Qualitative and Quantitative Analysis of Stomach Content of Ribbon Fish- *Lepturacanthus Savala* (Cuvier, 1829) From Karwar Waters, Karnataka, India

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Abstract:

The study of food and feeding habits has great importance in understanding the various aspects of fishery biology. The distribution of marine organisms, either their occurrence or fluctuations in occurrence determines the food of a fish species. Food and feeding may also affect the shoaling behavior, migration, growth, and reproduction in fishes which indirectly affect the fishery (James P. S. B. R., 1967). Natarajan and Jhingran (1973), opinioned that in the occurrence method, the quantity of each item of food is not considered similarly the quantitative methods do not record the repeated occurrence of food items. Thus, from the occurrence or quantitative methods, only one method is not suitable for proper food analysis in the fish. In view of this, an Index takes into consideration the occurrence and quantity of the food item eaten by the fish. 'Index of Preponderance' appears to be most suitable for studying food and feeding, for this purpose volumetric or displacement method is used by many authors for the most accurate results.

Keywords: Food and feeding, Ribbon fish, *L. savala*, Qualitative, and Quantitative analysis.

Introduction

The study of food and feeding habits in fish has great importance in understanding the various aspects of the biology of fish like shoaling behavior, migration, growth, and changes in general well-being. *L. savala* is a commercially important fish most commonly found in Indian waters.

Considerable information is available on the food and feeding of marine fishes. The major contributions are by Venkataraman (1944), on the food of Ribbon fish *Trichiurus* spp.; Vijayraghavan (1951) and Prabhu (1955), studied the food of Ribbon fishes of Madras and estimated the stomach contents of *T. savala* and *T. haumela* by volumetric method; Pillay (1952), in the critical reviews on the food and feeding habits of Bombay duck, *H. nehereus* and on the food and feeding in *T. haumela* used various methods of food analysis and concluded that the method used for any fish should suit to its diet but volumetric methods are most accurate and suitable for the carnivorous fishes.

Materials and Methods

Karwar is a major fish landing center located at 14^0 48' 30" N and 74^0 07' 42" E in Karnataka state. The total coastline of Karwar is thirty km. Tagore Beach is about five km and extends from the port light to Kali River. The ribbon fish, *Lepturacanthus* belongs to the family- Trichiuridae. Ribbon fish is carnivorous, its mouth is comparatively large and has strong canine-like teeth. Those are fang-like, inwardly curved, 7 to 15 in number found in both jaws. For the estimation of food, mostly onboard collected fish were used. During the study in Ribbonfish, it is observed that as time passes intestinal material becomes unsuitable for studying food and feeding behavior because either food material gets partially digested or deteriorated.

Fish samples were collected monthly as per the availability of catch from December- 2011 to December- 2012. From Baithkol, fish were collected from trawl landings and from Majali mainly from the non-mechanized boats. Also, fish were collected from trawlers, Shore seines, gillnet catches, and from the fish landing center Karwar to compare the food components. Soon after the fish is caught, onboard those were blotted with blotting paper to remove surface moisture, total and standard lengths were measured nearest to 1 mm and fishes were weighed nearest to 1 mg, then dissected. A total of 150 fish were examined for gut content. For each fish length and volume of the intestine and the weight and volume of the stomach' was taken separately. Then the guts were preserved in the 5% formaldehyde for further investigation.

Analysis of the stomach content

There are different methods of gut content analysis and data presentation in fish. Commonly the gut content is analyzed by the occurrence method, Qualitative (Numerical), and Quantitative Methods (Volumetric or Gravimetric) Qasim *et. al.* (1973).

***Qualitative analysis*:** In which all the food items or organisms were taken into consideration and identified up to the genera and wherever possible up to the species. Individuals for each kind of food item in the sample were counted. The numerical percentage of each item was computed, by Pillay (1952).

Quantitative analysis*: *Volumetric method to estimate the gut content of L. savala.

The percentage occurrence of various food items in different months was determined by adding the total number of occurred atoms from which the percentage occurrence of each item was calculated. The determination of the volume of each food item was made easy by using the displacement method. In this method, a narrow measuring cylinder was taken and filled up with water up to a certain mark. Each food item was then immersed in the water and the new level of water was noted. The difference between the two readings is the volume of the particular food item. The percentage volume of each food item was determined from the total volume of all the stomach contents, (James, P. S. B. R. 1967).

