

RECREATIONAL BOAT TRANSPORTATION IN MICHIGAN:
A STUDY OF USE PATTERNS AND CHARACTERISTICS
OF BOATERS WHO TRANSPORT THEIR BOATS

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ABSTRACT

RECREATIONAL BOAT TRANSPORTATION IN MICHIGAN: A STUDY OF USE PATTERNS AND CHARACTERISTICS OF BOATERS WHO TRANSPORT THEIR BOATS

By

Richard A. Meganck

The main problem examined in this thesis was the relationship between the behavior of a person who transports his boat for recreational purposes and selected socio-economic characteristics. This project was part of the 1968 Michigan Recreational Boating Needs Survey undertaken for the Waterways Commission, Michigan Department of Natural Resources by the Recreation Research and Planning Unit, Department of Park and Recreation Resources, Michigan State University. This study was designed to add to the overall transportation information which will be used in a computer simulation model to predict future demand for recreational boating in the State of Michigan.

A total of 21,764 questionnaires were mailed to a stratified random sample of registered boat owners in the State of Michigan. The sample was stratified by county and by boat length. A return of 5,674 questionnaires provided an acceptable sample from which to undertake the analysis.

The data was expanded to estimate by county the number of boat owners in Michigan who transport their craft. A linear regression analysis was run on the CDC 3600 computer at the Michigan State University Computer Laboratory. This analysis indicated that greater than 55 per cent of the respondents transported their boats during 1968; 75.1 per cent by trailer and 24.8 per cent by car top. It was also shown by comparison to the 1965 data that the boating fleet is becoming more mobile in the State of Michigan.

Age, occupation, and education of the family head ✓ and total family income were the independent variables tested in the regression analysis. All were found to be significant to the 5 per cent level and therefore, none were deleted from the model test. These variables accounted for a total of 6.4 per cent of the variance.

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A THESIS

Submitted to
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DEDICATION

To Mike and Judy Freed;
Whose Life-Style and Goals
Have Been an Inspiration to Me.

ACKNOWLEDGMENTS

A report of this type which fills a small gap in an already complex system for necessary information for state-wide planning of recreational facilities can succeed only if the author enjoys the help and cooperation of many individuals.

I wish to thank in particular Dr. Michael Chubb, my academic advisor and thesis director for many months of sincere dedication and encouragement during this study. A special thanks must also be given to Mr. Fiske, who directed the 1968 Boating Needs Survey and whom without his help and guidance, this thesis would have been impossible to undertake.

I would also like to express my sincere appreciation to Professor and Chairman of the Department of Park and Recreation Resources, Mr. Louis F. Twardzik for his unending allegiance to me throughout my undergraduate and graduate degree programs.

I wish to thank the secretarial staff and the staff of the Recreation Research and Planning Unit for their time in the preparation of this thesis, and also Mr. James Mullin

and Mr. Larry Paxton of the Michigan State University Computer Laboratory.

Lastly, I wish to acknowledge my parents Mr. and Mrs. Albert Meganck for their unending belief in my education goals and their encouragement in my career desires.

TABLE OF CONTENTS

Chapter	Page
I. BACKGROUND INFORMATION Growth of Boating Statement of the Problem Significance of the Problem Hypothesis and Objectives Definitions Review of Literature	1
II. PROCEDURES Selection of the Method Methods of Survey Research Design of the Questionnaire Sampling Procedures Evaluation of Bias Coding of the Data Hypothesis Testing Limitations	12
III. SELECTED CHARACTERISTICS OF BOAT TRANSPORTERS Analysis of Frequency Count Data Characteristics of "All" Boat Owners Compared to Characteristics of Boat Transporters Summer Storage Method and the Boat Transporter Socio-Economic Characteristics by Summer Storage Class Analysis of Boat Class and the Method of Transportation by Frequency of Transport in the 1968 Boating Needs Survey Expansion of the Number of Persons Transporting Boats to Statewide Values by County	26

