

Population Stability in the Gizzard Shad Population of Crab Orchard Lake, Illinois

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Abstract

A 25 year reanalysis of the gizzard shad, *Dorosoma cepedianum* (Le Sueur), population in Crab Orchard Lake, Illinois, was conducted for the purposes for comparison. The gizzard shad population has remained relatively stable in regard to age composition, however, the condition of the fish has dramatically declined. Coefficient of condition appears highest from May through September. Females exhibit higher K values than males.

Introduction

The gizzard shad is considered one of the most important forage fishes (Bodola, 1965; Lagler and Applegate, 1942; Lewis, 1953; Jester and Jensen, 1972). They represent an important species because they can utilize plankton and detritus as a food source (Bronoski, 1975; Tiffany, 1921a; Tiffany, 1921b; Jester and Jensen, 1972). Gizzard shad serves as forage for 17 important game fish (Miller, 1960), and may serve as the primary source of forage for most game fishes (Dubets, 1954; Schneidermeyer and Lewis, 1956; Jester and Jensen, 1972). As stated by Hubbs (1934), "The gizzard shad is the most biologically efficient of all forage fishes".

The initial analysis of the gizzard shad population of Crab Orchard Lake, Williamson County, Illinois, was performed by Lewis (1953). Lewis postulated that large die-offs of gizzard shad may control the age and size composition of the population. Reanalysis, therefore, serves as a comparison of the shad population over a 25 year period. It also provides qualitative data about this important forage fish.

Materials and Methods

A total of 1117 gizzard shad were collected by electro-shocking and seining from Crab Orchard Lake, Illinois, between March 1976 and February 1977. In order to obtain a representative sample of the fish population, three different homogeneous collecting areas which were ecologically similar, high in plankton and benthos, with depths ranging between 1 and 3 meters, were utilized. The electro-shocking device consisted of a 230 volt, 5000 watt, 180 cycle A.C. generator carried in a boat and connected to electrodes mounted on a boom extended from the bow of the boat. Seining was done in shallow waters and at a spillway. The seine was 50 feet long and had a ¼ inch mesh. Fish were collected either bi-monthly or semi-monthly and transported intact to the laboratory.

The fish were weighed to the nearest tenths of grams, measured to the nearest millimeter, sexed and aged. The latter was determined by means of the scale method.

Statistical analysis of the data was by means of SAS and was run on an Amdahl 470 computer.

Results

The coefficients of condition were determined for 1117 gizzard shad using the formula: $K_{TL} = \frac{W \cdot 10^5}{L^3}$ where K_{TL} = coefficient of condition, w = weight in grams, and L = total length in millimeters.

Comparisons of the coefficients of condition over a one year period (March 1976–February 1977) show females to possess highest K values from October through April (Fig. 1). Figure 1 also shows the K values to be lowest from November through April for both males and females.

The coefficient of condition decreases with an increase in the total length of the fish (Fig. 2). This decrease is seen also in the age groups which are directly correlated to the length of the fish (Fig. 3). Therefore, the lowest K values were recorded from gizzard shad greater than 310 mm (Fig. 2) which corresponds to the IV+ age class (Fig. 3).

The relationship between the length and weight in the gizzard shad was determined using the formula: $W^a CL^b$ where W^a weight in grams, C^b a constant, L^b length in millimeters, and n^a and exponent. The value obtained for the Log C was -15.11845 and the value for n was 3.05067 (Fig. 4). The gizzard shad population ranged in size from 49–353 mm (Figs. 2 & 4), and ranged in weight from 2.1–431.5 gms. (Figs. 2 & 4).

The gizzard shad population was comprised primarily of II+ and III+ fish. The maximum age fish obtained during this study was IV+ years.

Discussion

Gizzard shad constitute the principal forage fish in Crab Orchard Lake. It is for this reason that a thorough knowledge and understanding of their population is important and necessary.

The age class composition of the gizzard shad population has remained relatively constant since the original analysis of the population (Lewis, 1953). The population is comprised primarily of II+ and III+ year class fish with the third largest group being the II+ year class fish. The IV+ class represented less than two percent of the total sample size of gizzard shad.

