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Age, Growth, Fecundity and Food Habits of Fantail Darters in Boone County, Iowa[1]

James R. Karr

Abstract. Although 117 fantail darters (*Etheostoma flabellare*) were collected from Bluff Creek, Boone County, Iowa, during summer 1962 and winter 1962-63, only 1 was found in the Des Moines River. Slenderhead darters occupy the similar riffle areas in the river. Female fantail darters were 18.7, 34.8, and 42.4 mm at the first through the third annuli, respectively, and male darters were 18.5, 36.7, 59.0, and 62.0 mm at the first through the fourth annuli, respectively. No females were found that had formed a fourth annulus. Average coefficient of condition for 104 fantail darters was 1.749. Length-weight relationships for males and females were statistically the same. Food of the fantail darter was 93% insects. The peak of the spawning period is probably in May.

Darters were collected from the Des Moines River and its tributaries in Boone County, Iowa during the summer of 1962 and winter of 1962-63. Karr (1964) presented data on slenderhead darter, *Percina phoxocephala,* blacksided darter, *P. maculata,* and johnny darter,*Etheostoma nigrum,* collected during the summer. All except 1 of the 118 fantail darters, *E. flabellare,*

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collected were from Bluff Creek, a stream entering the Des Moines River at the SW corner of Section 22, R.-27W., T.-84N. in Boone County. The other was from the Des Moines River about 6 miles above the mouth of Bluff Creek.

Methods and Materials

Of the 118 fantail darters, 17 were collected with a seine and 101 with a long-handled dip net as described by Karr (1964). When this method is used, the net is placed several feet downstream from the collector, who kicks around on the stream bottom while moving toward the net. Care must be taken to insure that the rim of the net rests on the stream bottom, or fish will be lost.

On several occasions, a 220-volt alternating current electric shocker was used on Bluff Creek, but since the fantail darter frequents the faster, rockier riffles, this method was not useful for collecting darters because shocking operations ceased at each riffle while the boat containing equipment was dragged over the rocks.

Fantail darters were found in the swifter riffle areas (usually those with rocks larger than 3 inches in diameter) in Bluff Creek, habitats very similar to those of the slenderhead darter, the most abundant darter in the Des Moines River. Since the fantail darter appears to be a small stream fish and the slenderhead darter is a river fish, their habitats, though similar, do not overlap.

Measurements

Fish were killed and preserved in formalin and water solutions when captured. Standard (SL) and total lengths (TL) were measured within 24 hours, and measurements were to the nearest millimeter in larger fish and were interpolated to tenths of a millimeter in smaller individuals. Weights were measured with a triple beam balance to hundredths of a gram and interpolated to the nearest thousandth of a gram.

In fantail darters ranging from 17 to 70 mm total length, total length equaled 1.19 standard length.

Age and Growth

A critique of the scale method of determining age and growth of fish was presented by Van Oosten (1929). Scales were taken from just below the lateral line at the posterior end of the pectoral fin as it was folded back along the body and were later read on a scale projector at 80X magnification. Dried mucous on the scales presented a problem in scale reading, but a sufficient number of scales were taken from each fish to insure that at least one scale could be read. The scales were mounted

dry between two glass microscope slides. Annuli were designated as areas where circuli showed crowding. If the scales were slightly out of focus, annuli showed up as darkened areas. Raney and Lachner (1943) and Karr (1964) reported, as I found here, that only the anterior field showed evidence of annulus formation.

Scale radii were measured across the anterior field at 80X magnification, and the following equation of body length to scale radius was computed by the least squares method where:

$L = 0.03 + 1.227\ R$
L = total length (millimeters) and
R = anterior scale radius (millimeters) X80.

Fish were divided into eleven 5-mm length groups for computations. Since the intercept of the body-scale regression was only 0.03 mm, it was assumed that growth of the scale was directly proportional to growth in total length.

Lengths at each annulus (Table 1) were determined with a nomograph, using zero as the intercept (Carlander and Smith, 1944). The 101 fantail darters showed slower average growth than slenderhead, blacksided, and johnny darters of Boone County, Iowa, (Karr, 1964) for their first 3 years (Figure 1), but, at the fourth annulus, fantail darters averaged 15 mm shorter than blacksided darters and 6 mm longer than slenderhead and johnny darters.

Table 1. Growth data for fantail darters, by sex and combined, Des Moines River, Boone County, Iowa, 1962.

