total production of whitebaits during the last decade (Fig. 4). The yearly production trend, as in any other pelagic fisheries was highly fluctuating.

However, the landings in Kerala evinced a decreasing trend from 1992. This mostly appeared to be the result of switching over to stay fishing and distant water fishing by the trawlers. The statewise average contribution (Fig.5) during 1981-2000 was West Bengal 94t (0.1%); Orissa 932t (1.4%);

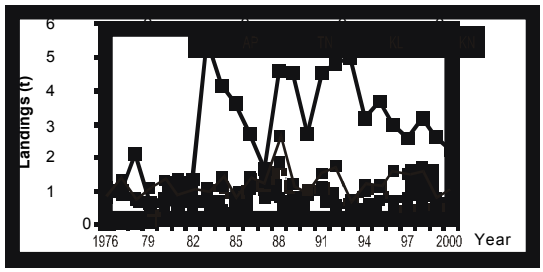


Fig. 4 Trends in annual landings of whitebaits in the four maritime states

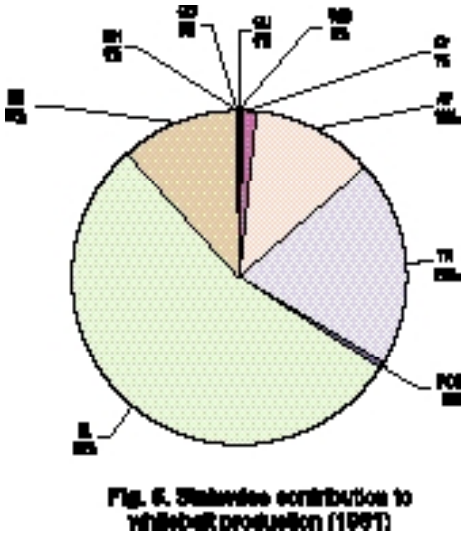


Fig. 5. Statewise contribution to whitebait production (1981)

Andhra Pradesh 7,747t (12.1%); Tamil Nadu 12,780t (19.9%); Kerala 34,699t (54.2%); Karnataka 7,257t (11.3%), Goa 134t (0.2%); Maharashtra 109t (0.2%); and Gujarat 2t (0.003%).

Species available

Ten species of whitebaits have been found to occur in our seas. They are Encrasicholina devisi (Fig. 1), E.heterolobus, E.punctifer (Stolephorus buccaneeri), Stolephorus andhraensis, S.baganensis (S.macrops), S.commersonii, S.dubiosus, S.indicus, S.insularis and S. waitei (S.bataviensis) (Fig. 2). The dominant species available throughout the coast are E.devisi, S.bataviensis, E.punctifer, S.commersonii, S.indicus and S.baganensis. However, E.devisi and S.bataviensis constitute the mainstay of the fishery along both coasts and other species occur seasonally. The availability and abundance of all these species indicate inter-annual variations.

The popular name in English and the local languages in different maritime states are as follows: S.waitei Spotted anchovy (En), Katali (Mr), (Kozhuva/Netholi (M), Nethili (T), Ballanethallu (Tg), Gang maurala (B); E.devisi Devil's anchovy (En), Netholi (M), Nethili (T) Chauli/Nettalu (O); S.indicus Indian anchovy (En), Dindus/Katali (Mr), Valiya Kozhuva (M) Nethili/Nethallu (T), Gang maurala (O) and Bada chauli/KokiliKondanetta (B); S.buccaneeri Buccaneer anchovy (En), Karinetholi (M); S.commersonii (Commerson's anchovy), Valiya kozhuva (M), Nethili/Nethallu (T), Chauli, Gang maurala (O); and S.macrops (Estuarine anchovy), Vella kozhuva (M)

(En= English, Mr = Marathi, M = Malayalam, T = Tamil, Tg = Telugu, O= Oriya, B= Bengali)

Species availability and gearwise contribution (Av. 1995-2000)

Karnataka: E.devisi (75.6%), S.waitei (11.9%), E.punctifer (10.9%) and S.baganensis (1.3%) constituted the fishery (Fig.6) and were mainly exploited by the purse seine (51%) and trawl (47%).

