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Fish biology a.fishery

OBSERVATIONS ON THE BIOLOGY AND FISHERY OF BLACK POMFRET  
*PARASTROMATEUS NIGER* (BLOCH) FROM THE BAY OF BENGAL

OBSERWACJE NAD BIOLOGIĄ I POŁOWEM  
*PARASTROMATEUS NIGER* (BLOCH) W ZATOCE BENGALSKIEJ

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The biology and fishery of black pomfret *Parastromateus niger* (Bloch) have been studied for the first time from the northern part of Bay of Bengal along the West Bengal-Orissa Coast. The fish is a carnivore feeding mainly on *Acetes*, copepods and jellyfishes\*.

The spawning ground is located in the vast shallow continental shelf lying to the north of River Mahanadi along Orissa – West Bengal Coast. The size at first maturity is 28.0 cm SL in males and 30.0 cm SL for females. The sex ratio is close to one.

The species contributes to nearly 4.0% of total drift gill-net catch at Chandipur.

INTRODUCTION

The black pomfret *Parastromateus niger* (Bloch) forms an important fishery in the Indo-West Pacific region. Its systematic position amongst perciform fishes is controversial

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\* *Acetes* are small prawns of the family *Sergestidae* (Decapoda) very common in the coastal waters of India.

(Haedrich, 1967). Authors, from time to time, have assigned it to diverse families like *Stromateidae* (Day, 1878), *Carangidae* (Regan, 1902; De Beaufort and Chapman, 1951; Apsangkar, 1953), *Apolectidae* (Jordan, 1923; Sujuki, 1962), *Parastrumateidae* (Mc Culloch, 1929) and *Formionidae* (Berg, 1940); (Kuronuma and Abe, 1972). However for fishery purposes it is included in the stromateid group. Our knowledge of the biology of the black pomfret is confined to the accounts of De Jong (1940) from the Java Sea and of Sivaprakasam (1965, 1967) from the Gujarat coast. Excepting for the brief accounts by Basheeruddin and Nayar (1962), Srinivasa Rao (1967) and Rao (1972), no detailed information is available from the Bay of Bengal. The present paper deals with the biology and fishery of the black pomfret from the West Bengal-Orissa Coast.

## MATERIALS AND METHODS

Samples for the present study were collected at weekly intervals from gill-net catches at Chandipur (Fig. 1) an important pomfret landing centre along the Orissa Coast. Representative samples were collected from the trawl catches off Pradip (Orissa) and gill-net catch at Digha (West-Bengal). A total of 460 specimens ranging from 3.4 cm to 45.5 cm SL were examined from January 1972 to December 1973.

The stomach contents were examined by the modified points method (Swynnerton and Worthington, 1940; Frost, 1943; Hynes, 1950; Pillay, 1952). Direct observation of maturity stages and occurrence post-larvae as well as juveniles were made for the study of maturation and spawning. Ova diameter measurements were made according to the method of Clark (1934); Hickling and Rutenberg (1936); De Jong (1940); Karandikar and Palekar (1950); Prabhu (1956) and others. Detailed observations on the fishery were made at Chandipur during 1969–1970 to 1973–1974.

## FOOD AND FEEDING HABITS

The stomach contents are mainly in the form of semidigested pulpy mass and often resembles shredded tissues observed in other stromateids. The remarkable pharyngeal teeth of *P. niger* could have been the agents in this shredding. Basheeruddin and Nayar (1962) and Sivaprakasam (1965) also noted a high proportion of pulpy matter in the stomachs of black pomfrets from Madras and Gujarat coast respectively.

### Qualitative and quantitative analysis

The mean percentage composition of the stomach contents for the whole period of investigation is as follows:

*Acetes* – 7.4%, copepods – 4.6%, ctenophores and medusae 2.6%, amphipods – 2.2%, ostracods – 0.1%, cladoceran 1.2%, *Lucifer* 0.6%, decapod remains – 1.8%, zoea and



megalopa — 0.4%, marine insects — 0.1%, polychaete larvae — 0.4%, *Sagitta* — 0.1%, molluscan larvae — 0.1%, cuttle fish — 0.1%, fish eggs and larvae — 0.3%, fish scales — 0.4%, diatoms — 0.6%, semidigested pulpy mass — 77.0%.

