A STUDY ON THE FOOD AND FEEDING HABITS OF THE MAHSEER
TOR TOR (HAMILTON)

M. DASGUPTA *

Department of Zoology, North - Eastern Hill University, Shillong - 793 014, India

ABSTRACT

The food and feeding habits of the mahseer Tor tor (Hamilton) has been studied. The species was found to be an omnivour as evident from gut content analysis and R. L. G. value. It can be considered as voracious feeder subsisting mainly on algae and vegetable matter. The feeding intensity increased with the increasing length of the fish. The food habit of the fish changed from carr - omnivorous to herbi - omnivorous which is also evident from the increasing R. L. G. value increasing with the length of the fish.

INTRODUCTION

Most studies on the food and feeding habits of fishes from various habitats have shown that they differ in time and space with regard to food requirement at different stages of growth (Hardy, 1924; De Silva, 1973), thereby emphasizing the need to study the food and feeding habits of a species in more details.

Although much is known on the food and feeding habits of Tor mahseer (Thomas, 1873; Hora, 1940; Mac Donald, 1948; Desai, 1972; Pisolkar and Karamchandani, 1981), so far there is no report on the food and feeding habits of this fish from north - eastern India and therefore the present work was undertaken.

MATERIALS AND METHODS

The materials for the present study was collected from River Simsang, Garo Hills (Meghalaya). Food and feeding habits of the fish during the present study was based on the examination of a total of 166 guts. Soon after collection, specimens were dissected and digestive tracts were carefully removed from the body cavity and preserved in 5% formalin. In the case of smaller specimens the whole fish was directly preserved but before placing them into preserving they were killed in order to prevent regurgitating their stomach contents.

For analysing the data, the entire length range of the examined specimens (100 - 350 mm) was arbitrarily split into five size groups of 50.0 mm class interval (100 - 150 mm, 151 - 200 mm, 201 - 250 mm, 251 - 300 mm, 301 - 350 mm) to observe whether these demarcated size groups were discrete in their choice of food. The gut contents were also analysed for elucidating seasonal variations in the diet components. The number of individuals of each food item in each gut has been counted. These were summed to enumerate totals for each kind of food item in the whole sample and then a grand total of all the items was made.

The quotient of these gave the percent-

* Present address : Department of Zoology, Shibpur Dinobundhoo Institution, Howrah - 711 102, India.
age representation by number of each type of food item (Hynes, 1950).

Gastroscopic Index

The Gastroscopic Index was calculated by the following formula (Bhatnagar and Karamchandani, 1970):

\[
G. S. I. = \frac{\text{Weight of gut content}}{\text{Weight of the body}} \times 100
\]

Relative length of the gut

The ratio between the gut length and total length (R. L. G.) has been estimated by dividing the gut length by total length of the body (Al-Hussaini, 1949).

Regression method was applied to gut length and body length of the fish and between weight of gut content and length of the fish to describe the relationship between them.

**RESULTS**

The gut contents of *T. tor* can be grouped into ten broad groups, i.e. (i) algae, (ii) unidentified vegetable matter, (iii) Protozoa, (iv) Nematoda, (v) Insecta, (vi) Crustacea, (vii) Hydracarina, (viii) Gastropoda, (ix) unidentified animal matter and (x) sand particles.

**i. Algae** : This group formed 35.88% in the gut content and was represented by Chlorophyceae, Bacillariophyceae and Cyanophyceae.

a. **Chlorophyceae** : This group was represented by *Spirogyra*, *Hyalotheca*, *Ulothrix*, *Closterium* and *Pleurodiscus*. *Spirogyra* was the most abundant genus. Chlorophyceae formed 17.31% of the gut content.

b. **Bacillariophyceae** : This group of algae was represented by *Navicula*, *Fragilaria*, *Cymbella*, *Pinnularia*, *Amphora*, *Tabellaria*, *Achanthes*, *Gamphonema*, *Diatoma*, *Pleurosigma*, and *Surirella* in varying percentages and the group as a whole formed 18.102% of the gut content. *Navicula* was found to be most abundant followed by *Fragilaria*.

c. **Cyanophyceae** : This group of algae formed 0.47% of the gut content and was represented by *Spirulina* and *Oscillatoria*.

