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THE ROLE OF RESEARCH IN MINNESOTA FISHERIES MANAGEMENT

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by

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ABSTRACT

The Investigational Report Series, which was initiated in 1938, contains most of the results from fisheries research in Minnesota. To date, 380 reports have been published in 11 major categories which cover most Minnesota fisheries management activities. Creel surveys have had the most extensive reporting followed by resource assessment, procedure and technique development, walleye propagation, walleye stocking, walleye and associated species, lake rehabilitation, salmonid propagation, salmonid stocking, winter rescue of northern pike and investigation of pollution related problems. Current management techniques are discussed in relation to research's role in developing the techniques.

INTRODUCTION

The protection and proper management of Minnesota's aquatic resources has long been the principal responsibility of the Department of Natural Resources' Section of Fisheries. This task is of vital concern to our state's economic health and social well-being. For many years management consisted solely of traditional activities such as walleye stocking or the posting of spawning areas, with little thought given to the need for or evaluation of these activities. Innovative work by the Fisheries Research Unit in the past 20-30 years has become the basis of a more scientific and professional approach to fish management that is finally being acknowledged and promoted. This enlightened outlook has enabled Minnesota fish management to progress far beyond the days when fingerling walleye were stocked by the "can" into nearly every lake and pothole in the state. Management is becoming more efficient and effective, and consequently the angler is now receiving more value for his license dollar.

The contribution of research to Minnesota fish management can be described by the Fisheries Investigational Report Series. Investigational Reports were initiated in 1938 and were considered through 1984. These were compiled by subject matter into 11 categories covering basic Minnesota fisheries management activities. Some titles were included in more than one category because equal emphasis was placed on more than one subject area.

RESULTS

The Section of Fisheries' Research Unit has investigated many areas of concern to fish managers since the 1930's. Virtually all management activities have been examined repeatedly in the 380 Investigational Reports completed since then.

The most frequent activity of Investigational Reports has been the creel census, which includes the actual surveys and those studies which led to the development of current creel census techniques (Table 1). These methods have been refined and expanded into one of management's primary tools and provide the manager essential information about his clientele and their effects on the resource. The quantitative creel census of sport fisheries was begun in 1951 to measure angling pressure and harvest on representative lakes. Moyle and Franklin (1955) described the methods used and results obtained for the early years of census and Schupp (1964) adapted those methods to large lake fisheries. A recent example of the importance of creel census is Thorn's (1984) documentation of the lack of adverse effects of the controversial continuous season on Mississippi River walleye and sauger populations. Creel census techniques are now routinely used by fish managers.

The second most extensively examined category was assessment of the resource. This includes lake survey and population assessment work that provided basic information on the status of a species or the fishery as a whole. This information enables managers to inventory the aquatic resources within their purview and provides them with a scientific basis for management. Through the early 1950's, lake surveys were developed and conducted almost exclusively by research personnel and the first lake survey guide was developed by Fisheries Research. Examples of

Investigational Reports of this type are those by Johnson (1968), Johnson and Johnson (1971) and Schupp (1972). They present comprehensive descriptions of the status and dynamics of some of Minnesota's major naturally reproducing walleye populations plus recommendations concerning potential future management strategies. Strand's (1984) report on identifying spawning areas and seasonal movements of Leech Lake muskellunge typifies assessment work that has far reaching implications for management of muskellunge and other highly valued species.

Another category receiving substantial attention from Research has been the development of procedures and techniques used to collect basic population data. This includes field and statistical comparisons of net types and materials (Scidmore 1955; Scidmore and Scheftel 1957; Bonde 1965; Davis in progress), the development of specialized sampling methods such as pulsed direct current electrofishing gear (Newburg 1973) and a stomach pump for sampling the food of live fish (Seaburg 1957). Considerable research effort has also been devoted to developing many of the procedures for determining fish age and growth. Pioneering work was done in this area by Carlander (1939; 1944), Eddy and Carlander (1940; 1941) and Franklin (1951). More recent work has reexamined and refined some of these assumptions and techniques (Olson 1980).

