

Seasonal Variations in Gut Contents of Wallago Attu and Catla Catla in Mahanadi River System at Cuttack

Dr. Prafulla Chandra Rout

Assistant Professor
Dept. of Zoology
Model Degree College
Deogarh, Odisha, India

Dr. Smrutiranjana Sahoo

Lecturer
Dept. of Zoology
Bijupatnaik College
Antei Kendrapara, Odisha, India

Abstract

Gut content analysis was studied before and is helpful in the study of feeding habits and feeding ecology. Study of gut content analysis helps to trace out food chains, food web and energy transfer in the ecosystem. It helps to explain ecological phenomena between the organisms such as predation and competition.

Key words: Gut Content, Feeding Ecology, Macro Invertebrate, Macrophyte.

Introduction

The process of transformation of food into energy begins with the process of feeding succeeded by digestion and it is completed with the process of assimilation. The production of any fish stock is related to the steps in which there is transformation of food (Ricker, 1971).

Feeding ecology has been worked out by Hartman and Brandt (1995), Hansen (1998), Chipps and Garvey (2007), Braga et al.(2012).

State Orissa and its Geography

State Orissa of the Indian subcontinent extends from 17° 49' N to 22° 34' N latitude and from 81° 27' E to 87° 29' E longitude on the eastern coast of India (Figure 1). It is bounded by the state, West Bengal in the northeast, the Bay of Bengal in the east, the state Jharkhand in the north, Chhattisgarh in west and Andhra Pradesh in the south. Orissa is a beautiful land enriched with abundant natural resources, beautiful mountains, perennial rivers and waterfalls, rich marine wealth and valuable forest heritage, spreading over an area of 15,57,070 sq. Km.

Orissa falls under the “sub-humid” category implying deficit in winter rain. The south-west and the retreating north-east monsoon effectively control its climate. The average rainfall of the state varies from 4.0 mm to 480.0 mm. and the mean atmospheric temperature varies from 16° C to 38° C at different places.

Geography of Cuttack District

Cuttack district is located between Dhenkanal on its

northern side and Khurda on its southern side and is present between $18^{\circ} 45'$ E- to $19^{\circ} 40'$ W and $85^{\circ} 48'$ N- $84^{\circ} 27'$ S. The river Mahanadi bifurcates at 20.28° N to 85.52° E to river Mahanadi and Kathajodi.

Climatology of Cuttack District

From the climatic condition it is marked that the area is geographically situated in a subtropical and sub humid zone. The climate of the area is subtropical monsoon type characterized by oppressive hot summer, biting cold winter in high humid rainy season. The maximum air temperature up to 35.1° C and was observed during May, 2021 while minimum temperature was noticed during December, 2006. This highest average rainfall of 315 was recorded during June 2021, while during December 2020, the lowest 4 mm was recorded.

Higher percentage of humidity throughout the year and well distributed rainfall during monsoon, in fact modified the topography of the local climate to some extent.

Summer Season

The summer season continues from March to June. During this period maximum air temperature varies from 28° to 35.1° C and the heat is oppressive. The average duration of bright sunshine is 7.85 h per day.

Rainy Season

This is a hot and humid and wet season. It starts after the first fortnight of June and continues up to October. The south-west monsoon sets in towards the end of June. The rainfall is intensified in the months of July and August during

which the sky remains cloudy. For several days at a stretch the sky remains cloudy. The average duration of bright sunshine hours is at the minimum i.e. 3.84 h per day. The maximum air temperature varies from 26.5⁰C to 30.2⁰C. Due to high humidity, the weather remains stuffy and sweaty.

Winter Season

The winter season is from November to February. In this season during both day and night the temperature begins to drop steadily. December and January become the coldest period of the year. The maximum temperature of this season varies from 19.5⁰C to 27.9⁰C. The sky remains clear and the duration of the bright sunshine hours is 8.35 h per day.

River System of Orissa

The major river systems of Orissa are Subarnarekha, Budhabalanga, Baitarani, Bhrahmani, Mahanadi and Rushikulya. The river Subarnarekha originates in the highlands of Chotanagpur and falls at the Bay of Bengal flowing through the Balasore district. The Budhabalanga river originates from Similipal area of Mayurbhanj district and joins with Bay of Bengal near Chandipur. The river Baitarani originates from Gonasika Mountains of Keonjhar district and falls at the Bay of Bengal through Dhamara delta. The Brahmani river originates from the highlands of Chotanagpur and joins with the Bay of Bengal. The river Mahanadi is one of the major waterways of India and the longest river of Orissa. It originates from the highlands of Chhattisgarh near Sihawa in the extreme south-west of Raipur district and falls at the Bay of Bengal.