**ii. Unidentified vegetable matter** : This was the most important item in the gut content next to algae, forming 31.89% in the gut content and was represented by macrophytes, decaying vegetable matter, seeds and spores.

**iii. Protozoa** : It formed 0.34% of the gut content.

**iv. Nematoda** : It formed 1.31% of the gut content.

**v. Insecta** : This group was represented by larvae and adults of Coleoptera, Odonata, Ephemeroptera and Diptera in varying percentages and formed 12.97% of the total gut content. Among insects, larvae of Ephemeroptera were found to be the most abundant, followed by larvae of Diptera.

**vi. Crustacea** : This group was represented by Cladocera and Copepoda and formed 1.65% of the gut content.

**vii. Hydracarina** : It formed 0.45% of the gut content.

**viii. Gastropoda** : It formed 3.68% of the gut content.

**ix. Unidentified animal matter** : This group was represented by semidigested ani-
mal matter and invertebrate eggs and formed 4.36% of the gut content.

x. Sand particles: It formed 7.35% of the gut content.

Food composition of various length-groups

The relative importance of different broad items at different length-groups of T. tor is shown in Fig. 1 and the percentage composition of different broad items has been presented in Table 1.

Monthly fluctuation in the gut content

The percentage of different broad items in the gut content of T. tor has been enumerated in Tables 2 and 3 from which it can be seen that there were considerable variations in the percentage of different items during different months of the year. Algae and vegetable matter formed the major items throughout the year.

Feeding intensity

The gastrosomatic index (G. S. I) or in other words feeding intensity at different length groups of T. tor is shown in Fig. 2A and monthly fluctuations in Fig. 2B.

Feeding intensity in different length-groups

It can be observed from Fig. 2A that there is no definite trend in the feeding intensity. However, highest feeding intensity (G. S. I) has been observed in length-group IV (251-300 mm) and the lowest feeding

Table 1. Percentage of different food items (broad) in different length-groups of T. tor

<table>
<thead>
<tr>
<th>Length groups</th>
<th>V/N</th>
<th>Veg. matter</th>
<th>Anim. matter</th>
<th>Sand particles</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (101-150 mm)</td>
<td>V</td>
<td>39.07</td>
<td>58.24</td>
<td>2.48</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>58.85</td>
<td>29.95</td>
<td>5.84</td>
</tr>
<tr>
<td>II (151-200 mm)</td>
<td>V</td>
<td>39.89</td>
<td>41.63</td>
<td>4.31</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>62.08</td>
<td>16.95</td>
<td>1.89</td>
</tr>
<tr>
<td>III (201-250 mm)</td>
<td>V</td>
<td>53.38</td>
<td>41.63</td>
<td>10.08</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>73.02</td>
<td>43.68</td>
<td>5.02</td>
</tr>
<tr>
<td>IV (251-300 mm)</td>
<td>V</td>
<td>93.71</td>
<td>6.28</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>98.71</td>
<td>1.35</td>
<td>-</td>
</tr>
<tr>
<td>V (301-350 mm)</td>
<td>V</td>
<td>93.95</td>
<td>6.08</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>96.39</td>
<td>3.60</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: V = Volume, N = Number.
TABLE 2. Monthly fluctuations in the percentage of the number of the broad items in the gut of T. tor (upto 150 mm total length)

<table>
<thead>
<tr>
<th>Months</th>
<th>Veg. matter</th>
<th>Anim. matter</th>
<th>Sand particles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug.</td>
<td>69.44</td>
<td>30.56</td>
<td>-</td>
</tr>
<tr>
<td>Sep.</td>
<td>65.56</td>
<td>34.52</td>
<td>-</td>
</tr>
<tr>
<td>Oct.</td>
<td>64.68</td>
<td>34.33</td>
<td>-</td>
</tr>
<tr>
<td>Nov.</td>
<td>76.26</td>
<td>23.72</td>
<td>-</td>
</tr>
<tr>
<td>Dec.</td>
<td>46.68</td>
<td>53.23</td>
<td>8.33</td>
</tr>
<tr>
<td>Jan.</td>
<td>43.34</td>
<td>63.66</td>
<td>3.23</td>
</tr>
<tr>
<td>Feb.</td>
<td>58.64</td>
<td>46.66</td>
<td>4.11</td>
</tr>
<tr>
<td>Mar.</td>
<td>61.25</td>
<td>31.24</td>
<td>7.50</td>
</tr>
<tr>
<td>Apr.</td>
<td>64.94</td>
<td>32.47</td>
<td>2.60</td>
</tr>
<tr>
<td>May</td>
<td>72.01</td>
<td>22.00</td>
<td>6.00</td>
</tr>
<tr>
<td>Jun.</td>
<td>67.57</td>
<td>32.43</td>
<td>-</td>
</tr>
<tr>
<td>Jul.</td>
<td>80.25</td>
<td>12.50</td>
<td>7.25</td>
</tr>
</tbody>
</table>

Note: The monthly values given here are the averages of two years data (Aug., 1978 through July, 1980).

