CRITERIA FOR THE SELECTION OF PUBLIC ACCESS SITES ON INLAND LAKES IN MICHIGAN

By

Michael Dale Freed

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Resource Development

1973

ABSTRACT

CRITERIA FOR THE SELECTION OF PUBLIC ACCESS SITES ON INLAND LAKES IN MICHIGAN

By

Michael Dale Freed

The purpose of this study is to develop a criteria system for selection of public access sites for recreational boat launching on the inland lakes of Michigan. Measurement of recreation benefits associated with boating is developed through the use of a ranking system which includes intangible benefits by assigning priorities rather than dollar values.

The methodology used in the study consisted of a complete inventory and mapping of all public access sites in the State as well as coding and filing these records on a suitable data retrieval system. The existing supply is compared to the future demand in each county in Michigan to obtain an index of how many sites are needed by 1980. Criteria for proposed projects, or tests of preferredness, are developed for selecting potential public access sites for acquisition.

A regression analysis was applied to the data to examine which characteristics of a county influenced the amount of boating in that county. A total of 19 variables including resource characteristics

of the county (such as number of inland lakes, total lakes acres, and existing public access sites) and characteristics of the population of the county (such as total population, population density, and disposable income) were run against the total number of boating days in 1968 in each county in Michigan. Six characteristics concerned with inland lakes proved to be important, explaining about 55% of the variance (R^2 = .5448)--"boats" (the number of registered boats in the county), "angler days" (the total number of days or part-days spent fishing in the county each year), "lake acres" (total acres of lake surface in the county), "public campsites" (the number of campsites in the county provided in state parks, state forests, and national forests), "income" (effective buying income per household in the county), and "parking" (total parking capacity at public access sites in the county). These characteristics were then used to select appropriate criteria for acquisition and to prepare a county-by-county ranking priority list of inland lakes where public access sites should be purchased.

The county by county approach was found to be unworkable due to transfer of demand; that is, in some counties, the supply of potential public access sites was inadequate to meet future demand. A planning region approach was then developed from the reorganization of existing county data to the economic planning regions of the state. Planning Region Two consisting of Hillsdale, Jackson and Lenawee counties is used as an example of the application of the criteria.

The major conclusion of the study is that a weighted criteria system can be developed and applied to produce a priority list of lakes for acquisition of public access sites. Recommendations are forwarded for improvement of boating research and for further development of the planning and policies framework of the Waterways Division of the Michigan Department of Natural Resources.

ACKNOWLEDGMENTS

I died for beauty,
But was scarce adjusted in the tomb
When one who died for truth was lain
In an adjoining room.

He questioned softly why I failed?
"For beauty." I replied
"And I for truth, --the two are one;
We brethren are" he said.

And so, as kinsman met a night,
We talked between the rooms,
Until the moss had reached our lips
And covered up our names.

Emily Dickenson

Thanks must therefore be accorded to each professor who stimulated or ignored me as we met and peered across the social distance.

This then, is the state of my art, that men who studied the systems of the real world were to be my guide. These men who guided my inquiry and my academic program deserve very special thanks and gratitude. Dr. Milton Steinmueller, my committee chairman, has been the best model one could want of a dedicated advisor and professor. The members of my committee, Professor Louis F. Twardzik, Chairman of the Department of Park and Recreation Resources, Dr. Keith Hudson, Department of Forestry;

Professor Sanford Farness, School of Urban Planning and Landscape Architecture; Dr. Michael Chubb, Department of Geography, gave their time when they did not have time to spare and helped define the direction of my research.

Other professors have been equally diligent in sharing knowledge, not hiding it away as a secret message. These are men who do not ask to see blood on the hurdle as a badge of achievement, but are willing to accept students as colleagues. I must give them special thanks for the excellence of their ideas and teaching methods. Dr. Georg Borgstrom, Dr. Everett Rogers, Mr. Charles Barr, Dr. Gerhardt Schneider, Dr. Dieter Brunnschweiler, Dr. William Cooper, Dr. Clifford Humphrys, Mr. Paul Risk, and Dr. Raleigh Barlowe.

Graduate students have provided the foil and backdrop for my education. Special thanks must therefore go to Ron Hodgson, Whit McDermutt, Rich Meganck, Steve Gibson, Randy Byrne, Marv Watson, Paul Fiske, Jim Ahl, Bob Dittrick, Bob Pfister, Kerry Joy, Karl Lamb, Bob Vertrees, Ron Kaiser, and Tony Abar.

The people I have worked with in the Michigan Department of Natural Resources all deserve thanks for their help and assistance given freely. Keith Wilson, Director of the Waterways Division has provided the ideal climate for research and programs based on research. His help and support have been immeasurable. Ed Eckart, Bill Colburn, and Gale Jamsen have worked closely on developing and

defining the criteria system. For the many others who helped with this research, I can only say thank you.

The most appreciation and special thanks are reserved for my wife, Tawny, who watched in disbelief as my undergraduate degree, my Master's thesis and the dissertation became a reality. Her patience and understanding through many late hours of study have made this work possible.

The last round of special acknowledgments and thanks for their many years of support must go to my parents who have helped in every way to make education an important focus for my life.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

Environmental quality and the use of natural resources are becoming important issues of national policy. Some of the traditional arguments for the preservation, conservation and development of resources are being questioned in the face of complex ecological problems and competing uses of land, water, and air resources.

Recent developments in Federal policy will have a critical bearing on environmental issues, yet little attention is focused on these administrative areas. The general public is unaware, for the most part, of the far reaching ramifications of "PPBS" and "benefit-cost analysis."

PPBS, the planning-programming-budgeting system of the Federal Government, is an accounting and planning system which reviews public expenditures in terms of broad objectives in order to determine which programs are most effective or efficient in terms of each dollar spent. For example, under the broad objective of national transportation, one of the programs will be the interstate highway system. In a program budget, the output will be compared to the input such that, each mile of interstate will cost "X" dollars. Rather than accounting for tons of concrete or the number of men

employed, a program budget will put these elements together under the function they perform.

"Benefit-cost analysis," on the other hand, is a calculation of dollar costs of each unit or each program compared to the benefits received in dollars. Projects can then be compared on a ratio basis. For each dollar spent, Project A will return two dollars worth of benefits while Project B will return only one and one-half dollars. Benefit-cost is one of the analytical tools which can be used within PPBS. Such analyses have been developed largely for comparing alternative large-scale water resource projects such as dams, reservoirs, and flood control projects.

With increased Federal activity in all phases of natural resource policy, these methods of analysis will be developed and used more widely to decide what uses of our national resources will prevail. Organizations and interested citizens concerned with resource use or misuse must be able to defend their position in terms of the criteria of PPBS and cost-benefit analysis. Most important, measurement of intangibles, nonmarket goods, social values, environmental values, and other such non-dollar considerations must be developed or else decisions at the Federal level will tend to leave these values out of the analysis of natural resource projects and national resource policy.

The Problem

It is the purpose of this study to suggest some alternative methods for measuring intangibles such as recreation benefits and environmental values. A case study of public access sites[1] in Michigan will be presented to emphasize how a criteria system could evolve using a qualitative approach where projects are ranked according to their desirability, but dollar values are not assigned.

Need for the Study in Michigan

As the Federal Government became more deeply involved with PPBS in the Defense Department, and with cost-benefit analysis in water resource developments, the states began to look to program budgeting as a tool for planning and fiscal management. In the California Department of Parks and Recreation, for example, a cost-benefit procedure for budgeting state park acquisition was developed for explanatory purposes.

> In the past, project acquisition recommendations had lacked the element of explainability so that controversy had arisen, not so much over the quality of projects that were selected but, rather, over the question of why certain desirable projects had not been selected.[2]

---

[1] Public access site - a publicly owned property, usually with river or lake frontage, which is developed for the purpose of providing access to the waters of the state.

[2] Alfred Baxter and Associates, Which Parks and Why: A Cost-Benefit Procedure for Budgeting State Park Acquisition (Berkeley, California; Alfred Baxter and Associates, 1966). p. 1.

In Michigan, the Governor requested program evaluation from all departments to aid in fiscal planning at the executive level. Departmental Communication No. 7 to all state departments on August 9, 1970, requested program evaluation for the 1971-72 budget.

> I intend to effectively manage the State's resources to achieve maximum benefits. One way to meet this responsibility is with program evaluation. We have been developing various approaches to evaluation in the program and budget structure. . . . I am hereby announcing a refinement and acceleration of these processes. The 1971-72 budget and each budget thereafter will stress program evaluation as well as the traditional cost estimation for budgeting. [1]

The intent of the program budgeting system is to lay out policy decisions in a logical framework, to quantify the decision-making process wherever possible, and to make explicit all decisions which involve judgment.

When controversy arises, the problem of "explainability" also looms large. The majority of problems involving the public are communication problems which center around how decisions are made and who makes them, as well as why individual projects are chosen. Clear, forthright criteria, as set forth in an analytical program framework, are very useful in explaining programs, priorities, and individual projects to the public. Once the criteria are agreed upon as reasonable and proper, the projects which fall out as most

---

[1] Michigan, Executive Office of the Governor, "Departmental Communication No. 7," Lansing, Michigan, August 19, 1970, p. 1 (in the files of the Michigan State Waterways Commission).

desirable are seen to fit into a total system of planning rather than administrative fiat or unexplained judgment.

The purchase of public access sites on inland lakes in Michigan has often caused considerable controversy among riparian[1] owners on those lakes which were chosen for site acquisition and development. The question of why put a site on "our" lake was often raised. Thus, when the program came under fire, the Governor turned to the explanatory value of the program budgeting system.

On June 25, 1970, Governor William Milliken imposed a ban on purchase of public access sites in Michigan pursuant to a complete statement of program goals and program standards of the Michigan State Waterways Commission.

> No further steps are to be taken by the Waterways Commission toward the acquisition of new property for this program until a complete review and evaluation of program policies has been completed.[2]

He further stipulated that the ban was to be in effect until such time as "criteria" for selection of public access sites in Michigan were approved.

---

[1] riparian - a legal definition used in eastern states referring to the rights of owners of land adjacent to water bodies to certain uses of that water. A broader definition would refer to streamside or lakeside land as riparian land.

[2] News release of a statement by Governor William G. Milliken on June 25, 1970. p. 1 (in the files of the Michigan State Waterways Commission).

> He had instructed the Department of Natural Resources to conduct a review of project criteria prior to further acquisition of properties on inland lakes by the Michigan State Waterways Commission [emphasis supplied].[1]

At the same time, the Office of Planning Services in the Department of Natural Resources was developing a program evaluation procedure for each segment of the Michigan Outdoor Recreation Plan which had to be submitted to the Bureau of Outdoor Recreation in order to qualify the State for Land and Water Conservation Fund monies.[2] These two concomitant events led to the development of the program planning structure in the Waterways Division.

Prior to this time, the Michigan State Waterways Commission had been moving in this direction through its research program, on the one hand, which provided data on recreational boating in Michigan,[3]

---

[1] Ibid.

[2] Michigan, Department of Natural Resources, Office of Planning Services, "Goals, Functions, and Structure of the Recreation System," Michigan Outdoor Recreation Plan, 1970 (Lansing, Michigan Department of Natural Resources, December, 1970). Volume 1, Chapter 4.

[3] Three publications encompass the history of the Waterways Research Program: (1) Michigan, Department of Conservation, Waterways Division, Transportation Predictive Procedures: Recreational Boating and Commercial Shipping. (Lansing, Michigan: State Resource Planning Program, Michigan Department of Commerce, December, 1966), Technical Report No. 9C; (2) James Oakwood and Michael Chubb, Planning Public Recreational Boating Facilities in Michigan. (East Lansing, Michigan: Recreation Research and Planning Unit, Department of Park and Recreation Resources, Michigan State University, February, 1968), Technical Report No. 1. (3) Michael Chubb, Outdoor Recreation Planning in Michigan by a Systems Analysis Approach, Part III, The Practical Application of Program RECSYS and SYMAP. (Lansing, Michigan, State Resource

and the budget structure on the other hand, which required a budget submitted to the office of the Governor organized by program classes.[1]

The broad program framework and the basic criteria for selection of public access sites were submitted to the Governor on September 1, 1970. They were revised after extensive public hearings and accepted by the Governor on January 22, 1971, at which time the moratorium on the purchase of public access sites was lifted. The following generalized criteria are now being used as guidelines for the public access site program (see Appendix 2 for full explanation of each criteria).

1. Magnitude of anticipated use.
2. Feasibility of acquisition.
3. Ecological considerations.
4. Safety and regulation.
5. Increased satisfaction or quality of experience.
6. Interprogram effects.
7. Resource preservation or creation.
8. Cost effectiveness.
9. Secondary benefits.
10. Equitable distribution of facilities.

The criteria were not yet defined in measurable terms. The application of the criteria required definition in a quantitative sense so that potential public access sites could be measured under the criteria and ranked according to their desirability. The basic question is: "Given this amount of money and these criteria, how many public access sites can be purchased and developed; where should

---

Planning Program, Michigan Department of Commerce, 1967), Technical Report No. 12.

[1]Michigan, Executive Office of the Governor Loc. cit.

they be purchased; and which sites should be purchased first"? Development of the criteria necessary to answer these questions is the basic purpose of this study.

CHAPTER II

METHODOLOGY USED IN THE STUDY

The Research Proposal

The study proposed to develop a criteria system for the selection of public access sites in Michigan. Measurement of recreation benefits associated with boating were developed through the use of a ranking system which measured intangible benefits by assigning priorities to lake acquisition rather than dollar values.

Research Methodology

1. A criteria system for proposed projects was developed for ranking public access sites for future acquisition.

2. The criteria system was then weighted according to significant predictors of boating demand which were identified by a regression analysis.

3. The criteria system was applied to data on public access sites in Michigan in order to identify specific sites for future acquisition.

Date Requirements

1. Public access sites in Michigan were inventoried and mapped on a county by county basis. The sites maintained by the Fish Division, Forestry Division, Parks Division, Game Division, and Waterways Division of the Michigan Department of Natural Resources and the U. S. Forest Service were listed on a master list of public access sites. A numbering system was developed to number all of the sites.

2. A public access site inventory was completed by field personnel, stating the pertinent data on each site such as location, parking spaces, acreage, frontage feet, etc. The Lands Division files were compared with each inventory to fill in information on acquisition date, price paid, etc. (See Appendix 4 for a copy of the inventory sheet.) This data was coded on mark-sense forms into appropriate data fields and key punched onto computer cards for data storage. (See Appendix 5 for a copy of the mark-sense form and data fields.)

3. Data on county population, disposable income, registered boats, number of lakes, and other characteristics of the destination county were collected and coded into data fields for key punching. (See Appendix 10 for a copy of County Data Sheets.) A large number of data sources were compiled to quantify the variables for each county. (Data sources are listed with each X variable in Appendix 1.)

Computational Procedures

1. A duplicate tape of the 1968 Boating Demand Study data file from the Michigan Recreational Boating Needs Questionnaire was secured from the Michigan State University Computer Center where similar analyses were being run on the CDC 6500 using the county of origin and socio-economic characteristics of registered boat owners as the areas of inquiry. This study was undertaken by the Recreation Research and Planning Unit, of the Department of Park and Recreation Resources at Michigan State University.

2. The county data was tested against the actual boating days which occurred in each county in 1968, with a linear multiple regression analysis using a least squares stepwise deletion routine. The equation or mathematical model used in the analysis took the following general form:

$$Y = a + b_1 x_1 + b_2 x_2 \ldots + b_n x_n + u$$

Where:

Y = The observed dependent variable to be explained or predicted. (In this case, it is the number of boating days in each destination county.)

$x_1 - x_n$ = The independent variables used to explain or predict Y. (In this case, it is characteristics of the destination county. See Appendix 1).

$b_1 - b_n$ = The coefficient of the $x_1 - x_n$ variables, the slope of the regression line for each of the independent variables.

a = A constant variable, the intersect of the regression line with the y axis.

u = The random error term.

The calculations were run on the Michigan Department of State Highways Burroughs 5500 computer. A BMD-02R-Linear Regression routine as described in "BMD-Biomedical Computer Programs"[1] was used in the analysis.

3. The significant predictors identified in the regression, were used to develop a weighted criteria system for public access site acquisition.

The Hypothesis

The hypothesis of this study is that a criteria system based on the previously described data meets the requirements of the Michigan State Waterways Commission for a public access site selection procedure. And further, that this criteria system will provide a ranking priority list of potential public access sites which does not assign dollar values to the costs and benefits of each site but assigns their priority on the basis of qualitative criteria.

---

[1] W. J. Dixon, ed. BMD-Biomedical Computer Programs, University of California Publications in Automatic Computation No. 2 (Berkeley; Los Angeles: University of California Press, 1968). p. 5.

A subhypothesis of this study is that a relationship exists between the total amount of recreational boating activity taking place in a given county, and specific characteristics of that county (the county of destination). A multiple regression model will be used to test this relationship and identify "significant predictors" of recreational boating. The dependent variable will be the number of boating days which occurred in the county in 1968. The independent variables include resource characteristics of the county (such as number of inland lakes, total lake acreage, and number of public access sites) and characteristics of the population of the destination county (such as total population, population density, and disposable income). A complete list of independent variables is presented in Appendix 1.

Definitions Used in the Study

Boating Day

For the purposes of this study, a boating day will be "each part day spent boating" as defined in the Michigan Recreational Boating Needs Questionnaire.[1] This will be considered synonomous with "boat use-period" as used by Chubb (1967).[2]

---

[1] See Appendix 8 for the Michigan Recreational Boating Needs Questionnaire.

[2] Michael Chubb, Outdoor Recreation Planning in Michigan by a Systems Analysis Approach Part III. The Practical Application of Program RECSYS and SYMAP. Technical Report No. 12 (Lansing, Michigan: State Resource Planning Program, Michigan Dept. of Commerce, 1967). pp. 12 and 285.

Registered Boat

In Michigan, a registered boat is legally defined by the Marine Safety Act of 1967 (Act 303, P. A. 1967)[1] as a "motorboat--any vessel propelled by machinery whether or not machinery is the principal source of propulsion." All motorboats must be registered with the Department of State and assigned a boat registration number. Three propulsion categories are used by the Secretary of State--inboard, outboard, and sailboat. Five length classes are used--under 12 feet, 12-20 feet, 20-30 feet, 30-40 feet, and over 40 feet (see Appendix 9 for a tabulation of registered boats in Michigan as of December 31, 1968).

RECSYS-SYMAP

"RECSYS" is a systems model for recreation planning which uses an origin-destination matrix to simulate and measure the location and amount of recreation activity, in this case recreational boating. Counties are the origin and destination units used in this statewide planning study. "SYMAP" is the synagraphic computer based mapping procedure used to produce maps of the distribution of recreational activity.

---

[1] Michigan, Public Acts of 1967, Act 303 Section 6(c) and Section 31, p. 4.

PPBS:

- a commonly used abbreviation for the Planning-Programming-Budgeting System. A system of functional accounting where costs are assigned to the program under which they accrue. Entire programs can then be projected or forecasted into the future and alternatives examined, rather than examining only objects-of-expenditure or line item budgets. Complete programs can be evaluated rather than separate material costs, labor costs, administrative costs, etc.

Cost-Benefit Analysis:

- a system for measuring project costs against project benefits to obtain an index of economic feasibility.

Public Access Site:

- a publicly owned property, usually with river or lake frontage, which is developed for the purpose of providing access to the waters of the State.

Non-Parametric:

- literally non equal interval. A system of measurement that does not use equal intervals. A ranking or ordinal numbering system such as a priority list or a high school class ranking list.

Limitations and Assumptions

1. Great Lakes and connecting waters boating were included in the analysis but program criteria were derived on the basis of inland lake boating only.

2. Unregistered boats were not considered. This includes canoes and other nonpowered craft as well as craft which are powered but illegally unregistered. An estimated 60,000 unregistered boats exist in Michigan.[1]

3. Boating use was studied at the destination county where it occurs.

4. The criteria were developed for the public access site program of the Waterways Division. Other program classes such as the harbors-of-refuge program and the seasonal marina program were not applicable under these criteria. Recommendations for application of criteria to other programs are forwarded.

5. The criteria were applied to acquisition priorities only. Development of new sites or redevelopment of existing sites will need additional criteria although the criteria may overlap.

---

[1] Ronald Kaiser, "A Study of Multiple Boat Ownership in Michigan" (unpublished Master's Thesis, Department of Park and Recreation Resources, Michigan State University, 1970), p. 52. This is a considerable underestimate since the sample was taken from registered boat owners, thus each of these 60,000 unregistered boats represents a second boat owned by the same person. Second, this estimate does not include illegally unregistered boats, that is, boats which are powered and should be registered.

CHAPTER III

THE STUDY SETTING

Recreational Boating in Michigan

Recreational boating has expanded rapidly in the last two decades. In this country it has developed at a more rapid pace than the traditional recreation activities such as hunting, fishing, and swimming.