River Mahanadi

The river Mahanadi is one of the largest rivers of India. It is about 860 kms in length, one of the World' largest earthen dams is built over it at Sambalpur. Mahanadi arises from Dhamtari district of Chhattisgarh and falls in the Bay of Bengal. The basin of river Mahanadi is shared by Maharashtra, Jharkhand, Orissa and Chhattisgarh. The area occupied by the basin in each state is Chhattisgarh 75,136 sq.km., Orissa 65,588 sq.km. Jharkhand 635 sq.km. Maharashtra 238 sq. Km.

Study Sites

The study has been carried out in (i) Naraj (M_1);

The present study was carried out at three fixed sampling stations (M_1) from (January 2020 to september 2021

Site M_1 (Naraj)

It is about 10 kms. Upstream of river Mahanadi from sampling station M_2 (Sikharpur), this study site is 5 kms. Away from township and in the upstream direction the public interference is less. The river water always remains enriched with surface runoff from nearby locality, runoff agricultural water and very low rate of sewage contamination from nearby villagers; this site is treated as the little contaminated zone of the river .

Material and Methods

The stomach contents of two different groups of adult fishes with different feeding habit a carnivore *Wallago attu* (Seh Fig.1) and a herbivore *Catla Catla* (Ham Fig.2) were analysed for one year 2020 during summer, winter and rainy

season according to Windell (1971). Gut content analysis methods have been worked out by Brown (1996), Ahlbeck et al. (2012),



Fig.1 Wallago attu

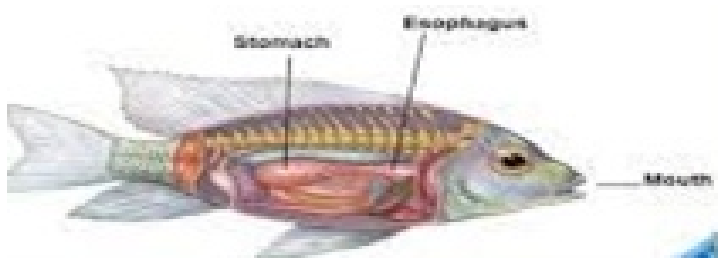


Fig. 2. Catla catla diagrametic

Stomach content analysis of fishes have been carried out by Natraj and Jhingran(1961) ,Mohan and Shankar (1998),Pearson and Shankar(1998),Hsylop(1980) and Manko(2016).

Number of macro-invertebrates, macrophytes intact and also the broken pieces of other organisms were counted with the help of hand lens, whereas, the zooplankton and phytoplankton were counted under the microscope after adding 25cc of distilled water to stomach contents.

Quantitative and quantitative data of each food group

was recorded and the percent by number and weight were calculated. Each stomach was studied separately considering as a unit and the average values were considered.

Observations

The data from the analysis of stomach contents from *Catla catla* and *Wallago attu* has been given in table 2 and 3 seasonal variation is given in table 1. Around 40% to 50% of the stomach was found empty during the rain in the case of *Wallago attu*.

The major constituent of food consists of macro invertebrates i.e. insects (10% to 15%) and insect larvae in winter. During the summer period the constituents were shrimps, annelids (*Stephenson chactogester langi Bretscher* and *Ptenobdella sp.*) odonate, nymphs, coleoptera larvae and adults. *Ranatra elongats*, *Aphelocherius variegates* (Kinsbshenks), *Macrobrachium sp.* and Gastropods viz. *Cyclophorus indicus*, *Deshanges*, *Cyclophora sp.* *Assimineia sp.* *Vivipara bengalensis* and *Anisus converxius culas*, *Hutlon* as the secondary food.

30% to 35% of the fish fingerling and fish fry found in the stomach are found to be *Amblypharyngodon mola* (Ham), *Channa punctatus* (Blotch), *Puntius stigma* (Day) and *Mystus sp.*

During the monsoon season the fish were found to be mainly piscivorous in nature (82% to 85%) and consumed insects and gastropods as the secondary food items (8% to 15%).

The analysis of gut contents of *Catla catla* revealed

that the fish survived on phytoplankton, (43% 50%) during the winter and during the summer the consumption of phytoplankton was found less by the *Catla catla* (35% to 40%).

