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## Comparative Growth of Four Species of Fish in Three Different Types of Iowa Artificial Lakes

JAMES MAYHEW<sup>1</sup>

*Abstract:* Growth of four species of fish are compared in three different types of Iowa artificial lakes and reservoirs. The lakes were classified by similarity of physical, chemical, and biological characteristics. Scale samples and total length measurements were obtained from 14,705 fish at 71 impoundments. Largemouth bass, bluegill, black crappie, and white crappie growth was greatest in Group I lakes. Factors influencing differences in growth rate in the three types of impoundments are discussed.

One of the ultimate goals of sport fishery management is to produce fish of harvestable size in the shortest period of time. Slow-growing fish are neither desirable to the angler, nor advantageous to the population structure. Before fishery management can be effective, expectations of maximum and/or minimum growth must be determined. These factors are readily established by comparative growth studies in varying environments.

Since 1944, annual fishery inventories of reproduction and adult fish populations have served as the major tool for management of the sport fishery in Iowa recreational lakes. Limited studies of growth characteristics of major species of fish are an integral segment of these surveys. Approximately 15 scale samples are obtained from representative size groups of each species. Additional scales are also obtained from related projects such as, creel censuses and population eradications. These scales are aged by microprojection and compared for rapidity of growth. Growth is determined by the total length of each individual specimen at a given age rather than mathematical calculation.

This is a comparative study of the growth of largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), and white crappie (*Pomoxis annularis*) in three different types of southern Iowa artificial lakes. Although this is not a complete list of sport fishes in the artificial lakes, these are the most popular and widespread.

Scale samples were collected from 14,705 fish at 71 artificial lakes and reservoirs. The samples were separated into lake classification categories based on similarity of physical, chemical, and

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biological characteristics. Total length was recorded to the nearest 0.1 inch. Mean length was calculated for each age group and recorded in graphical form. Maximum and minimum length for each age group was combined for all three types of lakes and transposed to the graphs.

#### LAKE CLASSIFICATION

*Group I Lakes.* Included in this group is most of the state and county recreational lakes and several municipal water supply reservoirs. The lakes are characterized by woodland protected shorelines and deep narrow basins. Watersheds are relatively stable with privately-owned land within the drainage farmed with approved agricultural conservation practices. Siltation is minimal with excessive turbidity confined to spring runoff.

Thermal and chemical stratification is present throughout summer. Chemical stratification is so severe that dissolved oxygen is wholly absent below depths of 8 to 12 feet.

Fish populations in Group I lakes are rather stable. Fluctuations of population abundance and age structure are infrequent, and when occurring are usually temporary. The most prevalent problems are over-production of bluegill and crappie which results in retarded growth and poor body condition, or in rare cases over-exploitation of predators.

*Group II Lakes.* This group of lakes is classified by having similar unwooded, open shorelines, shallow basins, and numerous mud shoals and small bays. Turbidity varies with individual impoundments, but most of these lakes are subject to long periods of restricted water clarity. Siltation is chronic with mud shoals extending into the lake basin from all water courses. Most of the lakes in this group do not thermally stratify, but may have temporary depletion of dissolved oxygen near the bottom during extended windless periods.

Fish populations in Group II lakes, particularly bluegill, crappie, and bullhead, are rather unstable. One species will dominate the entire population structure, then as natural or angling mortality reduces its magnitude, another abundant year class of the same species or a different species will develop rapidly. Stunting is a common occurrence. Severe retardation of growth and body condition results when two consecutive year classes of the identical species survive in large numbers.

*Group III Lakes.* This group is comprised of municipal water supply reservoirs. These reservoirs are used mainly for commercial water supply with recreation and angling secondary benefits. Success of fish management programs are dependent

upon the compatability of water supply operations and secondary uses.

The reservoirs are characterized by low fertility, rapidly fluctuating water levels, and absence of vegetative growth. Routine and often excessive treatment with copper sulfate for control of filter-clogging algae is common. Several of these impoundments have thermal and chemical stratification depending upon basin shape and wind protection.

Fish populations are characterized by chronic reproductive failure, slow growth, and instability of population structure and abundance.