#### Seasonal variation in food:

*Acetes* occupied first place in the diet and occurred during all months except September. Copepods were recorded throughout the year, and ranked second in the diet. Amphipods were present during all the months except June and July and formed a significant part of the food. Ostracods were observed only in March and May. Cladocerans occurred in small quantities during most months except April and June. *Lucifer* was present in the diet during June, September, November and December. Decapods remained an important part of the stomach contents throughout the year. Zoea and megalopa were noticed in the stomach during August and September. Marine insects were encountered occasionally in the diet and were recorded in the months of July and December. Ctenophores and medusae ranked third in the diet and were noted during all the months excepting March to May and July to August. Polychaete larvae formed an insignificant part of the food and occurred in January, April, October, November and December.

Molluscan larvae were recorded occasionally, in December and January. *Sagitta* spp were observed in May and October and remains of cuttlefish in November and January. Fish eggs and larvae were observed in the stomach contents during February, September, October and December. Fish scales were present in many months except March, May, July, August and September. Diatoms were encountered in the stomach except in March, May, June, August and October. Semidigested matter formed the bulk of the stomach contents and contributed to as much as 77% of the total contents.

#### Food of the juveniles

The postlarvae of *P. niger* measuring 3–4 cm SL feed mainly on phytoplankton. Zooplankton are added to the diet later in juveniles. The juveniles measuring from 4.0 to 9.0 cm SL were common in the trawl catch off Paradip and their stomachs contained detritus indicating a demersal life. *Acetes* and hydromedusae occur in specimens measuring 9–10 cm SL and above.

### MATURATION AND SPAWNING

For the study of maturation and spawning in adults, 320 specimens were examined. The classification of maturity stages is given in Table 1.

Table 1

Classification of maturation stages of  
*Parastromateus niger*

Stage of maturity	Description intraovarian egg	Mode of largest group of eggs	Maximum size of intraovarian egg
I	Virgin	0.06	0.13
II	Maturing	0.24	0.32
III	Developing	0.38	0.48
IV	Developed	0.52	0.64
V	Gravid	0.72	0.84
VI	Spawning	0.86	0.90
VII	Spent	0.24	0.32

### Spawning habit

A study of ova diameter frequency was made to ascertain the spawning habit by the method outlined by Clark (1934), Hickling and Rutenberg (1936) and others. The ova diameter measurements were grouped in the interval of 2 md (1md = 0.01 mm) and their percent frequencies have been presented in separate polygons (Fig. 2). In the ovary, only one batch of eggs from the general egg stock undergoes maturation to be spawned during the ensuing spawning season. It would therefore appear that each adult female releases the eggs in one spawning act.

### Spawning season

The gonads of the adults were examined during different month of the year to determine the spawning season. Females with ovaries in stages I and II were recorded from July to September. In October and November adult females in stage III make their appearance. Adult females in stage IV were recorded during December and January. In February, females in stage V appear in the commercial catches. Only one ripe female in oozing condition (stage VI) was recorded in March 1973. Spent fishes were common in the catches from March to June indicating that the fish spawn during this period. Males present a similar picture. Adult males in early stages are common during July to February. Two oozing males were recorded in March 1973 from gill-net catch at Chandipur. Post-larvae measuring 3.0–4.0 cm SL appear in the bottomset nets and trawl-nets from April to July providing further evidence that the spawning season extends from March to June. The wide range in the length of post-larvae and juveniles from 3.0 cm to 7.0 cm SL (Photo 1) in July indicates that although the spawning is restricted to a short and definite period, the spawning season is protracted over a period of four months for different individuals of the population.