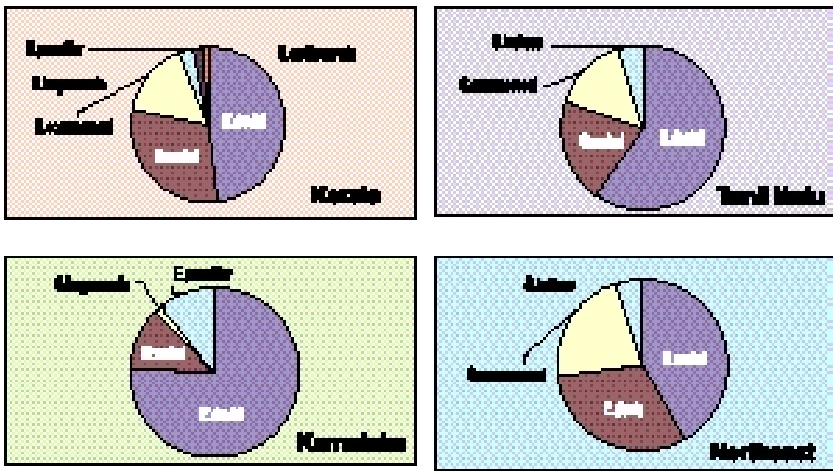


Fig. 6. Species composition

Kerala: The important species supporting the fishery were S.devisi (48%), S.waitei (30%), S.commersonii (16%), S.baganensis (3%), E.punctifer (2%) and S.andhraensis (1%) (Fig.6). The gearwise catch was: ring seine (53%), trawl (32%) and others (15%). At Vizhinjam the boat seine (90%) and Netholivala (9%) contributed to the catch.

Tamil Nadu: Along southeast region S.indicus (96%) and S.commersonii (4%), but in northern areas E.devisi (60%), S.waitei (20%), S.commersonii (15%) and S.indicus (5%) supported the fishery (Fig.6). Gears exploiting the resource are trawl (36%), non-mechanised gill net (34%), shore seine (17%) and others the rest. At Pondicherry, the non-mech. gill net shared 64%, trawl 23%, shore seine 9% and boat seine 4%.

Andhra Pradesh, Orissa and West Bengal: Along the northeast coast the main contribution came from Andhra Pradesh. Production from the other two states was less. S.waitei (42%), E.devisi (12%), S.commersonii (22%), S.indicus (5%) and others supported the fishery (Fig.6). Along Andhra coast non-mechanised gears (76%), trawl (20%) and boat seine (4%); in Orissa the trawl (56%), shore seine (43%) and others (1%); and in West Bengal the shore seine (42%) non-mechanised boat seine (26%), mechanised boat seine (15%) and others exploited the resource. The quarterwise production of whitebaits and the size range of different species are given in Table 1 and 2.

Table 1. Quarterwise production (%) of Whitebaits (Av. 1995-2000)

Region	I QR	II QR	III QR	IV QR
Karnataka	45.0	27.0	1.0	27.0
Kerala	18.7	20.4	21.1	49.8
Tamil Nadu	20.2	5.4	50.3	24.1
Northeast region (AP,OR,WB)	33.4	13.3	38.2	15.1

Table 2. Length range (mm) of whitebaits exploited along east and west coasts of India

Centre	Gear	Species	Size range (mm)	Centre	Gear	Species	Size range (mm)
Manga-	TN	E.devisi	45-95	Vizhinjam	BS	E.devisi	35-95
lore	TN	S.waitei	50-105		SS	E.devisi	70-95
	TN	S.baganensis	60-75	Kakinada	TN	E.devisi	45-100
	PS	E.devisi	55-95		TN	S.waitei	45-140
	PS	S.waitei	80-110		TN	S.commersonii	70-170
Kochi	RS	E.punctifer	80-110		TN	S.indicus	65-160
	RS	S.commersonii	60-100	Chennai	TN	E.devisi	70-130
	RS	S.baganensis	70-105		TN	S.waitei	70-90
	TN	E.devisi	70-90	Mandapam	SS	S.indicus	55-125
	TN	S.commersonii	75-120		TN	S.commersonii	90-135
	TN	S.baganensis	75-100		TN	S.indicus	75-135
	TN	S.waitei	70-95				