GROWTH

*Largemouth Bass.* Scale samples and measurements of total length were obtained from 3,536 largemouth bass at 71 lakes. With the exceptions of age groups II and V, mean total length for each age group was greatest in Group I lake (Fig. 1). At

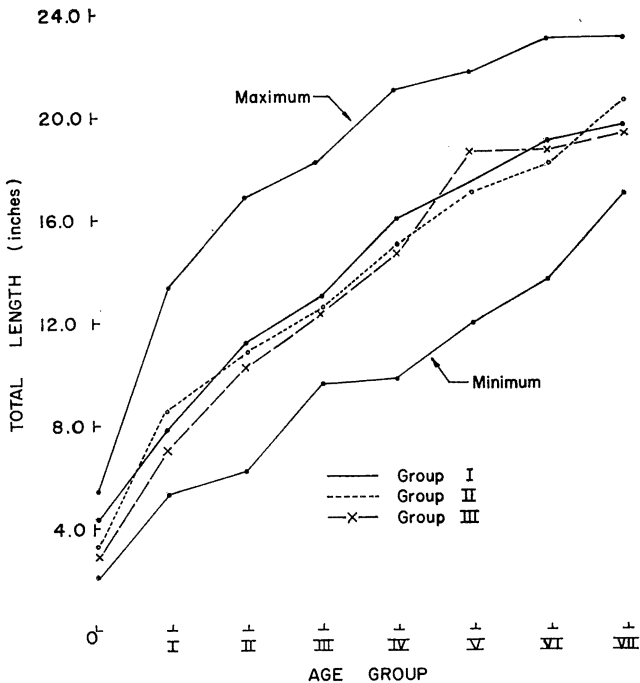


Fig. 1. Growth of largemouth bass in three different types of Iowa artificial lakes.

these ages largemouth bass were slightly longer in Groups II and III lakes. Poorest growth rate was attained in Group III lakes. Mean growth in Group I lakes, based on summations of mean increments, was approximately 4% greater than Group II lakes, and 12% greater than Group III lakes.

*Bluegill.* Growth determinations were based on 5,385 bluegill scale samples and total length measurements. As illustrated by Fig. 2, fish in Group I impoundments were slightly longer at each age group than the other types of lakes. Mean growth rate of fish in Group I and II was approximately the same, whereas growth averaged 12% less in Group III lakes.

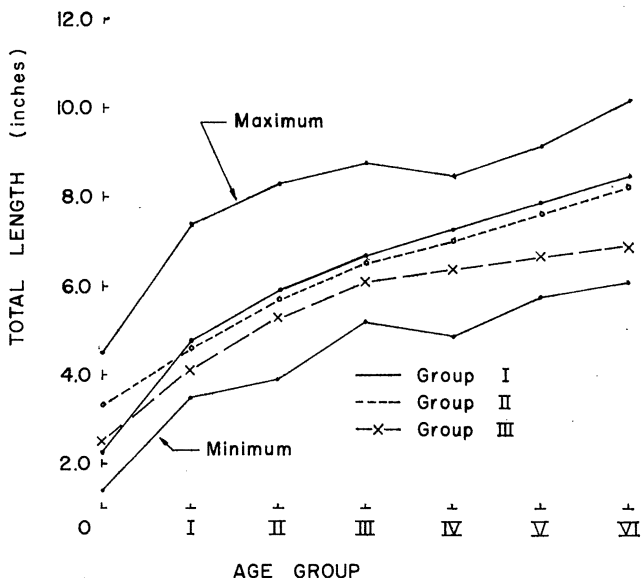


Fig. 2. Growth of bluegill in three different types of Iowa artificial lakes.

*Black Crappie.* Total length measurements and scale samples from 3,358 black crappie at 65 artificial lakes and reservoirs were used in the study. Length at each age group was significantly greater in Group I lakes. Mean rate of growth was approximately the same for Groups II and III. Total length averaged 10% greater in Group I lakes than the other two groups (Fig. 3).

*White Crappie.* Scale samples and total length measurements were taken from 2,426 white crappie at 46 Iowa artificial lakes and reservoirs. As illustrated in Figure 4, growth was best in Group I, followed by Group III and Group II respectively. Mean growth of white crappie in Group I lakes was approximately 25% greater than Group II lakes and 6% greater than Group III impoundments. This is the only species whose growth in Group III exceeded that in Group II.

