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24 The fishery and resource characteristics of pomfrets

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ABSTRACT

*Pomfrets contribute to about 2% in all India fish catch. They are abundant along the coasts of Maharashtra, Gujarat and Orissa. *Pampus argenteus* forms 65.9%, *Formio niger* 33.2% and *Pampus chinensis* 0.9% of the catch. They feed on planktonic organisms like salps, medusae and ctenophores. Both *P. argenteus* and *F. niger* have prolonged spawning with two peaks. The breeding ground of *P. argenteus* is the depth realm 55-90 m off Cambay and Sand head; while the inshore areas of Bombay, Cambay and Sand head appear to be the nursery grounds. They are pelagic and are caught mainly in driftnet, trawl net and dolnet. The estimated MSY for *P. argenteus* for Indian waters is 38,194 t while for *F. niger* is 20,446t. The fishery of *P. argenteus* has collapsed in Maharashtra due to growth and recruitment overfishing.*

Introduction

Pomfrets belonging to the family Stromateidae, enjoy wide distribution in the depth upto 150 m of tropics. They are highly relished table fishes in internal and export markets and command high unit value. The annual average catch of 38,090 t, forming about 2% of all India marine landings, comprises of *Pampus argenteus* (65.9%), *Formio niger* (33.2%) and *Pampus chinensis* (0.9%). Most of their production is from Gujarat and Maharashtra in the Northwest coast and Orissa in the Northeast coast of India. In spite of

their economic importance, the research inputs on the biology, fishery and population dynamics from the distributional range are scanty and scattered over a couple of decades. Some of the research works worth mentioning are those of Kuthalingam (1962), Gopalan (1967), Pati (1980, 1982, 1983), Sulochanan and Rao (1964), Kagwade (1990) and Khan *et al.* (1992).

Material and methods

The catch and effort data collected by the Fishery Resource and Assessment Division of the C.M.F.R. Institute were utilized for the present studies. In addition, length data were collected from one of the landing centres of the respective state. Biological information on food and feeding habits and maturation and spawning were also collected. Growth parameters, L_{∞} and K , were estimated using ELEFAN 1 programme (Gayanilo *et al.*, 1988). Mortality estimates were made following length converted catch curve. Estimates of MSY were made using relative yield per recruit programme of ELEFAN 2. Yield (catch in weight) and stock biomass were predicted for various levels of fishing effort using length converted Thompson and Bell analysis (Sparre, 1985). The output of Jone's length cohort analysis, namely the recruitment and fishing mortalities formed the inputs for length converted Thompson and Bell analysis.

Craft and gear

Mostly two types of gill netters namely dugout canoes and plank built boats are operated. The dugout canoes are mostly mechanised with outboard engine of 6-9 hp, whereas plank built boats varied in shape and size in various states according to the local design and fitted with inboard engine of 24-85 hp. Pomfrets are mainly landed in drift net of 140-155mm mesh size. Smaller mesh size of 70-130mm are also in vogue in some states. Most of the trawlers operated are 13-15m OAL with 58-102 hp engine. Mostly shrimp trawl of 10m length is used with cod end mesh of 15-20mm. Dol net is operated mainly from plank built boats viz. wahan and machhua in Gujarat while Lodhiya and Satpati in Maharashtra.

Biology and behaviour

Mostly digested material and gelatinous substance were recorded in the stomach content of *P. argenteus*. On very few occasions copepods and

amphipods were noticed among digested materials. On one occasion young ones of *Apogon* spp; *Myctophum* spp; *Nematopalaemon tenuipes* and fish scales were also observed in large sized specimens. The stromateids possess toothed pharyngeal sac which acts as grinding mill and converts the food into a pulpy mass (Haedrich, 1967). Most of the earlier workers consider copepods a very important part of diet (Rege, 1958; Kuthalingam, 1967 and Rao, 1967). Pati (1980) recorded copepods 3.87 to 19.22% and semidigested matter 67.4 to 90.4%. Many workers have recorded salps, medusae and ctenophores (Rege, 1958; Chopra, 1960 and Haedrich, 1967). Those maserated semidigested materials may in all probability be salp, medusae and ctenophores. *F. niger* is a carnivore feeding on large zooplanktonic organism viz. crustaceans, polychaetes, cuttle fish. The salps, *Tasis zonaria* may be considered as indication of abundance of *F. Niger* (Sivaprakasam, 1963).

