

SOME ASPECTS OF BIOLOGY OF *LATES CALCARIFER* (BLOCH)
FROM CHILKA LAKE

S. PATNAIK* AND S. JENA

*Chilka Investigation Unit of the Central Inland Fisheries Research Institute,
Balugaon, Orissa.*

ABSTRACT

Lates calcarifer (Bloch) locally known as bhekti is a carnivore. While the adult fish feeds on fishes and prawns, the chief food of fry and fingerlings are copepods and mysids respectively. The general length-weight relationship followed the cube law. Maturing specimens have been observed during April-July. Ova-diameter studies revealed a single group of mature ova, indicating single spawning by each individual. The mature ovary produced on an average 0.76 million eggs per kg of fish. Bhekti is a catadromous species.

INTRODUCTION

The Chilka lake is the largest brackishwater lagoon in India, occupying an area of about 1040 sq. km. The lake is an important source of fish supply in the region. The average fish landings during 1957-61 was about 3511 tonnes of which perches accounted for about 231 tonnes. Of the many species of perches recorded from the lake, *Lates calcarifer* (Bloch) known locally as bhekti is commercially the most important, constituting 53.5 percent of the perch landings. Bhekti landings during the years 1957-61 amounted to 174.27, 136.18, 150.81, 102.22 and 55.26 tonnes respectively which formed 3.9, 3.5, 4.0, 3.9 and 1.9% of the lake's total yield of fish during these years. *L. calcarifer* was first recorded from the lake by Chaudhuri (1923) and subsequently some information pertaining to its landings, distribution and growth were given by Devasundaram (1954), Jones and Sujansingani (1954), Roy and Sahoo (1962), Jhingran (1963) and Jhingran and Natarajan (1966, 1969). The present investigation deals with food and feeding, length-weight relationship, maturity and spawning and fecundity of the species.

FOOD AND FEEDING

The food of *L. calcarifer* has been worked out by Mukherjee *et al* (1946), Menon (1948), Dunstan (1959) and De (1971). The method followed for the present study was that of eye estimation, suggested by Pearse (1915).

* Present address: Central Inland Fisheries Research Substation, Cuttack, Orissa.

The study revealed (Table 1) that fish of size range 24-50 mm depend mainly on planktonic forms consisting of copepods (47.7%), nauplii (13.8%), molluscan larvae (11.4%), prawn larvae (8.3%) and cladocerans (5%). The food, those of sizes 51-150 mm constituted mainly of mysids (34.9%) followed by prawns (34.2%) and small fishes (24.8%). The food of fishes above 150 mm size was found to be comprised of fishes (51.2%), prawns (39.3%) and stomatopods (7.0%). As may be seen from Table 1 the percentage of empty stomachs are fairly high among bigger fishes which could be due to their tendency to disgorge their stomach contents when captured, as reported by Dunstan (1959). The fish feeds actively and, though a carnivore, do not show any special preference (Table 1) for any commercially important fish or prawn in Chilka so as to cause alarm.

LENGTH-WEIGHT RELATIONSHIP

The length-weight relationship can be described by the general equation $W = cL^n$ where W is the weight and L is the length of fish, c is a constant and n an exponent. The study is based on 563 specimens ranging in length from 24-1010 mm and 0.2-12,707 g in weight regardless of sex, size and period of collection. The relationship was found to be:

$$\log W = 2.9166 \log L - 4.70792$$

MATURITY AND SPAWNING

During the present study, in all, 75 specimens were examined. Bhikti being a large-sized fish, its high cost became a limiting factor towards examining large number of specimens. The smallest mature female encountered was 700 mm and male 505 mm in total length.

