

Gut content analysis of *Mastacembalus armatus* (Dharey baam) of Begnas Lake, Kaski, Nepal

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Abstract

Gut content analysis is an approach which provides insights into feeding behavior, dietary composition and feed preference of fish species. A total of 36 guts of *Mastacembalus armatus* of Begnas Lake were collected from December 2023 to March 2024 from the fish landing site of Begnas Lake. The growth pattern of *Mastacembalus armatus* was found to be negative allometric, with a growth coefficient (b) of 1.7667. The gut content analysis showed that *Mastacembalus armatus* mainly feeds on animal-based items, with prawns (52.99%) being the most abundant food source, followed by fish (33.46%), aquatic insects (8.26%), zooplankton (4.05%), chironomid larvae (0.78%), and phytoplankton (0.46%). These findings indicate that *Mastacembalus armatus* is predominantly carnivorous.

Keywords: Gut content, Feeding behavior, *Mastacembalus armatus*, Begnas

Introduction

Gut content analysis (GCA) is an approach that is particularly relevant to assess fish diet composition [1]. The study of the feeding habits of fish and other animals based upon gut content analysis has become a standard approach [2] which is a commonly employed method to determine the feeding habits and diets of fish species. Gut content analysis (GCA) is a popular approach in several disciplines of research, including ecology, fisheries management, and conservation biology for investigating fish eating habits, trophic interactions, food web structure, and seasonal and geographical variation [3]. Various factors, such as species [4], size [5], environment [6], and food availability [7], influence the types of feed that fish choose. It entails the inspection and determination of food items found within a fish's digestive tract, providing a picture of its recent feeding activities. Researchers are increasingly using gut content analysis to determine the feeding habits and diets of fish species [8, 9, 10, 11].

Begnas Lake, a beautiful freshwater lake located in Pokhara Valley, is known for its peaceful beauty and ecological value [12]. Begnas Lake is the second largest lake after Phewa, situated in the southeast of the Pokhara valley [13]. It is located at an altitude of 650 m and lake water covers an area of $17.96 \times 10^6 m^3$ [14]. According to The National Lake Conservation Development Committee [15], source of water for this lake are Syankhudi and Talbesi stream, while Khudi Khola is an outlet that connects with the Seti River.

M. armatus (Lacepede, 1800) is found in India, Bangladesh, Pakistan, Sri Lanka, Nepal, Burma, Thailand, Malaysia, and Southern China [16,17,18]. It is one of the most popular table fishes with delicious flesh quality having a special flavor, characteristic texture and high protein, oil and vitamin C content and thus has a good market demand [19]. Now, it is also popular as an aquarium fish due to its attractive color pattern and has high demand among the aquarium fish hobbyist [20]. The detail study of gut content analysis of *Mastacembalus armatus* has been reported by researchers [21,22,23] in different parts of world. This is the first study undertaken on gut content analysis of *Mastacembalus armatus* of Begnas Lake. So, the purpose of the study was to

ascertain the feeding habits of this native fish in Begnas Lake.

Materials and methods

Description of study area

The study was carried in Begnas Lake of Pokhara valley. This lake has geographical grid coordinates 28.1621-28.2167 latitude and 84.0814-84.1332 longitude [24]. It is fed by a perennial stream with a catchment area of 19 km² and an average depth of 6.6 m [25].