Gopalan (1967) observed that the size at first maturity for *P. argenteus* male and female is 22cm and 26cm total length respectively. Pati (1982) recorded size at first maturity at 15cm for males and 17cm standard length for females. There are two spawning periods for *P. argenteus* with peaks in April and August on the east-coast of India (Pati, 1982). Prolonged spawning season extending from February to August with peak during April to June has been reported by Gopalan (1967) on the west coast; whereas two peak spawning periods have been noticed during February-August by Bapat *et al.* (1982). Hussain and Abdullah (1977) observed that spawning of *P. argenteus* spreads over a long period of time, beginning in April and extending to September with peak in April-May and September in Kuwaiti waters. Gonadosomatic index also indicated 2 peak spawning. Two peak periods, one in October another in February-April appear in the occurrence of small sized fish (Khan, 1982). Ova diameter studies have indicated that the species spawns in two batches. *F. niger* is known to have a prolonged spawning season extending from July to October with peak in August to September (Sivaprakasam, 1965). Prolonged spawning season extending from November to March has also been reported by Bapat *et al.* (1982). Observations at Cochin indicated that *F. niger* spawns twice in a year with a major peak during June-September and a minor one during January-February. A fish, however spawns only once a year (Sivaprakasam, 1965). The size at first maturity was estimated to be 275 mm (Khan *et al.* 1992).

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P. argenteus exhibits diurnal migration. Hence drift gill net is operated at night and bottom drift gill net during day. The movement of fish coincide with the vertical ascend and descend of its main food item copepod (Pati, 1980). Both *P. argenteus* and *F. niger*, move in bigger shoals and bumper landings are often reported (Perumal and Algarswami, 1980 and Kagwade, 1987). However, both catch rate and catch were better in pelagic trawl during survey by M.T. 'Muraena' (Bapat *et al.* 1982). The species though available at all depth ranges up to 360m the species occur in large numbers in the depth range 55-90m.

Young ones of *P. argenteus* are landed in dol net in the Gulf of Cambay and also in the Gulf of Kutch along the Bombay coast, indicating that inshore water is the nursery ground of the fish particularly in Gulf of Cambay. Only stray young ones of *F. niger* are landed indicating that its breeding ground and nursery ground are away from the shore. In *P. argenteus* speciation is in progress (Pati, 1983).

Fishery

On an average pomfrets contributed 38,090 t during 1985-93 forming about 1.93% of the total marine fish landed in India. *P. argenteus* contributed 25111 t forming 65.9%, *F. niger* 12662 t forming 33.2% and *P. chitensis* 337t forming 0.9%. The following states contributed to the fishery and landings of *P. argenteus* and *F. niger*.

Maharashtra: On an average pomfrets contributed 12600 t (1985-93) forming 4.18% of the total catch in Maharashtra, shared by *P. argenteus* (8464 t), *F. niger* (4116 t) and *P. chitensis* (20 t). Their landings showed a decline compared to 1975-1984 (15740 t forming 5.8%). The maximum contribution was from the district of Thane (62.3%) followed by Greater Bombay (21.2%), Ratnagiri (10.8%) and Raigad (5.6%). *P. argenteus* had high CPUE in September-October in gill net and September-November and April-May in dol net. Ratnagiri district contributed 44.5% of the total *F. niger* landings in Maharashtra.

Gujarat: An estimated average catch of 9917 t of pomfrets were landed in Gujarat forming 3% of the total catch. *P. argenteus* constituted 7830 t while *F. niger* 2061 t and *P. chitensis* only 26 t. The catch indicated a declin-

ing trend when compared to earlier average of 10974 t (1975-84). Saurashtra contributed 62.3%, Jamnagar 21.4%, South Gujarat 13.0% and Kutch 3.3% in the total pomfret landings (Kagwade, 1987). The CPUE was high in April-September.

Karnataka: The state contributed 2117 t forming 1.16% of the total fish landed. *F. niger* formed a major fishery contributing to 1657 t (78.3%), *P. argenteus* 394 t (18.6%) and *P. chinensis* 66 t (3.1%). Peak landings were recorded in third or fourth quarter.

Kerala: Pomfret fishery in Kerala formed only less than 1% of the total catch in the state. The estimated catch was 1923 t comprising of *F. niger* 1106 t (57.5%), *P. argenteus* 732 t (38.1%) and *P. chinensis* 85 t (4.4%). The peak CPUE was during February-April and August-October in drift net. Young ones of *P. argenteus* in the size range 35-70mm were caught in trawlers during September-December.

West Bengal: Pomfrets formed an important fishery in West Bengal with an average catch of 2288t forming 5.16% of the total catch. *P. argenteus* contributed 1764t (77.1%), *F. niger* 473t (20.7%) and *P. chinensis* 51t (2.2%) towards their fishery. Pomfret's production registered a general increase from 531 t in 1975 to 5775 t in 1983. Maximum landings were at 24 Parganas district (66%) and Midnapur (34%). The peak catches were made during the fourth quarter (69%) followed by first (14.97%) and third quarter (14.67%).