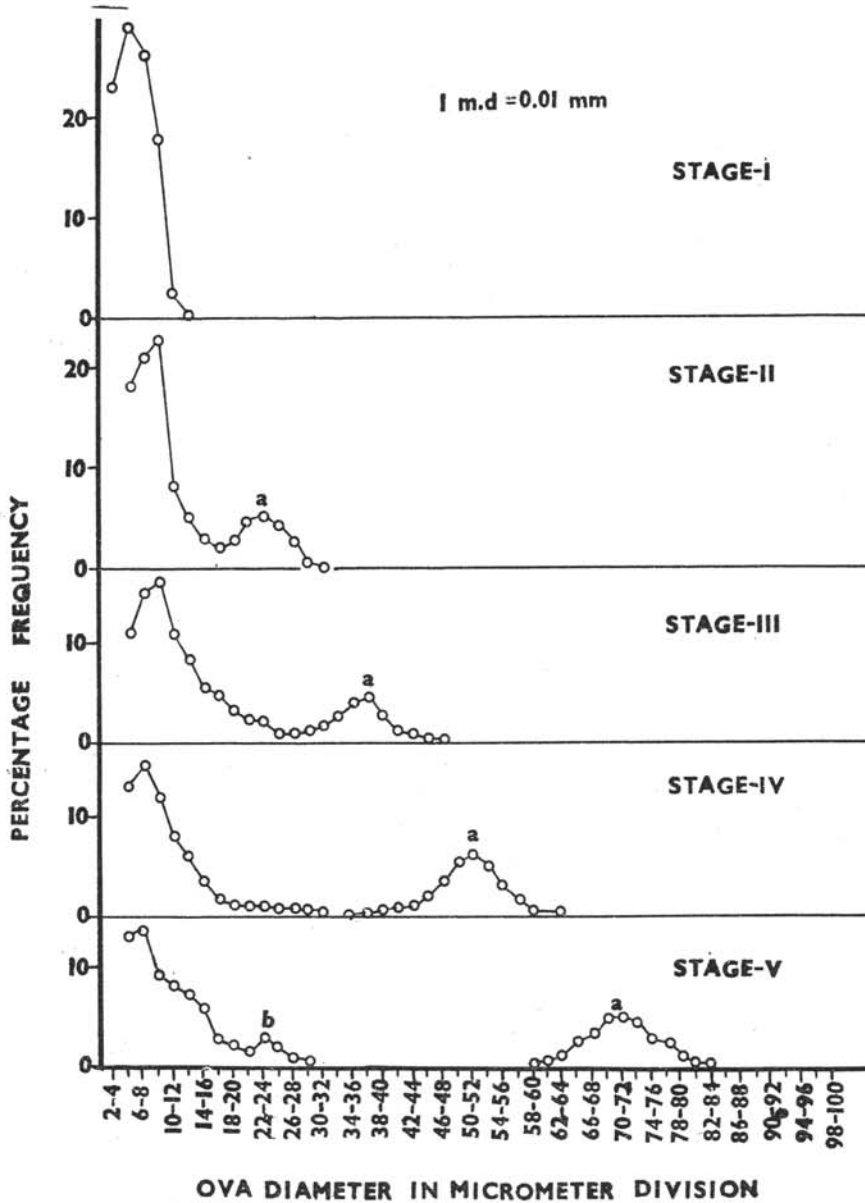


Fig. 2 Ova-diameter frequency polygont of ovaries of *Parastromateus niger* in various stages of development.

#### Spawning ground

The occurrence of ripe fishes and post-larvae along West Bengal-Orissa coast indicates that the area is the spawning and nursery ground of black pomfrets. The lost larvae measuring 3.0 cm SL represent the first record of the smallest stage of the species from the Indian waters.