The coefficients of condition varied greatly from those given by Lewis (1953). Lewis (1953) found the mean K value to be 1.82, whereas, the present study reveals a mean K value of 0.86.

The coefficient of condition of the gizzard shad were greatest from May through September (Fig. 1) and consistently lower from October through April for both sexes (Fig. 1). Differences in K values may be attributed to parasites. The acanthocephalan, *Gracilisentis gracilisentis*, is a highly pathogenic parasite (Jilek, 1979a). The degree of pathology produced by this parasite can be compared to the normal histology of the uninfected gizzard shad intestine (Jilek, 1979b). *Gracilisentis gracilisentis* may be in part or totally responsible for this marked decline in the K values since its seasonal periodicity (Jilek, 1978) coincides with the period of lowest K values.

The coefficient of condition also decreased with increasing age/size of gizzard shad (Figs. 2 & 3). It should also be noted that larger fish are more heavily infected with *G. gracilisentis* (Jilek, 1978). The increased K values for females during May, June and July may be attributed to an increase in gonadal tissue during the spawning season.

The length/weight relationship for the gizzard shad from Crab Orchard Lake provides a reliable fit whereby the age of the fish may be determined (Fig. 4). The length/weight relationship is also consistent with that of Lagler and Van Meter (1951) and Jester and Jensen (1972).

With the exception of the K values it appears that the overall population of gizzard shad in Crab Orchard Lake remains relatively stable. This may be due to the die-offs of millions of gizzard shad each year as postulated by Lewis (1953).

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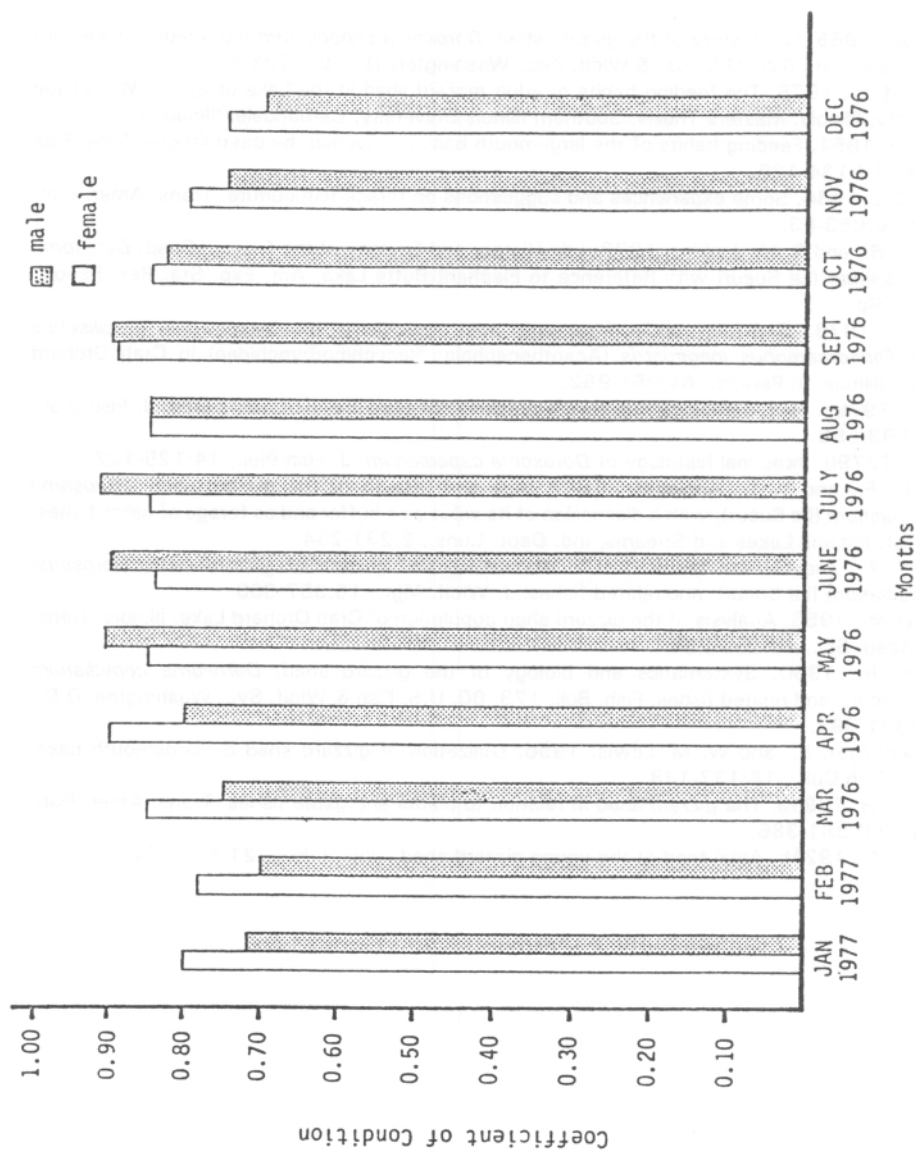


