

Caloric Densities of Ingested Food of *Etroplus suratensis* (Bloch) Grown in a Culture Pond

SUMITRA-VIJAYARAGHAVAN, L KRISHNA KUMARI, R M DHAWAN* & JOSEPH P ROYAN

National Institute of Oceanography, Dona Paula, Goa 403 004

Received 10 October 1980; revised received 20 February 1981

Analyses of stomach contents of *E. suratensis* indicated that it is principally a phytoplankton--detritus feeder. Biochemical analyses of the ingested food showed that of the total consumed food, 44% was contributed by ash content, while 56% was contributed by the organic constituents. C:N ratio was found to vary within the reported range. In general the ratio of body caloric to food caloric was high.

Food and feeding habits of pearl-spot (*Etroplus suratensis*) a common estuarine fish are fairly well known¹⁻⁴, but very little information is available on the biochemical constituents of the consumed food⁵. The importance of such a study has been recently dealt with⁶. The present communication deals with the dietary intake defined qualitatively and quantitatively by analysing the stomach contents of *E. suratensis*.

Specimens of *E. suratensis* (3 to 15 cm in total length) were obtained by cast net from culture pond belonging to the Fisheries Department (Goa) at monthly intervals from June 1979 to June 1980. Stomach contents of about 350 specimens were examined during investigation. Freshly-caught fishes were preserved in ice and on reaching to laboratory their stomach contents removed. Only fishes with full stomach were taken for this study. The stomach contents were collected in finger bowls containing melted ice to prevent bacterial decomposition^{4,6}.

The number of stomachs examined for gut contents varied from 20 to 30 each month. Even though earlier workers have pointed out that different stages of this fish have different feeding habits⁷, in the present study no appreciable differences in the composition of the stomach contents were found. It may be due to the controlled condition and smallness of the pond (0.16 ha). Hence, stomach contents of the individual fishes were pooled.

From the total quantity of the stomach contents, 1 to 3 aliquots were removed and preserved in 5% formaline for microscopic examination and the different items present were enumerated. The remaining major portion of the stomach contents was transferred to petri-dishes and was dried in an oven at 70°C. Little amount of the body muscles from each specimen was taken and also dried in the oven at 70°C.

The dried material was powdered and used for biochemical estimations.

Biochemical constituents of the ingested food were determined following the standard methods⁸⁻¹⁰. Percentage of ash was calculated by subtracting the values of protein, carbohydrate and lipid from 100. Organic carbon was estimated according to Elwakeel and Riley¹¹. For the determination of total nitrogen, method of Christopher *et al.*¹² was adopted. Energy values of food and fish muscle were estimated in a Parr adiabatic calorimeter (1200).

Different items present in the stomach contents were broadly grouped into diatoms, blue green algae, green algae, zooplankton (inclusive of crustacean remains), sand grains and unidentifiable organic aggregates (detritus). The various items were counted under microscope and expressed as per cent composition.

Fig. 1 shows the percentage composition of each group of organisms in the ingested food during

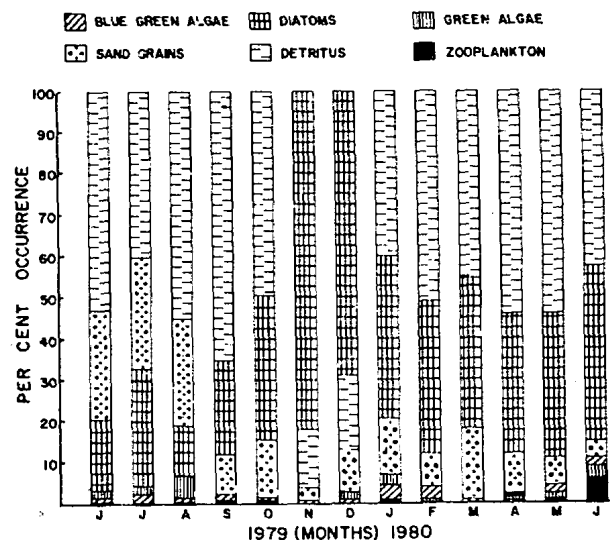


Fig. 1—Percentage composition of different food items in the ingested food of *E. suratensis* during different months