Ova-diameter study: Ova samples from anterior, middle and posterior regions of each ovary were mixed and 800 measured at random by means of an ocular micrometer where one division corresponds to 19.4μ . Ova less than 8 micrometer division (m.d.) were not measured as they were encountered in great numbers throughout the year in each ovary. The polygons in Fig. 1 are frequencies from measurements of 3 ovaries. It is seen that there are two distinct batches of ova, one immature (mode 'a') which are the general egg stock present in ovaries of all stages of maturity and the other mature (mode 'b') forming a clear mode, which are to be shed during the approaching spawning season. The ova in the intermediate stage of maturity are few and do not form a separate mode. Since all the ova forming mode 'b' (ranging in diameter 20-36 m.d.) are fully yolked, opaque and well-separated from the immature stock of ova (mode 'a'), they are the ova destined to be spawned in the ensuing spawning season. Thus the fish may spawn only once, during a short period. This is further confirmed from the examination of two spent ovaries collected in May and June, which showed a single group of immature eggs along with a few residual eggs left over after spawning. Therefore, it is likely that an individual of *L. calcarifer*

TABLE 1. Composition of stomach contents of *L. calcarifer* of different size groups.

Food items	24-50 mm (T.L.)		51-150 mm		above 150 mm	
	% age occurrence	Details of items	% age occurrence	Details of items	% age occurrence	Details of items
Fishes	3.3	Fish larvae	24.6	<i>Thrissocles</i> , <i>Barbus</i> , <i>Anchoviella</i> , Gobids.	51.2	<i>Anchoviella tri</i> , <i>Hemiramphus-gaimardi</i> , <i>Thrissocles</i> sp., <i>Mystus gulio</i> , <i>Nematalosa nasus</i> , <i>Hilsa kanagurta</i> .
Prawns	8.3	Postlarvae of prawns	34.2	<i>Penaeus indicus</i> , <i>Metapenaeus dobsoni</i> , <i>Palaemon rudis</i> .	39.3	<i>P. indicus</i> , <i>M. dobsoni</i> , <i>M. monoceros</i> , <i>P. semisulcatus</i> , <i>Palaemon</i> sp.
Stomatopods	—	—	—	—	7.0	<i>Squilla scorpio</i>
Mysids	—	—	34.9	<i>Macropsis orientalis</i>	—	—
Amphipods	—	—	1.7	<i>Quadrivisia</i> , <i>Orchestia</i>	—	—
Copepods	47.7	<i>Pseudodiaptomus</i> , <i>Cyclops</i> , <i>Nitocra</i> , <i>Acartia</i> .	—	—	—	—
Cladocerans	5.0	<i>Daphnia</i>	—	—	—	—
Nauplii	13.8	—	—	—	—	—
Molluscan larvae	11.4	Lamellibranch, gastropod larvae	—	—	—	—
Diatoms	4.4	<i>Pleurosigma</i>	—	—	—	—
Miscellaneous	6.1	Insect larvae, algal filaments	4.6	Crustacean remains, weed fragments.	2.5	Crustacean remains, fish scales, weed fragments, gastropod shells.
No. examined	30	—	67	—	96	—
Percentage of empty stomach	10	—	15	—	39	—

may spawn once only in a year. Occurrence of spent and ripe fishes at the same time for a long period suggest a prolonged spawning season. Simultaneous occurrence of mature and immature fish of the same size range in the catch confirm the view of Dunstan (1959) that all adult fish do not spawn each year.

Gonado-somatic index: The gonado-somatic index (Fig. 2) in the female rises from 0.5 in January to a maximum of 7.0 in May, after which it drops to 2.2 in July suggesting spawning. The same trend is noticeable also in males.

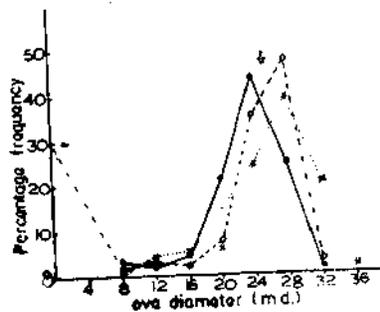


FIG. 1. Frequency polygons of ova diameter of *L. calcarifer*.

