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GUT CONTENT ANALYSIS OF *Terapon jarbua* FROM THE VIZHINJAM COAST OF SOUTH INDIA

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Author AT designed the study, performed the statistical analysis and wrote the protocol and first draft of the manuscript. Author KGM managed the analyses of the study and the literature searches. Both the authors read and approved the final manuscript.

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Short Research Article

ABSTRACT

Food plays an important role in the growth, development and reproduction of fishes. The nature of food content in the gut helps to understand the ecology and trophodynamics of the fish**.** The present study is an attempt to identify the gut contents of *Terapon jarbua* collected from the Vizhinjam Coast of South India. The different food items in the gut of the fish collected for a period of one year were identified and grouped in to 10 different categories. Monthly variation in the percentage composition of the gut contents were assessed. The food components in the gut of male fish were in the order: Sand > Digested matter > Miscellaneous > Fish > Bivalves > Crustaceans > Gastropods > Polychaetes > Phytoplankton > Zooplankton. The composition of gut contents of female fishes followed the order: Polychaetes > Crustaceans > Miscellaneous > Digested matter > Sand > Fish > Phytoplankton > zooplankton > Bivalve > Gastropods. The feeding intensity and food preferences varied monthly and Crustaceans were found to be the most dominant food item in the diet. Gastro somatic index indicated decline during the monsoon months. The study indicated that *Terapon jarbua* is a euryphagous fish with broad feeding habits.

Keywords: Food preferences; diet composition; gastro somatic index; feeding biology; digested residues; stomach content analysis.

1. INTRODUCTION

Food is vital for the fish essentially for the growth, development, survival and existence of the species. The food and feeding habitat is a crucial characteristic of the life-history strategy of a species which helps to understand the foremost necessary functional role of the fish inside their living ecosystems [1]. Diets of fishes represent an integration of many important ecological components that included behavior, condition, habitat use, energy intake and inter/intra specific interactions [2]. The quality of the food for

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fish therefore depends on the environmental situation. Feeding habits of fish help to know the inter-specific relationship and the productivity of the water bodies. Moreover the knowledge of feeding biology helps to produce optimum yield by utilizing all the available potential food of the water bodies properly without any competition [3]. Thus, the analysis of the Feeding Biology of the fish helps to comprehend the nature of food, feeding habits and the ecological status of the fish.

Analysis of gut content is widely used to ascertain the food and feeding habit of fish species. Food and feeding habits of different species of fishes are studied across the word viz., Morris et al [4] studied the feeding ecology of invasive lion fish in Bahamian archipelago. The stomach contents of *Gerres oblongus* from Jaffina lagoon, Srilanka was assessed quantitatively and qualitatively by Abyerami and Sivashanthini [5]. The feeding habits of Ribbon fish in Ratnagiri coast was studied by Pallavi and Swapnaja [6]. The diet composition of Red lion fish from Cuddalore coast was evaluated by Pryiyadarsini *et al* and percentage composition of each item was estimated [7]. Similar study was conducted by Manoharan et al [8] in *Terapon jarbua* collected from Parangipettai coast and grouped the individual food items into different food categories. The present study aims to evaluate the gut content of *Terapon jarbua*, commonly known as Tiger perch. *Terapon jarbua* is a medium-sized fish belonging to the *Terapontidae* family. It forms an important constituent item in trawl fisheries in Kerala coast and is widely used as a food fish. In this article, the food preferences of *Terapon jarbua* found across the coast of Vizhinjam, Kerala are explored with special emphasis to identification of food items in the stomach of the fish, categorising of food items and assessment of Gastro somatic index.

2. MATERIALS AND METHODS

2.1 Study Area

The fish samples for the study were collected from Vizhinjam Fish landing port (Long: E. 76°59'15", Lat: N. 8°22' 30") located in the coastal village of Vizhinjam in Neyyattinkara Taluk of Thiruvananthapuram District, Kerala.

2.2 Data Collection

350 specimens of fish were collected from over the period of May 2015 and April 2016. They were preserved in dry, ice-filled boxes. After recording the standard length and weight of the fishes, stomachs were separated and fixed in 10% buffered formalin.