*Directorate of Fisheries, Government of Goa, Daman & Diu, Panaji, Goa 403 001

different months. Detritus formed the major food of *E. suratensis* in this study area and it made up about 44% of the total food consumed. Diatoms were the next important item, making up 38%. Sand grains occurred throughout and formed 14% of the total food consumed. The remainder of the food was mostly composed of green algae (1.6%), blue green algae (1.3%) and zooplankton (1.4%).

Among the major items found in the stomach contents, there was some seasonal variation. Eventhough detritus made up the bulk of food throughout the year, it accounted for a smaller proportion in November (13.2%)-December (15.5%) months. During this period, diatoms contributed a much greater proportion than at other times (82% and 70%).

There is considerable difference of opinion with respect to food and feeding habits of *E. suratensis*⁷. Recently it was reported that the larvae and juveniles feed more on animal matter and phytoplankton, while, the adult fish switches over to a diet containing less animal matter and more of detritus and micro-vegetation⁵. From what has been recorded in the present studies, it appears that higher proportion of detritus-diatom and sand grains in the stomach contents suggests that the species is principally a phytoplankton-detritus feeder. This is in agreement with earlier report⁵. Presence of sand grains in the stomach contents suggests that the fish browses on the bottom mud and small sand particles are ingested along with detritus.

Biochemical constituents of the ingested food during the different months showed marked variations (Table 1). The results represent average values of 3 estimations for each parameter. Carbohydrate content varied from 3.5% (April) to 16.67% (June). Lipid content fluctuated between 3.34% (March) and 22.66% (July). Maximum value for protein was in October (40.67%), while minimum (25%) was in January. Organic carbon varied from 9.83% in November to 24.12% in January. Nitrogen content was in general low (3.79 to 6.77%). C:N ratio varied from 1.45 (November) to 6.36 (January) with an average value of 3.29. In general C:N ratio was low. Caloric value of the ingested food (Table 1, column 1) showed significant correlation with the biochemical constituents (Table 1, columns 2 to 9).

The energy content of the ingested food varied from 1404 cal/g dry wt to 3898 cal/g dry wt and the average energy content of the body muscle was high (4243 to 4900 cal/g dry wt). On an average, the organic part of the ingested food was about 56% while ash was found to be high and formed 44% of the total food ingested. Of the total energy ingested, the energy derived from protein accounts for 54%, while lipid and carbohydrate contributed 42 and 14% respectively.

In the absence of information on the biochemical composition of the food of *E. suratensis*, a comparison is made here with those of available data for some of the marine fishes⁶. The carbohydrate and lipid values of *E. suratensis* are close to those reported for *Sardinella longiceps*, *Rostrelliger kanagurta* and

Table 1—Caloric Values and Biochemical Constituents in the Ingested Food of *E. suratensis*

	Energy food Cal/g dry wt	Carbo-hydrate %	Lipid %	Protein %	Carbon %	Ash %	Nitrogen %	C:N	Energy body Cal/g dry wt	Body: food energy ratio
1979										
June	2606	6.38	8.03	37.59	12.54	48.0	6.00	2.09	4900	1.88
July	3746	10.7	22.66	27.31	18.65	39.33	3.96	4.71	4628	1.24
Aug.	3552	11.0	16.03	37.4	16.02	35.57	5.84	2.74	4403	1.24
Sept.	2267	6.6	3.71	39.0	11.46	50.69	6.00	1.91	4605	2.03
Oct.	2393	6.81	4.23	40.67	10.91	48.29	6.50	1.68	4471	1.87
Nov.	2611	8.8	7.66	36.1	9.83	47.44	6.77	1.45	4519	1.73
Dec.	3827	13.5	18.11	36.88	22.86	31.51	4.98	4.59	4518	1.18
1980										
Jan.	3439	7.2	17.53	25.0	24.12	50.27	3.79	6.36	4419	1.28
Feb.	3373	12.8	12.59	39.11	22.08	35.5	5.26	4.2	4444	1.32
March	1404	4.24	3.34	32.58	10.73	59.84	5.23	2.05	4639	3.3
April	2959	3.5	16.25	30.26	14.26	49.99	3.84	3.71	4542	1.53
May	2476	7.32	8.27	32.66	17.78	51.75	4.23	4.20	4394	1.77
June	3898	16.67	16.32	39.34	16.02	27.67	5.29	3.03	4243	1.09
Average	2706	8.89	11.90	34.92	15.94	44.30	5.21	3.29	4518	1.65
r =		0.96	0.98	0.9	0.96	0.63	0.68	0.68	0.65	