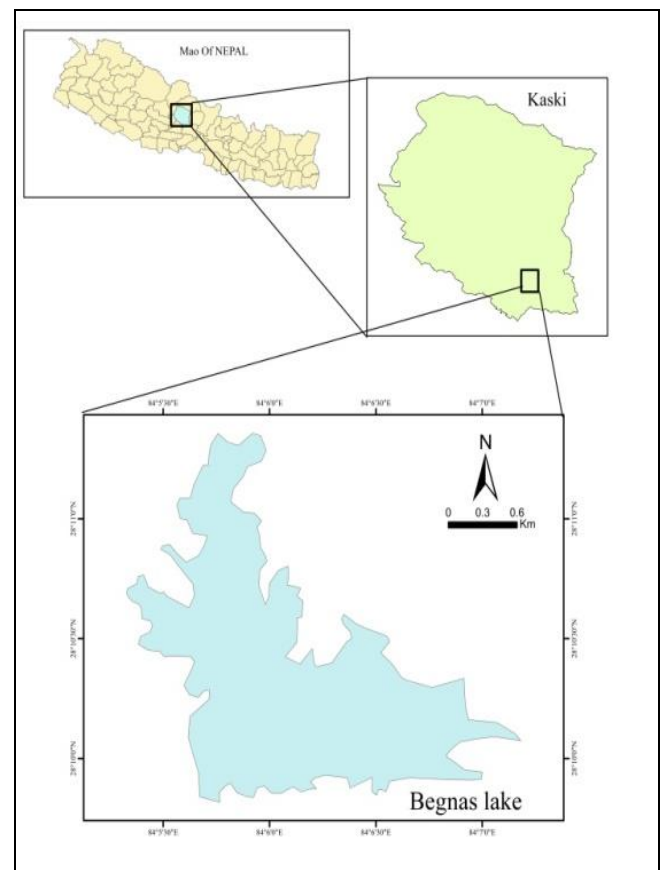


Fig 1: Map of Nepal showing Study Area [26]

Fish gut collection

A total of 36 fish was collected (December, 2023 – March, 2024) from Begnas Fish Collection Center. At first the total length and total weight were measured with the help of scale and digital weighing balance. Using scalpel, longitudinal cut was made on the ventral side of the fish from just behind the isthmus of the gills reaching to the anal fin. The stomachs extracted from the live fish were preserved immediately in 5% formaldehyde solution for later analysis [27].

Gut Content Analysis

To remove excess formalin, gut was placed out of formalin for 5-10 minutes. The stomach or gut segment was opened with the help of fine scissors or a scalpel. Larger prey items were directly taken out and other gut contents were dissolved in distilled water. The gut contents were dissolved in 10ml of distilled water and observed under microscope. The gut content was analyzed using frequency of occurrence and volumetric (point method) [28].

Frequency of occurrence: The relative importance of food items to the diet of different fish species were analyzed using the frequency of occurrence.

The frequency of occurrence was computed as:

$$\% \text{ Frequency of occurrence} = \frac{\text{Number of fish containing food items (} Ji \text{)}}{\text{Number of fish with food in their stomach (} Pi \text{)}} * 100$$

Volumetric method: It can be calculated by using formula

$$\% \text{ Volume of food item } i \text{ (} Vi \text{)} = \frac{\text{Point allocated to food item } i \text{ (} Vi \text{)}}{\text{Total Point allocated to subsample}} * 100$$

Index of preponderance: Index of preponderance provide clear and measurable basis of grading food items and calculated based on Natarajan & Jhingra (1961) [29].

Index of Preponderance =

$$\frac{\%O(\text{Frequency of occurrence}) * \%V(\% \text{ of volumetric contribution})}{\Sigma(\%O + \%V)} * 100$$

Length weight relation: It was calculated by using formula $W = aL^b$ [30]. Where W is body weight, L is the standard body length (in cm), a is the intercept and b is the slope.

Statistical analysis

Ms. Excel was used for descriptive statistics. The length weight correlation calculation was done by using SPSS software version 29.

Result

Length weight relationship

A total of 36 species were collected and assessed for the length weight relationship. The size and weight of Dharey baam ranges from (10.1-37.5) cm (33.5- 312.2) gram respectively. The length weight relation obtained for *Mastacembalus armatus* was $y = 0.4123x^{1.7667}$. The R^2 value for fish species was 0.931, which indicate strong positive correlation between length and weight, whereas the b value was 1.7667 as shown in in Fig. 2 which indicates negative allometric growth.

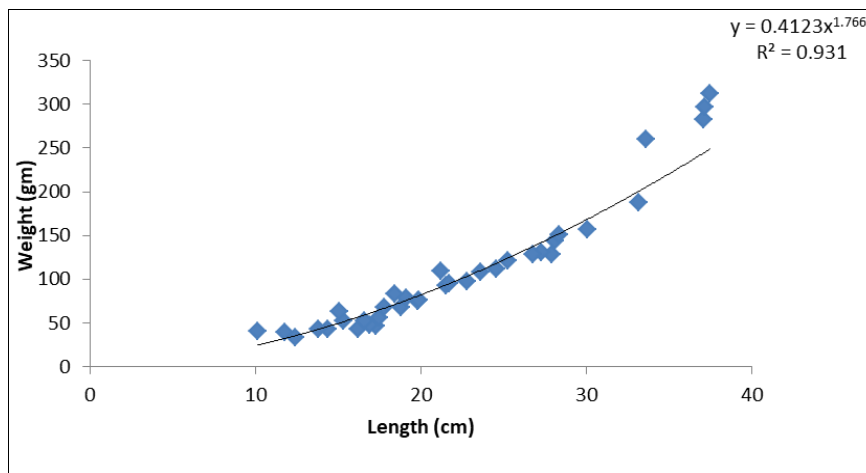


Fig 2: Length-Weight relationship of Dharey baam (*Mastacembalus armatus*)

Diet composition of *Mastacembalus armatus*

The gut analysis of Dharey baam indicates that the primary dietary components included were prawns, fish, and insects. Along with these chironomid larvae, zooplankton and phytoplankton were also present.