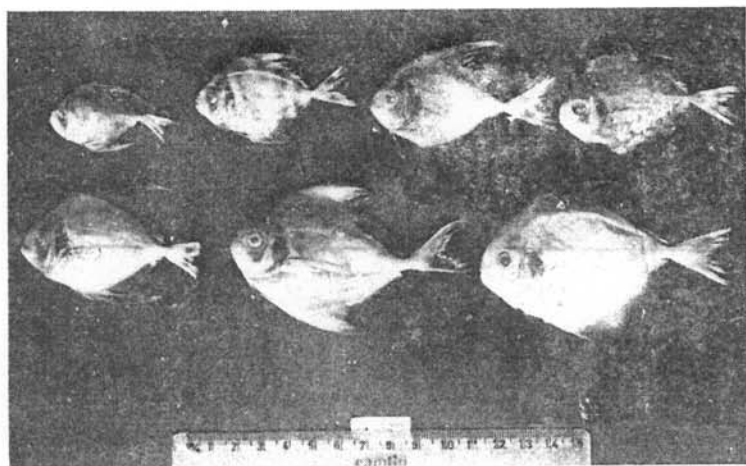


Photo 1 Post-larvae and early juveniles of *Parastromateus niger*.

#### Size at first maturity

Mature specimens available during the spawning period (March-June) were used to determine the size at first maturity. The smallest female with spent ovary measured 30.0 cm SL which may be considered as the size at first maturity. The smallest male with oozing testes measured 28.0 cm SL. Males attain sexual maturity earlier than the females.

#### Sex ratio and fecundity

The ratio of males to females was 1:1.2 during the period under investigation. The commercial catch was composed of both sexes, the females in general outnumbering the males. The number of eggs present in the ovary of the only ripe female (32.6 cm SL) encountered was 86,250.

### FISHERY

Along the east coasts, black pomfret are captured in drift gill-nets, boat-seines, shore-seines and surrounding-net. Because they are pelagic, the adults are poorly represented in the trawl catches, whereas the demersal juveniles are caught in good number in them. According to Kuthalingam (1967) black pomfrets accounted for 5.3% of the total pomfret catch during the trawling operations of Kalyani I-V in the Orissa – West Bengal coast from Sandheads to Gopalpur. Along Orissa – West Bengal coast Adhuan, Chandipur, Kirtania and Digha are the important landing centres of black pomfret. In the inshore waters of these places gill-nets are deployed in the night from mechanised boats.



Photo 2 Fishing base at Chandipur with mechanised boats used for drift gill-netting.

The statistics of gill-net catch with mechanised boats from the Government Fishing Base at Chandipur (Photo 2) for 12 years is appended in table 2. The drift gill-nets in use measure nearly 1,000 meter in length with 8–10 cm stretched mesh and are operated in the night. Black pomfrets contribute to 4.17% of the total catch off Chandipur. The catch per unit effort (i.e. boat-days) ranged between 1.54 kg and 4.60 kg. The maximum

Table 2

Statistics of landing of black pomfret at the  
Government Fishing Base, Chandipur (in tonnes)

Year	Total No. of boats in operation	Total No of boat days	Total landing of all fish	Total landing of black pomfret	Catch per boat day
1964–65	4	819	35.36	2.25	2.75
1965–66	9	1069	60.71	4.92	4.60
1966–67	7	1042	98.20	*	—
1967–68	23	3134	147.66	12.63	4.03
1968–69	24	3125	214.46	5.28	1.68
1969–70	37	3448	228.38	5.33	1.54
1970–71	33	3339	202.64	14.04	4.20
1971–72	36	3287	205.46	5.20	1.58
1972–73	38	2928	146.55	10.62	3.62
1973–74	15	1829	175.25	8.68	4.76
1974–75	29	1665	91.48	3.41	2.04
1975–76	47	2260	197.45	6.73	2.98

\* Data is not available for pomfrets



yield of black pomfrets was 14.04 tonnes in 1970–1971 with a total effort of 3,339 boat days.

The monthly pattern of catch was worked out from the specieswise landing data of five years (1969–1970 to 1973–1974) and the results are raphically represented in Fig. 3. It is of interest to note that black pomfrets show poor representation in the gill-net catch during March to May which coicides with their spawning period. Observation on fishery was not possible as commercial fishing is suspended during June and July due to roughness of the sea. But during August to September, which coincides with the post-spawning period, the black pomfrets are abundant in drift gill-net catch, with a small peak in December.

