

Food Habits of the Larval Tiger Salamander (*Ambystoma tigrinum*)

CLARENCE F. DINEEN, University of Notre Dame

The importance of the temporary role of larval salamanders in the trophic dynamics of small aquatic communities has been underestimated. Scientists have overlooked this phase of community dynamics or have regarded it as negligible. Also of interest is the variation of feeding habits by the tiger salamanders. Manion and Cory (1) stated that the larvae of the tiger salamander feed by snapping at prey individually when the light intensity is high and become plankton-feeders when light intensity is low. The works of Nicholas (2) and Powers (3) support their conclusion. This phenomenon plus the scarcity of quantitative data on food habits prompted the author to make large day and night collections from a single pond.

Habitat

All of the larvae were taken from a large pond, maximum depth 5', in a pasture in Cass County, Michigan. *Polygonum* and *Ambrosia* flourished along the margins of the pond. The aquatic plants which sheltered the larvae, namely, *Potamogeton*, *Hydrodictyon*, and *Spirogyra* formed a dense but not uniform cover in more than half of the pond. The bottom was firm and irregular. Many depressions, made by the trampling of livestock, were a foot deep. Consequently, the physical conditions of the microhabitats of the larvae varied greatly. Numerous tadpoles of anurans, a few larval jefferson salamanders and one fish (*Pimephales promelas*) inhabited the pond.

Methods

Plankton collections were taken prior to the collection of the larvae. A total of 329 larvae was collected with a 6-foot minnow seine. The date and time of each collection are given in the Tables. The specimens were killed immediately with chloroform. In the laboratory the total length was recorded, stomach removed and the contents analyzed for each larva. The stomach contents were separated into 3 parts, namely, 1) Chaoboridae, 2) other macroscopic organisms, and 3) plankton and detritus. Individual counts (Sedgewick-Rafter Cell was used for the microscopic organisms) were made and volumetric measurements (centrifuged) were determined.

Discussion and Results

The larvae ranged in total length from 70 to 132 mm. (mean 102.9 mm.). The specimens from the August 7th portion of the entire collection were older, consequently larger (mean 112.6 mm.). All larvae transformed to adults and left the pond for terrestrial habitats about a week after the last collection.

Species of Diptera (chiefly Chironomidae and Chaoboridae) were the predominant larger food organisms, more than 50% in every collection, Table I. Odonata, Ephemera, Hemiptera and Coleoptera were other important orders of insects in the diet of the larvae. A few Trichoptera, Arachnida, Mollusca (*Physa* and *Musculium*) and tadpoles were eaten. The larval salamanders were not surface feeders; terrestrial insects floating on the water and surface dwelling invertebrates were insignificant food items. Very little plant material was contained in the stomachs. As indicated by the net-plankton collections, the chironomids were strictly bottom-dwellers, while most of the chaoborids were on the bottom during the early collecting hours and became abundant in the plankton (feeding on the smaller plankters) at night, particularly after 9:00 P.M. The sky was clear at 6:00 P.M. on both collecting days. On the 23rd of July clouds formed shortly before 9:00 P.M. and a breeze produced small ripples on the water. Undoubtedly the light intensity was greatly reduced in the microhabitats of the larvae. The reduced light intensity was correlated with a pronounced decrease in the number of chironomids taken as food, and an increase in the number of chaoborids. (Note figures for the two late collections as compared with those of the earlier collections, Table I). This conclusion is supported by the volumetric measurements of the Chaoboridae and the plankton (Table II). Individual counts of the zooplankters showed that the increase in volumetric measurements was a change in the actual number of organisms and not a change in the amount of detritus. The chief zooplankters were Cladocera (*Simocephalus*, *Chydorus* and *Daphnia*) and Copepoda (*Diaptomus* and *Cyclops*). Also from direct observation of the stomach contents, it was recorded that less than 22% of the stomachs in the early collections (9:00 P.M. and earlier) contained large amounts of zooplankton; while the two late collections were 54% and 64%, respectively. The increase in the amount of total food (Table II) in the stomachs from the late collections was due to an increase in feeding activity and to an accumulation of food in the stomachs.

In conclusion the larvae of the tiger salamander have dual feeding habits; snapping at larger organisms and gulping water in order to seine out the plankters. Light intensity is perhaps the major factor controlling the extent to which the larvae feed on plankton. Under field conditions, clouds, angle of light rays, moonlight, turbidity, physical conditions of the microhabitats and many other factors regulate the amount of light that is available to the individual salamander. The larger food organisms were chiefly insects. Chironomidae (Diptera) was the most important family. The bulk of the planktonic organisms consisted of Cladocera, Copepoda and Chaoboridae (Diptera).

TABLE I. Macroscopic Organisms in Stomachs

Collection Dates	7 Aug. 1952		23 July 1952			
	6:00 P.M.	6:00 P.M.	7:30 P.M.	9:00 P.M.	10:30 P.M.	12:00 P.M.
# of Larvae	51	43	54	57	53	71
Food Items ¹						
Odonata	4.7	1.3	1.0	1.6	4.5	3.8
Ephemera	5.9	9.8	7.8	8.6	11.6	11.3
Hemiptera	5.6	6.8	6.2	7.7	8.1	8.8
Coleoptera	15.5	7.7	3.7	6.9	4.7	11.9
Diptera						
Chironomidae	44.9	55.5	65.6	62.0	37.5	28.8
Chaoboridae	7.5	11.4	10.0	9.9	30.3	29.4
Others	*	2.3	1.0	*	—	*
Trichoptera	2.3	*	*	*	*	2.7
Mollusca	13.1	4.8	4.6	2.2	2.1	2.6
Other Organisms	*	—	—	—	1.0	*

1. Data for food items tabulated in % as calculated from individual counts for each collection.

* less than 1%

TABLE II. Volumetric Measurements of Stomach Contents

Collections	Benthic Fauna	Chaoboridae	Plankton & Detritus	Totals
7 Aug. 1952				
6:00 P.M.	9.8	0.4	2.0	12.2
23 July 1952				
6:00 P.M.	5.5	0.7	4.0	10.2
7:30 P.M.	4.4	0.6	2.5	7.5
9:00 P.M.	6.1	0.6	4.0	10.7
10:30 P.M.	7.2	1.5	9.3	19.0
12:00 P.M.	6.3	1.5	11.3	19.2

Data (calculated for 50 larval salamanders in each collection) in cubic centimeters, centrifuged at 2000 R.P.M. (825 Relative Centrifugal Force Gravity) for 15 minutes.

Literature Cited

1. MANION, J. J., and Brother Lawrence Cory, F.S.C. 1952. Comparative ecological studies on the amphibians of Cass County, Michigan, and vicinity. (Dissertation in preparation for publication)
2. NICHOLAS, J. S. 1922. The reactions of *Amblystoma tigrinum* to olfactory stimuli. J. E. Z. 35:257-281.
3. POWERS, J. H. 1907. Morphological variation and its causes in *Amblystoma tigrinum*. Studies from the Zool. Lab. Univ. Nebr. No. 71:197-273.