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ESTIMATED SIZES OF VARIOUS FORAGE FISHES CHAIN PICKEREL CAN SWALLOW

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The chain pickerel, *Esox niger*, has been reported to be a voracious feeder on other fish. In the evaluation of fish populations, it is necessary to know the sizes of various forage fishes that piscivorous fishes can swallow. Without such information, it is impossible to determine accurately such population values as I_F, S_F and the Y/C ratio. This paper presents, in tabular form, a preliminary estimate of the sizes of gizzard shad, *Dorosoma cepedianum*, bluegills, *Lepomis macrochirus*, golden shiner, *Notemigonus crysoleucas*, and green sunfish, *Lepomis cyanellus*, that various sizes of chain pickerel can swallow.

The basic steps underlying such a tabulated estimate of sizes of forage fish a given piscivorous species can swallow were given by Lawrence.* The length-depth relationships of bluegills, golden shiners, and green sunfish from that publication, and additional calculations on the body depth-total length relationships of gizzard shad are included in this report. The equations for the body depth-length relationship of gizzard shad are as follows:

Total Length Interval, MM.	Equation
55-99	$L = 31.0 + 2.381\ D$
100-199	$L = 15.2 + 3.351\ D$
200-299	$L = 81.9 + 2.452\ D$
300-399	$L = 147.3 + 1.869\ D$

Exactly how the chain pickerel catches and orients its prey for swallowing is unknown, but the anatomical structures limiting the size of prey a given chain pickerel can swallow have been investigated. This fish does not possess the semirigid pair of cleithrum bones surrounding the anterior portion of the esophagus as do the Centrachid basses. Rather, there is a series of slim, pliable

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* Lawrence, J. M., Estimated sizes of various forage fishes largemouth bass can swallow. Proc. S. E. Assoc. Game and Fish Comm., 11:220-225. 1957.

bones in this area that permit the opening of the esophagus to expand to a greater degree than is possible in the basses.

After careful checking of stomach contents and measuring various portions of the mouth and body of a number of chain pickerel, it was concluded that they can swallow another species of fish whose body depth is equal to, or less than, its own body depth when the abdomen is not distended. (The body depth of this piscivorous species was determined by placing the fish on its right side and measuring from the top of the body to the bottom of the stomach. Care was taken to be sure that no pressure was applied to the area of the measurement, since it is possible to increase the body depth by compression.) This assumption was checked on a number of chain pickerel of various sizes by using several species of forage fishes. In all instances the chain pickerel were able to swallow forage fishes whose body depth was the same as or less than their own.

Thus, it was necessary to calculate the relationship of total length-body depth of chain pickerel. The equations for these length-depth relationships for different intervals of total length of this species were as follows:

Total Length Intervals, MM.	Equation
100-199	$D = 1.95 + 0.110 \ L$
200-299	$D = -3.19 + 0.134 \ L$
300-399	$D = -18.59 + 0.182 \ L$
400-499	$D = -22.08 + 0.193 \ L$
500-599	$D = -29.47 + 0.203 \ L$
600-699	$D = -77.53 + 0.264 \ L$

Since a chain pickerel can swallow a forage fish whose depth of body is equal to its own, this relationship may be expressed as follows:

Body depth (forage) [less than or equal to] Body depth (chain pickerel)

Based upon the above relationship, and using the various equations for length-depth relationships mentioned previously, the estimated sizes of certain forage species of fish a chain pickerel can swallow were computed. These data are summarized in Table I.

TABLE I

ESTIMATED SIZES OF FORAGE FISH CHAIN PICKEREL CAN SWALLOW

Chain Pickerel Total Length In.	Depth Body Mm.	Total Length of Forage Fish in Inches			
		Shad	Bluegill	Green Sunfish	Golden Shiners
4.5	14.5	2.56	2.12	2.20	2.94
5.5	17.3	2.93	2.38	2.50	3.37
6.5	20.1	3.31	2.65	2.80	3.80
7.5	22.8	3.36	2.90	3.08	4.20
8.5	25.8	3.67	3.18	3.40	4.67
9.5	29.1	4.52	3.49	3.75	5.17
10.5	32.6	4.98	3.82	4.12	5.71
11.5	35.9	5.43	4.13	4.47	6.22
12.5	39.1	5.86	4.43	4.81	6.70
13.5	43.8	6.49	4.88	5.30	7.43
14.5	48.4	7.10	5.31	5.79	8.13
15.5	53.1	7.73	5.75	6.29	8.85
16.5	58.8	8.50	6.29	6.89	9.72
17.5	63.6	9.14	6.74	7.40	10.46
18.5	68.6	9.81	7.21	7.93	11.22
19.5	73.5	10.47	7.67	8.44	11.97
20.5	76.9	10.93	7.94	8.66	12.49
21.5	80.5	11.41	8.42	9.28	13.04
22.5	84.1	11.89	8.89	9.81	13.59
23.5	87.8	12.39	9.39	10.37	14.16
24.5	91.4	12.89	9.92	10.84	14.71
25.5	95.1	13.36	. . .	. . . .	. . . .
26.5	98.7	13.85	. . .	. . . .	. . . .
27.5	102.2	14.31	. . .	. . . .	. . . .