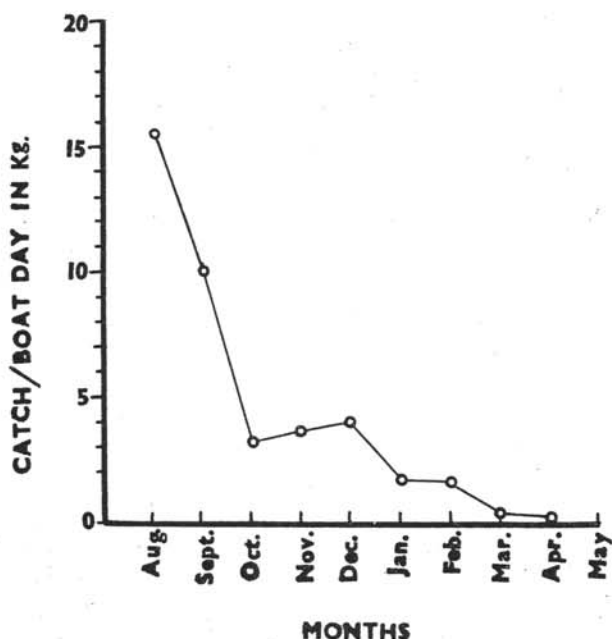


Fig. 3 Montly pattern of catch of *Parastromateus niger* at Chandipur.

## DISCUSSION

Basheeruddin and Nayar (1962) recorded white pulpy matter, scales, bones of fishes, copepods and *Acetes* in the stomach of juveniles from Madras waters, Srinivasa Rao (1967) in his brief investigation recorded mostly remains of crustaceans and fish scales together with copepods, amphipods and cladoceran in the stomach of adult black pomfrets from Andhra coast. Sivaprakasam (1967) recorded a high percentage of thaliacea along with prawns, lucifers, mysids, ostracods, crustacean larvae, polychaetes, cuttle fish, medusae and semidigested matter in the stomach contents of adult *P. niger* from Gujrat waters.

The present investigation reveals that *Acetes*, copepods and medusae dominate the food of *P. niger*. Amphipods, cladocerans, lucifers decapods remains form a significant part of the diet. Ostracods, marine insects, crustacean larvae, molluscan larvae, *Sagitta*, cuttle fish, fish eggs and larvae, form occasional items in the diet. *Thaliacea* constituted the major food-item of black pomfret from the Gujart coast and Sivaprakasam (lop. cit.) suggested the possible utilization of salpa *Fasozonaria* as an indicator species. But their insignificance in the diet of *P. niger* from Orissa-West Bengal coast is noteworthy. The nature of the diet indicates that the early juveniles are demersal whereas the adults are pelagic. Change of larvae abode is characteristic of many fishes and is well marked in the black pomfret.

The individuals of *P. niger* from the Bay of Bengal spawn once in a year with a short and definite spawning period. This confirms the findings of De Jong (1940) from the Java Sea and that of Sivaprakasam (1965) from the Arabian Sea. But Sivaprakasam (lop. cit.) observed the spawning season of *P. niger* to extend from July to October in the Arabian Sea but the present investigation from Bay of Bengal indicates the spawning period to extend from March to June.

The fish appears to spawn in the offshore region of Bay of Bengal in the broad continental shelf lying to the north of River Mahanadi. This area is enriched by influx of the Ganga and Bramaputra and is highly productive (Prasad, 1968; Koblenz — Miske et al. 1973) and constitutes the marine nursery of many fishes including silver pomfrets (Peter, 1969; Pati, 1978). A broad continental shelf in the same latitude along Gujart — Maharastra coast forms the spawning ground of pomfrets from the Arabian Sea (Sivaprakasam, 1965; Gopalan, 1969).

The fishery of *P. niger* appears to be governed by its pelagic migratory habits. The fish moves in shoals (Moses, 1947) swimming on its side a few feet down and looking like large silvery discs (Smith, 1949). Naturally they are caught effectively in the drift gill-nets, with poor representation in the bottom trawls. Along Orissa coast, black pomfrets contribute to nearly 4.0 % of the drift gill-net catch at Chandipur, whereas they are insignificant in the trawlcatch off Paradip being mainly represented by juveniles. Specimens ranging in size from 10–50 cm SL are abundant in the inshore waters during August and September after which coincide with the catch registers a fall. From January to April, which coincides with their prespawning and spawning period, they become negligible in the inshore catch.