In the rainy season the consumption of phytoplankton's decrease up to 10% to 12%. Zooplanktons constituted 30% to 38% of the diet in the summer season. The percentage rose up to (45% to 48%) during the winter season and fell sharply in the rainy season (10% to 12%). The major zooplankton cladocera and copepods constituted the major bulk of the food during the summer and winter season. The phytoplanktons which contributed to the major food items were diatoms and green filamentous algae. Submerged aquatic plants, macrophytes were also reported around (10% to 15%) during the winter season. Detritus were found in the stomach during the summer period.

During the study period it was observed that 40% of the stomach was always found to be empty.

Discussion

The major food of *Wallago attu* consisted of fishes of heterogeneous group and macro invertebrates. The piscivorous nature of the fishes during the summer and winter season is attributed to the surplus availability during these periods, the stagnant and lower water level facilitate more predation. But on the contrary, during the rainy season the conditions are altered. There is lesser occurrence of insects and gastropods, so the primary food items are the fish fry and fingerling and 35% of the stomach remains empty.

The food consumption is higher during the summer and winter than the rainy season. During the rainy season the adult fishes spend most of their time for mating and courtship and therefore they neglect their feeding. This may be one of the possible reasons for their empty stomach during the monsoon period.

The *Catla catla* depends on phytoplankton, zooplankton and vegetable debris as the major source of food during the summer and winter period. The phytoplankton such as *Ulothrix* sp., *Zygnema* sp., *Euglena viridis*, *Spirogyra* sp. are mainly reported phytoplanktons from the stomach content. *Oscillatoria* sp., were reported more in amount during the summer and winter season. The bacillariophyta are found to be partially digested as immediately digestion begins soon after ingestion.

The Rotifers and Cladocerans form the major food components during the winter (45% to 60%). During the summer Copepods form the major components of the diet. About 50% of the important zooplanktons found in the stomach content are *Daphnia carinata.*, *Mesocyclops* sp., *Keratella tropica*. The macrophytes form a general component of the diet during the winter and early summer and were not found during the winter and early summer and were not found during the rainy season. *Ceratophyllum demersum.*, *Hydrilla* sp., *Chara* sp., are the main macrophytes found in the stomach contents. Besides the planktons and macrophytes, mud, detritus are found in the gut content in relation to 25% of the whole weight of the stomach content during summer.

Table 1. Seasonal Variation in the Stomach Contents of Wallago attu (Sch) & Catla catla

Wallago attu (Sch)					Catla catla (Ham)					
Season	Month	Sl. No. of Fishes	Standard Length of Body (in cm)	Wt of body (in kg)	Wt of the Whole Stomach (in gms)	Wt of Stomach contents (in gms)	Standard Length of body (in cm)	Wt. Of Body (in kg)	Wt of the whole stomach (in gms)	Wt of Stomach contents (in gms)
Winter	Jan	1	65.0	3.25	530.0	462.5	80.0	6.30	731.0	668.0
		2	73.5	3.70	268.0	216.0	72.0	5.70	589.0	560.0
		3	56.0	2.75	215.0	197.0	68.0	5.40	580.0	479.0
		4	53.0	2.80	192.0	171.0	63.0	5.10	592.0	430.0
Summer	May	1	68.0	3.95	241.0	195.0	59.0	3.60	452.0	419.0
		2	56.0	3.70	250.0	223.5	48.0	2.70	390.0	331.0
		3	48.0	2.65	162.0	239.5	50.0	3.00	395.0	304.0
		4	42.0	2.20	169.0	128.0	41.0	2.25	341.0	242.0
Rainy	Sept.	1	40.0	1.90	172.0	139.0	58.0	3.70	471.0	410.0
		2	48.0	2.60	190.0	156.0	45.0	3.10	380.0	309.0
		3	35.0	1.60	185.0	135.0	60.0	3.90	435.0	346.0
		4	29.0	1.40	135.0	98.0	32.0	1.70	210.0	149.0

Table 2 Percentage Composition of Food Items in the gut of Catla Catla

Season	Phytoplankton	Zooplankton	Macrophyte	Detritus
Summer	40% - 41%	30% - 32%	-----	-----
Rainy	10% - 12%	11% - 13%	-----	-----
Winter	40% - 45%	45% - 49%	10% - 16%	-----

Table 3 Percentage Composition of Food Items in the gut of Wallago attu

Season	Phytoplankton	Zooplankton	Macrophyte	Detritus
Summer	75% - 80%	20% - 25%	-----	-----
Rainy	80% - 89%	11% - 20%	-----	-----
Winter	90% - 85%	10% - 15%	-----	-----

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