TN = Trawl, PS = Purse seine, BS = Boat seine, SS = Shore seine, RS = Ring seine

Distribution and migration

Whitebaits are distributed mostly in areas with bottom depths of 10-50 m and indicate diurnal vertical migration. E.devisi is abundant between 15 m and 45 m bottom depth, whereas S.waitei is a surface dwelling form found mostly within 25-30 m depth. E.punctifer and S.baganensis occur during monsoon in Kerala compared to pre and post monsoon in Karnataka.

The seasonal movements of whitebaits have been found to be directly related to the transport of water masses. In April, a southward movement begins and the stock starts accumulating in the Gulf of Mannar during June-August/September. After the monsoon (June-August) they disperse again along the coast north off Quilon during September-October/December and spread northwards along the Malabar Coast in the dry season. E.devisi and S.waitei exhibit difference in vertical distribution. In the purse seine, ring seine, shore seine and gill net operated at or near the surface areas, E.devisi constituted 65-83% of the total whitebait catch, where as the latter species constituted 1-20%. On the contrary in the shrimp trawl S.waitei dominated forming 60-70% and E.devisi 20-30%.

3. Biology

Spawning, fecundity and abundance of eggs and larvae

S.waitei spawns intermittently throughout the year with peak spawning activity during March to May and a secondary peak in November. The percentage of spawners varied between localities. Fecundity varied from 900-2500. The size at maturity is around 75-77.5 mm. E.devisi spawns almost throughout the year at Visakhapatnam with peak in February, March and in July and at Chennai during April to September. At Vizhinjam also they spawn throughout but with a peak during March-May and November-December.

Individual fish would shed three batches of eggs in quick succession at one multiple spawning and could effect the second set of multiple spawning after a period of about 3-4 months in both these species. Taking into consideration the growth rates, and the size at first maturity as 64.5 mm for E.devisi and 77.5 mm for S.waitei, the second set of multiple spawning would take place when the former is around 85 mm length along both the coasts, and when the latter species is around 92 mm in the east coast and around 95 mm in the west coast. The fecundity is around 1700-6790 eggs for E.devisi of 60-95 mm and 300-4800 eggs for S.waitei of 80-120 mm during the course of multiple spawning.

Recruitment pattern

Two pulses of recruitment were evident, the major one around March and the minor one in December in the case of both E.devisi and S.waitei. Along the west coast, in the case of S.waitei, major recruitment takes place around February and the minor one around November. The interval between the major and minor pulses of recruitment appears to be four months for both the species.

Mixed species of whitebait larvae are the most numerous of the clupeids along the southwest coast of India and are met within almost all the months, with dominant periods of occurrence from March to July and a secondary dominance in November. Relatively dense concentration of the larvae are seen in the area south of Kasargode to the Gulf of Mannar with maximum values over the outer shelf in the area from 7^0 30'N-11^0 '30 N. Larvae of whitebait formed 12-13% of the total fish larvae in the International Indian Ocean Expedition samples.

A large majority of the clupeoid larvae collected from an area extending from Ratnagiri to Tuticorin during the ichthyoplankton survey carried out by the UNDP/ FAO Pelagic Fishery Project, Cochin (1971-79) mainly consisted of whitebaits (Stolephorus spp.). There was clear evidence from the acoustic surveys conducted concurrently that Stolephorus spp. accounted for the largest clupeoid fish biomass in the project area.

Food

The food of E.devisi, S.waitei, S.baganensis and E.punctifer mainly comprised of copepods, Acetes spp. mysids and other zooplankters. Large food items are

generally found in S.waitei. During monsoon, a large number of veliger larvae have been encountered in the stomachs of these species. Occasionally phytoplankton like Coscinodiscus has also been noticed.

Growth

The L_{∞} and K value of E.devisi along both east and west coast were 103.5mm and 1.6 respectively. For S.waitei it was 134.5 mm and 1.2 along the east coast and 130 mm and 1.4 for west coast.