FIGURE 1

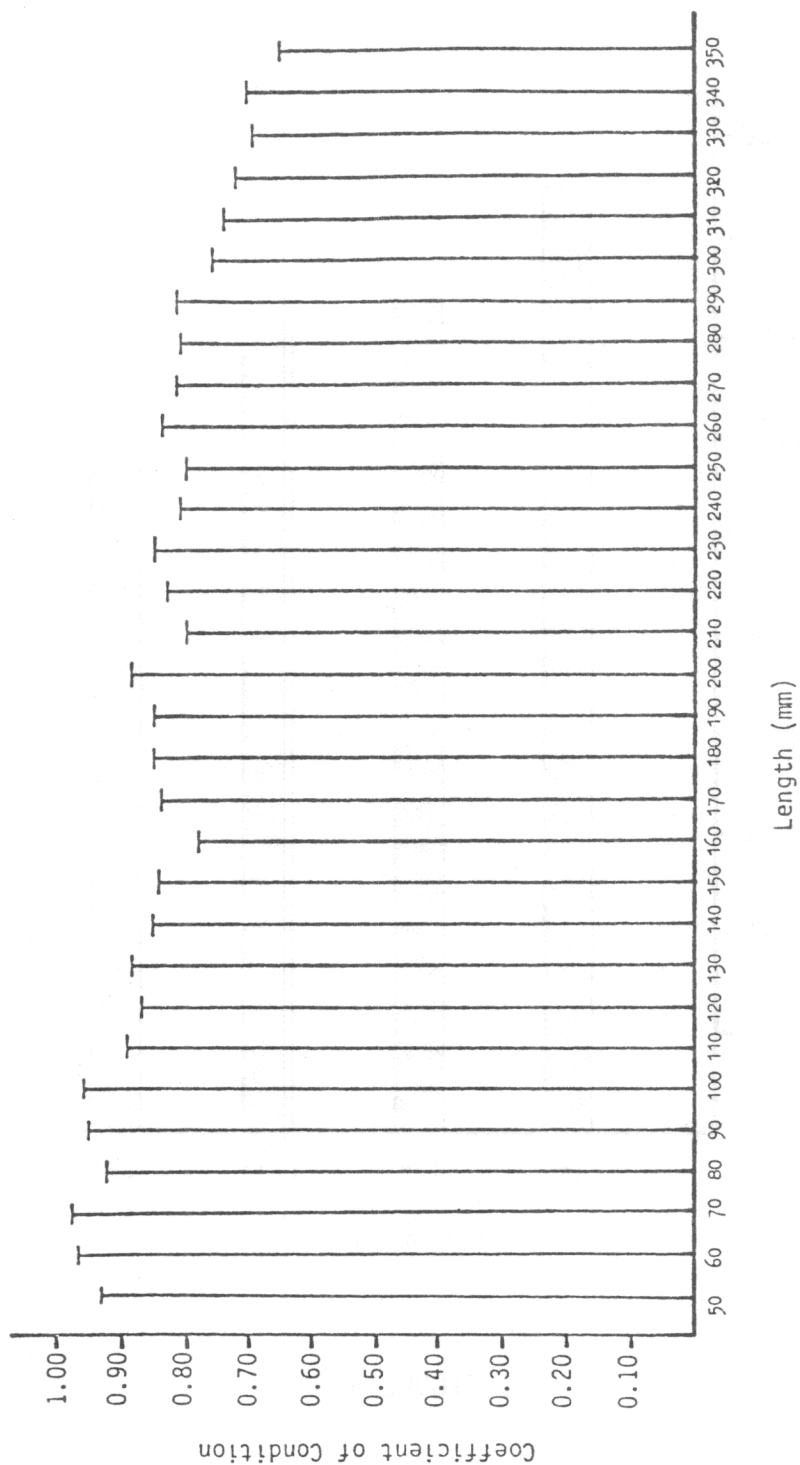