The first indicator which can be used to indicate the growth in boating is the number of boats. The long-term trend shows a growth from an estimated 15,000 boats in 1904 to nationwide total or 4,700,000 registered boats in 1968.[1] More recently, the number of recreational boats in the U. S. is estimated to have increased 120 percent between 1950 and 1964.[2]

The Federal Boating Act of 1965 now requires all boats over 10 horsepower to be registered with the State; however, some states

---

[1] U. S., Great Lakes Basin Commission. "Great Lakes Basin Framework Study, Appendix 9, Recreation Navigation." Rough draft of a report by the Recreation Navigation Task Force to the U. S., Great Lakes Basin Commission. December, 1970 (from the files of the Michigan State Waterways Commission).

[2] National Association of Engine and Boat Manufacturers and Outboard Boating Club of America, Boating 1964--A Statistical Report on America's Top Family Sport (New York: National Association of Engine and Boat Manufacturers and Outboard Boating Club of America.

register other recreational watercraft as well, such as sailboats and canoes. In 1968, Michigan had the greatest number of registered watercraft in the nation with 438,000.[1] The growth in boat registrations in Michigan is represented in the following graph. The 3-year registration cycle makes projection of intermediate years difficult (see Figure 1).

Four hundred thirteen thousand of these boats are under 20 feet and about 24,000 under 20 feet--roughly 17 times as many smaller boats. These are the boat sizes which are more easily trailered and hence, launching ramps are the prime consideration in planning for their use. Seventy-eight per cent of all trailered boats fall in the 12-20' class.[2]

Forty-one per cent of all registered boat owners, a surprisingly large number, own more than one boat--about 180,000 multiple boat owners. In addition, the number of unregistered boats is estimated to be 60,000.[3]

---

[1]Michigan, Department of State, "Size and Type of Registered Boats in Michigan Counties," Lansing, Michigan, December, 1968, p. 9. (mimeographed)

[2]Richard A. Meganck, "Recreational Boat Transportation in Michigan: A Study of Use Patterns and Characteristics of Boaters Who Transport Their Boats" (unpublished Masters Thesis, Department of Park and Recreation Resources, Michigan State University, 1971), p. 46.

[3]Ronald Kaiser, "A Study of Multiple Boat Ownership in Michigan" (unpublished Masters Thesis, Department of Park and Recreation Resources, Michigan State University, 1970), p. 51.

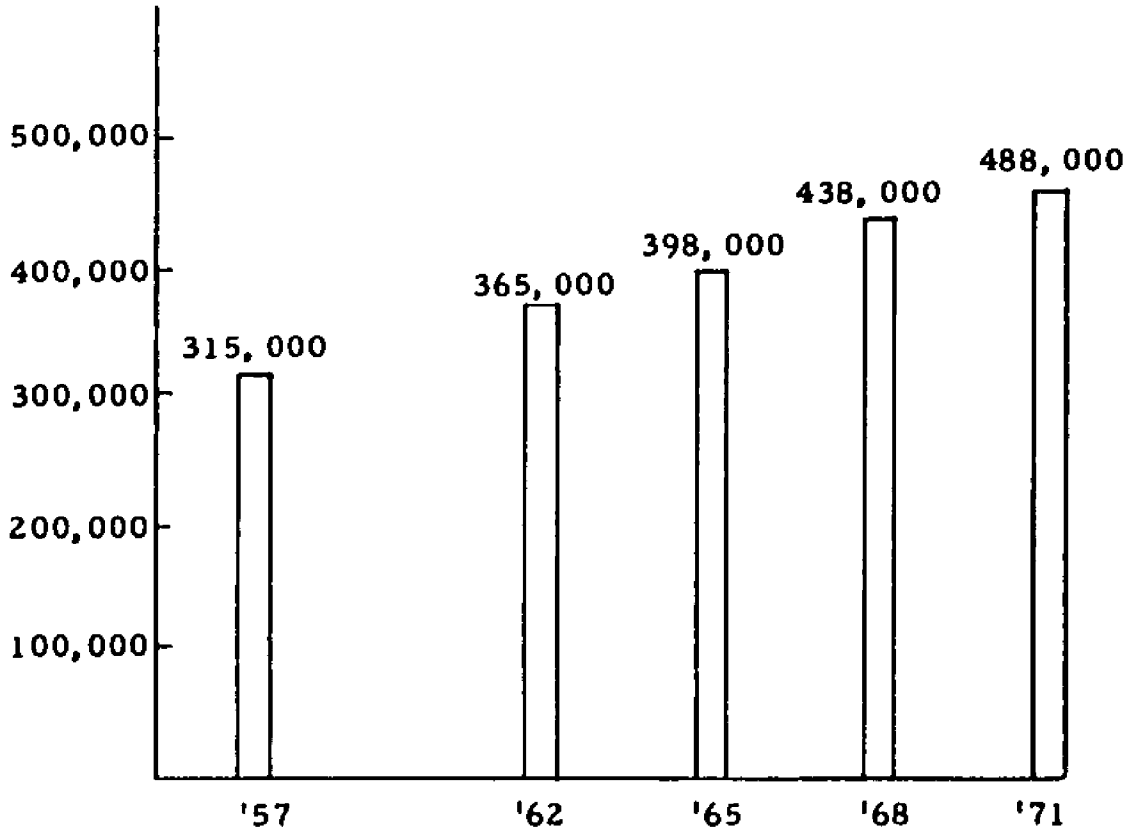


Figure 1.--Michigan Boat Registrations--1957-1971.

Source: Compiled from boat registration data in the files of the Michigan State Waterways Commission.

Another indicator of the increase in boating is the growing number of people who are recreating with boats. In three years, from 1964-1967, the number of the Americans boating increased from 38.5 million to 41 million.[1] In 1970, the Director of the Bureau of Outdoor Recreation, G. Douglas Hofe, Jr., estimated that one out of every four Americans boated--more than 50 million boaters.[2]

A third indicator of the popularity of boating is the wide range of economic and social classes of people who are boating. Forty-three per cent of boat transporters in a 1968 study of Michigan boaters had incomes under $10,000.[3] .The 1966 Michigan Outdoor Recreation Demand Study[4] prepared for the first Michigan Outdoor Recreation Plan (using 1964 data) shows 62.1 per cent of Michigan boaters studied had incomes under $10,000. Kaiser, using 1968 data and different sampling methods, shows 44.6 per cent of the boaters studied had incomes under $10,000; however, the income breakdowns he used are different.[5] The important point to consider is that about 50 per cent is a significant proportion of boaters with incomes less than $10,000.

---

[1] Meganck, op. cit., p. 30.

[2] G. Douglas Hofe, Jr., Address to the National Symposium on Parks, Recreation, and Environmental Design, Chicago, Feb. 15, 1971.

[3] Meganck, loc. cit., p. 30.

[4] Michigan State University, Department of Resource Development, Michigan Outdoor Recreation Demand Study (Lansing, Michigan: State Resource Planning Program, Michigan Department of Commerce, June, 1966). Vol. I and II.

[5] Kaiser, op. cit., p. 28.

Demand and Supply Relationships

The above discussion is illustrative of the growth of participation in boating within the Great Lakes basin. It has expanded rapidly and it is expected to grow even larger by 1980 and 2000. To satisfy the needs of these boaters, planning of facilities and management is important. Adequate projection of the size of the boating fleet in the Great Lakes and its tributaries must be developed to provide needed information on how many facilities are needed and where they must be built.

This is especially difficult because of the transfer of demand for boating. People do not boat solely where they live. Boat trailers and vacation mobility make recreation planning difficult. Fifty-five per cent of Michigan boat owners, for example, transported their boats in 1968. Seventy-five per cent of these used a boat trailer and 25 per cent used cartop boats.[1] It is this time-distance factor of boating use at varying distances from major centers of population that causes transfer of demand. Water resources are not always where the people are. The demand for boating in 1980 could be handled much more easily if we could tell the boater where he must boat in the region, but in fact, we must supply facilities where the boater needs them.

---

[1] Meganck, op. cit., p. 54.

Studies indicate that most boaters do not travel more than one hour from home for day-use boating. The problem is providing recreation opportunities where people need them, not where they are just available. In this respect, the emphasis on recreation planning has changed from providing the most facilities at the least cost to providing the most recreation at the least cost. This change in attitude forces planners to make better cost-benefit decisions and therefore serve the boater better.

Peak load is another difficult problem. Extremely heavy use occurs on holiday weekends during the summer. Memorial Day, the Fourth of July, and Labor Day are heaviest use periods or peak-load periods. During the summer, three-day weekends and normal two-day weekends generate the majority of use at marinas and public access sites. At some locations, an estimated 75 per cent of use occurs during weekends while weekday use is very light. If future increases in boating participation could be spread to the weekdays, the present facilities would be better able to handle boating demand.

Looking ahead to the future, how do we then meet this upsurge in boating demand and its associated problems? The question is how to plan recreational boating facilities for 1980 and 2000.

First, a detailed assessment of present recreation facilities and the supply of recreation opportunities is necessary. Second, an analysis of the components of boating participation is needed. These components must be extrapolated into the future to get an estimate

of future boating demand. In other words, we must find out what factors cause increases in recreational boating participation, such as the increased accessibility of water, population growth, increased disposable income, improved transportation, or increased leisure time. These factors can be looked at separately to see whether they will increase in the future in a manner similar to the past.

Third, we must compare the present supply of facilities with the expected future demand to give an understanding of probable needs in the coming 10-year and 30-year period (1980 and 2000). From these comparisons, we can develop a coordinated program to fulfill these needs by developing the potential supply while accounting for the problems of boating participation transfer, peak use, and changes in boating characteristics.

The Access Problem

In spite of the fact that Michigan has the largest number of registered boats in the Nation, as well as a copious supply of water based recreation resources, the problem for the boater is how to get to the water. The privilege of using water resources in states with a riparian doctrine of water rights requires that the user obtain ownership to the land which borders the water. Although the waters of the state are a public resource, the land bordering the waters is often in private ownership. To obtain "access" to the water is to trespass on private land. Therefore, the first and foremost

requirement of a Public Access Site Program is to purchase public property on bodies of water in the state or to use existing publicly owned property such as state forests and state parks.

The second part of the "access problem" is development. Once suitable land is in ownership bordering suitable bodies of water, the public may use that land to launch boats onto the water. In the past, a gravel road to the lake and a small load of gravel spread at the water's edge would suffice for the boater to launch his small fishing or hunting boat. But as boating use increased, two problems became apparent. First, the larger, trailered boat with outboard or inboard motors became common. Launching ramps were needed to allow proper launching of these larger, heavier boats and parking lots were needed to prevent destruction of the site. Second, the lakes received more boaters with more different recreation needs so user conflicts and overcrowding appeared. Fishermen objected to high powered motor boats; water skiers endangered scuba divers; litter, noise and garbage of the boaters offended the property owners around the lake. These and a long list of other conflicts created the "access problem."

Because of this growing demand for boating and the associated boating problems, the Waterways Division was directed by the State Legislature in 1968 to pull together all responsibility for boating from the several agencies who supplied "access" of one form or another - the Game Division, the Parks Division, The Forestry Division, and the Fish Division. The Public Access Site Program

was created as an amalgamation of previous programs--Public Fishing Sites, Public Hunting Sites, State Park Boat Launching Sites, State Forest Campground Sites, etc.

Since most registered boats use outboard or inboard motors, the Federal Highway Gas Tax was investigated as a source of funds. When the Waterways Commission was first established in 1947 to develop recreational boating facilities in the state, 1/2 per cent of the Gas Tax monies were allocated to boating. The State Legislature raised the allocation to 1 1/2 per cent in 1968 and transferred additional functions to the Waterways Division, the major responsibility being the Public Access Site Program.

To plan for future boating needs to 1980 and 2000 the unusual characteristics of the supply must be examined. The ownership of public riparian land is the important factor, not just the supply of water surface.

Criteria for selection of these public access sites must therefore evolve through a research and planning framework which considers both the unusual characteristics of the supply and the growing demand for these recreational boating facilities. The methodology in this study required an inventory of all existing sites and a quantification of criteria for priorities of acquisition for new sites.

CHAPTER IV

EXPERIMENTAL APPLICATION OF TECHNIQUES

Data Collection and Analysis

The first phase in the development of the criteria system for public access sites was the Public Access Site Inventory. Initially, the data sources and indeed the administration of public access sites were spread across several agencies. A complete field inventory of all public access sites in the regional and division files was carried out by the field personnel in each region. Some of these inventory sheets are still coming into the Waterways Division office as an old site is rediscovered or a legal description is cleared up. In many cases, the filing system of the region and the division differed. The assigned numbers were different, the sites were not on both lists, or the description and the survey were not complete. A filing system and a master list of public access site with new assigned numbers and complete descriptions were prepared to correlate all separate files from the three regional offices or from other Divisions. The master list was then coded for developed and undeveloped sites; river, lake or Great Lakes sites; and finally by administration, whether it was a

Waterways Division, Parks Division, Forestry Division, or Game Division Site.

The information on each field inventory was coded and key punched onto cards. Future comparisons and analysis of the raw data can now be readily accomplished using the remote terminal for the state computer system. Each site was color coded by administrative agency and plotted on county maps. All sites were then remapped and renumbered onto a complete set of county maps after legal descriptions and titles, transfers, acreages, etc. had been checked as completely as possible through Lands Division. These steps had together produced a filing system for public access sites, a master list of sites and a set of county maps of all sites. From this data, a map of all the public access sites in Michigan (see Figure 2) was prepared along with a county by county statistical summary.

In visual format and in data format the Waterways Division could begin to piece together the patterns of development, and where priorites had been. For the first time, the state-wide situation could be examined in total. One thousand three hundred public access sites existed in Michigan, 968 were administered by the Waterways Division, 84 were in state parks, 131 in state forests and 194 in state game areas. There were an additional 41 sites in national forests. More important, the sites were available on one map to assess the balance and expression of previous policy. Generally, the policy could be summarized as purchasing the most sites for the money. This

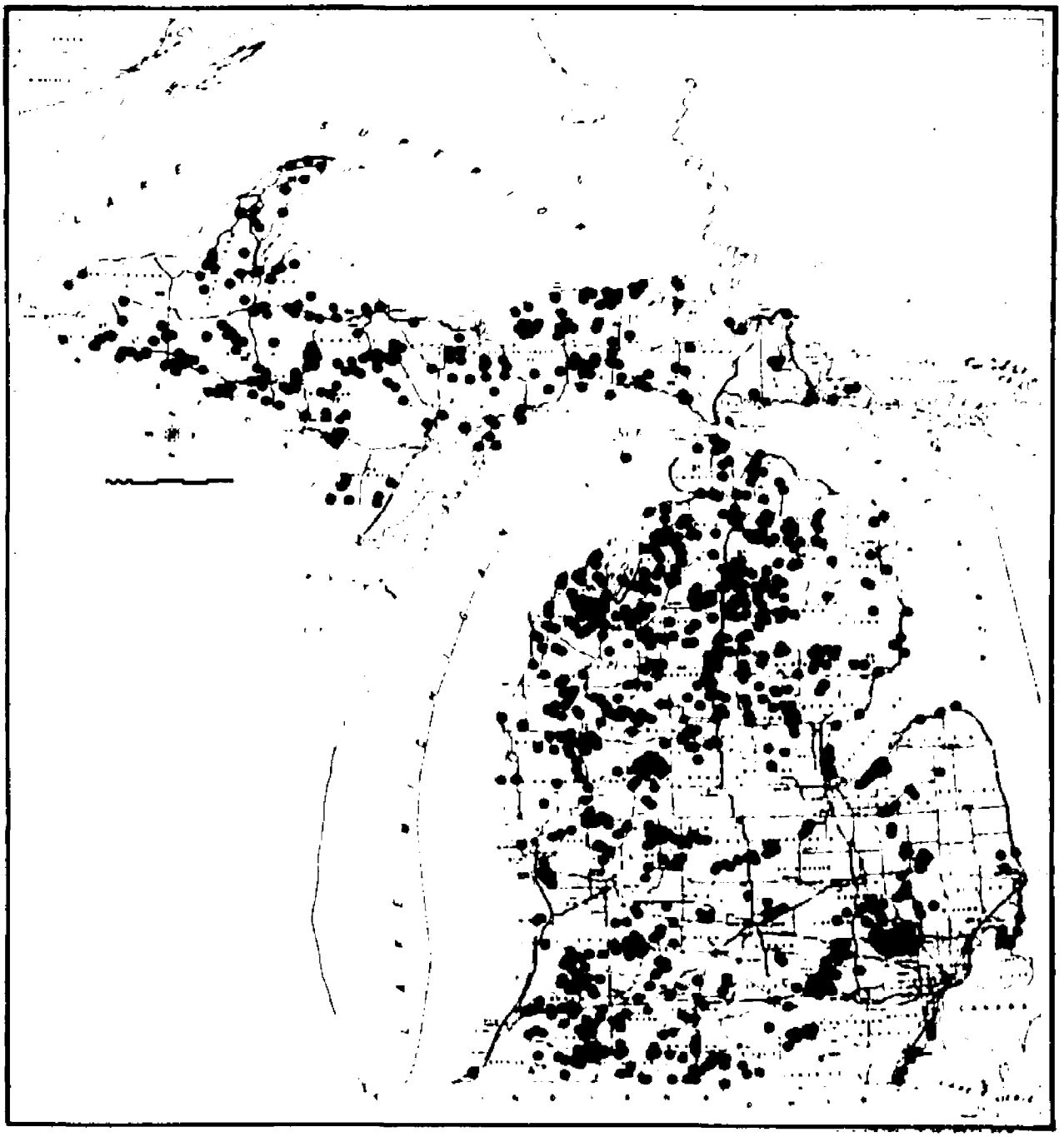


Figure 2.--Public Access Sites in Michigan

Source: Compiled by the Waterways Division from the public access site inventory.

meant a greater proportion of sites in northern Michigan and the Upper Peninsula, away from development and high land prices.

Comparing this distribution to the boating demand situation pointed up the disparity between supply and demand. The boating demand was high in Southern Michigan, the number of public access sites was high in Northern Michigan.[1] A new policy was in order based on purchasing the most boating use for the money. This entailed a cost effectiveness logic. For example, even though land prices were two or three times higher in Southern Michigan, seven or eight times as many boaters could be served.

The Public Access Site Inventory, then, was the first phase in analysis of the supply characteristics--what facilities were available and what natural resources were important. To complete this picture, a study of the total resource potential was needed. The 1965 Lake Inventory,[2] for example, produced a statistical summary of the number of lakes and lake areas by size class in Michigan. This data was refined by concentrating on all lakes over 100 acres. A list of these individual lakes with name and acreage was prepared for each

---

[1] Most of the older sites did not have a wide variation in capacity thus a map of the site distribution will give a general impression of the site capacity. Newer sites, especially those in southern Michigan near urban areas, have a larger parking capacity. A new map which plots capacity statewide should be developed.

[2] Michigan, Department of Conservation, Recreation Resource Planning Division, "Michigan Lake Inventory." (Unpublished computer tabulations from 1965 survey)

county from "Lakes and Ponds in Michigan" by C. R. Humphrys.[1] These lakes were then ranked by size in each county (see Appendix 12). Of the approximately 7,600 lakes in Michigan over five acres, about 1,000 are over 100 acres and conversely about 100 are over 1,000 acres. These 1,000 lakes are a basic resource for future boating potential. The criteria system for selecting lakes required the compilation of this master list of all lakes over 100 acres to produce a final list of eligible lakes.(see Figure 3).

Another consideration for future planning is the separation of all the public access sites into great lake, river, and inland lake sites. This has not been accomplished to date. Base maps of Michigan with these resources plotted on three separate maps at the same scale were not available in the Department of Natural Resources; however, the Great Lakes Basin Commission had completed a set of maps for the great lakes drainage which included all of Michigan. These three-color maps were printed with separate negatives for rivers, great lakes, and inland lakes. The negatives were obtained and reproduced onto mylar segments. These segments must be fitted together and photographically reproduced onto one large mylar sheet for each base map to complete this phase of the project. Then ozalid or blueprint copies can be run from the master. When these three sets of maps are completed at the same scale, overlays of river,

---

[1] C. R. Humphrys Lakes and Ponds in Michigan (East Lansing, Michigan: Department of Resource Development, 1965).

great lakes and inland lake public access sites can be mapped for separate program criteria and separate program planning for each of these differing resources.

Another phase of study involved the Great Lakes boating facilities. The Waterways Division contracted with the Recreation Research and Planning Unit at Michigan State University to carry out a field inventory of Great Lakes marinas. From this inventory, the necessary data was available to develop a listing of marinas on the Great Lakes, a data summary of broadside mooring, slip mooring and total mooring capacity by county, and finally a map of recreational harbors in Michigan with total mooring capacity.