Table 3. The lengths (in mm) attained by two major whitebait species at various centres

Age in months	3	6	9	12	15	18	21	24
E.devisi								
Vizhinjam	52.5	77.7	90.2	96.4	99.5	101.0	101.8	102.1
Mangalore	57.6	79.8	93.1	101.0	105.8	-	-	-
Visakhapatnam	37.9	61.1	75.7	85.0	90.8	94.4	96.7	98.2
S.waitei								
Vizhinjam	56.6	81.5	98.5	111.1	117.9	124.2	126.9	129.4
Mangalore	52.4	77.1	92.3	101.5	107.1	110.6	112.7	114.0
Visakhapatnam	50.9	77.9	96.2	108.6	116.9	122.6	126.4	129.0

Survival in captivity

Results of the holding experiments on four species of whitebaits at Vizhinjam have indicated that generally species of the genus Encrasicholina appeared to be promising as effective live-bait for pole and line fishing for tunas in our seas. E.punctifer is very hardy and can withstand captivity for about three months.

Utilisation

Consumer preference for various species differ from place to place in our country. While E.devisi and E.punctifer are not preferred at Kochi and Mangalore, they are in great demand in the southern and interior parts of Kerala. During June-July E.punctifer is exploited in large quantities by the ring seines in the Alleppey-Quilon belt. But during glut large quantities are wasted, as sun drying is difficult during the monsoon. Though drying platforms have been suggested, the method was found uneconomical. Large shoals of S.baganensis appear off Cochin. The stock is exploited in large quantities by the ring seines during June-August. Most of the species are consumed fresh and in dried form. The large growing species like S.commersonii and S.indicus are in good demand. However, they are seasonal in occurrence and not landed in good quantity.

4. Stock assessment

The estimated potential of whitebaits is 90,000 t upto 90 m depth zone. However, the exploitation has crossed 1 lakh t during 1988. During the eighties the average

annual landings (64,000t) indicated an increase by 113% over that of the seventies but further it appeared to have stabilized around that level during the nineties. A number of factors like target fishing for export varieties, stay fishing and extension of fishing to deeper grounds have contributed to this reduction in the landings. Whitebaits are non-target groups and constitute only one of the by-catch items in most of the gears except in Choodavalai (ring seine), Netholivala and in the small meshed purse seines (at Mangalore). The by-catch in target fishing units amounts to nearly 2/3 of the total catches and is mostly thrown overboard. Further, small meshed purse seines once used to exploit this resource at Kochi during the eighties now employ only large meshed nets that target only other pelagics. Hence the purse seine catch at Kochi was nil during the last few years.

Along the east coast S.commersonii is subjected to higher fishing pressure whereas exploitation of E.devisi is at optimum level, and S.indicus and S.waitei are underfished. Along the west coast, in Karnataka, E.devisi is put to higher fishing pressure, but S.waitei is underfished. In Kerala, E.devisi and S.commersonii are exploited at optimum level and S.waitei is underexploited.

5. Management

Whitebaits are annually renewable resources and hence their periodic harvest during seasons of abundance is important to make full use of the fishery. Increasing the fishing pressure during the peak seasons of availability may be a practical option to enhance the whitebait production in the country. Since the whitebaits being a non-target species in most of the gears in which it is caught (except the Choodavala operated by ring seine units), the Maximum Sustainable Yield (MSY) and the effort required to obtain the MSY could be decided only in consideration with stock position of other resources caught in the gears. Distant water fishing and stay fishing by trawlers have created a vacuum in the 50m-depth zone especially along the Kerala coast leaving the resource for exploitation mostly to the ring seines and traditional gears. Further, the stay fishing units waste considerable amount of by-catches including the whitebaits. Presently there is no mechanism to economically utilize these low priced fishes and also this resource caught as by-catch mostly go unaccounted in the total marine fish production itself of the country. A potential yield of 2,40,000 t was estimated for whitebaits in the EEZ of India, of which the share of west coast, east coast and Andaman and Nicobar Islands may be in the proportion of 69%, 29% and 2% respectively. This indicates scope for a three-fold increase over the present yield of whitebait in India.