The 'Index of preponderance' is calculated by using the following formula:

$$IP = \frac{V \times O}{SumV \times O} \times 100$$

Where:

V = Percentage volume and

O= Percentage occurrence of a particular item of food

Results and Discussion

Qualitative and quantitative analysis of stomach content of *L. savala* (Fig. 1, 2 & 3)

The gut contents of 150 specimens of *L. savala* collected from Karwar waters were studied from December 2011 to December 2012. Occurrence and volumetric methods were used for analyses and graded by the Index of preponderance.

Some fish were collected from the trawl catches, which were with a 'full' stomach while a few of them were with an 'empty' stomach. According to Prabhu (1955), Ribbon fish *T. haumela* soon after capture dies in the nets. While going through death throes, they vomit most of the part of their gut contents. As the volumetric analysis did not have much proper value in judging the feeding activity of *L. savala*, thus the simple arbitrary assessment method was used along with the volumetric method. The amount of food left in the gut gives an idea about condition of stomach. Fish collected from the market was with partly digested food material. It is also observed that the stomachs of a few fish were full of Acetes spp., Anchovies, and trichiurids. Partially digested food had remains of some fishes, crustaceans, and molluscs and in small quantities, the unidentifiable digested pulpy matter was also seen. According to the food and feeding habits of fish, it seems to be clear that *L. savala* is piscivorous and also feeds upon crustaceans, molluscs, so carnivorous in feeding habits. Similar observations were made by James (1967) and Gupta (1967 a, b and 1968 a, b) in the reviews on the food of other species of Ribbon fish.

During the present study, the stomach content analysis of *L. savala* indicated that Anchovy, *Stolephorus* species was consumed by the fish throughout the year. Maximum consumption was in the months of March and April (31.2% & 36.9% respectively), which indicates that fish showed intensive feeding behavior after spawning while minimum consumption occurred from September (1.3%) to November (2.4%) when crustaceans were abundant. *Thrissocles* species occurred in the diet from January (11.2%) to March (0.27%) and again from July (4.3%) to December (3.1%). Juveniles of *L. savala* showed two peaks of occurrences which were coincided with the abundance of Anchovies in their diet

Clupeids were totally absent in the diet from January to June, *Sardinella* species were found from August (maximum consumption was 13.2%) to October (minimum consumption was 3.2%); *Kowala coval* (white sardine) July (3.2%) to September (3.1%) and *Dussumieria* (Rainbow sardine) October (1.3%) to December (1.1%). These clupeids were absent in the gut contents of *L. savala* from January to June and were replaced by main shrimps. Instead of Anchovy and Clupeids, Atherina was found in the gut content from July (1.4%) to September (2.6%). *Sphyraena* (Barracuda) was found in the months of March (1.2%) to May (1.5%). *Hemiramphus* (Halfbeak), constituted a minor part of their food in the months of March, May, July, and from October to December which were again replaced by White sardine and *Atherina* species. *Tetradon Leiognathus* (Ponyfish) occurred as part of gut content in the months of September (2.6%) to November (5.52%) when the Anchovy were scarce and the maximum feeding activity was seen in the month of October (19.7%). Juveniles of *L. savala* were also found as part of their

food in the months of August (3.5%) to October (1.2%), showed cannibalistic behavior.

Apart from *L. savala* fed upon other fishes and fish related foods such as fish scales, fish eggs, fish larvae and Juvenile fishes. Fish eggs were found in the gut content in bulk during June (18.87%) and July (11.6%).

Crustaceans mostly shrimps constituted as the major part of food in *L. savala. Acetes* species was consumed by the fish throughout the year except July and August. Maximum consumption of Acetes was found from March (29.7%) to June (27.3%). The highest consumption value recorded was 31.2% (April).

Other shrimps also contributed as a major part of the diet throughout the year, amongst *amphipods* (maximum consumption found in the month of May, 19.3%), *Stomatopods* (maximum consumption found in the month of January, 21.2%), *Squilla,* (maximum consumption found in the month of September, 19.2%), *Mysids* and *Lucifer* were also found as food constituents but were maximum in the months of September (7.3%) and October (15.9%) respectively. Crustacean shrimps were used as alternative source of food by the *L. savala*.