FIGURE 2

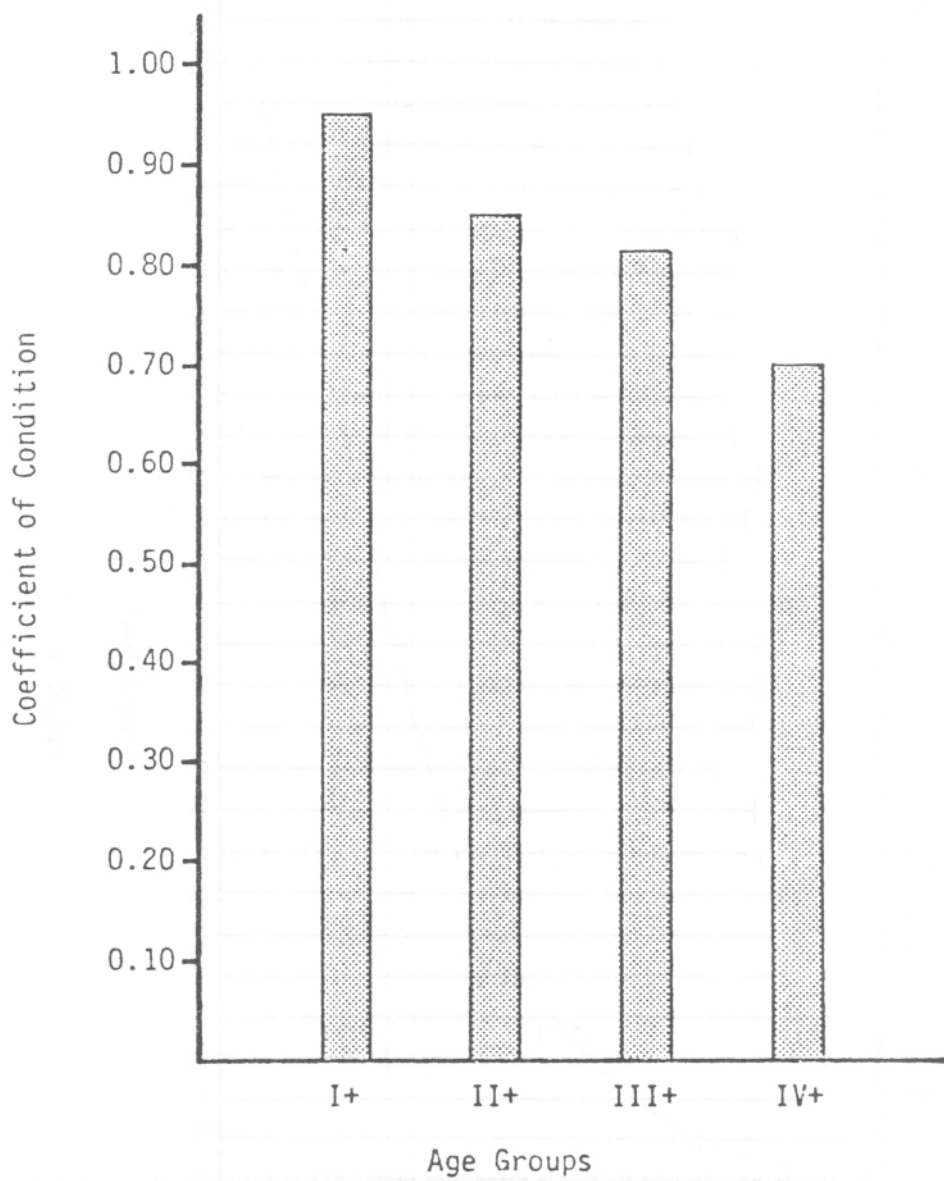


FIGURE 3

