INTRODUCTION

The use of length-frequency indices of fish stocks to evaluate the state of balance or structure of cool water fish populations and communities has been proposed by Anderson (1976). He recommends using the Proportional Stock Density (PSD) index. All that is needed to calculate this index is a definition of minimum lengths for stock- and quality-sized fish and a length-frequency distribution of the stock.

The objectives of this paper are: (1) to examine the validity of using Proportional Stock Density to evaluate the structure of the Escanaba Lake walleye (Stizostedion vitreum vitreum) population over a 27-year period, (2) to analyze the impacts of various parameters on Escanaba Lake walleye PSD's, and (3) to compare PSD's calculated using walleyes sampled by two different methods (fyke net and angling).

STUDY AREA AND METHODS

Escanaba Lake is a 293-acre soft water drainage lake located in north central Wisconsin (latitude 46°04', longitude 89°36') on undeveloped state-owned land in the Northern Highland State Forest. Since 1946, a compulsory complete creel census has been in effect for Escanaba Lake. All anglers are required to obtain a free fishing permit (at the contact station located at the only access point) prior to fishing and to return the permit along with any fish which are caught and kept to the checking station at the completion of their angling trip. Detailed morphological and chemical data for Escanaba Lake are found in Lerns (1982a).

There are at least 24 species of fish in Escanaba Lake (Kempinger et al. 1975). Important species in the sport catch in recent years have included: walleye, northern pike (Esox lucius), muskellunge (Esox masquinonyg), yellow perch (Perca flavescens), rock bass (Ambloplites rupestris), and black crappie (Pomoxis nigromaculatus).

Since 1946, the walleye sport fishery of Escanaba Lake has been unregulated by size, bag, or season restrictions. The lake has received an average annual fishing pressure of 17,400 hours for the period of 1946-82. Annual angler exploitation rates for walleyes averaged 25% from 1953-82 (Kempinger et al. 1975; Lerns, unpubl. data).

Walleyes were captured each spring shortly after ice-out and during spawning from 1956-69 and in 1972, 1974, 1977, and from 1979-82 in 1-inch² mesh fyke nets. Each fish was measured to the nearest 0.1 inch total length, jaw tagged and/or fin clipped, and returned to the lake. All walleyes harvested by anglers during the period of 1956-82 were measured to the nearest 0.1 inch at the contact station.

Proportional Stock Densities (PSD) were calculated for both angler-caught and fyke-netted walleyes for the period of 1956-82 when possible (in some years no spring fyke netting was done) using the formula:

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PSD (\%) = \frac{\text{number} \geq \text{quality size}}{\text{number} \geq \text{stock size}} \times 100
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For walleyes, stock and quality sizes have been defined as 10 and 15 inches, respectively (Anderson and Weithman 1978). The relationship between PSD values and various parameters was investigated by regression analysis.