Map: Study area

2.3 Analysis of Stomach Contents

The total length and total weight of gut were recorded. The stomach were split open and emptied in to a petry dish. The intestinal content of both males and females were examined and identified up to family level wherever possible. Regurgitated stomach is excluded in this study [9]. Occurrence method is used for the recording of food items as discussed by Hynes [10].

2.3 Analysis of Data

The percentage of weight of individual food item was estimated and monthly averages were calculated. Alimentary canal length and weight were measured with food and without food to calculate the Gastro-somatic Index (GaSI) as described by Rakesh Verma [3]. The calculations were carried out using the formula given below.

Gastro-somatic Index = Weight of gut/weight of body × 100

3. RESULTS

3.1 Gut Content Analysis

The various food items gathered from the gut of *Terapon jarbua* during the study period is presented in Table 1. The food items are categorized in to ten groups. They are crustaceans, polychaetes, fish, zooplankton, phytoplankton, bivalves, gastropods, sand, digested matter and miscellaneous.

Crustaceans forms the major item of the fish diet. In male highest percentage recorded was 10.31% in June 2015, followed by 9.52% in May 2015. The lowest percentage recorded as 6.72% in February 2016. The average of monthly variation of the composition of food is 8.55%. Polychaetes occur in high quantities throughout the year with a monthly variation in the range of 8.37%. The maximum percentage occurrence of fish recorded was 9.81% in June 2015. Bivalves were also found in the gut contents. The average male contribution was 7.66%. The highest contribution was 10.42% in January 2016, and the lowest range contribution was 5.42% in May 2015. Gastropods were also found in relevant quantities in the gut of fishes. The highest contribution gathered was in August 2015, which is 9.96%. The lowest range recorded in May 2015 and the final average ranges about 7.48%. The maximum percentage occurrence of zooplankton recorded was 9.12% in July 2015 and the lowest of 4.98% in May 2015. An average of 7.39% is gathered during the study period. Phytoplankton were also found in large scale in the gut, 8.63% to 8.65% in July and August of 2015. The average calculated for this item is approximately 7.50%. The least percentage of sand is recorded as 6.10% in October 2015. The average of 8.70% sand found in the gut analysis in the study period. Digested matter was found in the gut of fishes. The highest value is 2.46% in March 2016 and the lowest of 5.13% in June 2015. An average of 8.46% of sand found in the food composition of both male and female fishes. Miscellaneous items were recorded, which ranges from 6.84% to 11.14% in the gut analysis study in the month of March 2015 and October 2015 respectively. This group was also found throughout the year.

The food components in the gut found in the male fish are ordered downwards: sand > Digested matter > Miscellaneous > fish > bivalves > Crustaceans > Gastropods > Polychaetes > Phytoplankton > Zooplankton. Fig. 1 shows the monthly variation in the food composition of male fish.

The food items of female fish are arranged in the following decreasing order: polychaetes > crustaceans > miscellaneous > Digested matter > Sand > Fish > Phytoplankton > Zooplankton >Bivalves > Gastropods. The monthly variation in the percentage composition of food of female fish is shown in Fig. 2

The results indicate some significant variation of food items throughout the year. Crustaceans represent mostly items such as small shrimps and crabs. A number of large food items include fish such as Anchovy, Arius, Mugil and some squids.

3.2 Gastro-Somatic Index (GaSI)

Gastro-somatic index of *Terapon jarbua* varied from 2.01 to 8.98 during the period of investigation (Fig. 3). It showed maximum value in March (8.98) and declined in July (2.01). These values indicated that March is the favorable feeding month of *Terapon jarbua*.

4. DISCUSSION

The knowledge of food and feeding habits is a prerequisite to understand the energy relationship in an ecosystem [8]. Feeding habits of fish help to determine the ecological condition of fish, niche in the ecosystem and preferred food items [11]. This detailed research on diet and feeding habits reflects specific connections between fish and the ecosystem and the other species in the water world. The study on gut content analysis of *Terapon jarbua* delineates on the food composition of the species, while also highlights the eating patterns of the fish.