6. Suggested reading

Anon. 1974. Survey Results. 1972-73. UNDP / FAO. Pelagic Fishery Project, Cochin. Progress Report. No. 6 Bergen.

Anon. 1974. Plankton – Fish eggs and larvae studies. UNDP/FAO. Progress Report No. 7 Bergen.

Anon. 1976. Plankton – fish eggs and larvae studies. UNDP/ FAO Progress Report No. 17. Bergen.

Anon. 1976. A synopsis of the information on pelagic resources off the southwest coast of India. UNDP/ FAO Progress Report No. 18. Bergen.

George, K.C. 1979. Studies on the distribution and abundance of fish eggs and larvae off the southwest coast of India with special reference to Scombroids. Ph.D. Thesis. University of Cochin. 197 p.

Girijavallabhan, K.G. and J.C. Gnanamuthu, 1982. Occurrence of eggs of Stolephorus bataviensis in the fishing grounds of Madras. Indian J. Fish; 29 (1&2): 269-270.

Jones, R. 1984. Assessing the effects of changes in the exploitation pattern using length composition data (with notes on VPA and cohort analysis.) FAO Fish. Tech. Pap. 256: 118 p.

Luther, G. 1972. Whitebait fishery resources of the southwest coast of India. Symposium on Fishery Resources of the Seas around India, 11 – 13 December 1972. Abstract. 17, CMFRI, Cochin.

Luther, G. 1979. Anchovy fishery of southwest coast of India with notes on characteristics of the resources. Indian. J. Fish., 26 : 23-39.

Luther, G, G. Gopakumar and Madan Mohan. 1984. Tuna live bait fish investigations at Vizhinjam. Proceedings of the Symposium on coastal Aquaculture. 3, 861 – 875. CMFRI, Kochi.

Luther, G. Biology of Whitebait anchovies of Indian waters. In: Blaber, S.J.M. and Copland. J.W. (Eds.) 1990. Tuna baitfish in the Indo-Pacific region: Proceedings of a Workshop, Honiara, Solomon Islands. 11-13 December 1989. ACIAR Proceedings No. 30, 75-82.

Luther, G. 1990 K.V.N.Rao, G.Gopakumar, C. Muthiah, N.G.K.Pillai, Puthran Prathibha. K.N. Kurup, S. Reuben, P. Devadoss, G. Syda Rao, P. Sam Bennet and N.S. Radharkrishnan. 1992 Resource characteristics and stock assessment of whitebaits. Indian. J. Fish., 39 (3&4) : 152-168.

Menon, M.D. and K.C. George. 1975. Whitebait resources of the southwest coast of India. Seafood Export Journal. Cochin. 7 (1), 1-14

Rao, K.V.N., G. Syda Rao, G. Luther and M.N.K Elayathu. 1892. The emerging purse seine fishery for anchovy (Whitebaits) resources of the west coast of India. Mar Fish. Infor.Serv. T&E Ser., 36: 1-16.

Rao, G.S. 1988a Biology of Stolephorus devisi (Whittley) from Mangalore area, Dakshina Kannada. Indian J.Fish., 30: 28-36

Rao, G.S. 1988b. Some aspects of the biology of Stolephorus bataviensis Hardenberg from Mangalore area, Dakshina Kannada. Indian J.Fish., 30: 107-113.

Shomura, R.S. 1970. Indian Ocean coastal waters. In: J.A.Gulland (Ed.) The fish resources of the ocean. FAO Fisheries Technical Paper. 97: 115-129.Rome

Sreekumar, A. 1977. Development and distribution of larvae of the whitebait Stolephorus zollingeri Bleeker (Engraulidae, Pisces) along the southwest coast of India. Proceedings of the Symposium on Warm Water Zooplankton. Special Publication National Institute of Oceanography. Goa: 440-449.

Whitehead, P.J.P., G.J. Nelson and T. Wongratana. 1988. FAO Species Catalogue Vol. 7. Clupeoid fishes of the world. (Suborder Clupeoidei). An annotated and illustrated catalogue of herrings, sardines, pilchards, sprats, anchovies and wolf herrings. Part 2. Engraulidae. FAO Fisheries Synopsis (125) Vol. 7.Pt.2.305-579. Rome.