The next major segment or phase was the public access site program statement. These steps were, of course, not happening sequentially but rather concurrently as the study progressed. The program statement for public access sites was brought about by the moratorium on acquisition from the Governor's office. Prior to this time, the Waterways Division had been meeting with the Bureau of the Budget to establish program guidelines for submission of budgets to the Executive Office. The moratorium on acquisition put this effort into high gear since the requirement for ending the moratorium was a complete statement of program priorities and program criteria. Eight program criteria were first submitted and public hearings on these criteria were held at several locations around the State. From the public hearing recommendations and suggestions, two more

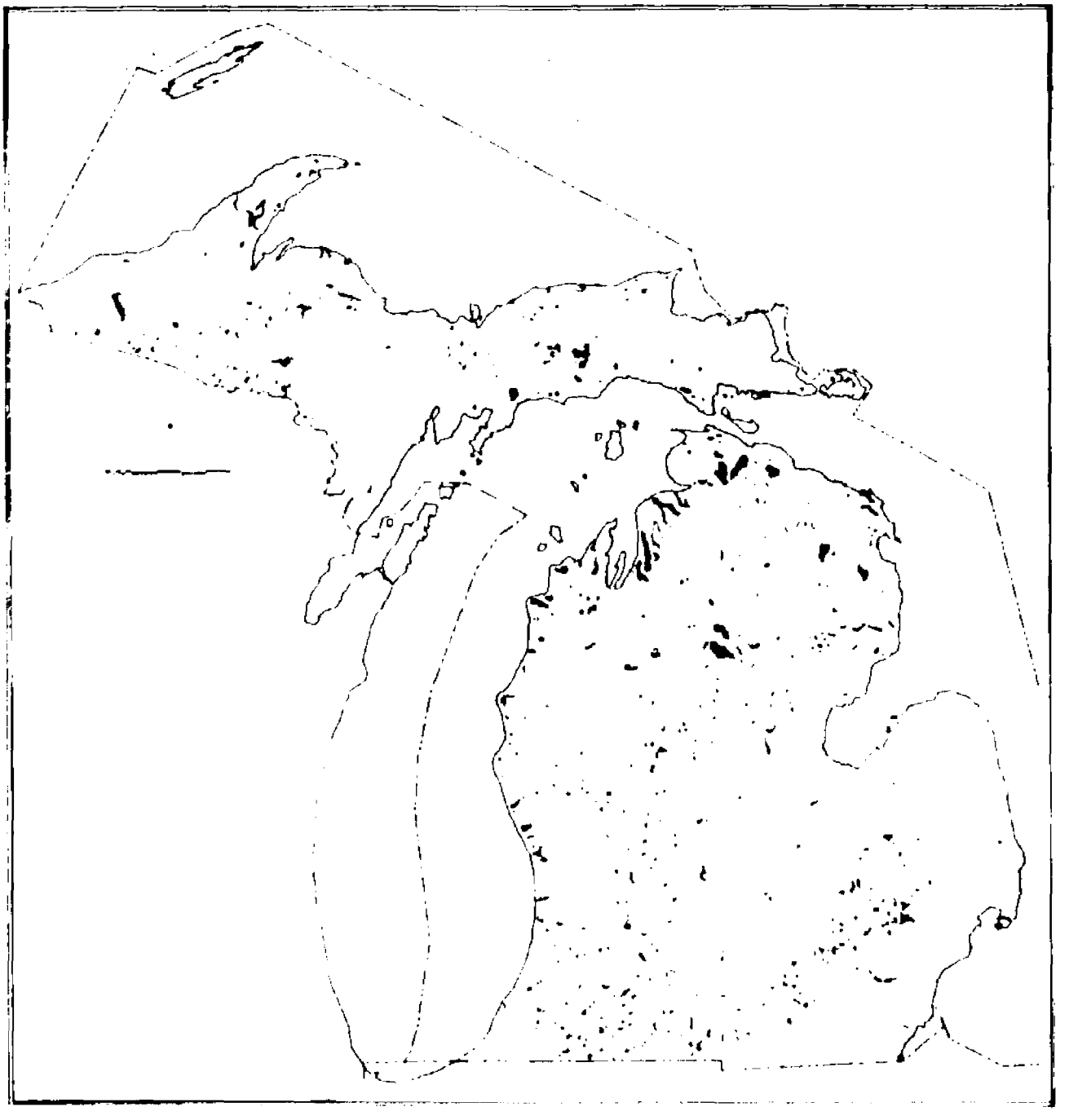


Figure 3.--Michigan's Larger Inland Lakes

Source: Adapted from base maps used in the Office of Planning Services, Michigan Outdoor Recreation Plan 1970, Vol. 1, chap. 4.

criteria were added. This policy framework of ten program criteria for acquisition and development of public access sites were forwarded to the Waterways Commission for approval and then to the Governor's Office. On the basis of these program criteria, the moratorium was lifted. The need remained, however, to operationalize these criteria into a framework that could help us decide which lakes were to be selected for public access sites, and where the boating capacity should be increased.

A very important and very large phase in the study was basically a theoretical model consideration, to examine the 1968 and 1980 boating demand data which came from a long series of boating studies going back to the 1964 Michigan Outdoor Recreation Demand Study.[1] In 1966, the Waterways Division contracted with Arthur D. Little, Inc., consultant, for a forecast of the recreational boating fleet by 1980 using aggregate demand to forecast fleet size.[2] Oakwood and Chubb criticized this planning methodology in a special report[3] and consequently the systems analysis approach using RECSYS-SYMAP was developed.[4] The systems analysis approach has been repeated three times in studies of boating use in Michigan; the exploratory

---

[1] Michigan State University, Department of Resource Development, loc. cit.

[2] Michigan, Department of Conservation, Waterways Division loc. cit.

[3] Oakwood and Chubb, loc. cit.

[4] Chubb, loc. cit.

study used 1965 data, a restudy used 1968 data and the third study currently in progress uses 1971 data. This series of studies produced the 1968 and 1980 Boating Demand maps which permitted investigation of patterns of boating use in the state. This is basically an origin-destination model which uses an attraction index at the destination to pull people out of the origin where they live, along specified transportation links to their boating destination. The population of the origin counties, along with other demand factors such as leisure, income, and mobility, are then projected to 1980. The estimated number of boating days produced by the origin counties in 1980 are rationed out to the destination counties on the basis of the attraction index of each destination county and the expected transportation improvements by 1980.

One important research concept to be forwarded in this thesis is that the location of boating use should be the focus for statewide planning. The following map (Figure 4) from the RECSYS-SYMAP method illustrates not only how many boating days occur in Michigan, but also where they occur, in what counties and around what resources.

This type of information is very necessary for planning future boating programs. Projections to 1980 for example, must take into account the general shift to Great Lakes boating. The important focus however, should not rest solely on statewide projections. The county by county format of the RECSYS-SYMAP model is necessary to break up the generalized demand model into discrete location units.

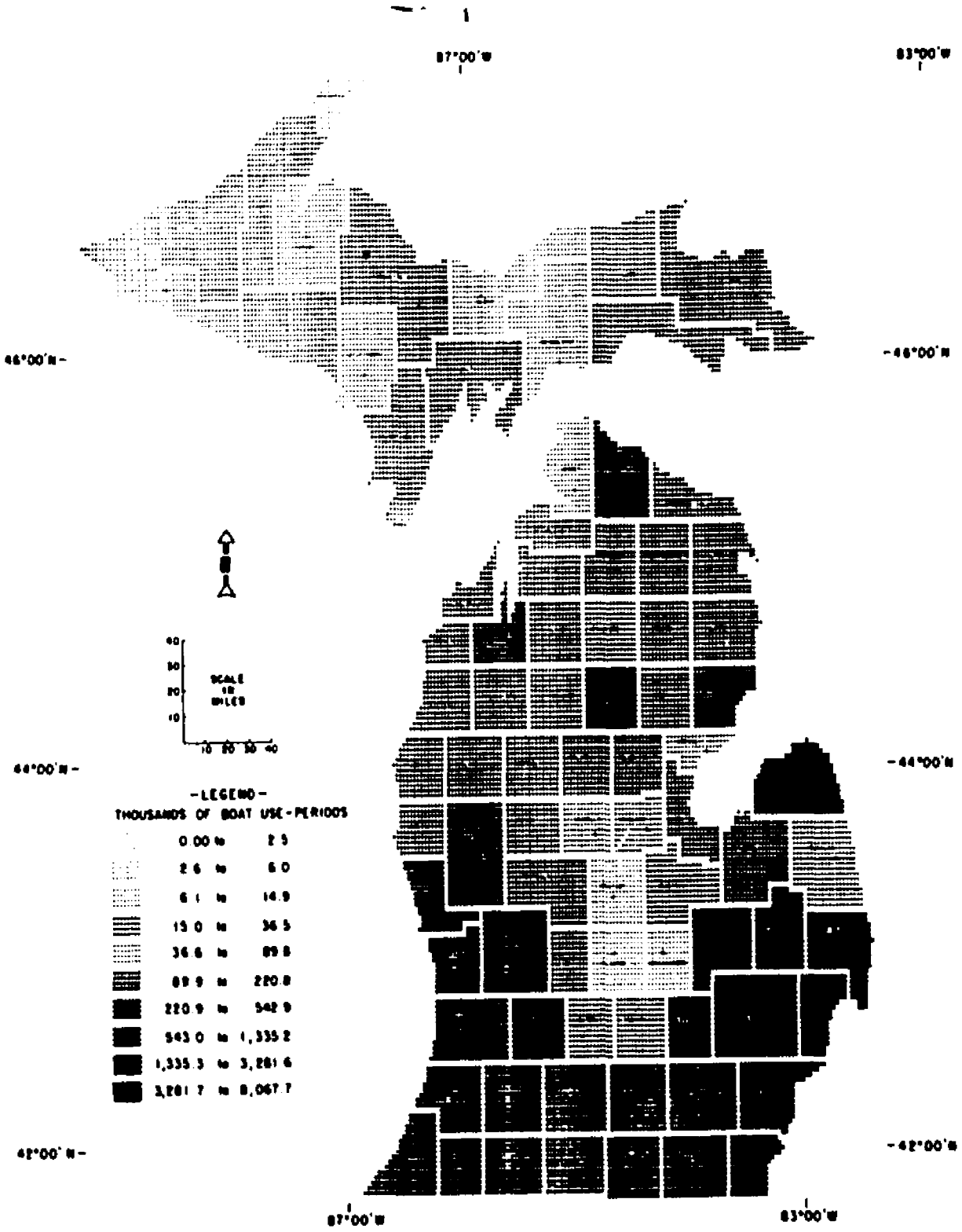


Figure 4.--Estimated 1965 Boating Days by County in Michigan

Source: Michael Chubb, Outdoor Recreation Planning in Michigan by a Systems Analysis Approach, p. 193.

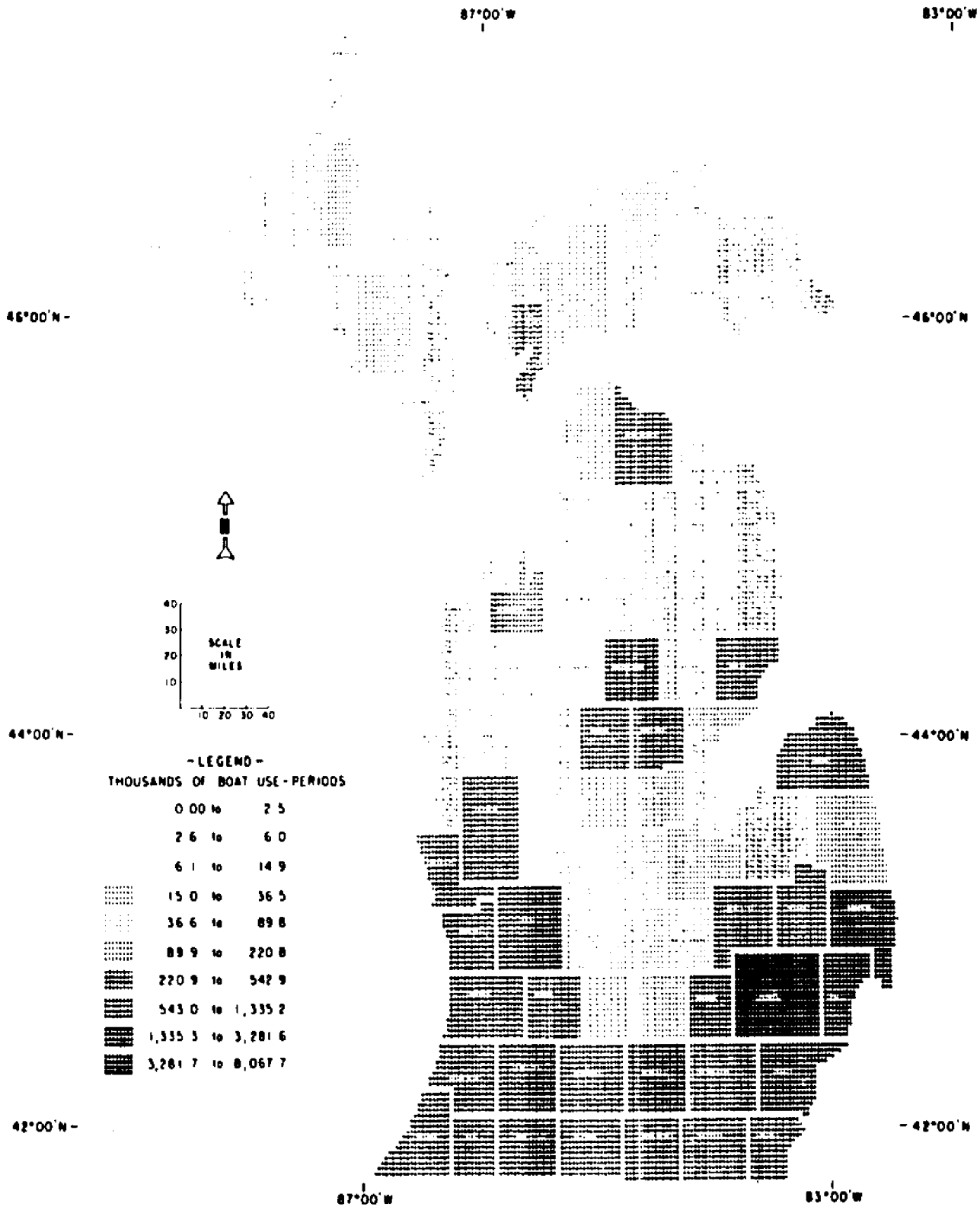


Figure 5.--Estimated 1980 Boating Days by County in Michigan

Source: Michael Chubb, Outdoor Recreation Planning in Michigan by a Systems Analysis Approach, p. 236.

A study of Michigan boaters at the origin county is presently being undertaken by Paul R. Fiske, a doctoral candidate in the Department of Resource Development at Michigan State University. He comments that

> while some progress has been made in estimating the level of use made of these watercraft within the state, very little is known about regional variation in participation by boat owners. [1]

His study therefore, investigates the socio-economic characteristics of the origin county population in relation to the amount of boating participation.

> The influence of socio-economic characteristics of boat owners, physical resource proximity, population density of counties, and distances of counties from major population centers will be considered as factors affecting recreational boating activity. A linear regression model will be developed for estimating the amount of boat use generated by specific origin regions in the state. [2]

The information about the characteristics of boaters at the origin county is very important to projections of boating to 1980. The characteristics of the destination county, however, are equally important. In spite of its significant contributions to the theory and methodology of recreation planning, the RECSYS-SYMAP model has several problems in actual application. One of the major areas where improvement is needed is the attraction index used in the 1980

---

[1] Paul R. Fiske, "An Analysis of Interregional Variation in Recreational Boating in Michigan" (unpublished study plan, Department of Resource Development, Michigan State University, 1972), p. 1.

[2] Ibid.

simulation to draw boaters from their origins to the county of destination. (See Table 1 - Attraction Index Calculation Form.) Chubb plainly acknowledges this problem in his discussion of the early runs of the model.

> It became clear that it would not be possible to undertake an extensive side investigation into the various aspects of boating attraction. Instead it was decided to proceed as Ellis suggests and an intuitive approach was used to develop crude indices which were then refined and adjusted during the fine tuning of the model . . .
>
> The twelve characteristics were selected on a purely intuitive basis and hence no attempt will be made to justify either their selection or the scoring systems used. Without quantitative information on the preferences and behavior of boaters in relation to such phenomena, arguments for or against specific aspects of this method are of little value. It was used as a 'stop gap' measure in order to make it possible to proceed with the test of the RECSYS SYMAP technique. Once adequate data is available on preferences and observed behavior, this intuitive type of attraction index estimation can be replaced with a method firmly based on fact. [1]

The refinement of the RECSYS model then, requires improved origin data for projections of <u>how many</u> boaters by 1980, and improved destination data for projections of <u>where</u> boating will occur by 1980. This is the crux of the RECSYS-SYMAP approach. This format provides information in four very critical areas where other boating studies do not provide data.

1. First, it shows the amount of boating activity which actually occurred in Michigan in 1968. This is hard

---

[1] Chubb, <u>op. cit.</u> pp. 158 and 162.

Table 1--Attraction Index Calculation Form

Characteristics	Scoring Schedule	Max. Score	Score
1. Average size of lakes	Small-under 25 acres = 0 Medium-25 to 99 acres = 10 Large-100 to 499 acres = 20 V. large-over 500 acres = 30	30	
2. Bonus for very large lakes	For each lake over 2,500 acres (Class 12 and over) score 5	25	
3. Per cent of lakes with good road access	25% = 10 : 50% = 20 75% = 25 : 100% = 30	30	
4. Per cent of lakes with public access sites	25% = 5 : 50% = 7 75% = 10 :	10	
5. Major town or city on shore of Great Lakes or very good lake	One = 5 : Two or three = 10 Three or four = 15	15	
6. Shoreline giving access to Great Lakes	Score 10 if county has Great Lakes shoreline	10	
7. Great Lakes harbor	Score 10 for each harbor	10	
8. Major river through county	Score 10 for each major river	10	
9. State park on Great Lakes or major river	Score 5 for each park	20	

Table 1--Continued

Characteristics	Scoring Schedule	Max. Score	Score
10. Fishing Quality	Generally good = 10 Very good = 20 Excellent = 30	30	
11. Special scenic attraction	Excellent = 5 Superb = 10	10	
12. General pollution of waters	Mild = minus 10 Serious = minus 20 V. bad = minus 30	-30	
	Total	--	

Source: Michael Chubb, Outdoor Recreation Planning in Michigan by a Systems Analysis Approach. p. 193.

quantitative data based on data from the 6,800 registered boat owners who responded to the 1968 survey.

2. Second, it shows the location of boating activity. Not only how much boating, but where it occurred in Michigan.
3. Third, it provides predictions into the future (1980) about where boating activity can be expected to occur.
4. Fourth, the origin-destination framework of the study is especially critical because the population growth, disposable income, and the number of registered boats in Wayne County will affect future boating in Oakland County, Macomb County, and even Cheboygan County, for example.

The RECSYS-SYMAP approach provides the basic data on boating activity from which the criteria will evolve. However, it must be remembered that the RECSYS values for probable future boating participation are crude estimates based on imperfect data. The task is to use this quantative data as the basis for the criteria system for future acquisition.

The Regression Analysis

The attraction index was considered to be one of the important areas where additional research was needed. The attraction index had previously been run on an intuitive scoring basis. Information on characteristics of the destination county and the resource characteristics which attract boaters needed quantification. Therefore, with

the information from the Public Access Site Inventory and with a wide range of additional information on the destination county, a regression analysis was planned to pin point important characteristics. Time-distance figures for each county to the nearest major population center were taken from the new systems model developed by the Highway Department. The 1970 Michigan Recreation Plan provided data on public and private campsites. The advance report of the census provided population and seasonal housing estimates. A sports fishing survey then in progress by the Research and Development Division provided inland lake angler days in preliminary tabulation form. County water resource data sheets provided Great Lakes frontage and miles of streams. The Public Access Site Inventory, the Great Lakes Marina Inventory and the 1965 Lake Inventory provided the number of public access sites, the parking capacity of public access sites, the total mooring capacity, the number of inland lakes and lake acres by county.