Table 1. Monthly variation in the composition of food items recorded from the gut of Terapon jarbua (May 2015 to April 2016)

S:No	Food item	May 2015	June 2015	July 2015	August 2015	Septemb er 2015	October 2015	Novembe r 2015	Decembe r 2015	January 2016	February 2016	March 2016	April 2016	Monthly Average
1	Crustaceans	9.52	10.31	8.43	7.96	7.93	8.81	8.16	8.52	9.21	6.72	7.91	9.10	8.55
2	Polychaetes	8.03	10.01	9.41	7.81	8.16	9.42	9.21	8.73	7.28	7.12	6.82	8.46	8.37
3	Fish	8.96	9.81	8.92	8.10	9.71	8.32	8.56	8.34	7.76	7.48	7.24	8.82	8.50
4	Zooplankton	4.98	7.82	9.12	7.10	7.18	6.29	8.28	7.38	7.24	7.62	7.61	8.06	7.39
5	Phytoplankton	5.41	8.76	8.65	8.63	6.92	7.26	7.98	8.62	6.98	6.14	7.82	6.78	7.50
6	Bivalves	5.42	6.48	7.14	6.92	9.12	7.15	7.51	7.31	10.42	7.46	9.46	7.48	7.66
7	Gastropods	4.52	6.51	9.42	9.96	7.21	6.52	8.12	8.51	7.84	7.84	5.68	7.58	7.48
8	Sand	9.15	9.41	7.92	8.41	6.52	6.10	7.63	8.18	7.56	8.42	12.63	12.42	8.70
9	Digested matter	8.63	5.13	6.64	7.68	6.32	7.10	6.58	9.62	12.16	10.12	12.46	9.12	8.46
10	Miscellaneous	6.84	6.94	8.12	9.42	8.32	11.14	10.32	9.98	9.12	9.86	7.96	7.15	8.76

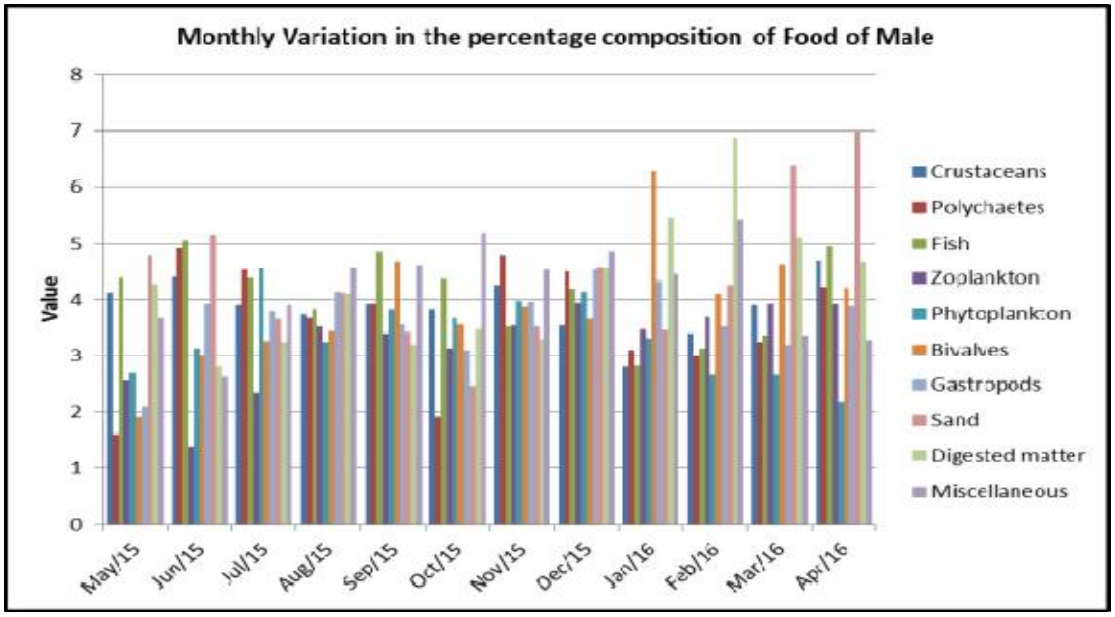

Fig. 1. Monthly variation in the percentage composition of food items of male *Terapon jarbua* (May 2015 to April 2016)