Fig 3(a): Prawn

Fig 3(b): Fish

Fig 3: Food items found in gut of Dharey baam (*Mastacembalus armatus*)

Quantitative analysis of gut of Dharey baam showed that, it mainly fed on food items of animal origin like prawn, fish, and aquatic insects. The only plant origin food found in baam was phytoplankton (Bacillariophyceae: *Navicula*, *Fragillaria* and Chlorophyceae: *Staurastrum*, *Pediastrum*)

which accounted for 0.47% of total food items. Likewise prawn (52.99%) contributed highest in food item followed by fish (33.46%), aquatic insects (8.26%) and zooplankton (4.05%).

Table 2: %Oi, %Vi, and IP of food items of Dharey baam (*Mastacembalus armatus*) Results

S. N.	Food items	% composition of food items		Vi*Oi	IP
		%Oi	%Vi		
1.	Phytoplankton	6.92	2.83	25.3	0.46
	Bacillariophyceae	2.73	1.06	7.10	0.13
	Chlorophyceae	4.19	1.77	18.20	0.33
2.	Fish (Naini, Glass fish)	24.89	30.17	1842.63	33.46
3.	Aquatic insect	13.32	13.92	454.74	8.26
4.	Prawn	29.58	40.20	2917.94	52.99
5.	Zooplankton	20.34	9.35	222.96	4.05
	Cladocera (<i>Bosmina</i>)	8.26	5.79	117.41	2.13
	Rotifera (<i>Brachionus</i>)	12.08	3.56	105.55	1.92
6.	Chironomid larvae	4.95	3.53	42.85	0.78

%Oi= frequency of occurrence of food item i

%Vi= Percentage of volume of food item i

IP= Index of preponderance

Discussions

Length-weight connections were utilized to assess fish condition and determine if growth is isometric (b = 3) or allometric (negative allometric: b < 3, positive allometric: b > 3) [31]. The results of this investigation suggest that the *M. armatus* exhibited negative allometric growth pattern since the value of growth coefficient (b) was lower than 3, i.e. 1.67. [32,33,18,34] also reported that the growth coefficient was less than 3 representing negative allometric growth in Dharey baam which is similar to our result.

The analysis of the *M. armatus* stomach contents shows that the fish are consuming range of feed types which includes prawn, fish, zooplankton, aquatic insects and phytoplankton. The diet of *M. armatus* comprised of aquatic arthropods as major food items along with fish, mollusks and some aquatic plants [35]. Likewise, shrimps, dipteran larvae, earthworm and minor carps with some aquatic vegetation as their major diet [19]. The most preferred food was prawn (52.99%) followed by fish (33.46), aquatic insects (8.26%), zooplankton (4.05%), chironomid larvae (0.78%) and phytoplankton (0.46%). The gut was dominated by fish parts (53.52%), followed by fish (35.85%), prawn (8.52%), insects parts (1.30%) and other food like fish egg, plant matters and digestive matter were found in negligible amount [23]. Fishes and prawn were most preferred food items followed by insects, Cladocera, Rotifers [21,22]. Similar to our findings, [21] reported that 85.99% of all food products were derived from animals, indicating that they are carnivorous in nature. Well-developed dentition, absence of gill rakers, strongly built stomach and short intestine, together with the dominance of animal matter in the gut contents, described the carnivorous and active predatory habits of *M. armatus* [20].

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Conclusions

The gut content of *M. armatus* was revealed that this fish feeding habit is diversified. This investigation showed that in addition to fish like Glassfish and Naini, there were also prawns (*Macrobrachium* spp.), Chironomid larvae, aquatic insects and phytoplankton. The most common meal in the stomach of fish was prawn followed by fish and aquatic

insects. This study will be helpful to domesticate of this fish for the aquaculture purpose.

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