TABLE 3. Monthly fluctuations in the percentage of the number of broad food items in the gut content of T. tor (above 150 mm total length)

<table>
<thead>
<tr>
<th>Months</th>
<th>Veg. matter</th>
<th>Anim. matter</th>
<th>Sand particles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug.</td>
<td>71.43</td>
<td>28.57</td>
<td>-</td>
</tr>
<tr>
<td>Sep.</td>
<td>55.75</td>
<td>44.25</td>
<td>-</td>
</tr>
<tr>
<td>Oct.</td>
<td>54.11</td>
<td>45.87</td>
<td>-</td>
</tr>
<tr>
<td>Nov.</td>
<td>33.72</td>
<td>66.22</td>
<td>-</td>
</tr>
<tr>
<td>Dec.</td>
<td>33.44</td>
<td>63.66</td>
<td>3.23</td>
</tr>
<tr>
<td>Jan.</td>
<td>34.83</td>
<td>64.53</td>
<td>0.65</td>
</tr>
<tr>
<td>Feb.</td>
<td>16.25</td>
<td>81.72</td>
<td>2.05</td>
</tr>
<tr>
<td>Mar.</td>
<td>19.52</td>
<td>78.48</td>
<td>1.69</td>
</tr>
<tr>
<td>Apr.</td>
<td>48.30</td>
<td>44.52</td>
<td>3.39</td>
</tr>
<tr>
<td>May</td>
<td>58.70</td>
<td>36.80</td>
<td>4.52</td>
</tr>
<tr>
<td>Jun.</td>
<td>58.68</td>
<td>41.32</td>
<td>-</td>
</tr>
<tr>
<td>Jul.</td>
<td>71.08</td>
<td>25.20</td>
<td>3.36</td>
</tr>
</tbody>
</table>

Note: The monthly values given here are the averages of two years data (Aug., 1978 through July, 1980).

intensity was observed in length group II (101 - 150 mm).

Seasonal variations in the feeding intensity

Monthly gastrosomatic index of T. tor during different months, has been presented in Fig. 2B. It is clear from the figure that there is a wide fluctuation in the feeding intensity. The highest value has been recorded during May in the first year whereas in April during the second year of study and the lowest during October in both the years of study.

Relation between feeding intensity and condition factor

The data on gastrosomatic index and condition factor of T. tor during different months of the period of study has been presented in Fig. 3. There exists a positive relationship between feeding intensity and condition factor.

Relation between gut length and body length

The logarithmic relationship between gut length (Y) and total body length (X) can...
Fig. 3. Relationship between condition factor, gastro somatic index and gonadosomatic index in T. tor.

be expressed by the regression equation between these two parameters which has been derived as:

$$\log Y = -0.5021 + 1.3516 \log X.$$  

The value of correlation coefficient $r$ was found to be 0.9724

Relationship between weight of gut content and body length

The logarithmic relationship between weight of gut content ($Y$) and total body length ($X$) can be expressed by the regression equation between these two parameters which has been derived as:

$$\log Y = -4.8757 + 2.2355 \log X.$$  

The value of correlation coefficient was found to be 0.7247.

Relative length of the gut

The variation of the relative length of the gut (R. L. G.) with the total length of the fish has been shown in Fig. 4A. The R. L. G. value shows a gradual increase from 1.74 in length group I (101 - 150) to 2.88 in length group V (301 - 350 mm). A positive relationship has been observed between gut length and the amount of vegetable matter in the gut whereas a negative relationship has been observed between gut length and the amount of animal matter in the gut content.