Among other crustaceans Isopods, copepods, their fragments & prawns contributed as part of food items and were maximum occurred in the months of June (8.2%), August (12.8), December (9.1%) and November (21,1%) respectively

Octopus, Sepia and Other molluscs were occasionally found in the gut contents in minor quantities.

Annually average percentage of various food items contributed as diet were crustaceans shrimps (30%), Fish and fish related (30% and 10% respectively), Other crustaceans and prawns (20%) and Molluscs (5.72%). James (1967) reported that Ribbon fish, *L. savala* prefers especially whatever food is available. James *et. al.* (1978) noticed that there is a certain amount of selectivity for fish like Anchovy and shrimp Acetes, especially in smaller ones

Food in relation to the size of *L. savala*

The percentage occurrence of various food items in the gut content of *L.* savala for various size groups is given in the. Fish found to be an important food material for *L. savala* contributed almost 30% part of their diet. Maximum consumption of fishes was observed in 300-600 mm sizes. Highest percentage of consumption was 35.2% in the 500-550 mm size group, followed by 34.5% (550-600 mm), 32.2% (450-500 mm), 30.2% (350-400 mm) and 29.6% (400-450 mm) size groups. It confirms that fish is predacious and piscivorous. Juveniles of *L. savala* mostly preferred fish eggs, shrimps and other crustaceans as food. Fish consumption found to be progressively increased as per increase in the age of fish.

Fish related food items contributed almost 10% part of their diet, especially fish eggs, fish scales, Fish larvae and Juvenile fishes were preferred by 100-350 mm size groups. Highest consumption was observed in 150-200 mm (33.2%) size group, followed by 100-150 mm (30.1%), 200-350 mm sizes (29.3%, 26.5% and 21.3% respectively). Fish related food items consumption found to be decreased as per increase in the age of fish.

Crustacean shrimps contributed about 30% part of their diet amongst *amphipods, Stomatopods, Squilla, Mysids,* and *Lucifer* were the most important ones. The 100-150 mm size group showed the

highest consumption of shrimps (40.6%) and the lowest by 350-400 mm (19.1%). An increase in the age of fish showed a decrease in the trend of shrimp intake. For the age sizes 300-600 mm shrimps supplemented about 20% part as food, along with fish.

Other crustaceans and prawns contributed about 20% part of their diet which includes fragments of parts, crabs, and their larvae and prawns, *Penaeus* spp. Crustacean fragments were found in the gut contents of juveniles. Age groups 300-600 mm preferred prawns (27. 15%) as part of their diet. Maximum intake of other crustaceans and prawns was seen in the age group 300-400 mm (29.5%). Molluscs contributed throughout the year, for all age groups as part of the diet in minor quantities (5.72%) mainly *Octopus* and *Sepia.*

During gut content analysis of *L. savala,* it is found that a fish feed upon fishes and diet is supplemented by the crustaceans and molluscs, which supports that the fish is carnivorous. Cannibalism was also seen, in which *L. savala* fed upon its own kind. During present study it was observed that apart from *Stolephorus* spp., *Sardinella* spp., and *Dussmieria* spp., Juveniles of *L. savala* fed upon larval stages and small juveniles of Anchovies and Clupeoides. They also fed upon larval stages of cephalopods and calanoid copepods. A major part of the diet comprised of Anchovy, Acetes, copepods, and post larvae, and larvae of penaeid prawns and shrimp, were selectively eaten by some of the fishes.

Venkataraman (1944), Ribbon fish are voracious feeders and exhibits a total lack of choice in their food. Prabhu (1950) and Vijayaraghavan (1951) studied the feeding habits of Ribbon fish. Their observations show that the Ribbonfishes are carnivorous mainly piscivorous and other food constituents were teleosteans, *Acetes,* copepods, *Lucifers,* Prawns, bivalve larvae, cirripeds, polychaetes, stomatopods, mysids, anomurans, ostracods, crab larvae etc.