In total, 19 variables were run against 1968 Boating Days in each county using a least squares stepwise deletion routine. The characteristics which were identified in the analysis as probably being most closely related to the number of boating days were, in order of their importance, the number of registered boats in the county (1), the number of angler days (2), the total number of acres of lake surface (3), the number of public campsites (4), the disposable income of the

and

Number of additional spaces needed by 1980 = (1980 Parking) - (1968 Parking)

This measure of demand, the "magnitude of anticipated use," was then compared to the supply criteria--"resource preservation and creation." The policy guidelines approved by the Waterways Commission provide the following standards for application of this criteria:

Table 2--Standards for Parking Capacity by Size of Lake [a]

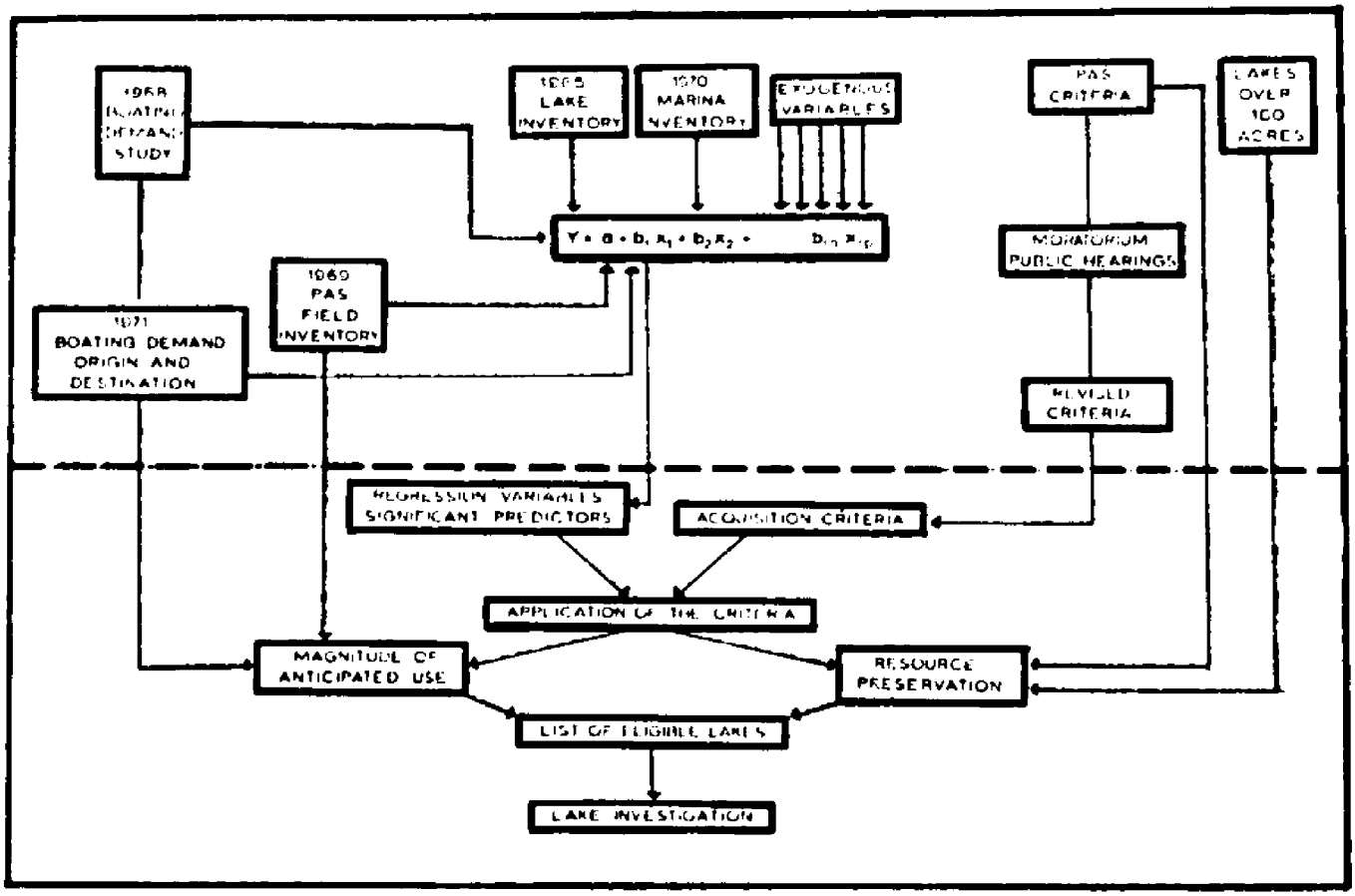
Lake Size in Acres	Number of Access Sites Allowed on Lake	Parking Capacity Allowed at Each Access Site
Under 159	1	10
160-249	1	15
250-399	1	35
400-599	1	75
600-999	1	100
1,000-10,000	2	100
Over 10,000	3	100

[a] Source: "Program Statement of the Public Access Site Program" (Mimeographed report in the files of the Waterways Division).

Each lake in the county is assigned the number of additional sites and parking that it can accommodate. Starting at the top of the lake list, the highest ranking lakes are selected first until the demand to 1980 has been filled. These lakes are then submitted to the field lake investigation team. If no suitable property can be found or if the

lake is removed from consideration by the legislature, it can be replaced by lakes further down the list provided that they supply the required capacity; that is, a lake of 600-999 acres will need two lakes to replace it--one of 400-599 acres and one of 250-399 acres. Two 400-599 acre lakes could also be substituted with one maintained at less than full capacity.

The criteria system that evolved from the demand and supply studies described in the previous pages has as its immediate product a list of eligible lakes. The on-going program, the field investigation, and the land buying process will modify this list of eligible lakes, but the basic framework based on the research studies should remain relatively stable. The planning process for this study has been summarized in the following flow chart which pulls together the basic steps involved (see Figure 6). The chart has been artificially divided into a top and bottom half--the top representing the data collection phases--the bottom representing the data analysis and application of the criteria. Across the top, the basic data sources and inventories are labeled. On the bottom, the two criteria "magnitude of anticipated use" and "resource preservation and creation" come together in the application phase which matches the demand in the planning region with the supply of lakes in each size class. The list of eligible lakes for acquisition is the end product of the application of these criteria.



Figures 6.--Flow Chart of Steps in Data Analysis and Criteria Application

Table 3--Steps in Data Collection and Analysis

Step Number	Task or Event in the Progression of the Study
1	Public Access Site Inventory
2	Filing system for public access sites
3	Master list of sites
4	Set of county maps of all sites
5	Map of all public access sites in Michigan
6	Data summary by county
7	Lakes by size class in each county
8	List of all lakes over 100 acres by name and by county
9	Great Lakes, river and inland lake base maps
10	Field inventory of marinas
11	Data summary of moorage by county
12	Map of recreational harbors
13	Governor's moratorium and public hearings on acquisition of public access sites
14	Public Access Site Program Statement
15	1968 Boating Demand Study
16	1968 and 1980 boating demand maps
17	Regression analysis of destination county characteristics
18	Selection of the program criteria for acquisition a. Magnitude of anticipated use b. Resource preservation and creation
19	Demand correlated with supply in each county (Parking spaces needed by 1980 correlated with the number of lakes in each size class by county)
20	Demand correlated with supply in each planning region
21	High priority lakes selected for field investigation

CHAPTER V

RESULTS AND LIMITATIONS OF EXPERIMENTAL APPLICATIONS

Analysis of the Results

The first run of the regression model indicated the basic factors of importance in the destination counties to be (1) mooring (the total number of public and private boat wells in the county), (2) angler days (the total number of days of inland fishing spent in each county in 1970),[1] (3) the number of seasonal homes in the county (as defined by the Census 1970 *Advance Report Series HC*), and (4) the total acres of lake surface in the county (from the 1965 lake inventory). These four factors together have a multiple coefficient of determination (R^2) of .8558; that is, they explain 85 per cent of the variance of boating days among counties in Michigan (see Table 4).

The first run of the model identified the basic factors of importance but several refinements were necessary. First, the overwhelming importance of mooring may have been masking the effect of other significant though less important variables so a new analysis eliminating mooring was run.

---

[1]Coho salmon fishing studies were not complete at the time of the first run. As the data on Coho fishing becomes available, it will be key punched into the file and run on future regressions.

Table 4--Summary Table BMD-02R Stepwise Regression

Step Number	Variable[a] Entered	Removed	Multiple[b] R	RSQ	Increase[b] in RSQ	F Value to Enter[b] or Remove	Number of Independent Variables Included
1	Moor	15	0.7204	0.5190	0.5190	87.4129	1
2	Ang Dy	11	0.9129	0.8333	0.3143	150.8106	2
3	Homes	10	0.9215	0.8491	0.0158	8.2613	3
4	Acres	2	0.9251	0.8558	0.0067	3.6131	4
5	Income	7	0.9283	0.8617	0.0059	3.2890	5
6	Pu Cmp	13	0.9298	0.8645	0.0028	1.5760	6
7	Park	4	0.9315	0.8676	0.0031	1.7775	7
8	400 K	17	0.9325	0.8695	0.0019	1.0657	8
9	Pr Cmp	14	0.9337	0.8718	0.0023	1.3034	9
10	PAS	3	0.9347	0.8736	0.0018	1.0413	10
11	100 K	16	0.9355	0.8752	0.0016	0.9138	11
12	Pop/Bo	12	0.9367	0.8773	0.0021	1.1986	12
13	Pop	6	0.9383	0.8805	0.0032	1.8217	13
14	Lakes	1	0.9389	0.8815	0.0011	0.6075	14
15	Stream	9	0.9398	0.8832	0.0017	0.9713	15
16	Boats	5	0.9401	0.8837	0.0005	0.2970	16
17	1000 K	18	0.9402	0.8840	0.0002	0.1265	17

[a]Variables used in regression are described in Appendix 1.

[b]Dixon, W. J., ed. BMD - Biomedical Computer Program, p. 5 and Snedecor, G. W., Statistical Methods, p. 132 - explains the use of R^2 and F values in determining the effect of independent variables on the dependent variables.

Since mooring data is entirely associated with Great Lakes boating, it points up the need for separation of Great Lakes boating and inland lake boating which is not presently available for destination counties in the 1968 Boating Demand Study. A much clearer picture of boating determinants will result if separate regressions can be run for inland and Great Lakes boating.

Second, the correlation matrix identified several independent variables which were inter-correlated. A basic assumption necessary to multiple regression is that the X variables are independent of each other; they cannot be highly inter-correlated or the R^2 value will be inflated. Each independent variable explains part of the variance and they are added up to explain a larger portion of the variance; in this case, the four major variables explain 85 per cent. If they are inter-correlated they are explaining the same variance twice, thus inflating the multiple coefficient of determination. To correct this, these variables were entered separately in future runs.

Third, the covariance matrix had several overflow fields; the numbers were too large to fit into the capacity of the computer to print the matrix. To correct this, the larger variables were divided by 100 and reset in the equation as transformed variables (T variables).

The second and third runs of the regression without mooring, and again without mooring and angler days, produced the following

results.[1] "Boats" (the number of registered boats in the country) "public campsites" (the number of campsites in the county at state parks, state forests, national forests, etc.) "lake acres," and "income" (effective buying income per household in the county as reported by Sales Management Magazine) were the four most important variables producing a coefficient of multiple determination (R^2) of .5448 to explain about 55 per cent of the variance. In summary, the variables which have been identified in the several regressions as "significant predictors" of boating demand in the destination counties are as follows:

1. Mooring facilities
2. Number of registered boats
3. Number of angler days
4. Number of seasonal homes
5. Acres of lake surface
6. Number of public campsites
7. Disposable income
8. Parking spaces at public access sites (This variable was always the next to enter the equation although it accounted for a very small amount of the variance.)

---

[1] A fourth and fifth run at the model using transformed variables, different groups of variables and a completely different regression routine (BASIS: STEPR Pages 9-21 in Burroughs Advanced Statistical Inquiry System) produced similar results to those described here for the BMD 02R Routine.

The next question is the relevance of the important regression variables to inland lake public access sites which are under investigation. Mooring facilities will not enter the criteria for this program evaluation although they will be considered for other programs such as evaluation of Harbors-of-Refuge and the Great Lakes Launching Ramp Programs. Seasonal homes will not be considered because they are private facilities. The assumption underlying the 1980 demand projection is that the public to private ratio will remain the same as it was in 1968.[1] This leaves registered boats, angler days, lake acres, public campsites, disposable income, and parking spaces at public access sites as relevant variables to compare to the public access site criteria.

Just as some of the regression variables do not apply to inland lakes, so not all of the public access site criteria apply to acquisition. Some of the criteria apply to design and development of the site, not to the selection process for acquisition. Of the ten criteria, six of them are applicable to acquisition. The following diagram lists the six important regression variables and the six acquisition criteria. The lines indicate which regression variable most fully applies to each criteria (see Figure 7).

---

[1] Public access site use studies are presently being formulated in specific counties to determine the per cent of public access boating versus private boating.

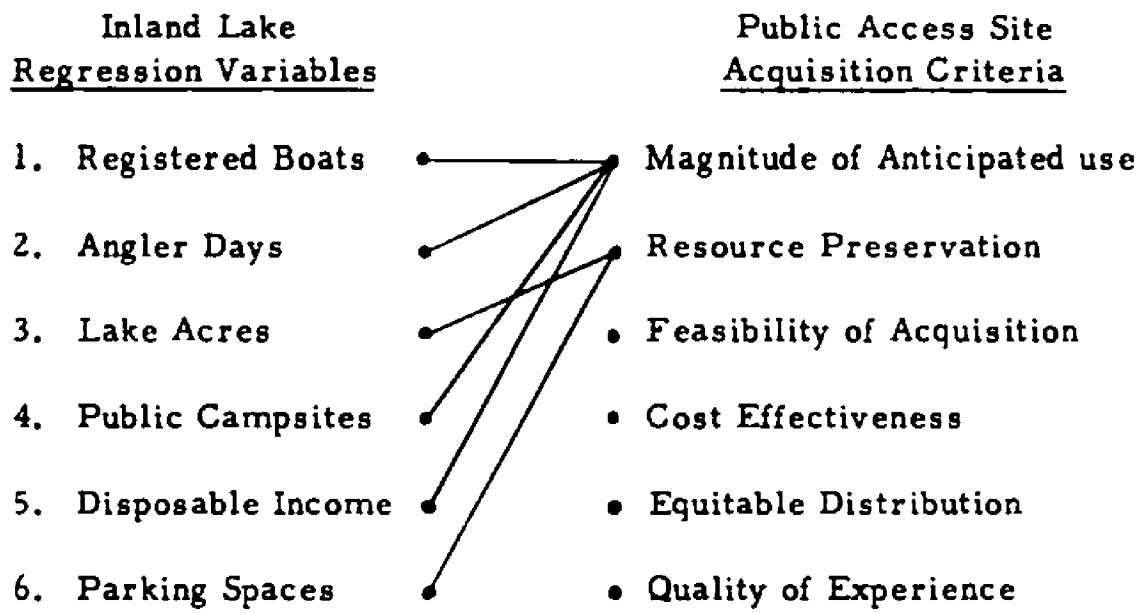


Figure 7--Application of Regression Variables to Acquisition Criteria.

Application of the Criteria

The two criteria used for the initial list of eligible lakes are "magnitude of anticipated use" which can be considered an index of demand, and "resource presentation and creation" which can be considered an index of supply. The remaining criteria will be applied and scored in a field investigation of eligible lakes.

1. Magnitude of anticipated use.

   Each planning region will be ranked according to the additional public access site capacity needed to meet the 1980 boating demand. (See Appendix 11 for a map of the official state planning regions.)

$$\frac{\text{1968 Boating Days}}{\text{1980 Boating Days}} = \frac{\text{1968 Parking Capacity}}{\text{1980 Parking Capacity}}$$

and

$$\text{1980 Parking Capacity} = \frac{(\text{1968 Parking})(\text{1980 Boating Days})}{(\text{1968 Boating Days})}$$

and

$$\text{Number of additional spaces needed by 1980} = (\text{1980 Parking}) - (\text{1968 Parking})$$

2. Resource preservation and creation.

   The lakes in each planning region will be ranked by size class and carrying capacity standards. The 1980 anticipated parking capacity requirement will be filled from top ranking lakes first and down to smaller size classes until 1980 requirements are met.

   Lakes up to 159 acres in size: One site with parking capacity not to exceed 10 cars and trailers.

   Lakes 160 to 249 acres in size: One site with parking capacity for up to 15 cars and trailers.

Lakes 250 to 399 acres in size: One site with parking capacity for up to 35 cars and trailers.

Lakes 400 to 599 acres in size: One site with parking capacity for up to 75 cars and trailers.

Lakes 600 to 999 acres in size: One site with parking capacity for up to 100 cars and trailers.

Lakes 1,000 to 10,000 acres in size: Two sites, each with parking capacity for up to 100 cars and trailers.

Lakes over 10,000 acres in size: Three sites, each with parking capacity for up to 100 cars and trailers.

If 1980 demand is not met by the available lakes within the planning region, the remaining unfilled demand will be transferred to lakes in the contiguous planning regions after they have fulfilled their internal demand requirements. The list of lakes so identified in each planning region will be submitted for field investigation and scoring on the basis of the remaining criteria.

3. Feasibility of acquisition.

If no property is available on a high priority lake without condemnation, or if the legislature has cut this lake from the lake list, the next lake on the list will take its place in priority. This criteria will be a yes or no consideration.

4. Equitable distribution.

Each lake will be given a 1-3 rating based on the following considerations:

3 = the need for additional boating facilities is acute in this area (within 1/2 hour travel time).
2 = the area needs additional facilities to handle future use.
1 = there are other facilities nearby.

5. Increased satisfaction or quality of experience.

3 = This is a high quality lake for fishing and boating.
2 = This is a medium quality lake for fishing or boating.

1 = This lake is not a high quality fishing or boating lake. It is shallow, muddy, poor fishing, not boatable or polluted, etc.

6. Cost effectiveness.

3 = Cost is very low considering the number of boaters this lake will serve.
2 = Cost may be high, but the number of boaters served is also very high.
1 = Cost is very high relative to the number of boaters this lake will serve.

County Versus Planning Region Approach

In the first attempts at selecting sites, a county by county basis was used. The counties were ranked by the number of boating days in 1968 and a list of lakes over 100 acres in each county was prepared (see Appendix 12). There are slightly more than 1,000 lakes in Michigan over 100 acres in size, thus the task of preparing a list of these lakes over 100 acres was formidable. The 1968 boating demand was then compared to the 1980 boating demand simulated in the RECSYS model. The per cent of increase in boating was compared to the number of existing access sites and more importantly, the existing capacity of sites for handling boating use. The number of additional parking spaces needed by 1980 was calculated by the formula described in the discussion of criteria number one, "magnitude of anticipated use."

The assumption is made here that the public to private ratio will remain the same; that is, if boating demand increases 10 per cent

from 1968 to 1980, then the public supply should be increased by ten per cent. For example, if a county has a present capacity of 200 parking spaces at public access sites, it would need 220 spaces by 1980, providing that the public is presently being adequately served and that the public to private ratio does not change in the county, thus putting more or less responsibility on the public sector to fill the recreation demand. These assumptions need further investigation. First, a study of latent demand may show that many potential users are not now being served, and second, a study of public access site use may clarify exactly how many boating days are generated by each public access site or each parking space at a public access site. A use study of selected access sites in Michigan is presently being proposed using traffic counters and questionnaire sampling at the site. Recreational boating research is hampered by the lack of attendance data that other areas such as state parks or state forest campgrounds have collected for many years.

Within these assumptions, the number of parking spaces needed by 1980 was calculated for several counties. This need was then compared to the lake list for these counties and in some cases the supply of lakes was inadequate to meet future needs. Thus, to satisfy the demand for boating by 1980, this need is spread to contiguous counties. The difficulty of spreading this excess need, in other words the difficulties of transfer of demand, required a planning region

approach. The "magnitude of anticipated use" and the "resource preservation" computations were therefore redone by planning region as shown in Table 5.

This example provides some insights into the problems associated with a nonparametric or ranking priority system. In the first attempt at a county by county system, the problems of what the size of the planning area should be are amply illustrated. The planning regions of the state more closely parallel the 1/2 hours time distance area around a major urban area, thus, a workable solution is available to 1980.

Another interesting observation of the public access site system relative to other recreation systems is the fractionalized units of access sites. They are small, less expensive, and located in many places within a given region, with some constraints due to the amount and location of water in the region. This is in contrast to natural areas or parks which come in large, rather expensive parcels located where circumstances have left large resource areas intact. These larger parks exhibit a "chunkiness"[1] of investment and location which differs from public access sites.

A last and very important measurement consideration is the weighting of each of the separate criteria. A system which scores

---

[1] For a discussion of investment "chunkiness" see Werner Hirsch "Program Budget for Natural Resource Activities" in Program Budgeting - Program Analysis and the Federal Budget. David Novick ed. Washington, D. C., Government Printing Office, 1965. pp. 218-236.