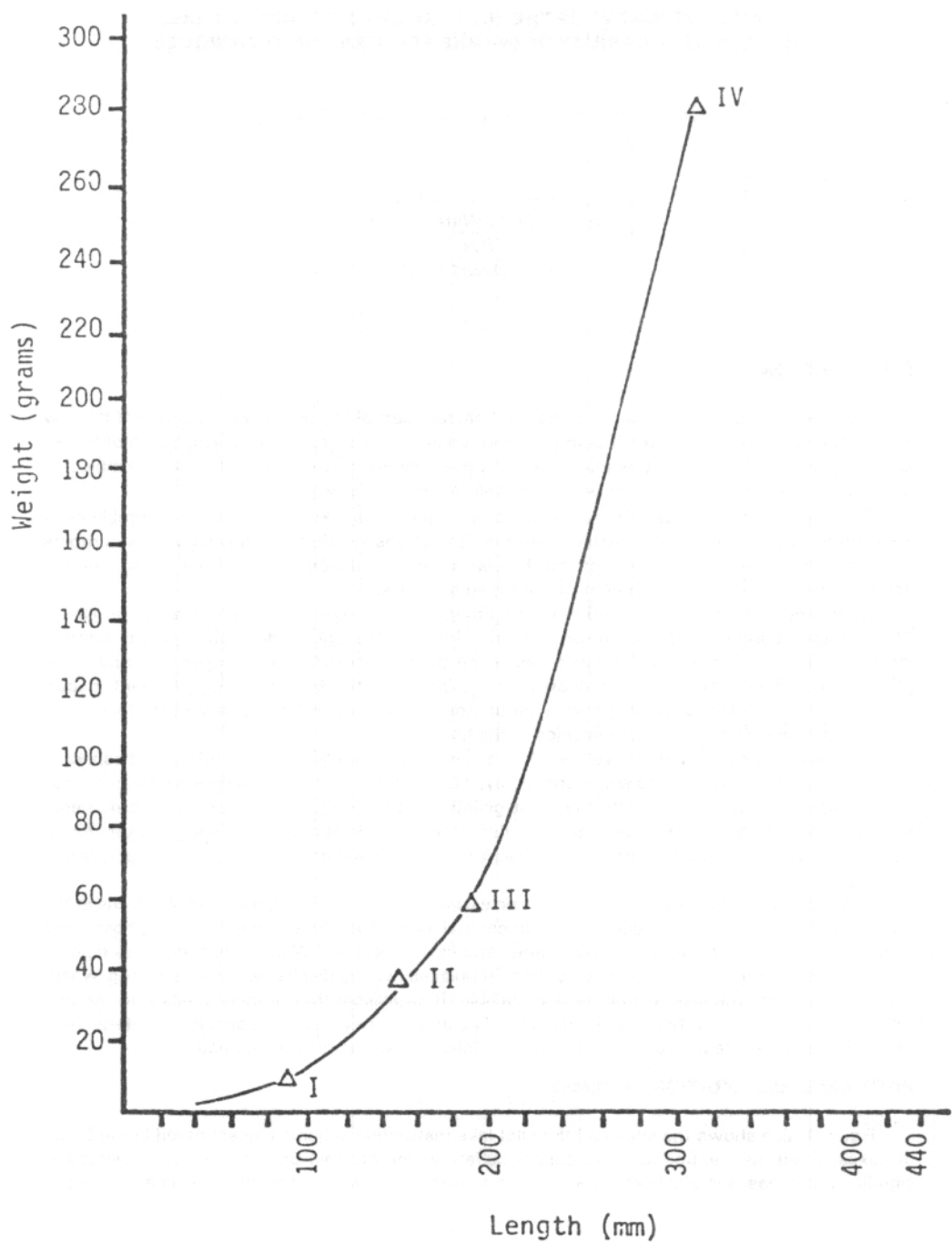


Figure 4.