According to James (1967), Study of food and feeding habits of *L. savala* indicated that the Ribbon fish are predacious, carnivorous and sometimes show cannibalistic behavior and also selective feeding behavior. Fish below 250 cm usually feed on smaller fishes and crustaceans but as they grow, they begin to add to their diet a greater variety of big fishes and prawns. The teeth and other oral structures of *L. savala* are suitable to hold the prey, bite and devour the same easily.

Some of the workers focused on the food and feeding habits of some commercially important fish including Ribbon fishes, amongst notable ones are; Venkataraman (1944), on the food of Trichiurus species; Mahadevan (1950), on *Caranx djedaba* and *T. haumela;* Vijayraghavan (1951), on Ribbon fishes of Madras; Prabhu (1950), Seshappa and Bhimachar (1955) and Savant *et. al.* (1969), studied on the food and feeding habits of *Johnius dussumieri*.

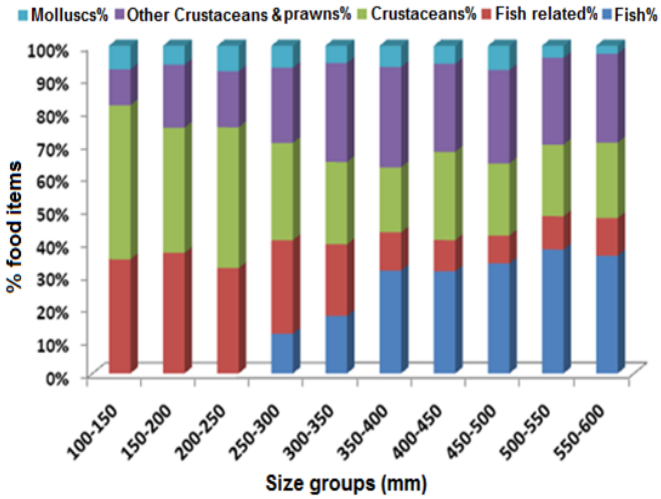

Fig. 1: Percentage of food and feeding intensity in relation to the size of *L. Savala*

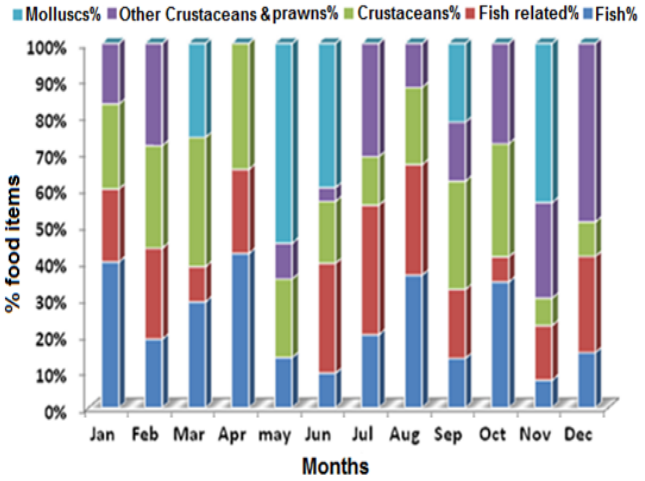

Fig. 2: Percentage of food items occurred in the gut content or Index of Relative Importance (IRI) of each constituent of the diet of *L. savala*

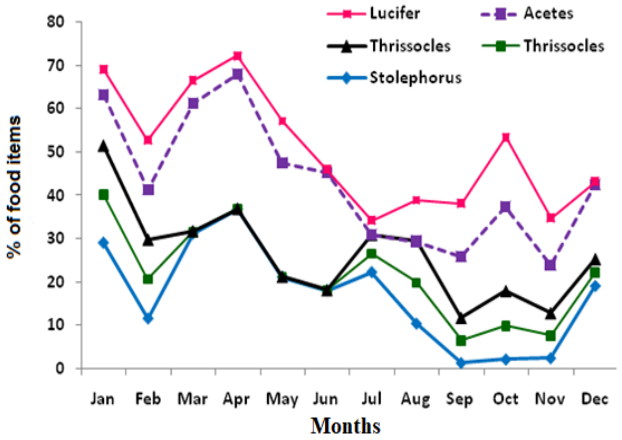

Fig. 3: Percentage of most preferred food items by *L. savala* throughout the year.

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