A Comparative Study of the Food of the Shiners Notropis Lutrensis and Notropis Venustus[1]

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Notropis lutrensis (Baird and Girard), the red shiner, and *Notropis venustus* (Girard), the blacktail shiner, are two of the most common minnows in Lake Texoma. Because of their size and availability, these fishes are undoubtedly important forage fishes in the lake. The two species tend to inhabit the same areas in the lake and are commonly taken together. Hybrids between the two are not unusual (Hubbs and Strawn, 1956). For these two reasons, a comparative food habits study to investigate the extent of competition between the two species was made during the months of June and July, 1962.

[1]Contribution from the University of Oklahoma Biological Station, Willis, Oklahoma, prepared under the direction of G. A. Moore. Drs. George Bick and J. Teague Self and Mr. Lothar Hornuff graciously assisted in determining and confirming identifications of many food items.

Five collections of from 3 to 24 fish were made in the months of June and July, 1962, from tributaries of Lake Texoma and from an island pond near the University of Oklahoma Biological Station. Collecting, with 10-foot bag and "common sense" ⅛-inch-mesh seines, was in water less than five feet deep. The *Notropis lutrensis* ranged in length from 29 to 55 mm; the *N. venustus* from 45 to 70 mm. The number of *N. lutrensis* collected (38) was more than twice the number (16) of *N. venustus*. Hubbs and Strawn (1956) noted a preference of *N. venustus* for swifter water which may explain the relative abundances in the lake.

For each collection, the nature of the bottom, the turbidity of the water and the time of day were noted (Table I).

TABLE I. COLLECTION DATA

Coll'n	Locality	Date	Water	Bottom
(1)	Mouth, Cowan Cr.	20 VI 10:30 a.m.	Clear or slightly turbid.	Sand, clay.
(2)	Mouth, Buncombe Cr.	22 VI 8-11 a.m.	High, turbid.	Sand, mud, gravel.
(3)	Mouth, Cowan Cr.	9 VII 10:30 a.m.	Warm, shallow turbid.	Soft mud. debris.
(4)*	Mouth, Cowan Cr.	20 VI 11 a.m.	Slightly turbid.	No report.
(5)	Largest Island	9 VII 10 a.m.	Clear	Packed sand, little brush.

* Collectors: J. Worsham and B. Whiteside

The contents of the digestive tract from the esophagus to the anus were placed in Hoyer's fluid and examined microscopically.

Analysis was by frequency of occurrence of an item in the digestive tract. The small quantity and the mixed nature of the contents made volumetric analysis unsatisfactory, while the degree of maceration and the presence of unidentifiable masses, as well as the frequent necessity of making identifications on the basis of scattered legs and wings in the absence of heads, indicated that the counting of parts would not be accurate. Items were occasionally selected from the contents and temporarily mounted on slides. Each fish was measured, sexed, numbered and preserved in formalin.

Each kind of item found in the stomachs and intestines of the minnows examined is listed, and the number of times that item occurred in a digestive tract is noted. In addition, each total for an item is expressed as a percent of the total occurrences for that item in each species (Table II).

As expected, the two species consumed a variety of organisms. For both *Notropis lutrensis* and *N. venustus*, insects form the largest class of food items, eleven orders being represented. Lewis and Gunning (1959) concluded that the steelcolor shiner, *N. whipplei* (Girard), was largely insectivorous. The hymenopterans in *N. lutrensis* and *N. venustus* were either winged forms or ants of several kinds. In specimens from Collection I, counts of 12, 17, and 23 heads were made, and the gut was frequently packed with insect remains that probably represent the winged species. Ants did not appear in these large numbers or occupy the tract exclusively as did the winged hymenopterans, but appeared more consistently throughout the collections. All trichopterans were larvae; all ephemeropterans

were nymphs. The order Diptera was represented by larvae (probably Chironomidae) and adults. McCann (1959) reported consumption of trichopteran and dipteran larvae by *N. hudsonius* (Clinton). Black (1945) found dipteran larvae (Chironomidae) a major insect item consumed by *N. volucellus* Cope.

In the Lake Texoma shiners, Hemiptera was represented by several terrestrial species and by the family Corixidae. Coleopterans were of

TABLE II. FOOD OF *NOTROPIS LUTRENSIS* AND *N. VENUSTUS* FROM COLLECTIONS FROM LAKE TEXOMA

Food item	38 *N. lutrensis* Frequency	38 *N. lutrensis* Percent	16 *N. venustus* Frequency	16 *N. venustus* Percent
INSECTA	(55)	46.6	(33)	47.1
Hymenoptera	24		10	
Trichoptera	9		9	
Diptera, adults	3		—	
Diptera, larvae	—		5	
Ephemeroptera	2		4	
Hemiptera	6		1	
Coleoptera	4		3	
Orthoptera	1		—	
Lepidoptera	1		—	
Neuroptera	—		1	
Homoptera	1		—	
Thysanoptera	4		—	
PLANTS	(20)	16.9	(7)	10.0
Algae	11		1	
Fiber	6		4	
Seeds	3		2	
SEDIMENT	(6)	5.1	(5)	7.1
CRUSTACEA	(2)	1.6	(5)	7.1
Cladocera	1		2	
Isopoda	—		2	
Amphipoda	1		—	
Copepoda	—		1	
FISH EGGS	(1)		0	
FISH SCALES	—		(1)	
NEMATODA	(2)		(4)	
OLIGOCHAETA	—		(1)	
GASTROPODA	—		(1)	
HYDRACARINA	(1)		(2)	
SPIDERS	(7)		—	
UNIDENTIFIABLE	(24)	20.3	(11)	15.7
Animal	10		5	
Plant	3		1	
Unknown	11		5	
TOTAL:	118		70	

