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THE DIET OF *PERCINA CAPRODES (RAFINESQUE), (PISCES: PERCIDAE)* IN SMALL STREAM IN PENNSYLVANIA[1]

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ABSTRACT

Stomach contents of 112 logperch, *Percina caprodes* (Rafinesque), were studied from Woodcock Creek upstream of Woodcock Creek Lake near Blooming Valley in Crawford County, Pennsylvania. Six collections were made from November 1990 through October 1991. Chironomids were the dominate prey item found in the stomach contents of the logperch. Simuliids, tipulids and ephemeropterans were predominately utilized in November and trichopterans in May and October. No significant difference ($p>0.05$) existed in the feeding habits of logperch based on sex or age class. Oligochaete worms comprised the bulk of the benthos sampled on all collection dates; however, they were absent in the stomach contents of logperch.
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INTRODUCTION

Percina caprodes (Rafinesque), logperch, is one of the most widely distributed of all darters (Scott and Crossman, 1973) and occupies the Ohio River basin and much of the upper St. Lawrence basin. It is native or introduced in some Atlantic drainages from the Potomac to the Hudson. The logperch inhabits a variety of environments and is found in warm streams to large rivers and lakes. It often populates reservoirs, which is unusual among darters (Kuehne and Barbour, 1983). The species is uncommon in small streams, which lack chutes and strong riffles (Kuehne and Barbour, 1983). In Pennsylvania, *P.c. caprodes,* Ohio logperch, is restricted to the Mississippi Valley and Great Lakes drainages. It has been found spawning near the mouth of small tributaries to Lake Erie (Cooper, 1983). Cooper (1983) reports that it is not a swift water species and can tolerate wide environmental conditions.

Logperch are visual feeders; feeding during daylight hours. Keast and Webb (1966) report that its feeding behavior consists of a series of short, forward searching movements with intervening rests on the bottom. It uses a rounded knob on its snout to overturn leaves and small stones to expose potential food. When a prey is discovered it is secured with a sudden dart forward; the ventroterminal mouth snapping shut. Emery (1973) reported that at night logperch seek cover and become inactive. The unique feeding behavior of *P. caprodes* and other logperches allows it to exploit food resources not available to other darters.

The feeding habits of *P. caprodes* have been reported by Turner (1921), Dobie (1959), Mullan et al. (1968), Thomas (1970), Murray and Tarter (1979) and others. Most of these studies, however, were restricted to feeding behaviors of logperch collected from reservoirs, lakes, or large streams and also did not compare the presence of aquatic insects in the stomach versus that available in the environment. The main objective of our study was to determine the diet of *P. caprodes* collected from a small stream and to compare diets of different age classes and sexes.

MATERIALS AND METHODS

Six collections were made in Woodcock Creek upstream of Woodcock Creek Lake in Crawford County, Pennsylvania, near Blooming Valley from November 1990 until October 1991. At this site, Woodcock Creek is approximately 5-10m wide and is heavily wooded on both sides. The substrate is mostly rubble, cobble, and gravel in riffle areas and sand and silt in pools. Water depth in the area studied ranged seasonally from 0.25m to 1.5m.

Logperch were collected with a 1.5 x 3.0m, 3.2-mm

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mesh seine for approximately 1 hour during daylight hours. Specimens were placed in a 10% formalin solution and within a few days transferred to 50% isopropyl alcohol and deposited in The Pennsylvania State University Fish Museum. Standard lengths of preserved specimens were measured to the nearest (mm) using dial calipers after the stomachs had been removed (Hubbs and Lagler, 1958). After removal of stomach contents, each logperch was weighed and measured to the nearest (g) using a digitized scale. Stomach analysis involved dissection and inspection of the entire digestive tract. Stomach contents of 112 logperch were identified under a stereomicroscope to the lowest practical taxon and enumerated. Specimens were sexed based on the presence or absence of modified scales on the breast. Presence of scales indicating males and absence indicating females. Age classes of logperch were determined from scale examination. Several scales were taken from the side of the body below the lateral line at a point midway between the first and second dorsal fins (Steinmetz and Muller, 1991), placed in a drop of water and annuli were counted using a stereomicroscope. Specimens were grouped into 0+, 1+ and 2+ age classes.

