I. INTRODUCTION

A. Perspective

Surveys are important. They (1) document the characteristics of the state's aquatic resources; (2) provide the factual basis for fisheries planning and management; and (3) supply data for other aquatic scientists and managers.

Good survey information becomes increasingly valuable as time passes and conditions change. Data collected by fisheries personnel over many years are essential for defining and understanding historical trends in fisheries and water quality. However, survey data become almost useless if their precision is in doubt, or if they are not recorded accurately or in sufficient detail. Quality control must be maintained for both present and future needs.

B. Survey planning

The problems of modern fisheries management are complex and diverse, and so are the types of information and surveys needed to solve them. Consequently, it is essential that survey objectives be carefully defined before field work begins so that the right data can be collected efficiently. In formulating survey objectives, consider the types of information needed, how precise it must be, limitations of sampling gear, and financial and time constraints. The SURVEY PLANNING form has been developed to aid the planning process.

C. Objectives and description of survey modules

The objective of lake and stream studies is to develop a description of a body of water, its watershed, and the inhabiting biota which will be useful for fisheries management. This description will be developed by the summation of data from several survey modules. The objective of the

individual modules is the description of one facet of either the water body, the watershed, or the biota. Descriptive techniques will obviously vary between lotic and lentic environments, and with size of the water mass. The biota will be characterized as either fish or supporting organisms, with considerably more effort devoted to delineation of the fish population.

It is recognized that seldom will there be occasion to complete a comprehensive study of a body of water, including its watershed and biota, in any one survey. However, it is advantageous to accumulate data in an orderly fashion by the completion of entire survey modules at every opportunity. In time, the summation of modules will thus furnish a complete description of all major waters of the state.

The following survey modules will serve as a guide for the orderly accumulation of data.

1. Drainage and basin description

The objective of this study module is to develop a description of the complete watershed of the subject lake or stream. The description should include the immediate drainage area and the lake or stream basin. Observations in the drainage should delineate characteristics which potentially may affect the subject body of water.

Lake basin descriptions should include shoreline features, bottom types and critical habitat subject to potential human degradation. Critical areas might involve marshes, spawning areas or shoreline areas subject to dredging, filling or erosion.

Stream descriptions will include observations of bottom types, stream profiles, volumes of flow, depths and critical areas subject to abuse and damage.

2. Limnology

The objective of this module is to measure physical and chemical parameters which reflect the biological productivity of the body of water and delineate fish habitat. Properties to be measured include pH, alkalinity, nutrient concentrations, clarity, and temperature-oxygen depth profiles.

3. Plants and invertebrates

The objective of this study module is to describe the biota, other than fish, insofar as they serve as indicators of productivity. The organisms of interest include phytoplankton, macrophytes, zooplankton, and benthos. Seldom do we have the luxury of sufficient time to enumerate abundance of individual species or even to make reliable estimates of community biomass. However, qualitative estimates of abundance often serve as indicators of productivity. Since phytoplankton is usually the most significant constituent of the primary producers, a measure of chlorophyll serves as the most practical measure of primary production. Estimates of both density and range of macrophytes are important not only as indicators of productivity, but also because of their role in fish shelter, spawning substrates, shoreline erosion protection, nutrient absorption, and indicators of general lake quality.

Analyses of zooplankton and benthos are highly desirable whenever they are sampled with a specific goal in mind, such as trout lakes (see VI-A13).

4. Fish surveys

Fish populations are usually studied for one of two reasons:
(a) to describe as completely as possible an unstudied population, or
(b) to evaluate apparent problems or past management programs.

Descriptions of fish communities should be as precise and as complete as possible to facilitate comparisons with past and future data. It is imperative that sampling effort be accurately described and standardized. Data from various fishing gear should be analyzed separately since each has its own built-in bias.

A basic description of the fish community will include (but not be limited to) species present, relative abundance, size frequencies, and if needed, growth rates.

More detailed analyses of fish populations should contain a measure of rates of recruitment, growth, production, and mortality. Additional data might include standing crop population measurements or observations on endangered and threatened species (VI-A11).

5. Fishery assessment

Local reports of fishing quality are worth recording if they are screened rather carefully. These might include reported catch or complaints in addition to estimates of fishing pressure, harvest, value of the fishery, or evaluation of management techniques. An accurate analysis of a fishery, however, requires a well planned and managed creel census. Methods of creel census can be found in VI-A9 and assistance is available at the Institute for Fisheries Research.

D. Forms and information systems

Many of the survey forms have been revised or replaced, and additional changes may yet occur. The main objectives were to require greater precision (e.g., more size intervals in the length-frequency records), simplify the recording of field data and its transfer to final forms, provide reminders and space for the taking of field notes, encourage and aid the analysis of survey results, and get the data into formats adaptable to computerization in the future. Paper files for summary-type forms will continue to be maintained at four locations (Lansing, region, district, Institute for Fisheries Research) even after computerization is completed. Certain types of computations--length-weight regressions, mark-and-recapture estimates, back-calculated growth--can now be submitted on designated forms for machine processing.

All forms are described in Section IV.