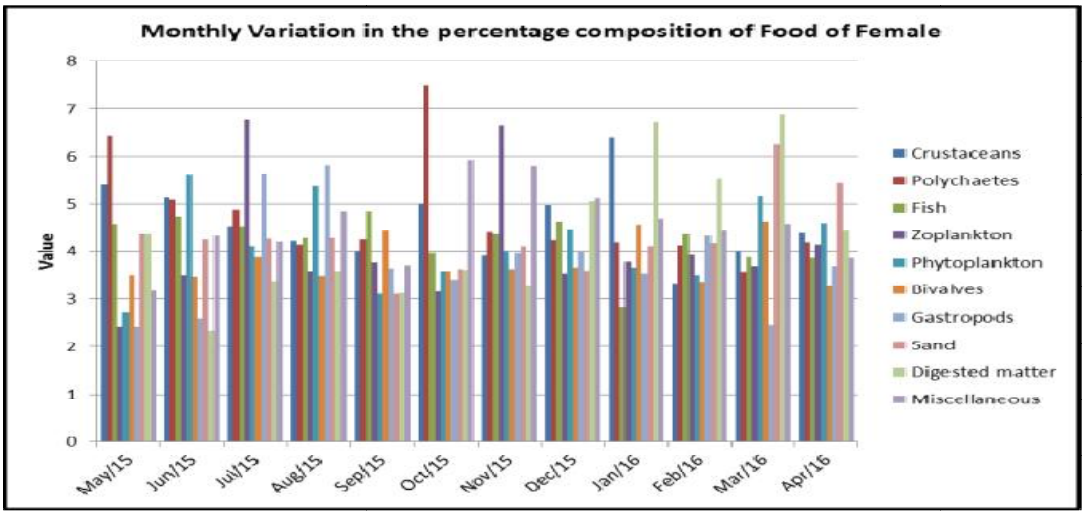

Fig. 2. Monthly variation in the percentage composition of food items of female *Terapon jarbua* (May 2015 to April 2016)

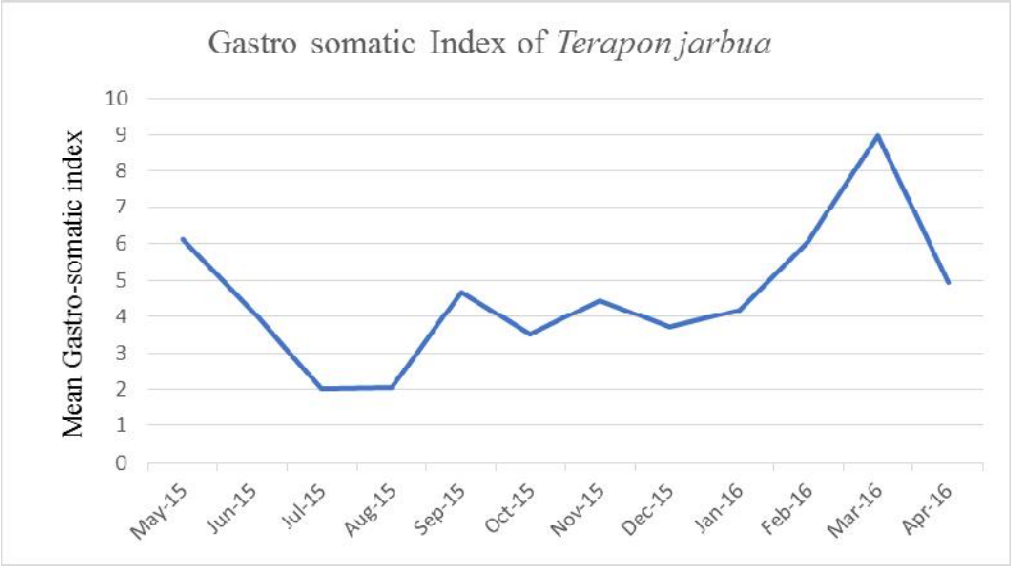

Fig. 3. Monthly variation in the Gastro somatic index of Terapon jarbua (May 2015 to April 2016)

The findings of the study suggest a major variance in the composition of food items. Crustaceans were found to be the most prevalent food item in the gut of the fish. This result quadrate with the study done by Manoharan et al [8] in *Terapon jarbua* collected from Parangipettai Coast.