The walleye is Minnesota's number one fish in terms of management effort, so considerable research effort has been devoted to its propagation. Seventeen Investigational Reports dealt with conditions in and operations of state-owned and cooperative walleye rearing ponds, especially work done by John Dobie in the 1940's and 1950's. Research effort in recent years has refined hatchery techniques to increase egg fertilization rates (Olson 1971) and more effectively coordinate walleye

fry emergence with available natural food (Olson 1974). A new concept that could revolutionize walleye hatchery operations is the subject of Investigational Report Number 373 (Olson 1981). This new technique is the hatching of fish eggs in a moist air or low water environment by means of a compact portable incubator. These incubators will perform the same function as a large, energy-consuming hatching battery requiring more than 100 times as much water. Once operational, this new system could reduce the cost of propagating walleye and other species through more efficient use of equipment and manpower and by eliminating the need for special hatchery buildings used for only a few weeks each year. This equipment is now in commercial production.

Other aspects of walleye management have also been examined and refined by the Research Unit. Walleye fry and fingerling stocking were originally done indiscriminately and were based on the premise that more is better. Research investigations in the late 1950's, early 1960's and 1970's examined walleye fingerling stocking and evaluated survival in subsequent years (Maloney 1956; Johnson 1957; Groebner 1959; Olson and Wesloh 1962; Johnson 1971). These studies led to the development of specific stocking guidelines to fit different management situations and objectives. Other studies have gathered considerable life history data on the walleye and its relationships with other species (Maloney and Johnson 1956; Wesloh and Olson 1962; Dobie 1966; Johnson 1975). These investigations have given new insight into the way lake ecosystems function and are leading to more sophisticated management of fisheries as communities rather than as isolated species.

Another important management activity developed by Fisheries Research is lake rehabilitation. Investigations of chemical reclamation

methods for warmwater and coldwater species began in the 1940's (Dobie and Moyle 1945; Appleget 1949). In the 1950's and 1960's, basic principles were developed regarding water chemistry parameters, target species and concentrations necessary for eradication (Johnson 1954; Scidmore 1955; Johnson 1959; Johnson and Micklus 1965). Studies in the 1970's examined the effects of lake reclamations on the entire lake ecosystem (Bandow 1980) and the selective use of toxicants to achieve partial eradication of some species while leaving others unharmed (Davis 1979). Lake reclamation is now an accepted management tool.

Field managers and hatchery personnel in Minnesota have benefited considerably from research on trout and other salmonids. Thirteen Investigational Reports have dealt with hatchery techniques and procedures, concentrating primarily on diet and treatment of disease (Schumacher 1950; 1953; 1957; Economon 1962; Thorn 1974 and others). Other studies have examined techniques for enhancing reproduction (Anderson 1983) and developing new strains (Scidmore 1966; Anderson and Woods 1979). Several have dealt with trout associations with habitat and habitat improvement (Hale and Jarvenpa 1950; Hale 1966; Hale 1967; Hale 1969; Thorn in progress). Nineteen Investigational Reports have evaluated trout and salmonid stocks in lakes and streams, including forage and predator species introductions. Conclusions and recommendations from many of these reports have been incorporated into The Management of Lakes for Stream Trout and Salmon (Johnson 1978), which has become the definitive manual for managing lakes for salmonids. This report was adapted nearly verbatim in the Lake Management Planning Guide (MNDNR 1982). Scientific management of Lake Superior has only recently become a high priority. Early research included endemic and exotic

species interactions. Contemporary research has provided the necessary evaluation of exotic salmonid introductions (Hassinger 1974; Close and Hassinger 1981; Close et al. 1984) Other studies are in progress assessing juvenile life stage dynamics prior to smoltification to Lake Superior.

The rescue of northern pike from potential winterkill situations is an extensive management practice in Minnesota. Hundreds of thousands of pounds of northern pike are removed and stocked into lakes with low northern pike populations which have adequate conditions for over-winter survival. Research has contributed significantly to the development of this activity. Scidmore (1964) and Groebner (1964) described the potential uses and contributions of rescued fingerling and yearling northern pike and Johnson and Moyle (1969) summarized the procedures. Maloney and Schupp (1977) gave the program needed perspective by proposing guidelines and recommendations for its use. These were incorporated in the Lake Management Planning Guide (MNDNR 1982).

Investigations of pollution problems have been conducted by Fisheries Research since the 1940's, when a study examined the physical and chemical properties of taconite tailings and their effects on Lake Superior fish (Moyle 1947). Other studies have dealt with environmental manipulation and management of enriched lakes. The increasing environmental awareness of the 1970's fostered the water quality and mercury monitoring programs which eventually were placed under the auspices of the Ecological Services Section. Recent concern with acid precipitation has inspired a cooperative venture with the Minnesota PCA to monitor a representative sample of lakes that are potentially vulnerable to acidification.