Table 5--Boating Days and Parking Capacity by Planning Region

	Planning Region 1	1968[a] Boat Days	1980[a] Boat Days	1968 Parking Spaces	1980 Parking Spaces	Additional Parking Needed
47	Livingston	264,384	342,277			
50	Macomb	773,654	950,525			
58	Monroe	183,479	217,389			
63	Oakland	643,562	345,910			
74	St. Clair	566,008	797,982			
81	Washtenaw	173,529	216,630			
82	Wayne	718,251	1,004,749			
		3,322,867	4,375,462	754	993	239
	Region 2					
30	Hillsdale	138,311	186,170			
38	Jackson	258,467	357,486			
46	Lenawee	138,311	186,170			
		535,089	729,826	118	161	43
	Region 3					
8	Barry	286,345	357,524			
12	Branch	157,091	296,736			
13	Calhoun	157,091	296,736			
39	Kalamazoo	113,578	133,144			
75	St. Joseph	186,628	250,410			
		900,733	1,334,550	893	1,323	430

Table 5--Continued

	Planning Region 4	1968 Boat Days	1980 Boat Days	1968 Parking Spaces	1980 Parking Spaces	Additional Parking Needed
11	Berrien	134,459	121,263			
14	Cass	186,628	250,410			
80	Van Buren	213,091	289,671			
		534,178	752,344	655	922	267
	Region 5					
25	Genesee	128,673	171,968			
44	Lapeer	128,573	171,968			
78	Shiawassee	16,001	10,171			
		273,147	354,107	73	95	22
	Region 6					
19	Clinton	5,473	6,163			
23	Eaton	28,269	15,648			
33	Ingham	28,269	15,648			
		62,011	37,464	41	25	--
	Region 7A					
9	Bay	109,044	135,104			
29	Gratiot	5,473	6,168			
37	Isabella	37,135	24,290			

Table 5--Continued

	Planning Region 7A	1968 Boat Days	1980 Boat Days	1968 Parking Spaces	1980 Parking Spaces	Additional Parking Needed
56	Midland	42,728	29,012			
73	Saginaw	15,523	26,136			
		209,903	220,710	70	74	4
	Region 7B					
32	Huron	86,289	88,942			
76	Sanilac	36,473	37,135			
79	Tuscola	28,860	38,242			
		151,622	164,319	8	9	1
	Region 7C					
6	Arenac	61,093	102,051			
18	Clare	163,747	246,816			
26	Gladwin	163,747	246,816			
35	Iosco	210,278	166,947			
65	Ogemaw	59,074	93,832			
72	Roscommon	366,433	741,098			
		1,024,372	1,597,560	337	526	189

Table 5--Continued

	Planning Region 8A	1968 Boat Days	1980 Boat Days	1968 Parking Spaces	1980 Parking Spaces	Additional Parking Needed
3	Allegan	173,409	265,420			
34	Ionia	89,625	110,760			
41	Kent	213,581	252,869			
59	Montcalm	89,625	110,760			
61	Muskegon	226,818	314,414			
70	Ottawa	255,355	318,901			
		1,048,413	1,373,124	511	669	158
	Region 8B					
43	Lake	73,408	82,459			
53	Mason	110,546	231,258			
54	Mecosta	110,293	158,049			
62	Newago	230,463	329,295			
64	Oceana	68,373	92,458			
67	Oscealo	110,293	158,049			
		703,376	1,052,198	1,162	1,738	576
	Region 9					
1	Alcona	109,706	237,451			
4	Alpena	139,831	186,977			
16	Cheboygan	280,449	443,566			

Table 5 --Continued

	Planning Region 9	1968 Boat Days	1980 Boat Days	1968 Parking Spaces	1980 Parking Spaces	Additional Parking Needed
20	Crawford	53,347	35,868			
60	Montmorency	88,103	100,990			
68	Oscoda	59,074	93,832			
69	Otsego	34,387	45,390			
71	Presque Isle	18,982	26,731			
		783,879	1,170,805	1,108	1,655	547
	Region 10					
5	Antrim	164,859	302,851			
10	Benzie	176,277	308,929			
15	Charlevoix	121,712	208,740			
24	Emmet	104,759	74,241			
28	Grand Traverse	292,999	538,478			
40	Kalkaska	41,848	44,787			
45	Leelanau	102,023	191,858			
51	Manistee	283,261	474,210			
57	Missaukee	41,848	44,787			
83	Wexford	82,556	121,527			
		1,412,142	2,310,408	1,183	1,935	752

Table 5--Continued

	Planning Region 11	1968 Boat Days	1980 Boat Days	1968 Parking Spaces	1980 Parking Spaces	Additional Parking Needed
17	Chippewa	161,080	119,846			
48	Luce	30,200	7,090			
49	Mackinac	130,639	232,516			
		321,919	359,452	316	353	37
	Region 12					
21	Delta	65,346	40,643			
55	Menominee	32,235	28,529			
77	Schoolcraft	57,265	25,898			
		154,846	95,070	660	405	--
	Region 13					
2	Alger	47,281	28,313			
22	Dickenson	34,387	19,834			
52	Marquette	103,293	153,256			
		184,961	201,403	631	687	56

Table 5 --Continued

	Planning Region 14	1968 Boat Days	1980 Boat Days	1968 Parking Spaces	1980 Parking Spaces	Additional Parking Needed
7	Baraga	43,335	63,161			
27	Gogebic	37,740	41,112			
31	Houghton	53,632	73,981			
36	Iron	63,163	85,610			
42	Keeweenaw	39,344	10,868			
66	Ontanogon	26,449	26,838			
		263,663	301,570	378	432	54
		11,887,121	16,430,374	8,898	12,002	3,375

	Planning Region			1968 Capacity	1980 Capacity	Additional Capacity
	1	3,322,867	4,375,462	754	993	239
	2	535,089	729,826	118	161	43
	3	900,733	1,334,550	893	1,323	430
	4	534,178	752,344	655	922	267
	5	273,147	354,107	73	95	22
	6	62,011	37,464	41	25	--
	7A	209,903	220,710	70	74	4
	7B	151,622	164,319	8	9	1
	7C	1,024,372	1,597,560	337	526	189
	8A	1,048,413	1,373,124	511	669	158
	8B	703,376	1,052,198	1,162	1,738	576

Table 5--Continued

Planning Region	1968 Boat Days	1980 Boat Days	1968 Capacity	1980 Capacity	Additional Capacity
9	783,879	1,170,805	1,108	1,655	547
10	1,412,142	2,310,408	1,183	1,935	752
11	321,919	359,452	316	353	37
12	154,846	95,070	660	405	--
13	184,961	201,403	631	687	56
14	263,663	301,570	378	432	54
	11,887,121	16,430,374	8,898	12,002	3,375

[a]1968 and 1980 boat days taken from preliminary tabular data of the "1968 Boating Demand Study" Recreation Research and Planning Unit, Michigan State University. The 1968 data is based on the questionnaire sample while the 1980 boat days are estimated through the use of computer simulation.

each criteria on a 3, 2, 1 ranking basis is essentially assuming that all criteria are of equal weight. It is to be emphasized that the criteria simply present a means of arriving at systematized judgment for selecting high priority projects. The system does not offer a magical mathematical formula for arriving at infallibly correct solutions, but rather is intended to be a tool which will facilitate and require the application of organized thinking, and orderly use of all relevant sources of information. The system should enable any two or more equally well-informed decision makers to arrive at similar decisions on a series of cases. At the very least, it should supply the means for clear explanation as to the basis for any particular decision, and the consequence of that decision. A project which everyone knows is a good project should not be discarded because it does not fit a rigid criteria system. Conversely, negative effects of a project should be counted even though explicit criteria do not exist for negative effects. Staff judgment should be considered at all times for special factors or exceptional weighting of certain criteria.

This is a politically sensitive area, however. The logic behind program planning and project criteria is often more for the "explainability" to the public and for justification of projects than for systematized judgment. More and more, the public and often the policy makers want a system that assigns a score on an almost mechanized basis and tells us which project is best. The very real importance

of staff judgment is deemphasized. This will only lead to inflexible criteria which may overlook truly outstanding projects or resources which cannot score high because of their uniqueness.

Planning Region Two as an Example

In order to demonstrate the application of the criteria, Planning Region Two, consisting of Hillsdale, Jackson and Lenawee counties, will be used as an example. (See Appendix 12 for the county lists of lakes for Hillsdale, Lenawee and Jackson county.) The six criteria are applied on a step-by-step basis using the data collected for this planning region. The same methodology can be utilized in each planning region of the state. The final result of the application of such a methodology is a list of lakes where public access sites should be purchased, how many parking spaces are allowed on each lake, and if no property is available on the highest priority lakes, which other lakes may then be selected.

1. Magnitude of anticipated use.

$$\frac{\text{1968 Boating Days}}{\text{1980 Boating Days}} = \frac{\text{1968 Parking Capacity}}{\text{1980 Parking Capacity}}$$

$$\frac{534,089}{729,826} = \frac{118}{X} \qquad X = 161, \text{ 1980 Parking Capacity}$$

1980 Parking - 1968 Parking = Number of additional spaces needed by 1980

161 - 118 = 43 additional spaces needed in planning Region Two

2. Resource preservation and creation.

Lakes up to 159 acres in size:	One site with parking capacity not to exceed 10 cars and trailers.
Lakes 160 to 249 acres in size:	One site with parking capacity for up to 15 cars and trailers.
Lakes 250 to 399 acres in size:	One site with parking capacity for up to 35 cars and trailers.
Lakes 400 to 599 acres in size:	One site with parking capacity for up to 75 cars and trailers.
Lakes 600 to 999 acres in size:	One site with parking capacity for up to 100 cars and trailers.
Lakes 1,000 to 10,000 acres in size:	Two sites, each with parking capacity for up to 100 cars and trailers.
Lakes over 10,000 acres in size:	Three sites, each with parking capacity for up to 100 cars and trailers.

Table 6--Lakes in Planning Region Two

County	Lake Name	Lake Acres	Possible Number of Sites and Parking Capacity
Hillsdale	Leann	485	1-75
	Bawbeese	329	1-35
	Long	213	1-15*
	Cub	128	1-10*
	Bear	117	1-10*
	Bird	113	1-10*
Lenawee	Devils	1,330	2-100**
	Round	515	1-75
	Sand	440	1-75*

Table 6--Continued

County	Lake Name	Lake Acres	Possible Number of Sites and Parking Capacity
Lenawee	Evans	201	1-15
	Goose	200	1-15
	Posey	150	1-10
Jackson	Columbia	800	1-100
	Mich. Center	730	1-100*
	Portage (Big)	531	1-75*
	Vineyard Lakes	505	1-75
	Clark	470	1-75
	Wamplers	440	1-75*
	Goose	378	1-35
	Wolf	355	1-35
	Gillett	340	1-35
	Grass	326	1-35
	Pleasant	268	1-35
	Browns	210	1-15
	Farewell	195	1-15
	Stony	175	1-15
	Portage (Little)	174	1-15
	Mid	171	1-15
	Narvell Mill Pond	154	1-15
	Vandercook	144	1-10
	Brill	142	1-10
	Mud	140	1-10
	Clear	137	1-10
	Round	137	1-10
	Ackerson	130	1-10
	Welch	106	1-10

Table 6--Continued

County	Lake Name	Lake Acres	Possible Number of Sites and Parking Capacity
Jackson	Sweezey	105	1-10
	No Name	100	1-10
			26-855
	These Lakes will be Selected for Field Investigation		
	Devils	1,330	2-100**
	Columbia	500	1-75
	Round	515	1-75
	Vineyard	500	1-75
	Leann	485	1-75
	Clark	470	1-75

*Indicates there is already a site on this lake.

**Two sites presently.

3. Feasibility of acquisition.

Lakes Leann and Columbia have been eliminated from consideration by the Legislature.

	Devils	Round	Vineyard	Clark
4. Equitable distribution	1	2	2	2
5. Quality of experience	3	3	3	2
6. Cost effectiveness	2	3	2	3
	6	8	7	7

A site would be recommended for purchase on Round Lake if the field investigation team or the Lands Division can find a suitable site for sale. If not, Vineyard and Clark Lake would be considered.

From this example, it can be observed that the number of lakes under consideration has been drastically reduced from the existing 38 lakes over 100 acres to the 6 lakes which will be selected for field investigation. The selection process has pinpointed the higher priority lake so that the field investigation will be of manageable proportions.

Previous methods used in the Waterways Division relied on the regional field supervisor to submit lakes in his region which he thinks should have a public access site. When suitable properties come up for sale on these lakes, they are purchased and developed until the budget for that fiscal year has been used up. Two problems are evident in this method. First, the selection of lakes is entirely left to the judgment of the regional supervisor in consultation with the director and second, the needs of each region are not balanced against the present and future boating demand but against the budget allocation to each region. This budget allocation to be sure, used the best judgment of the Waterways Division, but it was not based on data which could demonstrate that for each dollar spent, the Division would maximize the number of boating days served.

While it is obvious that this example simplifies the field investigation process from 38 to 6 lakes and it replaces a judgment oriented process for a data based process, there is also a less obvious

advantage of this selection process: It balances the boating demand in this planning region against the boating demand of all other planning regions in the state. Thus only 6 lakes may be investigated out of 38 in this planning region where in another planning region, 12 lakes may be selected out of only 30 lakes over 100 acres. The boating demand, not the budget, determines how many lakes are selected. The budget can later be used to select how much of the demand can be met within fiscal constraints. This will give a measure of how well the needs of the boaters are being met by the budget.

This selection process therefore meets the guidelines set up by the Michigan State Waterways Commission in terms of acquisition criteria. The magnitude of anticipated use has been measured against resource preservation to produce a system which emphasizes the equitable distribution of facilities, and finally, the cost effectiveness of each expenditure can be considered when budgets are compared to the number of lakes where public access sites are needed. The feasibility of acquisition and the quality of the experience are also measured through the use of a scoring system to be administered by the field investigation team.

The criteria have been defined in measurable terms. The questions can now be answered as to how many public access sites can be purchased,where should they be purchased, and which sites should be purchased first.

The ranking priority list of potential public access sites can be produced for each planning region in the state if the selection process outlined here is followed. The process does not assign dollar values to costs and benefits of each site but assigns their priority on the basis of qualitative as well as quantitative criteria.

All of the above advantages of this selection process does not mean that the criteria system is without limitations. The imperfect data on boating demand should be improved. The projection of demand into the future is based on a set of assumptions which must be continually reexamined and updated. The location of boating activity across the state may change in the future. The type of boating activity preferred by boaters may change. All of these limitations, as well as those previously described in this chapter, will require that further improvements be made on this criteria system as it is applied and used by the research staff and field personnel.

CONCLUSIONS AND RECOMMENDATIONS

The major conclusion of this study is that a weighted criteria system can be developed and applied to produce a priority list of lakes for acquisition. This criteria system meets the requirements of the Michigan State Waterways Commission for a public access site selection procedure in that the criteria have been defined in measurable terms. The number of public access sites which should be purchased can be determined. The lakes where public access sites should be located can be determined. And finally, the sites which should be purchased first are identified in a priority list.

A scoring system was devised to rank lakes in each county on the basis of the desirability for purchase. Two phases of analysis were necessary--a measure of demand for boating (i. e., how many public access sites to buy); and a measure of supply of boating resources (where to buy public access sites to serve the demand, on which lakes, in which county).

The RECSYS SYMAP procedure first developed by the Office of Planning Services, Department of Natural Resources, was used to obtain a measure of demand by county in 1968 and 1980. The present capacity of the Public Access Site Program was then extrapolated in 1980 as a measure of the facilities necessary to meet the 1980 demand.

On the supply side, the lakes were first ranked according to size class, resource capacity, and existing facilities. The demand in each county was then compared to the resource supply starting with the high priority lakes first and proceeding down the lake list until the demand had been filled.

This procedure was applied on a county-by county basis and found to be unworkable due to transfer of boating demand; that is, the demand exceeded the supply of lakes in the county. The data was then reorganized on a planning region basis. The demand in the region was applied to the high priority lakes in the region. This procedure produced a final list of lakes, ranked by the resource capacity and size class, which could be considered for field investigation where the remaining design and development criteria could be applied.

A further conclusion of the study is that six characteristics of the destination county are important in determining the amount of recreational boating in that county. These characteristics are:

1. Boats (the number of registered boats in the county)
2. Angler days (the total number of days or part-days spent fishing in the county each year)
3. Lake Acres (total acres of lake surface in the county)
4. Public Campsites (the number of campsites located in each county in State Forests, State Parks, or National Forest Campgrounds)

5. Disposable Income (median effective buying income of families in the county--Sales Management Magazine)

6. Parking (number of parking spaces at public access sites in the county)

Of these six characteristics, four were applied to the criteria on the demand side--the "magnitude of anticipated use" criteria--and two were applied to the supply side--the "resource preservation and creation" criteria. From these two criteria, the scoring system was developed to rank lakes in each county on the basis of their desirability for acquisition of public access sites.

The results obtained in this study and the problems associated with application of new methods of analyses, require that recommendations for further use be outlined. The following recommendations are forwarded for refinement of the procedures in future studies and for further developmebt of the planning and policies framework of the Waterways Division Public Access Site Program.

1. The 1971 Boating Demand Study which will begin in October 1971 as an updating of the 1968 study should develop demand projections and SYMAP exhibits for both Inland and Great Lakes boating. The 1968 study provides only total boating demand in each destination county for 1968 and 1980. This refinement of the data requires that two additional 83 X 83 matrices be run on the RECSYS program.

2. The questionnaire which was used in the 1968 study was lengthy and detailed (see Appendix 8). In order to improve the

reliability of the data and to concentrate on the data needed for the inland and Great Lakes boating, the questionnaire should be reduced to four pages. The two inner pages should open up to two tables labeled "Inland Lakes" and "Great Lakes" in large captions with one table in each page.

3. The information on fishing, cruising, water skiing, etc.--the types of boating activities--should be omitted from the 1971 questionnaire. There are two reasons for this deletion. First, the information is detailed and confusing to the respondent. This confusion may be interfering with the reliability of the results on the more important data about the number of boating days spent in each county. It must be remembered that this is a recall questionnaire completed after the summer boating season is over. Second, the data on boating activities has already been obtained in the 1968 study. The only value in asking for this information again would be to examine whether the activities have shifted significantly in the last three years.

4. The 1971 Study should have a one year contract deadline from January 1, 1972 to January 1, 1973 for the analysis phase. The questionnaires will be sent out in the fall after the close of the 1971 boating season but before the December 31 final deadline for the three year registration cycle. This procedure will shorten the recall period even though the total population of registered boats will be slightly smaller than at the end of the registration cycle.

5. The RECSYS program should be run with the 83 counties of Michigan as separate origins and destinations rather than lumping two counties together as a single node. This procedure was used because of the limited data capacity of the CDC 3500. The limitation no longer exists with the CDC 6500. In addition, the out-of-state destinations should be separated from the associated Michigan county so that a single demand figure may be assigned to each destination rather than lumping them as in the previous study.

6. The 2300 Zone Traffic Forecasting System of the Michigan Department of State Highways should be investigated for inclusion in the RECSYS model. This system can accommodate the 83 county origin and destination requirements of the RECSYS system and provide updated highway time-distance data for the transportation linkage between each origin and destination.

7. Mark sensing or coding directly on the questionnaire should be investigated to eliminate a step in the data handling process.

8. A summary report of the 1971 boating demand study should be prepared for distribution by the Waterways Division. Appropriate tables, charts and maps should be utilized to present the data in understandable graphic format to the public.

9. Comparison of the 1965, 1968 and 1971 studies should be considered to detect shifts in the amount and location of boating demand.

10. After the completion of the 1971 boating study, when the Great Lakes and inland lake boating data becomes available, the following refinements in the regression analysis should be investigated.

A. Great Lakes and inland lake regression models should be run separately.

B. Coho angler days and associated Great Lakes fishing should be included in the Great Lakes analysis.

C. Variables with high intercorrelations should be run in separate groups.

D. Each variable should be individually tested against boating days to check for curvilinear relationships. These variables can then be reintroduced into the model as logarithmic or exponential variables.

11. The attraction index used in the RECSYS program should be reexamined and reweighted in the light of the results of the regression analysis of the destination counties. Further refinements in the regression should be considered to improve the attraction index. This recommendation and previous recommendations by Chubb in the first RECSYS program should be incorporated into the attraction index of the 1971 study if at all possible.

These recommendations have been largely procedural or methodological in nature, concerned with refinements for future studies. The following recommendations will concern the planning

and policies framework of the Waterways Division Public Access Site Program.

1. The total Public Access Site Program should be split into three parts for planning purposes--(1) Great Lakes, (2) rivers, and (3) inland lakes. Separate overlays of each kind of public access site should be prepared. This will require completion of the three negative separation mylars developed from the Great Lakes Basin Commission and Army Map Service 1:250,000 series.

2. Program criteria or goals should be established for river and great lake boating as they have for inland lakes. For example, one canoe launching site every two miles on canoe-classified rivers or one trailer launching site every five miles on boatable rivers depending on the classification of the river or other criteria yet to be established. Such a goal oriented system has worked well for the Harbor-of-Refuge Program designated every 30 miles along the Great Lakes. "Explainability" to the public has been an important factor in this program.