#### DISCUSSION

There are many factors responsible for growth of fish in one type of impoundment exceeding that in another. Difference in

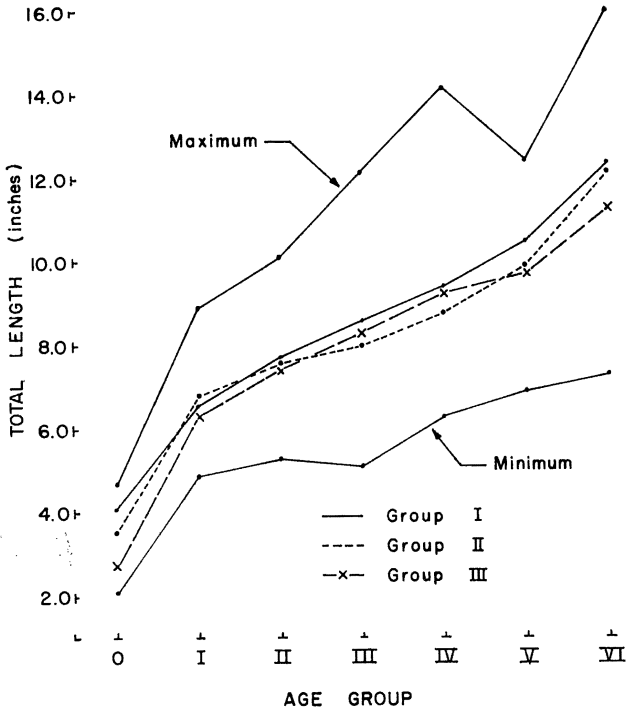


Fig. 3. Growth of black crappie in three different types of Iowa artificial lakes.

environment, such as physical characteristics and chemical composition, is paramount among these. Environmental stress and species suitability are reflected by rate of growth and other life functions.

In this study, lakes were placed in groups according to physical, chemical, and biological characteristics. Growth was consistently greatest in Group I lakes. These lakes are also more stable throughout the year in their physical properties and chemical composition. Changes that occur are usually temporary and minute.

Greatest environmental fluctuations occur in Group III lakes. Growth, with the exception of white crappie was also poorest in this group. All of the lakes in this group are used for municipal or commercial water supply. Water levels fluctuate rapidly. Annual volume of water in individual reservoirs may vary up to 50%. Most of these reservoirs are treated excessively with copper sulfate. Insoluble precipitates deposited on the bottom by these treatments reduce the production of organisms vital to the food chain of small fish. Without a source of bottom organisms and insect larvae entire year classes of fish fail to survive. This

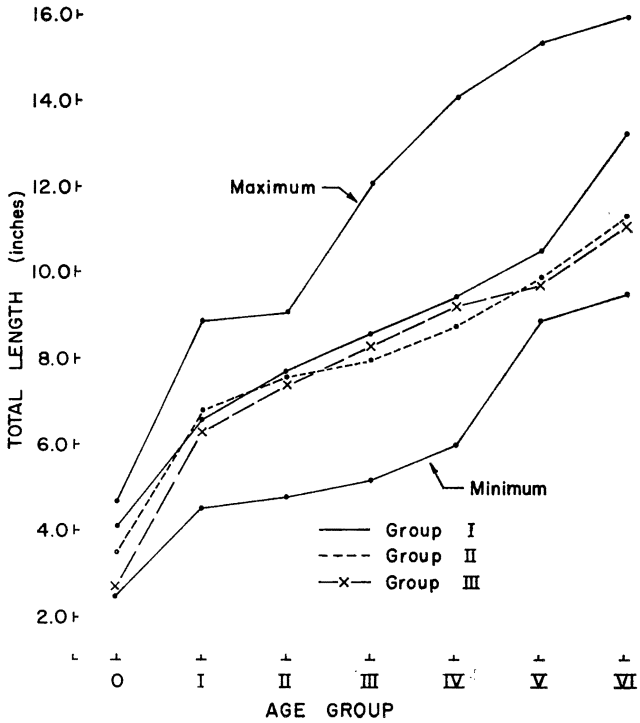


Fig. 4. Growth of white crappie in three different types of Iowa artificial lakes.

reduces the supply of food for larger fishes, particularly large-mouth bass and crappie.

There is virtually no difference in the lateral location of the lakes in this study. Consequently, there is no difference in the length of time for growth. The difference in growth are attributed to environmental factors.