Age		Number	Length at capture		Mean weight	Mean calculated total length at annulus			
class	sex	fish	Mean	Range	grams	1	2	3	4
0	combined	14	23	17-28	0.145				
I	combined	21	42	32-54	0.851	26.8			
II	female	49	47	36-59	1.137	19.2	35.6		
	male	10	56	43-62	1.758	21.6	39.9		
	combined	59	49	36-62	1.242	19.6	36.3		
III	female	8	52	46-62	1.669	15.8	29.9	42.4	
	male	11	60	51-65	2.163	16.8	34.7	48.8	
	combined	19	57	46-65	1.955	16.4	32.6	46.1	
IV	male	2	68	67-70	2.578	12.5	31.5	50.0	62.0
II-III	females	57				18.7	34.8	42.4	
II-IV	males	23				18.5	36.7	49.0	62.0
IV	combined	101				20.3	35.3	46.5	62.0
Increments									
	females					18.7	16.1	12.5	
	males					18.5	18.2	14.8	12.0
	combined					20.3	16.6	14.0	12.0
Number of fish									
	females					57	57	8	
	males					23	23	13	2
	combined					101	80	21	2

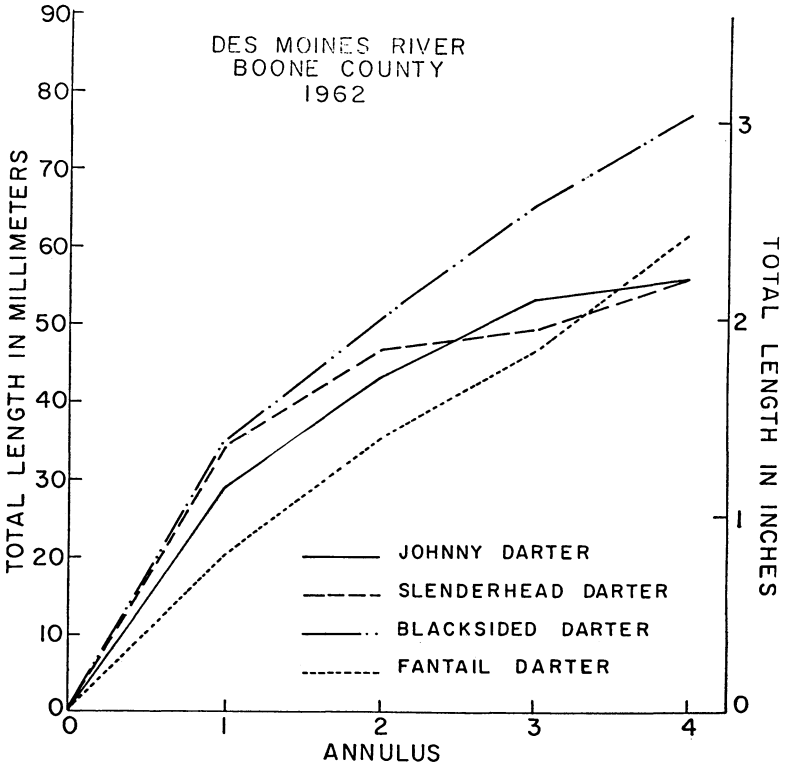

Figure 1. Growth comparisons of johnny, slenderhead, and blacksided darters (Karr, 1964) and fantail darters, Des Moines River, Boone County, Iowa, 1962.

Of 80 fish from age groups II, III, and IV for which sex was determined, 57 were females and 23 were males. Computed lengths (Table 1) were 18.5, 36.7, 49.0, and 62.0 for the first through the fourth annuli in males. For females the first through the third annuli were formed at lengths 18.7, 34.8, and 42.4 mm. No females were found that had formed the fourth annulus.

Fantail darter data show Lee's phenomenon (Ricker, 1958). That is, the younger fish appear to be growing faster than the older fish did early in their lives. The most likely explanations are that the sampling tended to be selective for the larger young fish and that the faster-growing fish are shorter-lived than the slower-growing fish.

Condition and Length-weight relationship

The relative robustness or well being of a fish (Lagler, 1956) has been expressed as the coefficient of condition from the formula

$$K(TL) = \frac{W\ 10^5}{L^3}$$

where W = weight in grams
L = total lenght in millimeters

The average K factor for 104 fantail darters from 17 to 70 mm total length was 1.749. Average K factors for slenderhead, blacksided, and johnny darters from Boone County, Iowa ranged from 1.362 to 1.392 (Karr, 1964). The fantail is a stockier fish than the three other darters.

The length-weight relationship was computed for 104 fantail darters as

$$\text{Log } W = -2.730 + 2.835 \text{ Log } L$$

where W = weight in grams
L = total length in millimeters.