3. Updating the public access system to accommodate larger boats and trailers should not occur at the expense of the original public fishing site system. Many of the sites purchased from 1938 to 1960 are less than one acre, developed primarily for fishing boats or cartop boats and located on smaller lakes in northern Michigan. These smaller sites should not be redeveloped for trailered boats. Extensive filling and dredging required to make low marshy shoreline

suitable for launching ramps, the lack of buffer space to protect neighboring properties, and crowded site conditions are often problems when sites on small irregular properties are developed. If a small one-acre site exists and the demand warrants a developed site, a new piece of property should be purchased on the lake rather than developing the old site. The new site should meet a minimum requirement of two acres and 200 feet of frontage. The smaller site, if suitable for use, should be retained for its original use--fishing and cartop boats.

4. Boating use regulations should be developed in line with a statewide system rather than in response to local problems on individual lakes. In particular, appropriate lakes should be designated for non-motor boating. Small lakes with complete public ownership of riparian properties can be selected for this type of less intensive boating use. Lakes with mixed public and private riparian ownership can come under boating use regulations provided that the property owners agree and pass favorably on the regulations under the provisions of the Marine Safety Act of 1967. Only a few lakes in Michigan have regulations which prohibit motors. On small lakes where property owners agree that a natural setting and a quiet leisure experience are desirable, such use regulations are appropriate. This recommendation is not suitable for most lakes in Michigan, especially larger lakes, where uses such as water skiing and cruising predominate, but a few lakes should remain where quiet boating activities such

as canoeing and rowboating can predominate. Other regulations such as time zoning and area zoning of the lake are possible under the Marine Safety Act. These regulations prevent conflicts between uses such as fishing and water skiing by separating them into separate parts of the lake or separate times of the day. Slow speed or no wake zones in the channels and near shore also reduce conflict and prevent boating accidents.

5. A "Guide to Public Access Sites in Michigan" should be developed from the Public Access Site Inventory. Developed sites with parking capacity and boat use regulations should be mapped and numbered on a small brochure for distribution to the public.

6. A visitor study of selected public access sites should be undertaken to investigate the patterns of use at the site--how many visitors, how many cars, how long the stay, what time of day is the heaviest use, what weekly and monthly patterns of use are typical, who uses access sites and what is the turnover time or multiplier for each parking space. A group of 25 sites could be monitored throughout the year with traffic counters at the entry. Five or six of these sites could be intensively investigated with user questionnaires or even observers to count trailers and visitors per car, kinds of boats, etc. These data can be integrated with the statewide demand studies to give a more detailed estimate of public boating in relation to private boating. The data on statewide boating demand in Michigan

is well developed while the traditional attendance figures common to State Parks and State Forest campgrounds are lacking.

7. A demonstration public access site should be developed in Region III with a large emphasis on landscaping and aesthetic design. Varied fencing materials, wide buffer areas planted with native vegetation for screening and noise control, redesigned sign kiosks, litter containers and seating areas could be used to create a beautiful as well as functional environment. Attractive toilet buildings and a landscaped parking lot should be integrated into the site with earth mounds. Existing trees should be carefully worked into the plan rather than being removed and replaced with a planted twig. A flat, treeless site may be chosen for this demonstration project to illustrate that earth mounds and wooden fencing with balled and burlapped shrubs, including a preponderance of evergreen material, can be used to create an aesthetically pleasing site. This should be augmented with 3" diameter trees planted in groups of three, five and seven to create an immediate overstory effect for shade and control of the perceptual environment.

8. Before and after pictures of this demonstration site including aerial photos should be considered. A group of slides describing the program whould be useful from the research and planning phase through to design and engineering, through actual construction, operation and maintenance and finally to the many recreation experiences and uses that occur on the site. These slides should not be considered

a publicity technique but rather the nucleus of a public access site slide presentation which can be used to explain the real benefits and real problems associated with all parts of the program from administration to maintenance. Unless the public understands the complexities of recreation planning, it will take the recreation resources of Michigan for granted. This will prevent future development and preservation of these resources because of lack of public support. On the other hand, understanding and appreciation of the resource and its many facets will bring support from the public as well as deeper enjoyment of their own recreation experiences.

SELECTED BIBLIOGRAPHY

SELECTED BIBLIOGRAPHY

Books

Chicchetti, Charles J.; Seneca, Joseph J.; and Davidson, Paul. The Demand and Supply of Outdoor Recreation. New Brunswick, New Jersey: Bureau of Economic Research, Rutgers-The State University, 1969.

Hirsch, Werner. "Program Budget for Natural Resource Activities," Program Budgeting - Program Analysis and the Federal Budget. David Novick, ed. Washington, D. C., Government Printing Office, 1965.

Humphrys, C. R. Lakes and Ponds in Michigan East Lansing, Michigan: Department of Resource Development, 1965 .

National Academy of Sciences. Alternatives in Water Management. Pub. 1408, Washington, D. C.: National Academy of Sciences, 1966.

Snedecor, George W. Statistical Methods, 5th ed. Ames, Iowa: Iowa State College Press, 1951.

Reports and Documents

Baxter, Alfred and Associates. Which Parks and Why: A Cost-Benefit Procedure for Budgeting State Park Acquisition Berkeley, California; Alfred Baxter and Associates, 1966 . p. 1.

Baxter, McDonald and Company. Budgeting for Development at State Park Sites: A Cost Effectiveness Approach, Berkeley, California: Baxter, McDonald and Company, 1968.

Chubb, Michael. Outdoor Recreation Planning in Michigan by a Systems Analysis Approach, Part III, The Practical Application of Program RECSYS and SYMAP, Technical Report No. 12. Lansing, Michigan: State Resource Planning Program, Department of Commerce, 1967.

Dixon, W. J. ed. BMD-Biomedical Computer Programs, University of California Publications in Automatic Computation No. 2 Berkeley; Los Angeles: University of California Press, 1968.

Michigan, Department of Conservation, Waterways Division. Transportation Predictive Procedures: Recreational Boaters and Commercial Shipping, Technical Report No. 9C. Lansing, Michigan: State Resource Planning Program, Michigan Department of Commerce, December, 1966.

Michigan, Department of Natural Resources, Office of Planning Services, Michigan Outdoor Recreation Plan, 1970, Lansing, Michigan: Michigan Department of Natural Resources, 1970. 4 Vol.

Michigan State University, Department of Resource Development, Michigan Outdoor Recreation Demand Study, Lansing, Michigan: State Resource Planning Program, Michigan Department of Commerce, June, 1966. 2 Vol.

National Association of Engine and Boat Manufacturers and Outboard Boating Club of America, Boating 1964--A Statistical Report on America's Top Family Sport, New York: National Association of Engine and Boat Manufacturers and Outboard Boating Club of America, 1964.

Oakwood, James and Chubb, Michael. Planning Public Recreational Boating Facilities in Michigan, Technical Report No. 1, East Lansing, Michigan: Recreation Research and Planning Unit, Department of Park and Recreation Resources, Michigan State University, February, 1968.

U. S., Department of Agriculture, Economic Research Service. An Econometric Model for Predicting Water-Oriented Outdoor Recreation Demand. ERS-402. Washington, D. C.: Government Printing Office, 1969.

U. S., Department of Agriculture, Economic Research Service. Socioeconomic Factors Affecting Participation in Water-Oriented Outdoor Recreation. ERS-403. Washington, D. C.: Government Printing Office, 1969.

Water Resources Council. Procedures for Evaluation of Water and Related Land Resources. Washington, D. C.: Government Printing Office, June, 1969.

Other Sources

Fiske, Paul R. "An Analysis of Interregional Variation in Recreational Boating in Michigan." Unpublished study plan, Department of Resource Development, Michigan State University, 1972.

Gullidge, Ellsworth J. and Urabeck, Frank J. "Planning for Pleasure Boating on Regional Basis." Journal of the Waterways, Harbors and Coastal Engineering Division. Proceedings of the American Society of Civil Engineers, Vol. 96, No. WW3, Washington, D. C., 1970.

Igo, Allison. "An Analysis of the Validity of Mail Surveys for Use in Recreation Research." Unpublished Master's Thesis, Department of Park and Recreation Resources, Michigan State University, 1971.

Kaiser, Ronald. "A Study of Multiple Boat Ownership in Michigan." Unpublished Master's Thesis, Department of Park and Recreation Resources, Michigan State University, 1970.

Meganck, Richard A. "Recreational Boat Transportation in Michigan: A Study of Use Patterns and Characteristics of Boaters Who Transport Their Boats." Unpublished Master's Thesis, Department of Park and Recreation Resources, Michigan State University, 1971.

Michigan, Department of State, "Size and Type of Registered Boats in Michigan Counties," Lansing, Michigan, December, 1968. (mimeographed)

Tucker, Thomas. "The 1980 Supply of Outdoor Recreation Facilities in Michigan." Unpublished Ph. D. Dissertation, Department of Forestry, Michigan State University, 1971.

U. S., Great Lakes Basin Commission. "Great Lakes Basin Framework Study, Appendix 9, Recreation Navigation." Rough draft of a report by the Recreation Navigation Task Force to the U. S., Great Lakes Basin Commission. December, 1970 (from the files of the Michigan State Waterways Commission).

Wildavsky, Aaron. "The Political Economy of Economy of Efficiency: Cost-Benefit Analysis, Systems Analysis and Program Budgeting." Public Administration Review, Vol. 26, No. 4 (April, 1966) 292-310.

APPENDICES

APPENDIX 1

LIST OF VARIABLES INCLUDED

IN MODEL

LIST OF VARIABLES INCLUDED IN MODEL

Variable Number		Variable Description
Y	=	Number of Boating Days (1970 Boating Demand Study)
X_1	=	Number of Inland Lakes Over Five Acres (1965 Lake Inventory)
X_2	=	Total Lake Acreage (1965 Lake Inventory)
X_3	=	Number of Public Access Sites (County Data Sheets--Waterways Files)
X_4	=	Number of Parking Spaces at Public Access Sites (County Data Sheets--Waterways Files)
X_5	=	Number of Registered Boats (Secretary of State--1968 Boat Registrations)
X_6	=	Total Population (1970 Census--Advance Reports)
X_7	=	Effective Buying Income Per Household (Sales Management Magazine "Survey of Buying Power")
X_8	=	Boats Per Population (X_5 / X_6)
X_9	=	Great Lakes Shoreline in Miles (Michigan State Water Resources Commission--County Data)
X_{10}	=	Miles of Inland Streams (Michigan State Water Resources Commission--County Data)
X_{11}	=	Number of Seasonal Homes (HC Series V. 1 Advance Reports)
X_{12}	=	Number of Public Campsites (Michigan Recreation Plan 1970--Appendix)

APPENDIX 1--Continued

Variable Number		Variable Description
X_{13}	=	Number of Private Campsites (Michigan Recreation Plan 1970--Appendix)
X_{14}	=	Number of Angler Days (Michigan Department of Natural Resources--Research and Development Reports 211, 234, 235)
X_{15}	=	Acres of Public Recreational Land--State Forest, State Park, State Game, State Recreation Areas, National Forests (Michigan Recreation Plan 1970--Appendix)
X_{16}	=	Distance to Major Population Centers Over 10,000 (Michigan State Department of Highway--SKIMTREE Time Distance Matrix)
X_{17}	=	Distance to Major Population Centers Over 50,000 (Michigan State Department of Highway--SKIMTREE Time Distance Matrix)
X_{18}	=	Distance to Major Population Centers Over 100,000 (Michigan State Department of Highway--SKIMTREE Time Distance Matrix)
X_{19}	=	Distance to Major Population Centers Over 1,000,000 (Michigan State Department of Highway--SKIMTREE Time Distance Matrix)

APPENDIX 2

STATEMENT OF PUBLIC ACCESS SITE LAND ACQUISITION PROGRAM CRITERIA

STATEMENT OF PUBLIC ACCESS SITE LAND ACQUISITION PROGRAM CRITERIA

The following criteria shall be applied in establishing priorities and in evaluating offered properties on the inland lakes of this State:

1. Magnitude of Anticipated Use.

   The Land Acquisition Program shall, to the extent possible, be predicated upon the demands for the period commencing 15 years hence, i. e. 1970 acquisitions shall be based upon 1985 needs. To determine future needs, future demands must be established and the existing supply of facilities deducted therefrom. For this purpose, reliance shall be made upon the RECSYS-SYMAP* system in predicting future demands. To provide adequate input data for this system, formal studies shall be conducted at least every three years to determine the extent of boating activity, participation rates by people from various origins, travel patterns of boaters, and the kind of waters on which they prefer to boat. To the greatest extent possible, it shall continue to be the policy of the Commission to shift boating usage from inland to Great Lakes waters through the development of adequate facilities.

2. Feasibility of Acquisition.

   Acquisition shall be made of properties freely offered by their owners and no use shall be made of the power of eminent domain.

3. Ecological Considerations.

   Sites shall be acquired that offer the best potential for public use with minimum degradation of the site. Site design shall be similarly oriented. All toilets provided at public access sites shall be of a design to assure they will not be or become a source of pollution. Maximum support shall be given to enforcement of anti-pollution and anti-litter laws and regulations. Suitable receptacles shall be provided at every developed site for deposit of litter and these receptacles shall be regularly emptied and the site kept in a litter-free condition.

4. Safety and Regulation.

   Consideration to safety shall be given in site selection. This consideration shall extend not only to boating and water safety, but also to traffic and pedestrian safety as well.

Enforcement of marine laws by the appropriate law enforcement agency shall be encouraged. Maximum use shall be made of current laws providing for establishment of regulations governing boating on inland waters. However, it is the policy of the Waterways Commission to recognize the right to seek boating regulations as being a right of local property owners which shall be respected to the greatest extent possible. Any regulations adopted in this manner shall apply equally to all users of the lake and shall be respected by the Commission in the administration of the site.

5. Increased Satisfaction or Quality of Experience.

To provide site use satisfaction to both the user and the local property owners, new sites shall not be opened to the public until completely developed. In addition, sites shall provide adequate buffer strips on each property line which shall be landscaped to provide maximum screening from adjacent properties. The site design shall give due consideration to aesthetic as well as utilitarian considerations. Density of site use shall be considered as a design criterion.

The staff shall continue research to determine the quality of the recreation experience of both site users and local property owners. The staff shall be responsible for submission of changes to this program criteria in the interest of enhacing the satisfaction of both site users and property owners.

6. Interprogram Effects.

Close coordination shall be maintained with all Divisions of the Department of Natural Resources and with other agencies of the State having programs which influence or are influenced by the Public Access Site Program in planning for future site acquisition. Reference shall be made to local zoning ordinances and existing land use when reporting to the Commission upon proposed property acquisitions. Prior to development of a site, local units of government shall be advised of the Commission's plans and given an opportunity to comment thereon. Safety aspects and enforcement needs of the site shall be discussed with local enforcement officials prior to development of the site.

7. Resource Preservation or Creation.

Every access site shall be designed to allow use of the water by the number of boats from the public sector the lake can reasonably support. Research shall be continued on the carrying capacity of

inland lakes until a means of reasonably determining such capacity has been established. Until such a system has been established, the following general guidelines shall be considered as limitations in acquiring property on inland lakes for use as public access sites:

Lakes up to 159 acres in size:	One site with parking capacity not to exceed 10 cars and trailers.
Lakes 160 to 249 acres in size:	One site with parking capacity for up to 15 cars and trailers.
Lakes 250 to 399 acres in size:	One site with parking capacity for up to 35 cars and trailers.
Lakes 400 to 599 acres in size:	One site with parking capacity for up to 75 cars and trailers.
Lakes 600 to 999 acres in size:	One site with parking capacity for up to 100 cars and trailers.
Lakes 1,000 to 10,000 acres in size:	Two sites, each with parking capacity for up to 100 cars and trailers.
Lakes over 10,000 acres in size:	Three sites, each with parking capacity for up to 100 cars and trailers.

The above guidelines are intended for use on intensively developed lakes and are to be considered as minimum standards. However, wherever the staff is of the belief that specific lake conditions require variation above or below these standards, such a recommendation shall be made to the Commission with the justification therefore and site acquisition efforts shall be based upon the decision of the Commission.

No effort shall be made to satisfy long-range boating demands of lakes of less than 160 acres. However, should a desirable body of water of less than 160 acres of size be located upon which an access site is especially desirable because of unique fishing or boating characteristics, acquisition may be recommended to the Commission.

Consideration shall be given to existing private and public access sites when reporting upon the desirability of access site land acquisition on a given body of water.

8. Cost Effectiveness.

Although it is generally assumed that individuals prefer to use smaller, more compact sites, construction and maintenance costs per unit are usually reduced by increasing the size of the site. Site size shall be based upon the capacity standards contained in Section 7 hereof plus the buffer requirements of Section 5 and other development needs such as suitable road access.

9. Secondary Benefits.

It is assumed that economic benefits accrue to the immediate vicinity of the site as a result of user expenditures. Benefits also accrue to the economy as a whole through the stimulation of sale of boats, fuel, and related items. However, the primary purpose of this program shall be to provide recreational boating opportunities rather than to stimulate economic development. Therefore, secondary benefits of an economic nature shall not be used as a program criterion at this time.

10. Equitable Distribution of Facilities.

Reliance entirely upon demand criteria could result in many areas of the State not being provided with public access sites. Geographic considerations shall be brought into the program by the Waterways Commission in its allotment of land acquisition funds to the various Planning Regions of the State.

*RECSYS-SYMAP (Recreation Systems Analysis and Synagraphic Mapping) is a computerized approach to planning. Under this system, data on residence of boat owner, use of the boat, frequency of use, and related matters are processed by computer to produce analysis in both tabular and map form. Projections can then be made of this data to predict future patterns of boating activity.

APPENDIX 3

NUMBER OF PUBLIC ACCESS SITES IN MICHIGAN

AS OF JULY 1970

REGION III

County	Waterways	State Parks	Recreation Areas	State Forest	Game	Total
Allegon	13				6	19
Barry	14		7		5	26
Berrien	4					4
Branch	15					15
Calhoun	10					10
Cass	17				6	23
Clinton	3				6	9
Eaton						0
Genesee	3					3
Gratiot	3				8	11
Hillsdale	7					7
Huron	5	2				7
Ingham					2	2
Ionia	3				5	8
Jackson	2		2			4
Kalamazoo	14				1	15
Kent	11				2	13
Lapeer	1		4		9	14
Lenawee	3	2			3	8
Livingston	6		6		2	14
Macomb	2					2
Monroe	6	1			3	10
Montcalm	17				12	29
Muskegon	2	1			1	4
Oakland	19	1	12			32
Ottawa	4	1			3	8
Saginaw					3	3
St. Clair	4	2			6	12
St. Joseph	15					15
Sanilac					1	1
Shiawassee					2	2
Tuscola	2				19	21
Van Buren	26					26
Washtenaw	3		8		8	19
Wayne	1				1	2
TOTAL	235	10	39	0	114	398

REGION II

County	Waterways	State Parks	Recreation Areas	State Forest	Game	Total
Alcona	3	1				4
Alpena	3			2	2	7
Antrim	29			1		30
Arenac	6					6
Bay	2	1			3	6
Benzie	20	1		2	1	24
Charlevoix	16	1		2		19
Cheboygan	18	3		4	5	30
Clare	14			3		17
Crawford	23	3		7	1	34
Emmet	6				2	8
Gladwin	9			4	7	20
Grand Traverse	23	2		6	3	34
Iosco	9			1		10
Isabella	3					3
Kalkaska	29			3	1	33
Lake	38			4		42
Leelanau	13	1		1		15
Manistee	23			1		24
Mason	17	1				18
Mecosta	19			2	6	27
Midland	2			1	1	4
Missaukee	4			5	5	14
Montmorency	18	1		5	4	28
Newaygo	19	1				20
Oceana	6	1				7
Ogemaw	21		2	2		25
Osceola	19					19
Oscoda	8			3		11
Otsego	15	1		6		22
Presque Isle	11	1		2	1	15
Roscommon	6	1		6	10	23
Wexford	7	1		1		9
TOTAL	459	21	2	74	52	608

REGION I

County	Waterways	State Parks	Recreation Areas	State Forest	Game	Total
Alger	10			2		12
Chippewa	11	3		4	5	23
Delta	20	1		1		22
Dickinson	20			5	4	29
Gogebic	12	2			1	15
Iron	26	1		1		28
Keweenaw	6					6
Luce	14	1		13	2	30
Mackinaw	12			9	1	22
Marquette	49	1		5	1	56
Menominee	7			2	2	11
Ontonagon	4					4
Schoolcraft	13	1			11	25
Baraga	20	1		4	1	26
Houghton	16	1		1		18
TOTAL	240	12		47	28	327
STATE TOTALS	934 Total 569 Usable	43	41	121	194	1333 Total 968 Usable

APPENDIX 4

PUBLIC ACCESS SITE INVENTORY

PUBLIC ACCESS SITE INVENTORY

Site Number

ARQ

Price

Location

Boat Population

Pot.