Orissa: Pomfrets formed an important fishery (7.2% of the total fish landed), *P. argenteus* was the major species with a mean catch of 2826t (72.2%), followed by *F. niger* 944t (24.8%) and *P. chinensis* 40t (1.0%). The pomfret landing was very erratic in Orissa and fluctuated from 10699t (1976) to 9072t (1980). Gill net caught 58.2% and remaining by trawl net and the non-mechanised gear. Peak landings were recorded during fourth quarter (44%) followed by third (20%) and second (16%). District of Balasore contributed 77% of the catch (Scariah et al. 1987).

Andhra Pradesh: Pomfrets formed 2.4% of the total catch in the state

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(3234t) shared by *P. argenteus*, 1990t (61.5%) and *F. niger*, 1236t (38.2%). Peak seasons of abundance were first and the fourth quarter. They were fished by drift gill net and trawl net.

Tamil Nadu: Pomfrets formed only 0.4% of the total fish catch. Species composition indicated the dominance of *P. argenteus*, 957t (74.8%), followed by *F. niger* 285t (22.2%) and *P. chinensis* 37t (3.0%).

Stock assessments of silver pomfret

Length weight relationships: Length weight relationship estimated for Gujarat: $\text{Log } W = 4.67166 + 3.07696 \text{ Log } L$; for Maharashtra: $\text{Log } W = 4.49568 + 3.005864 \text{ Log } L$ indicated a cubic relation.

Age and growth: The size range in drift net was 110-360mm, in trawl net 110-330 mm and in dol net 15-299mm. The growth curve of *P. argenteus* at Gujarat by ELEFAN I is given in Fig. 1.

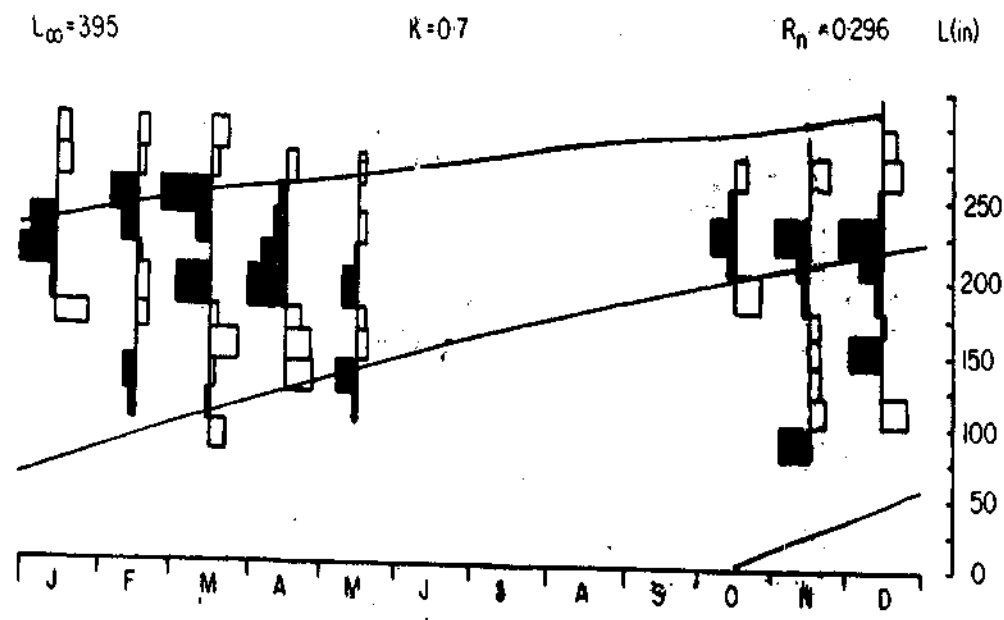


Fig. 1. The growth curve of *P. argenteus* (Gujarat) identified by ELEFAN I

The L_{∞} and K values estimated by ELEFAN I at different state are given below

	L_{∞} (mm)	K (Annual)
Gujarat	395	0.7
Maharashtra	390	0.7
Karnataka	360	0.69

Mortality and stock size (Gujarat): Total instantaneous mortality coefficient (Z) estimated by length converted catch curve analysis was 3.165 with regression coefficient of 0.97 for the period 1981-84 (Fig.2). The F/Z was 0.668. Length at first capture (L_c) was estimated to be 46 mm. The relative yield per recruit (YW/R) indicated E_{max} at 0.413 with L_c/L_{∞} ratio 0.12 and M/K 1.5 (Fig.3). Maximum sustainable yield (MSY) is estimated as 16265t when the average yield is 10038t with F/Z 0.668 indicating a 38% reduction in the effort. Low size at first capture and high F/Z indicate growth overfishing.