Chapter	Page
IV. HYPOTHESIS TEST ANALYSIS	52
Introduction	
Results	
V. CONCLUSIONS AND RECOMMENDATIONS	56
SELECTED BIBLIOGRAPHY	60
APPENDICES	62
Appendix	
A. 1968 Michigan Recreational Boating Needs Questionnaire	
B. Summary of Number of Boating Demand Study Questionnaires Mailed by County of Registration and Boat Length	
C. Optical Scan Sheets	
D. Expanded Estimates of the Number of Boat Transporters by County	
E. Statistical Regression Analysis Computer Run	
F. County Coding Identification Numbers	

LIST OF TABLES

Table	Page
1. A Comparison by Length in the Number of Boats Registered in the Years of 1965 and 1968	2
2. Summary of Mailed Sample, Returns and Usable Questionnaires by Boat Class . . .	19
3. Sample for Test of Survey Bias	21
4. Comparison by Occupation Categories of Non-Transporters to Boat Transporters in the 1968 Michigan Boating Needs Survey	29
5. Education Distribution for Non- Transporters and Boat Transporters in the 1968 Boating Needs Survey	32
6. Income Distribution for Non-Transporters and Boat Transporters in the 1968 Boating Needs Survey	32
7. Age Distribution for Non-Transporters and for Boat Transporters in the 1968 Boating Needs Survey	33
8. Age Distribution of Boat Transporters for the 1968 Boating Needs Survey	34
9. Per Cent of Transporters and Non- Transporters by Summer Boat Storage Type and Average Number of Times Transported	36
10. Transporters by Selected Summer Storage Type for the 1968 Boating Needs Survey . .	38
11. Number, Per Cent of Group and Average Transportation Rate Per Capita	41

Table		Page
12.	Number, Per Cent of Group and Average Transportation Rate Per Capita by Education and Summer Storage Type	43
13.	Number, Per Cent of Group and Average Transportation Rate Per Capita by Income and Summer Storage Type	44
14.	Number, Per Cent of Group and Average Transportation Rate Per Capita by Age and Summer Storage Type	47
15.	Boat Classes by Per Cent and Frequency of Transport when the Method of Transport is a Trailer	48
16.	Boat Classes by Per Cent and Frequency of Transport when the Method of Transport is a Car Top	48
17.	Frequency of Transportation for Trailer, Cartop and All Transporters . . .	50

CHAPTER I

BACKGROUND INFORMATION

Growth of Boating

Recreational boating has increased at an unbelievable rate in both the United States and Michigan during the last twenty years. In the days preceeding and immediately following World War II, it was a sport enjoyed primarily by the wealthy, although many middle class persons did own small boats which served their demand for water oriented recreation. But in the period from 1950 to 1964, there has been a 120 per cent increase in the numbers of recreational watercraft in the Nation.¹ The number of persons boating has also increased at a phenominal rate. The Boating Industry Association estimates that nearly forty-one million Americans boated in 1967 as compared to approximately thirty-eight and one-half million in 1964.²

¹National 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: N.A.E.B. and O.B.C.A., 1964), p. 8.

²Boating Industry Association, The Marine Market, Annual Market Research Notebook (Chicago: Boating Industry Association, 1967), p. 43.

Michigan has been a leader in the nationwide trend with the number of registered recreational watercraft increasing from 217,533 in March of 1958 to 398,902 in December of 1965.¹ By the close of 1968, a total of 438,017 boats was registered in Michigan.² Therefore, Michigan has experienced over a 100 per cent increase in the number of registered watercraft in the ten year period from 1958 to 1968. Table 1 shows the growth, by boat size class from 1966 to 1968. (In Michigan for general planning purposes, boats are divided into two major categories; under twenty feet in length and over twenty feet in length.)

TABLE 1

A COMPARISON BY LENGTH IN THE NUMBER OF BOATS REGISTERED
IN THE YEARS OF 1965 AND 1968

Year	Registered Boats Less Than 20 Feet		Registered Boats Greater Than 20 Feet		Total
	No.	%	No.	%	
1965	377,763	94.8	2,139	5.2	398,902
1968	413,949	94.6	24,068	5.4	438,017

¹Michigan Department of Conservation, Waterways Commission, Transportative Predictive Procedures, Technical Report No. 9c (Lansing, Michigan: Michigan Department of Commerce, April 1967), p. 4.

²Michigan Department of State, Secretary of State's Office, Division of Vehicle and Watercraft Records, "Size and Type of Registered Boats in Michigan Counties" (Lansing, Michigan: December 31, 1968).

