INTRODUCTION

In recent years fisheries management concerns have increased over the status of smallmouth bass populations in southwestern Wisconsin streams. Many streams in this region enjoyed excellent reputations for smallmouth bass fishing during the 1960s, but by the 1970s smallmouth bass populations in some of these streams had declined substantially (Forbes 1985 and in press). The causes and consequences of these declines are unclear.

Until now, information on smallmouth bass populations in southwestern Wisconsin streams has been collected primarily through studies focusing solely on the smallmouth bass. Knowledge of the current status of populations is based on short-term fish management surveys to assess abundance and size or age structure in a number of streams (Forbes 1985; Kerr, Wis. Dep. Nat. Resour., unpub. data), and a longer-term research study of smallmouth bass population dynamics in two streams (Forbes, in press).

By themselves, single species approaches to complex fisheries management problems may give an incomplete picture of the patterns and processes behind those problems. The current difficulty in assessing the causes behind the undesirable status of smallmouth bass fisheries in southwestern Wisconsin streams appears to provide an example of this (Matthews 1984). The complex web of instream habitat, water quality, land use, and biotic interactions in these streams suggests that we must broaden our approach in order to begin to understand the extent, causes, and consequences of smallmouth bass declines. In this paper we attempt to broaden the approach from the single species concept to a community level analysis (Gauch 1982). Using the existing statewide Fish Distribution Survey database (Fago 1982, 1984, 1985), we examined relationships between southwestern Wisconsin stream fishes and certain environmental factors, and relationships among different species of these fishes.

A community level analysis differs from a population level analysis in that all species present are considered together, rather than individually, and a relatively large number of sampling sites are included, rather than just one or a few. Typically, a community level analysis deals with a limited amount of information (such as presence/absence or relative abundance) about many species at many sites, while a population level analysis deals with a larger amount of information (such as population size, mortality, recruitment, age and size structure, growth, diet, etc.) on a single species at a limited number of sites. Thus, community level and population level analyses are complementary.

There are two main reasons why we chose to examine fish communities, or more accurately, fish assemblages, in southwestern Wisconsin. First, fish assemblages are better indicators of the overall health of aquatic ecosystems than individual fish species or populations (Karr 1981). Data are available on the distribution of all species at many locations in southwestern Wisconsin and on some general environmental characteristics at these locations (Fago 1982, 1985). By using a community level approach to analyze these data, it may be possible to develop insights into the interactions of fishes with their environment and with each other that would not be apparent in studies of individual species. A community level approach may also help to more clearly define the current status of different fish species in the region and help identify factors that are likely to lead to changes in their distribution and abundance.

The second reason we chose to examine fish assemblages and to use a community level approach relates to our interest in smallmouth bass. Population level studies on this species have provided much valuable information (Forbes 1985 and in press), but by themselves cannot explain regionwide patterns in smallmouth bass distribution and abundance. By using a community level approach to identify the typical habitat and associated fishes of the smallmouth bass, and by combining this information with the results of population level studies, we may be better able to understand the observed smallmouth bass declines and to identify the important environmental variables (physical, chemical, and biotic) that must be considered when attempting to restore populations. By identifying an assemblage of species that characteristically associates with the smallmouth bass, a community level approach may help identify indicator species whose presence or absence from a site may reveal the potential of that site to support smallmouth bass.

Our analysis of southwestern Wisconsin fishes focuses on three main questions:

1. Are there well-defined fish assemblages in southwestern Wisconsin? In other words, are there groups of fishes that tend to be found mainly with each other and only rarely with certain other fishes?

2. If they exist, are assemblages found in characteristic habitats (e.g., headwaters, larger rivers, etc.), and is their presence or absence at a site related to specific environmental variables (or groups of variables) such as stream width, depth, substrate, velocity, turbidity, temperature, or agricultural land use in the area?

3. Is there an assemblage of which the smallmouth bass is an important part? If so, what are the characteristics of this assemblage, and in what sort of habitat is it found?