Planning Region

Restriction Water Use

Entrance

Exist. Parking

Pot.

Frontage

Ramp

Exist. Camping

Well Type

Lake Area

Site Type

No. of Sites Per Lake

APPENDIX 5

PUBLIC ACCESS SITE INVENTORY

MARK-SENSE FORM

DEPARTMENT
OF
NATURAL RESOURCES
WATERWAYS DIVISION

PUBLIC ACCESS SITE INVENTORY

ADMINISTRATIVE DATA

1 SITE NAME	SITE NO.	EXAMINED BY	DATE
7 ACQUISITION METHOD		DATE OF DEED	PRICE

LOCATION AND AREA DATA

1 COUNTY	TOWN	RANGE	SECTION	2 NEAREST TOWN
ROAD AND MILEAGE TO SITE				
3 DEVELOPMENT OF SURROUNDING AREA				
4 EXISTING BOAT POPULATION				POTENTIAL FOR INCREASE
5 PRIMARY WATER USE				
6 LIMITATIONS ON WATER USE				

SITE DATA

1 TYPE(S) ROAD	LENGTH	WIDTH	SURFACE
CONDITION			
2 TOPOGRAPHY	SOIL TYPE		ACRES IN SITE
3 NO. PARKING SPACES		NO. ADDITIONAL SPACES POSSIBLE	
4 SITE AND WIDTH NAME		OFFSHORE SOIL TYPE	
5 DEPTH OF WATER	10 FEET FROM SHORE	20 FEET FROM SHORE	
6 TYPE(S)	TYPE BANK	ABOVE WATER AND 4.0 FEET BACK FROM SHORE	
7 FENCE ☐ YES ☐ NO	NO. SITES	NO. ADDITIONAL SITES POSSIBLE	
8 OTHER LIMITATIONS ON SITE			
9 NO. AND TYPE TOILETS	NO. BARRELS	SEPTIC TYPE AND SIZE	
10 REMARKS			

APPENDIX 6

MICHIGAN LAKE INVENTORY-1965

WEXFORD COUNTY

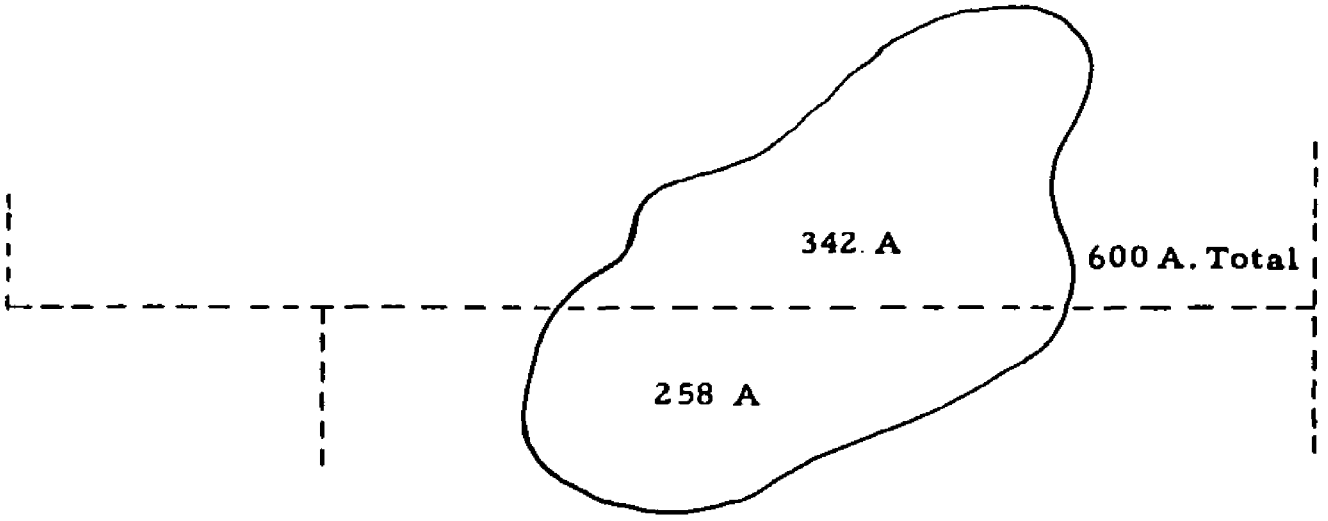
1965 Michigan Lake Inventory

Lakes By Size and By Type — Area Covered: Wexford County

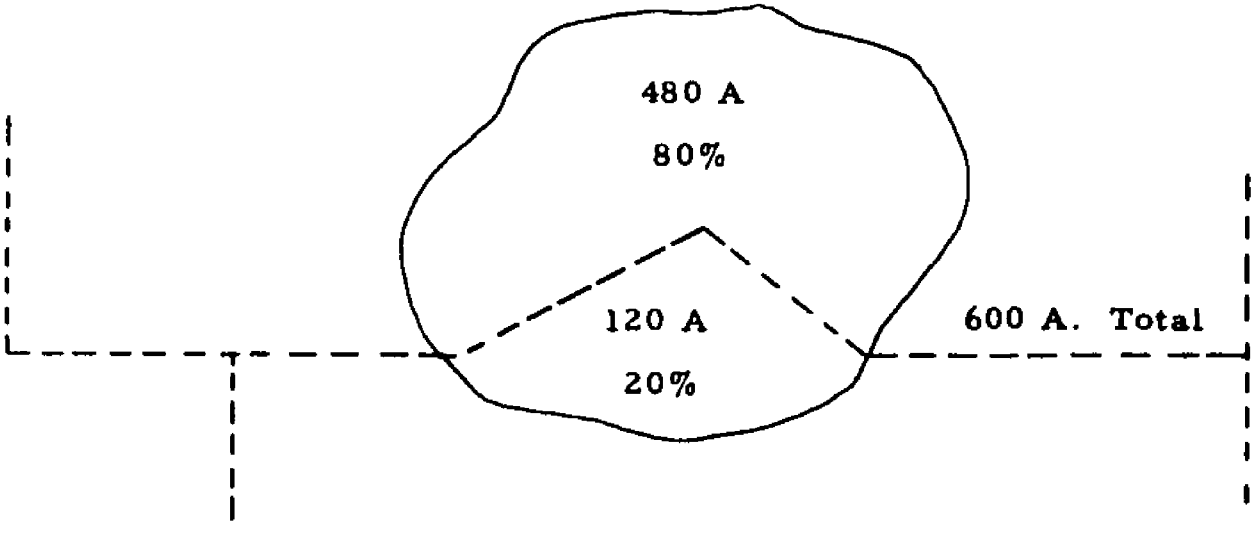
Size Class			Numbers of Lakes						Area of Lakes						Length of Shore					
1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No.	Acres		No of Lakes	% Of Col Tot	% Of All Lakes	Cum Tot	Cum Tot %	Inter Area Lakes Incld	Total Acres Asgnd & Not Asd	Acres Asgnd This Area	% Of Col Tot	% Of All Lakes	Cum Total	Cum Tot %	Miles	% Of Col Tot	% Of All Lakes	Cum Total	Cum Tot %	No.
1	5 -	9	9	35	35	26	**	0	57	57	1	1	6452	**	3.2	6	6	57.7	**	1
2	10 -	15	4	15	15	17	65	0	46	46	1	1	6395	99	2.5	4	4	54.5	94	2
3	16 -	24	3	12	12	13	50	0	52	52	1	1	6349	98	2.9	5	5	52.0	90	3
4	25 -	39	0	0	0	10	38	0	0	0	0	0	6297	98	0.0	0	0	49.1	85	4
5	40 -	59	1	4	4	10	38	0	0	52	1	1	6297	98	1.5	3	3	49.1	85	5
6	60 -	99	4	15	15	9	35	0	291	291	5	5	6245	97	6.6	11	11	47.6	82	6
7	100 -	159	1	4	4	5	19	1	229	119	2	2	5954	92	1.7	3	3	41.0	71	7
8	160 -	249	1	4	4	4	15	0	187	187	3	3	5835	90	3.5	6	6	39.3	68	8
9	250 -	399	0	0	0	3	12	0	0	0	0	0	5648	88	0.0	0	0	35.8	62	9
10	400 -	599	0	0	0	3	12	0	0	0	0	0	5648	88	0.0	0	0	35.8	62	10
11	600 -	999	0	0	0	3	12	0	0	0	0	0	5648	88	0.0	0	0	35.8	62	11
12	1000 -	1599	1	4	4	3	12	0	1235	1235	19	19	5648	88	6.8	12	12	35.8	62	12
13	1600 -	2499	1	4	4	2	8	1	1661	1613	25	25	4413	68	20.0	35	35	29.0	50	13
14	2500 -	3999	1	4	4	1	4	0	2800	2800	43	43	2800	43	9.0	16	16	9.0	16	14
15	4000 -	5999	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0.0	0	15
16	6000 -	9999	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0.0	0	16
17	10000 -	15999	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0.0	0	17
18	16000 -	*	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0.0	0	18
Total			26	**	**	26	**	2	6558	6452	**	**	6452	**	57.7	**	**	57.7	**	

APPENDIX 7

COMPARISON OF "1965 LAKE INVENTORY" AND C. R. HUMPHRYS' "MICHIGAN LAKES AND PONDS"



Humphrys' Intercounty Lake Acreage -
Acreage Which Lies in County



1965 Lake Inventory - Percent of Lake Shoreline
Which Lies in County

APPENDIX 8

MICHIGAN RECREATIONAL BOATING

NEEDS QUESTIONNAIRE

STATE OF MICHIGAN

GEORGE ROMNEY, Governor

DEPARTMENT OF NATURAL RESOURCES

RALPH A. MAC MULLAN, Director

Stevens T. Mason Building
Lansing, Michigan 48926
373-0436

Dear Boat Owner:

At this time of year, when boats are out of the water, the Waterways Commission, like everyone else, is making plans for the coming season and seasons ahead. We want to make sure that the rivers and lakes of Michigan, including the Great Lakes, offer safe and accessible recreation to all who love the water.

To help us in our job, we need your assistance in finding out more about the kinds of facilities you and other boaters require. If there are shortages in certain areas, we would like to know about them. We are, therefore, sending you this questionnaire with the request that you take a few moments to fill it out and send it back to us. This study is one of several research projects being undertaken for the Waterways Division by the Recreation Research and Planning Unit at Michigan State University.

Your name was taken at random from the list of boat registrants, and your reply need not be signed. It will be used with all the other replies to show us the pattern of boating in Michigan and indicate where we should be providing new or improved facilities. Simply place your completed questionnaire in the stamped, pre-addressed envelope and mail it back to us at your convenience.

Thank you very much for your help.

With best wishes for a good season in 1969.

Sincerely,

Keith Wilson

Keith Wilson
Director

KW:jaw
Enclosures

MICHIGAN
THE GREAT LAKE STATE

FOR YOUR ASSISTANCE:

A COUNTY AND HIGHWAY MAP OF MICHIGAN

MICHIGAN RECREATIONAL BOATING NEEDS QUESTIONNAIRE

PLEASE ANSWER QUESTIONS 1 THROUGH 13 FOR THE BOAT IDENTIFIED BY THE REGISTRATION NUMBER AND BOAT LENGTH WHICH APPEAR UNDER YOUR ADDRESS ON PAGE 1

1 WHAT TYPE OF POWER SYSTEM DOES THIS BOAT HAVE? (Check one)

☐ Outboard motor ☐ Inboard motor ☐ Inboard motor with outboard drive
☐ Sailboat with motor ☐ Other (write in) _____

2 WHAT IS THE HORSEPOWER RATING OF THE PRIMARY MOTOR (OR MOTORS) USED ON THIS BOAT?
____Hp. ____Hp.
Indicate horsepower of any other motors used on this boat: _____ , _____ , _____

3 WHAT COUNTY IS THIS BOAT REGISTERED IN? _____ County

4 WHERE DO YOU USUALLY KEEP THIS BOAT DURING THE BOATING SEASON? (Check one)

☐ At my permanent home, which is not on a lake or river.
☐ At waterfrontage located at my permanent home lot.
☐ At a commercial marina berth.
☐ At a summer cottage.
☐ At a publicly-owned marina.
☐ At a boat or yacht club.
☐ Other (specify) _____

5 WAS THIS BOAT TRANSPORTED FROM YOUR HOME OR OTHER LOCATION TO PARTICULAR LAUNCHING SITES DURING THE PAST BOATING SEASON (calendar year 1968)?

☐ YES ☐ NO If "NO" skip over questions 6, 7, and 8, and proceed with question 9.

6 WAS THIS BOAT TRANSPORTED BY ☐ trailer ☐ car-top carrier

7 PLEASE INDICATE THE TOTAL NUMBER OF TIMES YOU TRANSPORTED THIS BOAT FROM THE PLACE OF STORAGE OR MOORING TO THE PLACE OF USE. Number of times _____

8 IN THE TABLE BELOW, NAME THE COUNTIES WHERE YOU MOST OFTEN LAUNCHED THIS BOAT; AND INDICATE THE NUMBER OF TIMES THE BOAT WAS LAUNCHED AT EACH BOATING ACCESS POINT.

	County (Write in)	Number of Times This Boat Launched at–				
		Public Marina or Ramp			Commercial Marina	Private property or other
		City, County or Township	State Facilities	Federal		
Most Launches →						
2nd most Launches →						
All other Launches →						

9 DID YOU USE THIS BOAT ON ANY OF THE MICHIGAN SECTIONS OF THE GREAT LAKES, OR CONNECTING WATERS*, DURING THE PAST BOATING SEASON (calendar year 1968)?

*(Great Lakes and connecting waters are Lakes Huron, Superior, Erie, Michigan, and St. Clair; St. Mary's River, St. Clair River, and Detroit River.)

☐ NO ——— If "NO", please proceed to question 11.
☐ YES ——— If "YES" please continue with question 10.

---

10 IN THE TABLE BELOW, NAME THE THREE GREAT LAKES OR CONNECTING WATERS COUNTIES WHERE THIS BOAT WAS USED DURING THE PAST BOATING SEASON. Give the number of days that the boat was actually in the water under power or sail in each county; and give the number of boating days spent on particular activities. (See map on page 2.)

USE OF THIS BOAT ON GREAT LAKES AND CONNECTING WATERS ONLY

Note: Count each part day spent boating as a full day. The number of days spent on specific boating activities may not equal the total number of days shown in the left-hand column.

Count each part day spent on a particular boating activity as a full day for that activity.

	Total Days of Boating		County (Write in)	Boating Activities No. days you used this boat for – Trout/Salmon fishing (No. Days)	Other fishing (No. Days)	Hunting (No. Days)	Water skiing (No. Days)	Cruising (No. Days)	Other (No. Days)
EXAMPLE	17		Manistee	11	2	0	9	8	0
		County of most use							
		County of 2nd most use							
		County of 3rd most use							
		Boating in "All Other" Counties							

---

11 DID YOU USE THIS BOAT ON ANY INLAND LAKES OR STREAMS IN MICHIGAN DURING THE PAST BOATING SEASON (calendar year 1968)?

☐ NO ——— If "NO" please proceed to question 13.
☐ YES ——— If "YES" please continue with question no. 12.

---

12 IN THE TABLE BELOW, NAME THE THREE MICHIGAN COUNTIES WHERE THIS BOAT WAS USED MOST ON INLAND LAKES AND STREAMS DURING THE PAST BOATING SEASON' Give the number of days that this boat was actually in the water under power or sail in each of these counties; and give the number of boating days spent on various activities. (See map on page 2.)

USE OF THIS BOAT ON INLAND LAKES & STREAMS

Note: Count each part day spent boating as a full day. The number of days spent on specific boating activities may not equal the total number of days shown in the left-hand column.

Count each part day spent on a particular boating activity as a full day for that activity.

	Total Days of Boating	County (Write in)	Boating Activities — No. days you used this boat for – Trout/Salmon fishing (No. Days)	Other fishing (No. Days)	Hunting (No. Days)	Water skiing (No. Days)	Cruising (No. Days)	Other (No. Days)
EXAMPLE	18	Montmorency	2	14	3	2	0	0
	County of most use							
	County of 2nd most use							
	County of 3rd most use							
	Boating in "All Other" Counties							

13 DID YOU USE THIS BOAT IN ANY CANADIAN PROVINCE OR A STATE OTHER THAN MICHIGAN DURING THE PAST BOATING SEASON (calendar year 1968)?

☐ NO --- If "NO", skip over the remainder of this question and proceed with question 14.
☐ YES --- If "YES," please complete the table below.

	Other States: Give the Number of Days Boat was in the Water Under Power or Sail		
	County or nearest city (if known)*	Name of State or Canadian Province	Number of boating days**
County of most use:			
County of 2nd most use:			
County of 3rd most use:			

*If unknown, please consult a highway map.

**(NOTE: count each part day of boating as a full day).

THE FOLLOWING QUESTION CONCERNS OTHER RECREATIONAL BOATS OWNED IN ADDITION TO THE ONE IDENTIFIED BY THE REGISTRATION NUMBER ON PAGE 1.

(Note: If you own no other boats, please check here ☐ and skip over to question 15)

14 IN THE TABLE BELOW, GIVE THE NUMBER OF OTHER REGISTERED AND UNREGISTERED BOATS OWNED BY YOU, AND BY THE MEMBERS OF YOUR IMMEDIATE FAMILY RESIDING WITH YOU. Also, give the boat length and horsepower rating of the motor used on it.

Type of boat*	Length	Horsepower rating of the motor

*Include other inboards, outboards, sailboats, canoes, inboard-outboards, rowboats, etc

IN ORDER TO FORECAST THE FUTURE DEMAND FOR BOATING FACILITIES IN MICHIGAN, IT IS NECESSARY FOR US TO BE ABLE TO TIE IN FAMILY CHARACTERISTICS WITH BOATING USE PATTERNS. PLEASE ASSIST US BY ANSWERING THE QUESTIONS IN THE FOLLOWING SECTION.

15 PLEASE GIVE YOUR COUNTY AND STATE OF PERMANENT RESIDENCE, AND WRITE IN YOUR POSTAL ZIP CODE.

County name_____ State_____ Postal Zip Code_____

16 WHAT IS THE AGE AND SEX OF THE "HEAD OF YOUR FAMILY?"

Age: ___ years Sex: ☐ Male ☐ Female

17 GIVE THE AGE AND SEX OF EACH MEMBER OF YOUR FAMILY RESIDING WITH YOU (excluding the "head of household")

Male: ages:_____ Female: ages:_____

18 WHAT IS THE OCCUPATION OF THE "HEAD OF YOUR FAMILY?" (Please indicate the type of job that you hold, NOT the organization for which you work).

_____

(Write in)

19 PLEASE ESTIMATE YOUR TOTAL FAMILY INCOME FOR 1968 BY CHECKING THE PROPER BOX BELOW. (Check only one box).

☐ Under $3,000
☐ $3,000 to $5,999
☐ $6,000 to $7,999
☐ $8,000 to $9,999
☐ $10,000 to $14,999
☐ $15,000 to $24,999
☐ $25,000 and over

20 WHICH OF THE ANSWERS BELOW BEST INDICATES THE TOTAL YEARS OF EDUCATION COMPLETED BY THE "HEAD OF YOUR FAMILY?" (Check one box)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ or more

21 IN THE SPACE BELOW, PLEASE INDICATE ANY SPECIAL BOATING PROBLEMS YOU MAY HAVE:

THANKS FOR YOUR HELP!