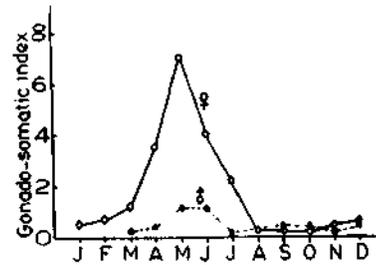


FIG. 2. The average gonado-somatic indices for females and males in different months.

Breeding and migration: Maturing specimens have been recorded from the lake during April to July. Ripe fish as well as spent fish have been observed in the outer channel during May-June. Advanced fry of bhakti (22-52 mm) are encountered in the lake-mouth area during July-September. It would appear that *L. calcarifer* performs seaward migration for breeding. This agrees with the views of Jones and Sujansingani (1954) and Jhingran and Natarajan (1969). Thus *L. calcarifer* is a catadromous species, which spawns and hatches in the sea and moves into the lake as advanced fry and fingerlings for feeding and growth.

Jhingran and Natarajan (1969), on the basis of recruitment to Chilka fishery in February as well as July/August, suggest two peak spawnings, one in January-March and the other during June-July. Dunstan (1959) observed two spawning peaks, one in October-January and other in January-March for *L. calcarifer* in Queensland waters. Shetty *et al* (1965) and Rao (1964), on the basis of availability of ripe specimens and large number of fingerlings (60-80 mm), have inferred October-November to be breeding period for Mahanadi bhakti. De (1971) suggests the breeding season of bhakti to be July-August from the occurrence of postlarvae (10-15 mm) in the vicinity of Junput in West Bengal. According to Alikunhi (1957) breeding of *L. calcarifer* occurs during

cold season. Partwee (1913) reports that *L. calcarifer* breeds during January-March in Ceylon. Pillay (1954) reports that bhukti breeds during rainy season in Sunderbans.

From the observations of various authors referred to earlier, it would be seen that the species spawn during different periods at different areas but within the span of January to August. The present study showed that *L. calcarifer* from Chilka, exhibiting a single batch of maturing ova, spawn during the period June-July. No mature fish to correspond with the peak breeding inferred around January-March by Jhingran and Natarajan (1969) have been observed. Fishes examined during November-January from the lake had immature gonads. However, the number examined were too few to draw definite conclusions. It may be quite possible that the spawning intensity during winter was of a lesser magnitude involving fewer breeders which could have accounted for their absence from the samples used in the present study.

Fecundity: Fecundity was estimated by counting the number of mature ova in a weighed portion of the ovary and estimating the number for the whole (Table 2). Delsman (1926) reports 3.7 million eggs from an ovary of *L. calcarifer* of 105 cm. Dunstan (1959) estimated 8.5 and 17 million eggs from the ovaries of fish of 42 and 48 lb respectively. This, on an average, works out to 0.61 million eggs per kg of fish, as compared to the present estimate of 0.76 million per kg of fish.

TABLE 2. *Fecundity of L. calcarifer.*

T. L. in mm	Wt. in g	Estimated no. of ova
700	4,923	44,48,496
735	5,593	46,29,840
820	7,428	52,12,160
825	7,258	56,64,120
830	6,832	64,87,976
902	8,930	63,81,281
990	10,886	66,57,187

CONCLUDING REMARKS

The *Lates calcarifer* of Chilka lake after attaining maturity migrate to sea for spawning and young ones enter the lake for breeding and growth. Each mature fish examined had one batch of eggs, and may release about 0.76 million eggs/kg of fish at one spawning.

The species is carnivorous but depends mainly on prawns and uneconomical fishes, which are abundant in the lake. Hence the lake can support a good population.

Bhekti attains great lengths and fetches very good price. Hence it is desirable that some conservation measures are enforced so that the overexploitation of breeders in the outer channel and fingerlings in the lake could be checked.

ACKNOWLEDGEMENTS

The authors are deeply indebted to Dr V. G. Jhingran, Director, Central Inland Fisheries Research Institute, Barrackpore, for suggesting the problem, guidance during the course of the work and for kindly going through the manuscript. We are also thankful to Shri R. D. Chakrabarty for going through the manuscript and offering suggestions.