Since the regression value is less than 3.00, the fish become less plump as they increase in average length. The reverse was reported for the slenderhead, blacksided and johnny darters (Karr, 1964).

Analysis of covariance was used to determine the differences, if any, in variance, slope, and elevation of the length-weight regression lines of the male and female darters:

19 female fantail darters	$\text{Log } W = -1.907 + 2.372 \text{ Log } L$
54 male fantail darters	$\text{Log } W = -2.812 + 2.894 \text{ Log } L$

In all three cases differences were found to be non-significant at the 5% level of confidence.

Food Habits

Stomach analysis on 50 fantail darters showed that 93% of the food items taken were insects (Table 2). Insect orders represented were Diptera, Ephemeroptera, and Tricoptera. Turner (1921) found that the fantail darter fed mostly on midge and mayfly larvae. Other food items were ostracods, hydrachnids, and the remains of one recently hatched crayfish. Small stones and plant material were found in several stomachs but these were probably picked up accidentally in normal feeding.

Egg Counts

Two females taken in November, 1962 had large ovaries that contained large numbers of undeveloped eggs. These eggs were very small and no attempts were made to count them, but it was estimated that each individual contained more than 800 eggs.

In fish collected in June and July, 1962, and in April, 1963, eggs of several sizes were evident. Lake (1936) found eggs of five distinct size groups in fantail darters taken during the spring. Lake (1936) reported an average of 226.2 eggs in 23 females.

Table 2. Food contents of stomachs of fantail darters, Boone County, Iowa, 1962.

	Per cent of occurrence	Per cent of items
Inorganic (small stones)	8	....
Organic	98	....
Plant	8	....
Animal	98	100.0
Undetermined	28	5.1
Determined	98	94.9
Insecta	98	93.0
Diptera	60	61.9
Chironomidae	58	61.7
Ceratopogonidae	2	0.1
Dolichopodidae	2	0.1
Ephemeroptera	37	12.8
Heptageniidae	32	5.2
Baetidae	34	4.7
Caenidae	18	2.9
Tricoptera	70	18.3
Hydropsychidae	70	18.3
Crustacea	4	0.2
Ostracoda	2	0.1
Malacostraca (crayfish)	2	0.1
Other		
Hydrachnida	8	1.7
Number of stomachs		50
Number of animal items		693

Total number of eggs and number of "mature" eggs were counted in each individual (Table 3). "Mature" eggs were large and yellowish while the rest of the eggs were much smaller and milky white in color. The highest numbers of mature eggs were present in late April. The peak of spawning is probably in May. Mature eggs were found in decreasing numbers in June and July fish. The peak of spawning period in New York was May 15, and females were free of eggs in June and July (Lake, 1936).

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Table 3. Total number of eggs present in female darters, Boone County, Iowa, 1962-1963. (Numbers in parentheses indicate numbers of mature eggs)

Month	Number of fish	Number of eggs	
		Mean	Range
April, 1963	2	496(119)	407-586(117-121)
June, 1962	3	213(60)	128-293(25-101)
July, 1962	3	171(23)	120-212(10-38)

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Large Glacial Erratics in Northeast Iowa

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Abstract. The location of large glacial erratics of gneiss and granite in northeast Iowa, specifically in the tri-county area of Bremer-Fayette-Chickasaw counties is described. Discussed are the possible origin, size, location, detectability on survey photos, and some historical features. Action to provide for protection of these glacial relics against destruction is urged.

In a recent communication from Paul M. Tilden, editor of the National Parks Magazine, concerning the Ice Age National Scientific Reserve, which was discussed in the August 1963 issue, he wrote: "I was most interested to hear of your plea before the geology section of the Iowa Academy of Science in behalf of at least a few of the glacial erratics in your area. I hope that the idea might actually take root." In the belief that a further study of these large erratics might contribute to their preservation for posterity, this study was undertaken by the writer.

The survey covers the area west of Highway 150, north of Highway 3, east of the Cedar River, and south of the Chickasaw-Howard county line in northeastern Iowa. No large erratics have been found north of Highway 24 east of U. S. 63, and only the most outstanding have been considered. Estimates based on above-ground dimensions indicate weights of the rocks may range from 100 to 1400 tons. Thousands of erratics, not counting many smaller ones piled along fences, are to be seen in a 50-mile drive about Sumner. Fifteen sizable and many small stones are visible west of Boyd in an area of about 80 acres.

A 2½-power glass will reveal such erratics on large-size aerial survey photos. In appearance they suggest pearls set in a piece of jewelry, with a dark fringe indicating either surrounding brush or shadow from the rock. However, it takes experience to appreciate their size and shape. Objects such as small build-