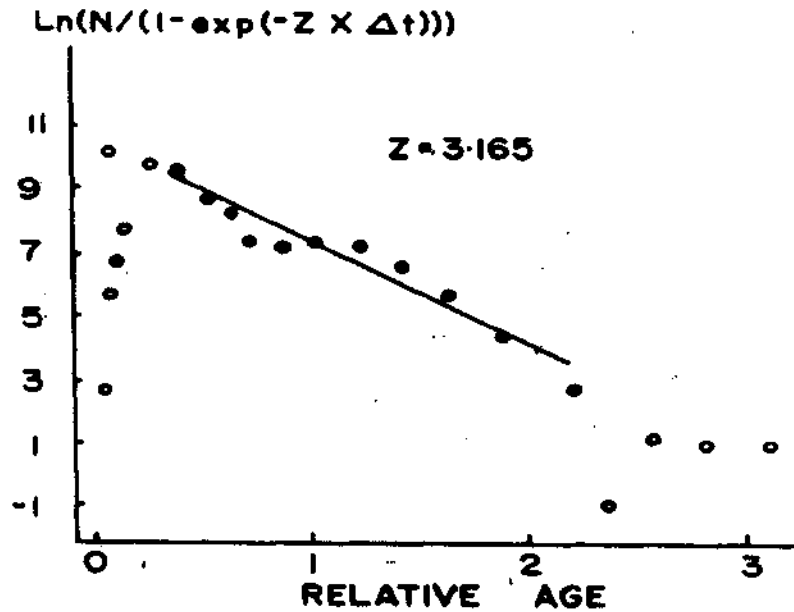


Fig.2. Total instantaneous mortality coefficient (Z) estimated by length converted catch curve analysis of *P.argenteus* (Gujarat)

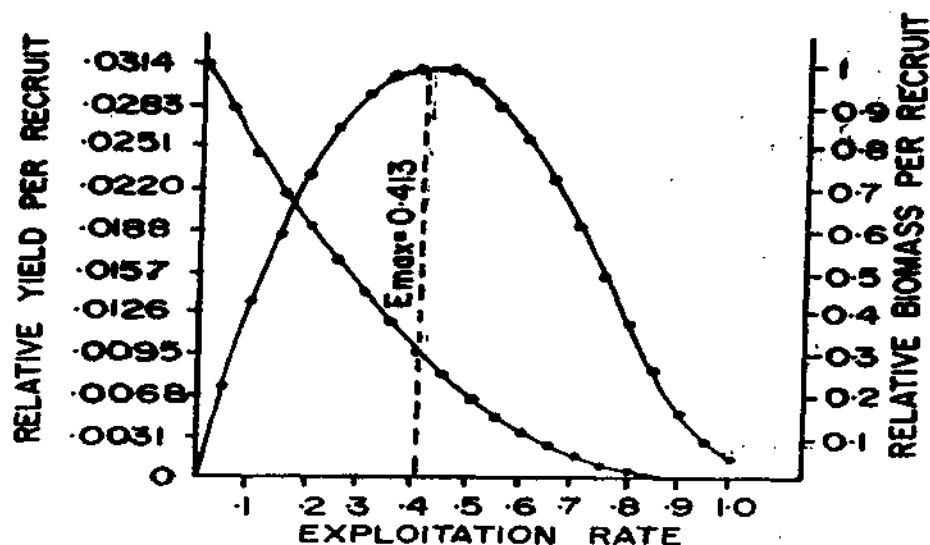


Fig.3. The relative yield per recruit YW/R of *P. argenteus* (Maharashtra).

Mortality and stock size (Maharashtra): The estimated values (1993-95) for $Z = 4.033$, $F/Z = 0.74$, $L_c = 232.2$ mm and B_{max} based on $L_c/L_{\infty} = 0.59$ and $M/K = 1.5$ as 0.8514. The present F/Z of 0.74 indicate scope for effort increase. The MSY, based on the E_{max} (0.561), is estimated at 10231 t, when average current yield is 4740 t with present $E = 0.74$.

Mortality and stock size (Karnataka): Z estimated was 5.054 and MSY 374 t and average catch 346 t at relative fishing effort of 0.5, indicating that stocks at Karnataka were heavily fished.

Stock assessment of black pomfret

Length-weight relationship of *F. niger* along Kerala is $\text{Log } W = -4.26513 + 2.7921841 \text{ Log } L$. The growth parameters based on drift net catch are $L_{\infty} = 560$ mm and $K = 0.73$ (annual).

In Kerala, the estimated Z was 4.4 and MSY 1055 t at relative fishing effort of 0.8, suggesting the need to reduce the effort by 20% (Khan et al. 1992).

Karnataka also gave a similar trend with Z as 6.45 and MSY 1856 t at a relative fishing effort of 0.413 indicating that the effort should be decreased by 60% (Khan *et al.* 1992).

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