DISCUSSION

The management of Minnesota's fisheries resources has progressed in the past 30 years with the Research Unit contributing significantly to that progress. For many years, management operated with little or no fish life history information. Virtually nothing was known of the basic biological requirements of the popular fish species. Consequently, management decisions were based on social or political rather than biological considerations. The most infamous example of this shortsighted approach was the importation and enthusiastic distribution of the European carp in Minnesota in the 1880's and 1890's.

The major activity of Minnesota fish managers from the 1890's to the 1960's was indiscriminate fish stocking. Numerous species were often stocked into the same lake with no concern for that lake's suitability for a particular species or its compatibility with other species already present. Stocking was based more on availability of the fish than on actual need as determined by assessment or management plan. One of many examples of this haphazard approach include the stocking of 7,000 winter-rescued yearling northern pike into a single 50 acre lake in the 1960's or the stocking of chinook salmon into Lake Minniebelle, Meeker County, prior to 1942 (Hutchinson Area Fisheries files). Many stockings of largemouth bass fingerlings were made into lakes that already supported substantial or even over-abundant centrarchid populations. These occurrences were almost never evaluated to determine their success, failure or the potential impact on indigenous species. In addition, stocking records were poorly kept or non-existent. Species names were often incomplete or ambiguous with such entries as "sunfish", "pike" and "crappie". Quantities of fish stocked were sometimes so vague as to be

meaningless. For example, from 1909 to 1945, 83 "cans" of walleye were stocked into Lake Washington, Meeker County.

Another activity that consumed considerable management funding and effort was the removal of roughfish by state crews. Ten seining crews, each consisting of 10-20 people, were utilized during the 1940's in southern Minnesota. This was reduced to six crews in the early 1950's. By the late 1960's, these personnel were incorporated into area field stations as the Research Unit began to point out the low return per effort of carp and bullhead removal. Scidmore and Woods (1961) examined the effects of roughfish removal on four southern Minnesota lakes and concluded that it was of no particular benefit to the game fish. These findings have helped fisheries management divert their manpower and resources into more productive endeavors and leave the harvesting of carp and bullhead to commercial operators.

These examples illustrate how far fish management in Minnesota has progressed in the past 20 years, largely due to the influence of the Research Unit. Research has provided the basic tools and knowledge necessary to categorize lakes according to their ecological characteristics and apply scientific principles to their management. At most Area Field Stations, management plans now incorporate principles originally conceived and refined by Research, especially the continuing assessment and evaluation of those management efforts.

This does not imply that the Research Unit's work is completed or that continued effort is no longer necessary. On the contrary, Minnesota's fisheries resources are under increasing pressure because they are the backbone of the tourist industry. Social and political considerations are becoming increasingly difficult to deal with as

angling pressure continues to rise. Fisheries is under the gun to produce more and bigger fish to meet this increasing demand.

Research is currently conducting some 20 different studies that will continue to provide management with new information and techniques to help meet these needs. These studies include warmwater research on species manipulation and interaction, evaluation of potential new predator species, the development of more efficient sampling gear and fish marking techniques, and techniques for culturing a potentially superior strain of muskellunge. Coldwater research studies seek information essential to many aspects of salmonid field ecology and dynamics. These include the evaluation of three different strains of lake trout and the development of lake trout management procedures, the use of Atlantic salmon in inland lakes, evaluation of trout stream habitat and habitat improvement techniques in southeastern Minnesota, assessment of habitat associations and compatibility of anadromous juvenile salmonids in the Lake Superior watershed, and evaluation of special angling regulations as a management tool for brown trout in streams of southeast Minnesota. As long as fishing and tourism remain among Minnesota's most important industries, the Fisheries Research Unit will remain a vital part of the Section of Fisheries' management effort.

Table 1. Section of Fisheries Investigational Reports by 11 major categories.

Category	Number of Investigational Reports	Percent of total
Creel Census	92	24.5
Survey & Assessment	57	15.2
Sampling Methods	35	9.3
Walleye Propagation	17	4.5
Walleye Stocking	8	2.1
Walleye and Associated Species	10	2.7
Lake Rehabilitation	13	3.5
Salmonid Propagation	13	3.5
Salmonid Stocking	17	4.3
Winter Rescue	10	2.7
Pollution Investigation Aquatic Nuisance Control Parasites & Diseases	29	7.7

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