The study reveals the diversity in food items category in the gut contents of *Terapon Jarbua* over several months of the year. Crustaceans were present in the top of the range from May 2015 to April 2016: (9.52, 10.31, 8.43, 7.96, 7.93, 8.81, 8.16, 8.52, and 9.21). The highest proportion of polychaetes was found between May (2015) and April (20016), ranging from 10.01 to 7.12%. However, the final average of this food element is 8.37%. Gastropods were also found as large-scale food content. This agrees with the earlier studies mentioned by Varadharajan [12] in feeding habits of different fishes across Indian Coasts. The results shows the presence of sand content ranging between 12.63% and 6.10% throughout the study. Manoharan et al [8] suggests that the prevalence of sand particles in the belly may be due to the accidental ingestion of sand taken along with food stuffs. Digested residues also occurred during the year at an average of 8.46%. The intestine also constituted

miscellaneous food particles. This shows that each type of biogenic composition of the substance has been decomposed by different stages [8]. It was very commonly to be existent within the range of 11.14% and 6.84% throughout the course of the study. Several studies have shown that the highest percentage of empty stomachs occur during breeding, as food intake of Terapontidae declines in the breeding season [2, 13]. Moreover, the study of Nandikeswari et al [14] on *Terapon jarbua* shows that the fish collected from the Bay of Bengal and Pondicherry have spawning in the months of February to July. This observation correlates with the present study.

The food components found in the stomach of male fish are as follows. Sand > Digested matter > Miscellaneous > Fish > Bivalve Fish > Crustaceans > Gastropods > Polychaetes > Phytoplankton > Zooplankton. The elements of foodstuffs in female fishes are in the order: Polychaetes > Crustaceans > Digested Matters > Sand > Fish > Phytoplankton > Zooplankton > Bivalves > Gastropods. Priyadharsini et al [7] in their study on Red Lion fish collected from Cuddalore Coast in the south east region of India also obtained similar food constituents suggesting the influence of ecological factors in the selection of diet. Food and feeding habits of fish mainly vary in water environments with time of day, fish size, and seasonal change and diverse ecological factors.

With its extensive feeding habits, *Terapon jarbua* is far more adaptive in terms of diet. The study let on a detailed record of variation in food items in the course of one year duration. Manoharan *et al* [8] classifies *Terapon jarbua* as a euryphagous carnivore. The present study shows that *Terapon jarbua* is a large-scale feeder of planktonic and benthic species. The fish can feed on commonly available food items and therefore it is easy to meet the dietary requirements. This study concur with previous studies [15, 16, 17, 18].

Gastro-somatic index of *Terapon jarbua* showed peak value in March (8.98) and declined in July (2.01) which corresponds to the breeding season. Previous studies have shown similar type of observation [19, 20, 21]. GaSI ranges from 2.01 to 8.98 during the period of study indicating that seasonal availability of food affects the feeding intensity of the fish. During monsoon period amount of basic food items are less so the rate of feeding appears to be affected [3]

5. CONCLUSION

The study reveals that *Terapon jarbua* is a euryphagous fish with a broad spectrum of feeding habits. The major contents of the stomach include food varieties under groups such as small fishes, crustaceans, gastropods, polychaetes, phytoplankton and zooplankton among which crustaceans form the major group. The study has established that *Terapon jarbua* is adapted to different environmental settings to survive. Food choices and gut contents indicate that the fish has a better diet to suit to marine environment. The feeding characters of *Terapon jarbua* is accustomed to feed on wide range of common foods available in marine environment and is therefore adaptive to survive varied seasonal and ecological challenges. Feeding patterns relates with seasonal changes and breeding cycle. The significant variation in the difference in quantity and type of feed among male and female fishes is to be addressed in connection with the breeding Biology. The study highlights the prospects of future studies in this ground.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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