Otolithus ruber; higher than that reported for *Lactarius lactarius*. Protein content in general appears to be low, while, ash content is high. These differences may be attributed to several factors such as habitat differences and differences in feeding habits. The data presented here are from a population that was reared under controlled conditions, while, those of the above mentioned fishes are from wild populations.

C:N ratio is of considerable importance in assessing the dietary requirements of animals. High C:N ratios were recorded in July and December, while, during the rest of the months it was generally low (Table 1). On an average, C:N ratio was 3.29:1 which lies within the reported range¹³.

The importance of estimating the energy values of body tissue in relation to the stomach contents of the fishes in determining the food conversion efficiency has been dealt with^{5,6}. In the present study, the ratios of body calorie to food calorie varied from 1.09 in June to 3.3 in March. Compared to the values reported for other fishes^{5,6}, the average value recorded here appears to be high. This may indicate that the fish is not efficient in converting the consumed energy. It is also possible that due to impounded and partially regulated environment, less competition for space and food, minimal enemies, etc. the species may have low magnitude of expendable energy for various metabolic

processes, resulting in a cumulative saving of energy reserves.

The authors express their gratitude to Dr S.Z. Qasim for his keen interest. Thanks are due to Drs T.S.S. Rao and A.H. Parulekar for critically going through the manuscript and for valuable suggestions.

References

- 1 Alikunhi K H, *Farm Bull Indian Coun agric Res*, **20** (1957) 144 p.
- 2 Jhingan V G & Natarajan A V, *Bull Cent Int Fish Res Inst Barrackpore*, **8** (1966) page var.
- 3 Prasad R D, *J Inland Fish Soc India*, **3** (1971) 72.
- 4 Jayaprakash V & Padmanabhan K G, *Abstract no 271: Symposium on coastal aquaculture 12-18 January 1980, Cochin, India*.
- 5 Qasim S Z, Sumitra-Vijayaraghavan & Easterson D C V, *Indian J Fish*, **20** (1973) 318.
- 6 Jacob P G & Rajagopal M D, *Indian J mar Sci*, **9** (1980) 207.
- 7 Gopalakrishnan V, in *Coastal aquaculture in the Indo-Pacific region*, edited by T.V.R. Pillay (Fishing News (Books) Ltd, London) 1972, 120.
- 8 Dubois M, Gillis K A, Hamilton J K, Rebus R A & Smith F, *Anal Chem*, **28** (1956) 350.
- 9 Folch J M Lees & Stanley G H S, *J Biol Chem*, **226** (1956) 497.
- 10 Raymont J E G, Austin A & Linford E, *J cons perm int Explor Mer*, **28** (1964) 354.
- 11 El Wakeel S K & Riley J P, *J cons perm int Explor Mer*, **22** (1957) 180.
- 12 Christopher F, D' Elia Staudler P A & Crowin N, *Limnol Oceanogr*, **22** (1977) 760.
- 13 Russel-Hunter W D, in *Aquatic productivity*, edited by W.D. Russel-Hunter (Macmillan Company, London) 1970, 153.