three families, Scarabaeidae, Cerambycidae and Dytiscidae. Each of the following orders was represented by one occurrence: Orthoptera (a minute head), Lepidoptera, Neuroptera, and Homoptera (all identified from wings). Thysanopterans were found in the two collections made at the greatest distance apart although within a two-day period. Black (1945) noted thrips infrequently.

Although plants constituted a large portion of the contents, I do not know whether they are a true food item. In several specimens algae were found in the gut, constituting as much as a fourth or a third (by estimate) of the total volume, but did not seem to have been affected by digestion.

"Sediment" designates muddy, red-brown fibers, and sand grains.

When cladocerans occurred, they were in large numbers, but the copepods were much less numerous, and isopods and amphipods were seen only as single fragments.

The nematodes, commensals of the genus *Camalanus,* cannot be considered as food since no evidence of digestion was noted.

"Unidentifiable" materials are those insects which could not be assigned to an order, material which appeared fibrous and possibly of plant origin, and homogeneous whitish-yellow masses of digested material with no hard parts or fibers.

A high incidence of algae, in fish from Collection I, reflects the presence of an algal bloom on the shoreline where the collection was made. The gut in which fish eggs were found was filled with them to the exclusion of most other items. The eggs, equipped with filaments, were undoubtedly of *Menidia audens* (Hay), the only fish in Lake Texoma known to produce such eggs.

Two gastropod shells were found in *Notropis venustus.* One of them, about 1 mm high, was probably a member of the family Pupillidae. The other, about 1.5 mm wide, was damaged and not identifiable.

Of the seven fish in Collection 3, five, including the only *N. venustus* in the collection, were parasitized by the copepod *Argulus.* These five fish, in contrast to the remaining two, had empty, or nearly empty, tracts and very little identifiable material. Cycloid fish scales ,about 1 mm in diameter, were mixed with sediment in a parasitized *N. lutrensis* and were the only recognizable item in that fish. Black (1945) stated that *N. volucellus* readily ingested loose scales, which were mostly from the same species.

N. venustus was not taken in Collection 4 from the mouth of Cowan Creek, although it was found at this location earlier and subsequently.

Collection 5 is the only collection in which *N. venustus* outnumbered *N. lutrensis.*

Table III compares the respective consumption by *N. lutrensis* and *N. venustus* of terrestrial, surface-dwelling and aquatic organisms. It is evident that *N. venustus* takes less food from the surface and more from the bottom than does *N. lutrensis.* The dipteran (Chironomid) and trichopteran larvae and the ephemeropteran nymphs are aquatic or bottom-dwelling organisms. *N. venustus* has a decidedly higher percentage of these items than does *Notropis lutrensis. N. lutrensis* exceeds *N. venustus* in percentages of dipteran adults, Hemiptera, Hymenoptera, and spiders, all flying, terrestrial, or surface-dwelling organisms. In addition, *N. venustus* has a slightly higher percentage of ingested sediment than does *N. lutrensis.*

TABLE III. SELECTION OF AQUATIC, TERRESTRIAL, OR SURFACE ORGANISMS BY *NOTROPIS LUTRENSIS* AND *N. VENUSTUS*

Food item	38 *N. lutrensis* Frequency	Percent	16 *N. venustus* Frequency	Percent
Diptera, larvae	0	—	5	7.1
Diptera, adults	3	2.5	0	—
Trichoptera	9	7.6	9	12.9
Hymenoptera	24	20.3	10	14.3
Ephemeroptera	2	1.6	4	5.7
Hemiptera	6	5.1	1	1.4
Sediment	6	5.1	5	7.1
Spiders	7	5.8	0	—

SUMMARY

1.) *Notropis lutrensis* and *Notropis venustus* are omnivores which feed mostly on insects, but will opportunistically seize anything available in the average size range.

2.) Since the diets of both minnows consist to a large extent of the same orders of insects, and smaller extent of plant and unidentifiable materials, the two species are definitely in competition for food. Slight differences (selection of more surface and terrestrial items by *N. lutrensis)* may lessen this competition.

LITERATURE CITED

Black, John D. 1945. Natural history of the northern mimic shiner *Notropis volucellus* Cope. Invest. Ind. Lakes and Streams, 2.

Hubbs, Clark and Kirk Strawn. 1956. Interfertility between two sympatric fishes, *Notropis lutrensis* and *Notropis venustus*. Evolution 10:341-344.

Lewis, William M. and Gerald E. Gunning. 1959. Notes on the life history of the steelcolor shiner *Notropis whipplei* (Girard). Trans. Ill. State Acad. Sci. 52(1 and 2).

McCann, James A. 1959. Life history studies of the spottail shiner of Clear Lake, Ia., with particular reference to some sampling problems. Trans. Amer. Fish. Soc. 88.