## CONCLUSION

Present investigation indicates clear variation in the food habits and spawning periodicities in the black pomfrets of Bay of Bengal and Arabian Sea. These two water masses are only separated by the Indian peninsula. The geographical variations may be attributed to the differential ecology of the coastal waters inhabited by the fishes.

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OBSEKWAJE NAD BIOLOGIĄ I POŁOWEM  
*PARASTROMATEUS NIGER* (Bloch) W ZATOCE BENGALSKIEJ

STRESZCZENIE

Biologia i połowy *Parastromateus niger* (Bloch) są przedmiotem badań po raz pierwszy w północnej części Zatoki Bengalskiej. Ryby te odżywiają się pokarmem zwierzęcym, głównie *Acetes* i skorupiakami dziesięcionogimi (*Decapoda*). Małżoraczki, larwy owadów, wieloszczety, głowonogi, larwy i łuski rybie spotyka się raczej przypadkowo. Za młodu żywią się fauną denną, gdy starsze pelagiczną. Zmiana miejsca pobytu z wiekiem ryb jest charakterystyczna dla tego gatunku.

*Parastromateus niger* odbywa rozród jednorazowo w czasie od marca do czerwca. Występowanie

większej ilości form post larwalnych lub narybku w lipcu wskazuje na przedłużenie okresu tarła. Tarliska obserwuje się na płycznach przybrzeżnych na północ od rzeki Mahanadi wzdłuż wybrzeża Zachodniego Bengal-Orissa. Dojrzałość płciową samce osiągają przy wielkości 28,0 cm a samice przy 30,0 cm l.t. Stosunek płci wyrównany.

*Parastromateus niger* stanowi ok. 4,0% ogólnych połowów dokonywanych pławnicami w Chandipur na wybrzeżu Orissa. Szczyt połowów przypada na sierpień do września i opada z małym szczytem w grudniu.

Zmiany w odżywianiu i czasie połowów w stosunku do analogicznych danych z Morza Arabskiego wskazują na występowanie zróżnicowania ekologicznego a co za tym idzie i różnicy pod względem rybackim w zakresie połowów.

C. Pati

#### НАБЛЮДЕНИЯ ЗА БИОЛОГИЕЙ И ЛОВОМ *PARASTROMATEUS NIGER* (BLOCH) В БИСКАЙСКОМ ЗАЛИВЕ

##### Р е з ю м е

Биология и лов *Parastromateus niger* (Bloch) в северной части Бискайского залива объект для исследований представляет собой первый раз. Питанием рыбы служит животный корм, главным образом *Acetes* и десятиногие ракообразные (*Decapoda*). Остракоды, личинки насекомых, многощетинковые кольчецы, головоногие, рыбы личинки и чешуя встречаются случайно. Молодь питается донной фауной, старшие — пелагической фауной. Изменение местобитания с возрастом это характерный признак исследованного вида.

У *Parastromateus niger* размножение происходит один раз в год на протяжении с марта до июня. Присутствие большого количества послеличиночных форм или молоди в июле указывает на продление периода нереста. Нерестлища наблюдаются по прибрежным мелководьям к северу от реки Mahanadi вдоль побережья Западного Bengal-orissa. У самцов половая зрелость достигается при величине 28,0 см, у самок — при 30,0 см l.t. Соотношение полов уравновешенное.

*Parastromateus niger* представляет собой около 4,0% общих ловов, получаемых с помощью плавной сети в Chandipur на территории побережья Orissa. Пик ловов наблюдается в период с августа по сентябрь, а затем падает с небольшим пиком в декабре.

Различия в питании и временах ловов по сравнению с аналогичными данными для Аравийского моря указывают на экологическую дифференциацию, а следовательно и на различия в области ловов.

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