REFERENCES

- ALIKUNHI, K. H. 1957. *Fish Culture in India*. Farm. Bull. No. 20, I.C.A.R., New Delhi.
- CHACKO, P. I. 1956. Observations on the biology and ecology of the inland water fishes of Madras with special reference to their suitability for culture. Govt. of Madras. *Fish. St. Rep. and Year Book 1954-55*: 247-270.
- CHAUDHURY, B. L. 1923. Fauna of the Chilka Lake, Fish, Pt. IV., *Mem. Indian Mus.*, 5 (11) 711-36.
- DE, G. K. 1971. On the biology of postlarvae and juvenile stages of *Lates calcarifer* (Bloch). *J. Indian Fish. Ass.* 1 (2): 51-64.
- DELSMAN, H. C. 1926. Fish eggs and larvae of Java Sea-8, *Dorasoma chucunda*. *Treubia*, 8: 389-94.
- DEVASUNDARAM, M. P. 1954. *A report on the fisheries of the Chilka lake from 1948-52*. Government Press, Cuttack.
- DUNSTAN, D. J. 1959. The Barramundi *Lates calcarifer* (Bloch) in Queensland waters C.S.I.R.O. *Australia Div. Fish & Oceanogr. Tech. paper No. 5*: 22p.
- JHINGRAN, V. G. 1963. Report on the fisheries of the Chilka lake, 1957-1960. *Bull. Cent. Inl. Fish. Res. Inst.* No. 1, 113 p.
- JHINGRAN, V. G. AND A. V. NATARAJAN. 1966. Final report on the fisheries of the Chilka lake, 1957-65. *Bull. Cent. Inl. Fish. Res. Inst.*, No. 8: 12 p.
- JHINGRAN, V. G. AND A. V. NATARAJAN. 1969. A study of the fisheries and fish populations of the Chilka lake during the period 1957-65. *J. Inland. Fish Soc. India*, 1: 49-126.
- JONES, S. AND K. H. SUJANSINGANI. 1954. Fish and Fisheries of the Chilka lake with statistics of fish catches for the years 1948-1950. *Indian J. Fish.*, 1 (1 & 2): 256-344.
- MENON, P. M. G. 1948. On the food of the 'Bekti' *Lates calcarifer* (Bloch) in the cold season, *Curr. Sci.*, 17: 156-157.
- MOOKERJEE, H. K., D. N. GANGULY AND T. C. MAJUMDAR. 1946. On the food of estuarine fishes of Bengal. *Sci. and Cult.*, 11: 564-65.

- PEARSE, A. S. 1915. On the food of the small shore fishes in the waters near Madison Wisconsin. *Bull. Wis. nat. Hist. Soc.*, **13**: 7-22.
- PERTWEE, A. H. 1913. Notes on the fresh water fishes of Ceylon. *Spol. Zeyl. Colombo*, **8** (32): 243-250.
- RAJ, B. S. 1916. Notes on the freshwater fishes of Madras. *Rec. Indian Mus.*, **12** (6): 249-94.
- RAO, N. G. S. 1964. On the distribution of larvae, post-larvae and juveniles of fishes in the Mahanadi estuary. *Indian J. Fish.*, **11A** (1): 407-422.
- ROY, J. C. AND N. SAHOO. 1962. *Bulletin on the Development of Chilka lake* (Chilke Fisheries, 1949-1955), Orissa, Govt. Press 5.
- SHETTY, H. P. C., R. D. CHAKRABARTY AND C. G. BHATTACHARYA. 1965. A report on the fisheries of the Mahanadi estuarine system, Orissa. *Bull. Cent. Int. Fish. Res. Inst.*, No. 5: 80 p.
- PILLAY, T. V. R. 1954. The ecology of a Brackishwater Bheri with special reference to the fish cultural practices and the biotic interaction. *Proc. Nat. Inst. Sci. India*, **20** (4): 399-427.