If you accidently misplace the return envelope provided, please mail to:

Recreation Research and Planning Unit
Room 312 Natural Resources Building
Michigan State University
East Lansing, Michigan 48823

APPENDIX 9

SIZE AND TYPE OF REGISTERED BOATS

IN MICHIGAN COUNTIES

Size and Type of Registered Boats in Michigan Counties (Prepared by the Michigan Department of State, December 31, 1968)

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
01	Alcona	Outboard	198	489	1	0	0	688
		Inboard	0	14	5	1	0	20
		Sailboat	2	2	1	0	0	5
			200	505	7	1	0	713
02	Alger	Outboard	357	500	4	0	0	861
		Inboard	3	7	11	1	0	22
		Sailboat	1	2	0	0	0	3
			361	509	15	1	0	886
03	Allegan	Outboard	2,006	2,091	57	0	0	4,154
		Inboard	27	113	47	13	3	203
		Sailboat	10	8	5	1	0	24
			2,043	2,212	109	14	3	4,381
04	Alpena	Outboard	745	2,348	51	1	0	3,145
		Inboard	5	62	28	4	0	99
		Sailboat	8	10	15	1	0	34
			758	2,420	94	6	0	3,278
05	Antrim	Outboard	550	1,599	14	1	0	2,164
		Inboard	3	145	49	1	1	199
		Sailboat	0	8	1	0	0	9
			553	1,752	64	2	1	2,372

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
06	Arenac	Outboard	130	434	7	0	0	571
		Inboard	1	18	10	1	0	30
		Sailboat	3	4	0	0	0	7
			134	456	17	1	0	608
07	Barage	Outboard	156	509	0	0	0	665
		Inboard	1	9	11	0	0	21
		Sailboat	3	0	0	0	0	3
			160	518	11	0	0	689
08	Barry	Outboard	1,586	1,895	77	0	1	3,559
		Inboard	8	95	17	1	0	121
		Sailboat	6	3	2	0	0	11
			1,600	1,993	96	1	1	3,692
09	Bay	Outboard	1,415	3,512	49	2	2	4,980
		Inboard	7	227	193	57	17	501
		Sailboat	9	34	14	2	1	60
			1,431	3,773	256	61	20	5,541
10	Benzie	Outboard	388	1,127	12	0	0	1,527
		Inboard	7	80	16	1	0	104
		Sailboat	4	1	3	0	0	8
			399	1,208	31	1	0	1,639

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
11	Berrien	Outboard	3,582	4,601	83	4	2	8,272
		Inboard	16	216	196	50	6	484
		Sailboat	7	20	8	7	0	42
			3,605	4,837	287	61	8	8,798
12	Branch	Outboard	1,604	3,384	115	1	0	5,104
		Inboard	6	118	4	1	0	129
		Sailboat	6	4	0	0	0	10
			1,616	3,506	119	2	0	5,243
13	Calhoun	Outboard	4,025	4,049	161	5	0	8,240
		Inboard	22	180	42	18	11	273
		Sailboat	14	5	0	1	0	20
			4,061	4,234	203	24	11	8,533
14	Cass	Outboard	2,348	4,038	169	3	0	6,558
		Inboard	6	240	20	1	1	268
		Sailboat	9	10	0	0	0	19
			2,363	4,288	189	4	1	6,845
15	Charlevoix	Outboard	511	1,234	62	1	0	1,808
		Inboard	7	150	88	11	2	258
		Sailboat	6	6	11	3	2	28
			524	1,390	161	15	4	2,094

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
16	Cheboygan	Outboard	426	1,907	25	0	0	2,358
		Inboard	3	157	70	9	1	240
		Sailboat	12	7	3	1	0	23
			441	2,071	98	10	1	2,621
17	Chippewa	Outboard	436	2,472	19	0	1	2,928
		Inboard	0	90	93	11	2	196
		Sailboat	8	1	9	0	0	18
			444	2,563	121	11	3	3,142
18	Clare	Outboard	655	694	20	0	0	1,369
		Inboard	2	22	7	0	0	31
		Sailboat	2	3	0	0	0	5
			659	719	27	0	0	1,405
19	Clinton	Outboard	879	1,605	42	0	0	2,526
		Inboard	10	29	11	3	0	53
		Sailboat	4	4	0	0	0	8
			893	1,638	53	3	0	2,587
20	Crawford	Outboard	192	311	23	1	0	527
		Inboard	5	9	4	0	0	18
		Sailboat	4	5	0	0	0	9
			201	325	27	1	0	554

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
21	Delta	Outboard	467	1,268	14	0	1	1,750
		Inboard	3	28	23	8	3	65
		Sailboat	3	5	1	3	0	12
			473	1,301	38	11	4	1,827
22	Dickinson	Outboard	756	848	4	1	0	1,609
		Inboard	4	15	1	2	1	23
		Sailboat	2	1	0	0	0	3
			762	864	5	3	1	1,635
23	Eaton	Outboard	1,439	1,992	75	1	0	3,507
		Inboard	12	75	16	3	0	106
		Sailboat	11	9	1	1	0	22
			1,462	2,076	92	5	0	3,635
24	Emmet	Outboard	542	1,418	29	0	0	1,989
		Inboard	5	157	66	17	3	248
		Sailboat	6	5	7	3	2	23
			553	1,580	102	20	5	2,260
25	Genesee	Outboard	7,772	13,941	386	1	0	22,100
		Inboard	48	816	242	83	14	1,189
		Sailboat	89	44	28	8	1	120
			7,859	14,801	656	92	15	23,409

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
26	Gladwin	Outboard	410	689	20	0	0	1,119
		Inboard	0	24	4	0	0	28
		Sailboat	3	1	0	0	0	4
			413	714	24	0	0	1,151
27	Gogebic	Outboard	510	1,348	11	1	0	1,870
		Inboard	2	29	22	5	0	58
		Sailboat	5	2	0	0	0	7
			517	1,379	33	6	0	1,935
28	Grand	Outboard	1,322	3,138	45	1	0	4,506
		Inboard	13	162	82	21	3	278
		Sailboat	23	23	10	5	0	61
			1,358	3,323	137	27	3	4,845
29	Gratiot	Outboard	753	1,273	29	0	0	2,055
		Inboard	3	45	5	2	0	55
		Sailboat	3	1	1	0	0	5
			759	1,319	35	2	0	2,115
30	Hillsdale	Outboard	1,062	1,544	49	1	0	2,656
		Inboard	4	44	6	1	1	56
		Sailboat	12	8	0	0	0	20
			1,078	1,596	55	2	1	2,732

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'1"	30'1" to 40'1"	40'1" & Over	Totals
31	Houghton	Outboard	433	1,383	6	0	0	1,822
		Inboard	1	81	70	13	3	168
		Sailboat	5	4	0	1	0	10
			439	1,468	76	14	3	2,000
32	Huron	Outboard	144	1,134	9	0	0	1,287
		Inboard	3	53	48	13	0	117
		Sailboat	1	5	2	1	0	9
			148	1,192	59	14	0	1,413
33	Ingham	Outboard	4,915	7,561	216	2	0	12,694
		Inboard	54	348	121	36	5	564
		Sailboat	35	47	8	3	0	93
			5,004	7,956	345	41	5	13,351
34	Ionia	Outboard	1,343	1,363	37	1	0	2,744
		Inboard	7	29	11	3	2	52
		Sailboat	10	5	1	0	0	16
			1,360	1,397	49	4	2	2,812
35	Iosco	Outboard	548	1,492	9	0	0	2,049
		Inboard	12	44	19	1	2	78
		Sailboat	3	3	4	0	0	10
			563	1,539	32	1	2	2,137

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
36	Iron	Outboard	791	1,128	9	2	0	1,930
		Inboard	5	13	1	1	0	20
		Sailboat	2	2	0	0	0	2
			798	1,143	10	3	0	1,954
37	Isabella	Outboard	701	957	23	0	0	1,681
		Inboard	0	38	9	1	1	49
		Sailboat	1	1	0	0	0	2
			702	996	32	1	1	1,732
38	Jackson	Outboard	4,560	5,065	217	6	0	9,846
		Inboard	26	302	42	12	1	383
		Sailboat	18	22	5	4	0	49
			4,604	5,389	264	22	1	10,280
39	Kalamazoo	Outboard	5,477	5,463	228	6	0	11,174
		Inboard	22	392	108	33	7	562
		Sailboat	21	20	13	2	1	57
			5,520	5,875	349	41	8	11,793
40	Kalkaska	Outboard	298	389	8	1	0	696
		Inboard	2	12	6	1	0	21
		Sailboat	1	1	0	0	0	2
			301	402	14	2	0	719

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" & 40'0"	40'1" & Over	Totals
41	Kent	Outboard	9,180	12,998	378	14	3	22,573
		Inboard	59	746	401	120	22	1,348
		Sailboat	49	70	35	11	1	166
			9,288	13,814	814	145	26	24,067
42	Keweenaw	Outboard	40	137	1	0	0	178
		Inboard	0	6	10	1	0	17
		Sailboat	0	0	0	0	0	0
			40	143	11	1	0	195
43	Lake	Outboard	315	320	1	0	0	636
		Inboard	1	4	2	0	0	7
		Sailboat	0	0	0	0	0	0
			316	324	3	0	0	643
44	Lapeer	Outboard	768	1,092	16	1	0	1,877
		Inboard	3	37	10	5	0	55
		Sailboat	3	2	0	0	0	5
			774	1,131	26	6	0	1,937
45	Leelanau	Outboard	357	1,314	25	0	0	1,696
		Inboard	2	113	59	6	1	181
		Sailboat	9	6	4	1	0	20
			368	1,433	88	7	1	1,897

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
46	Lenawee	Outboard	1,713	3,409	141	0	0	5,263
		Inboard	16	197	19	8	0	240
		Sailboat	12	7	0	0	0	19
			1,741	3,613	160	8	0	5,522
47	Livingston	Outboard	1,416	1,972	64	0	0	3,452
		Inboard	4	100	13	3	0	120
		Sailboat	2	6	2	1	0	11
			1,422	2,078	79	4	0	3,583
48	Luce	Outboard	266	485	4	0	0	755
		Inboard	1	6	1	0	2	10
		Sailboat	0	1	0	0	0	1
			467	492	5	0	2	765
49	Mackinac	Outboard	240	1,658	7	0	1	1,906
		Inboard	2	71	129	11	5	218
		Sailboat	2	2	2	1	0	7
			244	1,731	138	12	6	2,131
50	Macomb	Outboard	3,759	13,043	230	16	0	17,048
		Inboard	120	1,409	2,838	492	41	4,900
		Sailboat	60	119	135	14	3	331
			3,939	14,571	3,203	522	44	22,279

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
51	Manistee	Outboard	508	1,503	15	0	0	2,026
		Inboard	0	73	40	9	1	123
		Sailboat	6	7	5	0	0	18
			514	1,583	60	9	1	2,167
52	Marquette	Outboard	1,490	1,696	10	0	0	3,196
		Inboard	8	53	49	11	1	122
		Sailboat	4	15	5	0	0	24
			1,502	1,764	64	11	1	3,342
53	Mason	Outboard	539	1,622	11	0	0	2,172
		Inboard	3	63	43	8	0	117
		Sailboat	5	5	3	1	0	14
			547	1,690	57	9	0	2,303
54	Mecosta	Outboard	907	1,028	27	3	0	1,965
		Inboard	5	23	10	2	0	40
		Sailboat	4	0	1	0	0	5
			916	1,051	38	5	0	2,010
55	Menominee	Outboard	499	686	7	0	0	1,192
		Inboard	6	12	30	10	2	60
		Sailboat	3	9	4	2	2	20

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
56	Midland	Outboard	1,378	2,714	79	4	0	4,175
		Inboard	4	107	30	4	1	146
		Sailboat	10	19	9	2	1	41
			1,392	2,840	118	10	2	4,362
57	Missaukee	Outboard	235	370	9	0	0	614
		Inboard	2	6	0	0	0	8
		Sailboat	0	0	0	0	0	0
			237	376	9	0	0	622
58	Monroe	Outboard	1,172	3,375	67	5	0	4,619
		Inboard	14	214	270	61	4	563
		Sailboat	3	23	19	5	0	50
			1,189	3,612	356	71	4	5,232
59	Montcalm	Outboard	1,545	1,599	35	1	0	3,180
		Inboard	14	25	6	0	0	45
		Sailboat	8	1	1	0	0	10
			1,567	1,625	42	1	0	3,235
60	Montmorency	Outboard	354	473	18	0	0	845
		Inboard	3	8	2	0	1	14
		Sailboat	1	0	0	0	0	1
			358	481	20	0	1	860

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
61	Muskegon	Outboard	2,863	5,256	43	0	0	8,162
		Inboard	11	332	247	41	9	640
		Sailboat	14	29	30	6	1	80
			2,888	5,617	320	47	10	8,882
62	Newaygo	Outboard	1,080	1,404	17	2	0	2,503
		Inboard	3	32	11	3	1	49
		Sailboat	5	7	0	0	0	12
			1,088	1,443	28	5	1	2,564
63	Oakland	Outboard	11,414	20,689	439	19	0	32,561
		Inboard	89	2,172	1,119	457	93	3,930
		Sailboat	101	221	131	41	7	501
			11,604	23,082	1,689	517	100	36,992
64	Oceana	Outboard	421	747	4	1	0	1,173
		Inboard	1	20	13	2	1	37
		Sailboat	0	2	0	0	0	2
			422	769	17	3	1	1,212
65	Ogemaw	Outboard	428	607	8	0	0	1,043
		Inboard	2	6	2	0	0	10
		Sailboat	2	0	0	0	0	2
			432	613	10	0	0	1,055

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
66	Ontonagon	Outboard	183	459	1	0	0	643
		Inboard	0	13	16	1	0	30
		Sailboat	4	0	0	0	0	4
			187	472	17	1	0	677
67	Osceola	Outboard	501	436	9	0	0	946
		Inboard	7	12	4	0	0	23
		Sailboat	0	0	0	0	0	0
			508	448	13	0	0	969
68	Oscoda	Outboard	172	226	2	0	0	400
		Inboard	2	1	0	0	0	3
		Sailboat	0	1	1	0	0	2
			174	228	3	0	0	405
69	Otsego	Outboard	483	592	14	0	0	1,089
		Inboard	3	24	5	2	1	35
		Sailboat	3	3	2	0	0	8
			489	619	21	2	1	1,132
70	Ottawa	Outboard	2,113	4,041	98	2	1	6,255
		Inboard	14	369	260	74	9	726
		Sailboat	28	34	44	6	1	113
			2,155	4,444	402	82	11	7,094

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
71	Presque	Outboard	390	886	7	0	0	1,283
		Inboard	1	18	6	0	0	25
		Sailboat	2	3	0	0	0	5
			393	907	13	0	0	1,313
72	Roscommon	Outboard	430	2,452	126	0	0	3,008
		Inboard	4	70	9	1	0	84
		Sailboat	16	4	3	0	0	23
			450	2,526	138	1	0	3,115
73	Saginaw	Outboard	2,821	6,601	111	3	0	9,536
		Inboard	15	283	131	59	7	495
		Sailboat	18	28	26	5	0	77
			2,854	6,912	268	67	7	10,108
74	St. Clair	Outboard	882	4,366	35	8	0	5,291
		Inboard	9	512	710	90	18	1,339
		Sailboat	28	30	20	10	4	92
			919	4,908	765	108	22	6,722
75	St. Joseph	Outboard	2,625	2,822	95	0	0	5,542
		Inboard	14	75	14	8	3	114
		Sailboat	14	7	4	0	0	25
			2,653	2,904	113	8	3	5,681

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'0" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
76	Sanilac	Outboard	237	621	5	1	0	864
		Inboard	0	22	15	6	2	45
		Sailboat	2	3	0	0	0	5
			239	646	20	7	2	914
77	Schoolcraft	Outboard	405	838	4	1	0	1,248
		Inboard	3	6	8	0	0	17
		Sailboat	7	0	0	0	0	7
			415	844	12	1	0	1,272
78	Shiawassee	Outboard	1,118	1,937	42	0	0	3,097
		Inboard	6	51	21	3	0	81
		Sailboat	1	3	1	0	0	5
			1,125	1,991	64	3	0	3,183
79	Tuscola	Outboard	548	1,230	13	3	0	1,794
		Inboard	3	37	36	8	3	87
		Sailboat	4	6	0	1	0	11
			555	1,273	49	12	3	1,892
80	Van Buren	Outboard	2,207	2,268	31	0	0	4,506
		Inboard	2	66	23	5	0	96
		Sailboat	5	6	2	0	0	13
			2,214	2,340	56	5	0	4,615

APPENDIX 9--Continued

County Number	Name of County	Type of Propulsion	12'1" & Under	12'1" to 20'0"	20'1" to 30'0"	30'1" to 40'0"	40'1" & Over	Totals
81	Washtenaw	Outboard	3,275	4,260	116	2	0	7,653
		Inboard	22	250	80	37	8	397
		Sailboat	24	38	21	3	0	86
			3,321	4,548	217	42	8	8,136
82	Wayne	Outboard	15,546	41,433	633	37	4	57,653
		Inboard	207	3,706	4,267	1,247	202	9,629
		Sailboat	158	503	354	88	20	1,123
			15,911	45,642	5,254	1,372	226	68,405
83	Wexford	Outboard	626	1,227	25	0	0	1,878
		Inboard	4	21	7	3	0	35
		Sailboat	4	2	0	0	0	6
			634	1,250	32	3	0	1,919
84	Other	Outboard	3,148	7,671	213	0	0	11,032
		Inboard	14	494	248	79	9	844
		Sailboat	15	35	28	4	2	84
			3,177	8,200	489	83	11	11,960
State Totals		Outboard	137,029	256,756	5,651	166	16	399,618
		Inboard	1,068	16,535	13,038	3,317	537	34,495
		Sailboat	958	1,603	1,045	249	49	3,904
FINAL TOTALS			139,055	274,894	19,734	3,732	602	438,017

APPENDIX 10

COUNTY DATA SHEET

COUNTY DATA SUMMARY--ALCONA COUNTY

Lake Size Class*	Number Lakes	Number Acres	
5	4	29	
10	16	199	
16	4	72	
25	6	194	
40	5	228	
60	7	546	
100	1	115	
160	1	193	
250	0	0	
400	0	0	
600	1	729	
1,000	1	1,008	
1,600	0	0	
2,500	0	0	
4,000	0	0	
6,000	1	9,200	Hubbard 9,200 (2 sites)
10,000	0	0	
16,000+	0	0	
Total	47	13,489	

APPENDIX 10--Continued

Number Lakes	Number Acres	Number WW Sites	Lake Acres with WW Sites	Number of Sites Forestry, Park and Game Sites	Number Usable Sites	Demand 1965	Demand 1980
47	13,489	3	9,200	0	2	156,497	451,513
						Per Cent Increase	
						181 %	

*In acres.

APPENDIX 11

STATE PLANNING REGIONS AS OF JUNE, 1971

Alcona County

Water Resource Data

(1) Inland Lakes

Total number 91 Total area 12,260 acres

Number less than 200 acres--88 More than 200 acres--3

Largest lake--Hubbard, 8,850 acres

Other large lakes--Cedar (partially in Iosco County) 1,075 acres; McCollum (partially in Oscoda County) 224 acres and Alcona Dam Pond 1,007 acres.

Inland Streams

(1) Total miles of streams 362

Thunder Bay River drains about 275 square miles in the county.

The Pine River drains about 209 square miles in the county.

AuSable River drains about 98 square miles in the county.

(3) Great Lakes Shoreline--25 miles

Ground Water--Large supplies, temperature about 47°.

Power Dams

Name	River	Owner
Alcona Dam	AuSable	Consumers Power Company

(2) Public Water Supplies

Harrisville from wells

(1) Waterside Recreation Areas (State)

Public Fishing Sites--5.68 acres, 250 feet frontage on 1 lake site and 0.6 acres, 265 feet frontage on 1 stream site

Parks--Harrisville State Park, 77 acres, Lake Huron

U.S. Weather Bureau Station

Harrisville, annual precipitation 30.73 inches.

Irrigation--Two systems irrigating six acres.

Official State Planning Regions and Recreation Plan
Sub Regions as of June 1971

APPENDIX 12

COUNTY LAKE LISTS FOR HILLSDALE, LENAWEE AND JACKSON COUNTIES

Lake Acres	Lake Name	Number of Sites and Existing Parking	Lake Rank	Hymphrys' Lake Number
		Hillsdale County		
485.0	Le Ann	--	1	3
329.0	Baw Beese (First)	--	2	184
213.0	Long	1/8	3	278
140.0	Hemlock	1/10	4	194
128.0	Cub	1/10	5	274
117.0	Bear	1/0	6	259
113.0	Bird	1/10	7	245
		Lenawee County		
1330.0	Devils	1/10	1	45
515.0	Round	--	2	163
440.0	Sand	1/5	3	80
394.0	Wamplers	--	4	49*
201.0	Evans	--	5	130
200.0	Goose	--	6	4
150.0	Posey	--	7	172
125.0	Silver	--	8	7
104.0	Dewey	--	9	89
		Jackson County		
800.0	Columbia	--	1	519
730.0	Michigan Center	--	2	348
531.0	Portage (Big)	1/489	3	25
505.0	Vineyard Lakes	--	4	503
470.0	Clark	--	5	518

APPENDIX 12--Continued

Lake Acres	Lake Name	Number of Sites and Existing Parking	Lake Rank	Hymphrys' Lake Number
440.0	Wamplers	--	6	510*
398.0	Goose	--	7	127
355.0	Wolf	--	8	317
340.0	Gillett	--	9	161
326.0	Grass	--	10	134
268.7	Pleasant	--	11	34
210.0	Brown's	--	12	297
195.0	Farewell	--	13	601
175.0	Stony	--	14	368
174.00	Portage (Little)	--	15	23
171.0	Mud	--	16	141
154.0	Norvell Mill Pond	--	17	474*
144.0	Vandercock	--	18	396
141.9	Brill	--	19	159
140.0	Mud	--	20	494
138.0	Clear	--	21	32
137.0	Round	--	22	568
130.0	Ackerson	--	23	352
106.0	Welch	--	24	126
	Jackson County			
105.0	Sweezey	--	25	336
100.0	No Name	--	26	344