After each fish collection, benthic samples were collected with a D-frame kick net (0.9mm mesh) as described by Frost et al. (1970). The substrate was disturbed directly upstream of the net; nine randomly chosen samples (20 sec each) were taken and pooled. Macroinvertebrates were fixed in 50% isopropyl alcohol with a small amount of formalin and were identified, using stereomicroscope, to the lowest practical taxon according to Peckarsky (1990). The diet of logperch was characterized by combining data from all stomachs on each collection date. Strauss' Linear Index (L) was used to compare the prey items of the logperch with those available in the environment:

$$L = r_i - p_i;$$

where r_i and p_i, are the relative abundances or proportions of prey item *i* in the gut and habitat (Strauss, 1979). The index ranges from -1 to +1; with positive values indicating preference and negative values indicating avoidance or inaccessibility. A selection value of 0 indicates that a prey item was consumed in the same proportion as it occurred in the environment. A two sample t-test was used to determine if significant differences ($p < 0.05$) in feeding habits existed among age classes and between sexes.

RESULTS

Average standard length (SL) of logperch was 69.6 mm ±10.7, with a mean weight of 3.5 g ± 1.7. Mean SL of males was 71.1 mm ± 9.6, with an average weight of 3.6 g ± 1.7. Female mean SL was 68.3 mm ± 11.4, with a mean weight of 3.4 g ± 1.8. Mean SL of age class 0+ logperch was 58.2 mm ± 8.2, mean weight of 2.0 g ± 0.87, age class 1+ averaged 72.5 mm ± 6.2, mean weight 3.9 g ± 1.3, and age class 2+, 81.1 mm ± 8.3, with a mean weight of 5.4 g ± 2.3.

In the benthos collections (n=9), a total of 7,034 macroinvertebrates were identified. Oligochaetes were the most numerous taxa (10-60%) found in the benthos on all collection dates (Figure 1). Heptageniids (mayflies)

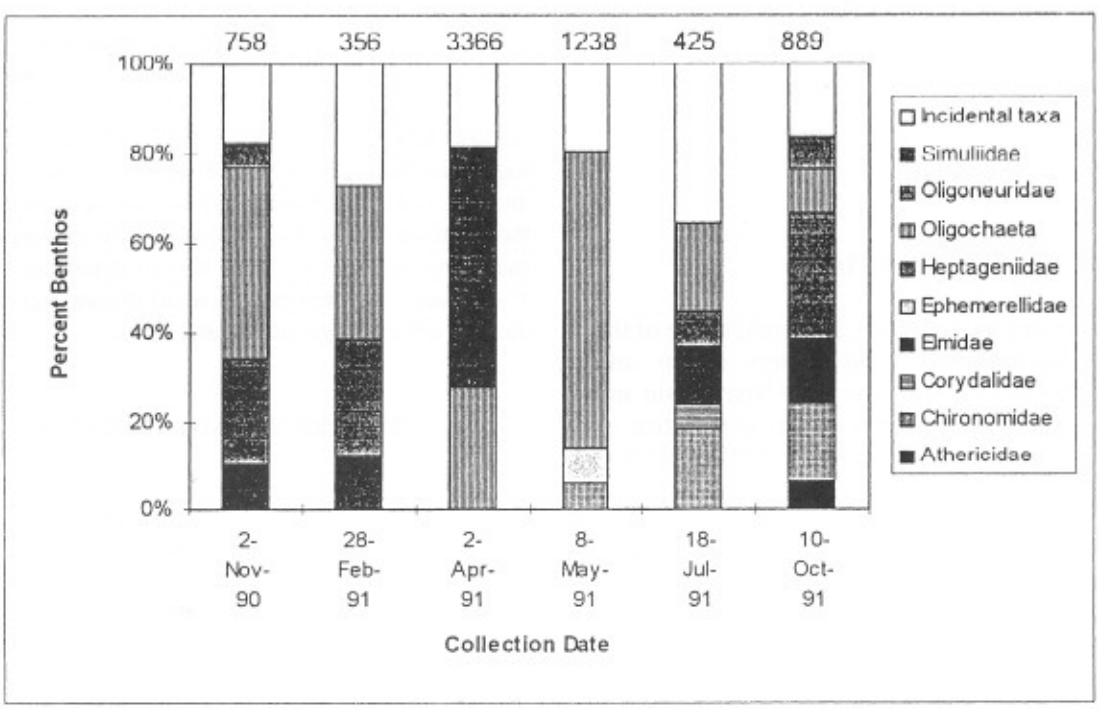

FIGURE 1. Plot of taxa proportions collected from the benthos on each sampling day. Incidental taxa represents the pooled proportions of taxa that did not comprise at least 5% of a sample on at least one day. Numbers above the bar indicate the number of macroinvertebrates collected on each date.

comprised 5-28% and elmids (beetles) comprised 10-14% of the benthic samples. Chironomids constituted 5-18% of the benthic samples collected in April thru October. Simuliids (blackflies) were only found in the April collection, comprising 45% of the benthic samples.