DISCUSSION

Nikolsky (1963) recognised three main categories of food on the basis of their importance in the diet of fishes; they being (a) basic food: which is normally eaten by fish and covering most of the stomach contents,
(b) secondary food: which is frequently found in the stomach contents, but in smaller amounts and (c) incidental food: which is found rarely in the stomach contents.

In accordance with the definition given by Nikolsky (1963), algae (35.88%) and vegetable matter (31.89%) can be considered as the basic food in Tor tor. Insects, unidentified animal matter, Protozoa, Nematoda, Crustacea, Hydracarina and Gastropoda which altogether formed 24.88% of the gut content can be regarded as the secondary food. Sand particles (7.35%) can be regarded as an incidental item.

Hora and Mukherji (1936) stated that Tor mahseer feeds preferably on filamentous algae and water plants. According to Hora (1940), the older fish subsisted on water plants, filamentous algae and gastropods. The present study is in conformity with their findings.

Qualitative and quantitative studies of natural food of T. tor made by Karamchandani et al. (1967) and Desai (1970) from River Narbada have shown that the species is herbivorous, feeding mainly on higher aquatic plants and filamentous algae and also subsists on molluscs and insects. However, in the present study, it has been found that the species consumes more of insects in its juvenile stage but thereafter prefer, mainly macrovegetation.

According to Jhingran (1975), T. tor is insectivorous in its juvenile stage, but becomes herbivorous on reaching the adult stage, which is in accordance with the results obtained in the present investigation. In the present study the amount of animal food was found to decrease in the gut content of T. tor with the increase in length.

Hora (1940) observed that younger fish feeds on slimy algal matter, encrusting rocks and stones. Karamchandani et al. (1967) and Desai (1970) stated that the juveniles subsisted mainly on insects and molluscs, and insignificantly on macrovegetation. Pisolkar and Karamchandani (1981) observed that the early fry and juveniles (upto 160 mm in total length) subsisted entirely on macrovegetation and filamentous algae and the fish started feeding on animal food (Insects and molluscs) in insignificant quantities after growing in size over 301 mm. In the present study it was observed that fry and juveniles (upto 150 mm in total length) subsisted mainly on animal matter and the proportion of vegetable matter increased in the diet above 150 mm total length.

The dietary habits of early fry and juveniles studied in the present case more or less agreed with those of Karamchandani et al. (1967) and Desai (1970) but are contradictory to that of Hora (1940) and Pisolkar and Karamchandani (1981). However, these variations in the food may be due to different nature of food organisms present in varying habitats.

Thomas (1973) observed mahseer feeding on small fish. Desai (1970) encountered bones and scales of large-sized fish in the guts of this fish. Pisolkar and Karamchandani (1981) also encountered flesh and long slender spines of fishes in the gut contents. Most of the authors considered fish as an incidental item in the diet of this species of mahseer. However, in the present study no fish matter was encountered in the gut content.

Tor tor was found to be a voracious feeder as indicated by the high values of its gastrosomatic index (G. S. I).
The study indicated a positive relationship between feeding intensity and condition factor in T. tor. According to Jhingran (1971), the principal factors that are likely to affect the monthly variation in the ponderal index are generally food and sexual maturity.

From the report on Tor tor by many authors (Desai, 1970; Pisolkar and Karamchandani, 1981; Lal and Chatterjee, 1962) it is evident that the ratio of fish length to gut length varies from 1 : 2 to 1 : 5 which is in agreement with the present finding (1 : 2.14). The R. L. G. value in the present study was found to increase as the fish grew in size along with the increase in vegetable matter in the gut content. The average R. L. G. value being 2.14 the fish can be kept in the category of omnivorous fishes, according to the values put forward by Das and Nath (1965). This is further supported by the result obtained on the food and feeding habits as well as the morphology of the alimentary canal. Morphology of the gut suggests that the gut is in a transitional stage between herbivorous and omnivorous condition.

Karamchandani et al. (1967), Desai (1970), Karamchandani (1972) and Pisolkar and Karamchandani (1981) based on the extensive feeding of Tor mahseer on macro-vegetation and algae in its natural habitat suggested its stocking in weed infested waters for biological control of vegetation.

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References


HORA, S. L. 1940. The game fishes of India. (D). The mahseer or the large scaled barbels of India (2). The tor mahseer, Barbus (Tor) tor (Hamilton). *J. Bombay nat. Hist. Soc.*, 41 (3) : 518 - 551.