A total of 1,264 food items were identified from stomach contents of logperch. Numerically, chironomids dominated the food throughout the year (35-91%) (Table 1); except on 2 November 1990 (Figure 2). In November, logperch fed primarily on elmids, simuliids and tipulids (craneflies). There was no food found in the stomachs of logperch (n=19) collected in February. The number of macroinvertebrates (n=356) collected in February benthos samples was not significantly different ($p > 0.05$) than macroinvertebrates collected in July (n=425). Chironomids comprised 44-91% of the prey items consumed by all three age classes in April thru July. In May, chironomids (44%) and hydroptilids, (caddisflies), (45%) were consumed in relatively equal proportions. In October, logperch consumed a variety of organisms with the bulk of the diet consisting of chironomids (35%) and limpets (24%).

Strauss' Linear Index indicated that logperch showed a preference for chironomids on April and July collection dates. In November, logperch showed a preference for simuliids (L=0.14) and tipulids (L=0.24) compared to chironomids (L=0.01). In May, Strauss' Linear Index value was slightly higher for hydroptilids than chironomids and in October, limpets were slightly favored to chironomids. Oligochaete worms, although found in the benthic samples, in abundance had a negative food selection index. The food selection index indicated that logperch either avoided the worms or they were inaccessible to predation. Both males and females primarily consumed dipterans (chironomids), ephemeropterans and trichopterans, with chironomids comprised over 30% of the diet on all collection dates except November. Strauss' Linear Index showed that both males and females preferred the same prey organisms on all collection dates except May. In May, males preferred hydroptilids (Trichoptera) and females preferred chironomids (Diptera). A two sample t-test indicated no significant difference ($p > 0.05$) in the feeding habits of logperch based on sex.

TABLE 1 Percentages of various food items found in the stomachs of Age Class 0+, 1+, and 2+ logperch collected at Woodcock Creek, Pennsylvania. (** = food items composing <0.01% of stomach contents)

	Collection Date														
	1990						1991								
	NOVEMBER			APRIL			MAY			JULY			OCTOBER		
Age Class (sample size)	0 (5)	1 (7)	2 (2)	0 (0)	1 (9)	2 (4)	0 (0)	1 (9)	2 (2)	0 (2)	1 (8)	2 (1)	0 (0)	1 (3)	2 (4)
Diptera															
Chironomidae					0.76	0.44		0.48	0.18	0.93	0.92	0.86		0.08	0.45
Simuliidae		0.16			0.11	0.48		**			0.01				0.03
Tipulidae	0.17	0.27			0.01			**		0.04	0.04				
Ephemeroptera															
Unidentified to Family		0.02	0.25		0.01	0.04		**	0.05	0.02					0.03
Baetidae	0.17				0.01			**	0.02		**				
Empididae								0.02							
Emphemerellidae											**				
Heptageniidae		0.12	0.5					**				0.14			0.03
Leptophleidae								0.01							0.03
Oligoneuridae		0.08												0.17	0.03
Trichoptera															
Unidentified to Family		0.02						0.01							
Hydroptilidae								0.44	0.5		**				
Hydrospychidae		0.03			0.03	0.04									0.03
Polycentropodidae	0.17	0.08							0.02		0.01			0.42	
Psychomidae					0.03										
Hydracarina															0.06
Amphipoda		0.02													
Anisoptera											**				
Annelidae															
Oligochaeta	0.17														
Coleoptera															
Unidentified to Family		0.02													
Elmidae	0.17	0.16									**			0.08	0.06
Plecoptera								**							
Perlidae	0.17		0.25												
Fish Eggs								**	0.25						
Limpet		0.02												0.25	0.24

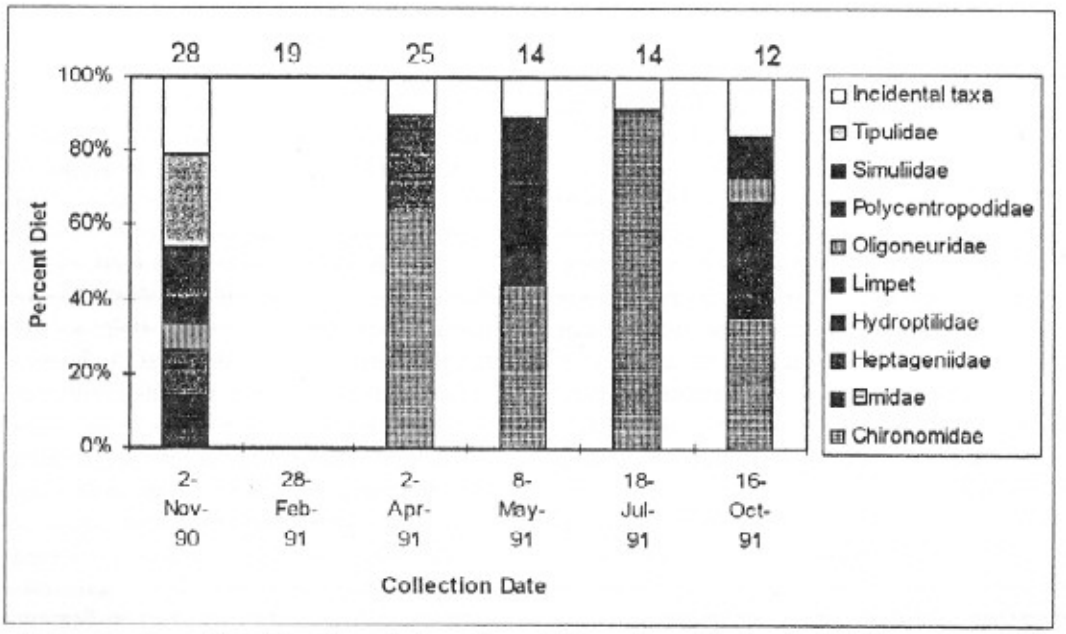

FIGURE 2. Plot of taxa proportions collected from logperch stomachs pooled for each sampling day. Incidental taxa represents the pooled proportions of taxa that did not comprise at least 5% of a sample on at least one day. Numbers above the bar indicate the number of logperch collected on each date.

Ephemeropterans were utilized heavily in November, whereas trichopterans (hydroptilids and polycentropodids) were consumed in May and October. Food was only found in the stomach of age class 0 logperch collected in November and July. As a result, we are unable to speculate on dietary shifts in maturing logperch. A two sample t-test indicated no significant difference ($p > 0.05$) in feeding habits of logperch based on age class. Age class 1 logperch consumed more total prey items on all collection dates except October 1991.

DISCUSSION

Chironomids were the predominant prey found in the stomachs of logperch throughout the study. They were, however found in the benthos samples in low proportions. Chironomids may have been under estimated in the environment because they demonstrate distinct preference for certain types of substrate, creating 'patchy' or microdistrubutional patterns. Because of their clumped distribution they may have missed in benthos samples, thus causing low abundance estimations. Dipterans (simuliids and tipulids) and ephemeropterans were predominantly utilized in November, and trichopterans in May and October. Oligochaetes comprised the bulk of the benthos samples on all collection dates however, they were not found in the stomach contents of logperch. The lack of feeding seen in February is possibly due to the inability of the logperch, because of reduced metabolism at low temperatures, to forage effectively to obtain prey and not scarcity of prey items. Reduced rates of feeding at low temperatures have been observed in many fishes (Keast, 1968; Mathur, 1973; Weddle, 1992).

Percina caprodes is a benthic invertivore feeding primarily on insect larvae (Turner, 1921; Mullen et al., 1968; Keast and Webb, 1968, and Murray and Tarter, 1979). A diet of small, bottom-dwelling organisms correlates with the position, diameter, and structure of the small, ventro-terminal mouth (Keast and Webb, 1996). Turner (1921) noted specimens collected from Lake Erie and inland lakes fed primarily on small crustaceans with amphipods and insect larvae increasing in the diet as the logperch matured. Logperch collected from streams, however, ate small crustaceans constantly, but in small proportion with Diptera and Ephemeroptera constituting most of the diet (Turner, 1921). Turner (1921) suggested that *P. caprodes* in its very early stages is a surface feeder becoming a bottom feeder as it matures. The results of our study are consistent with the results of previous studies.

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