There has therefore been an increase of greater than 39,000 or 8.9 per cent in the registered watercraft in Michigan in the three year period from December 1965 to December 1968.

The reasons for this increase in the number of registered boats and consequent increase in total boating participation are several. The increase in population in the United States and Michigan has had an effect on the growth of demand for outdoor water oriented recreation, although its effect is small compared to the other factors involved. An increase in the amount of disposable income coupled with an increase in the amount of leisure time resulting from a shorter work week and longer annual vacation periods has given more people greater opportunities to become involved in an entirely new spectrum of outdoor recreation activities. (The participation rate per capita has obviously played an important role in this demand increase.) People are becoming more mobile, and this fact coupled with the above mentioned factors, makes it easier for people to participate more often in boating. More ramps, launching and docking facilities, access sites and marinas have therefore been required. Technical advances such as the development of small, high horsepower motors and moderately priced watercraft have permitted many families to participate in waterskiing and other boating activities that were previously out of their financial reach. Finally, Michigan's

unique water resources with 3,288 miles of Great Lakes shoreline and 35,000 inland lakes, complemented the change in water oriented activities participated in by Michigan residents.¹

Statement of the Problem

In 1968, the Waterways Commission of the Michigan Department of Natural Resources² requested that the Recreation Research and Planning Unit, Department of Park and Recreation Resources, Michigan State University, undertake a long term study of recreational boating demand in order to predict future recreational boating characteristics and patterns by county for the State of Michigan. As a result, the 1968 Michigan Recreational Boating Needs Survey was conducted in order to gather socio-economic and participation data from boaters. This data was obtained from mailed questionnaires, and will be used in the RECSYS-SYMAP computer simulation model in order to predict possible future participation patterns.

Two sub-projects within this demand study were designed to analyse particular sections of the information obtained in the questionnaire, they are:

¹Detroit Edison Company, Growth--Southeastern Michigan, A Good Place to Grow (Detroit: Detroit Edison Company, Area Development Division, 1961), p. 14.

²The Michigan Department of Natural Resources was re-named the Michigan Department of Conservation in 1968.

1. An analysis of selected use patterns and socio-economic characteristics of multiple boat owners. This study was also concerned with estimating the number of unregistered watercraft in Michigan.¹
2. An analysis of the nature and patterns of transportation of recreational watercraft. The principal objective of this study was to discover if there is a relationship between the number of times a boat is transported and certain socio-economic characteristics. The author was responsible for this investigation and it is the subject of this thesis.

The first part of the thesis will be concerned with tabulations of the characteristics of boat owners who transport their craft. The frequency of launching, the type of storage facility used, the number of launches, the boat length, and the means of transporting the boat will constitute the main tabulations. Frequency counts indicating possible relationships between selected socio-economic characteristics and transportation characteristics will also be discussed in this section.

¹Ronald Kaiser, "A Study of Multiple Boat Ownership in Michigan" (unpublished M.S. thesis, Michigan State University, 1970).

The second part of the thesis will be an investigation of possible statistical correlations between boating transportation patterns and certain socio-economic characteristics. This area of investigation is of great importance to the Waterways Commission's planning staff and it was one of the tasks specified in the contract between the Recreation Research and Planning Unit staff and the Commission.

Significance of the Problem

The Michigan Department of Natural Resources has agreed to the Recreation Research and Planning Unit using the RECSYS computer simulation technique¹ for predicting the probable distribution of recreation demand by county on a statewide basis. This model will continue to be used to predict boating demand and therefore serves as a valuable tool for planners in the Waterways Commission. They feel that such information would also be of assistance to other resource management agencies involved in determining the magnitude and direction of programs related to recreational boating.

The analysis of the characteristics and behavioral patterns of boaters who transport their boats could

¹Michael Chubb, Outdoor Recreation Planning in Michigan by a Systems Analysis Approach: Part III--The Practical Application of "Program RECSYS" and "SYMAP" (East Lansing, Michigan: Department of Park and Recreation Resources, Michigan State University, 1967).

eventually assist in improvement of the transportation link in the RECSYS simulation computer model.

Hypothesis and Objectives

The main hypothesis of this thesis is that the number of times a person (registered boat owner) transports his boat is related to certain of his socio-economic characteristics. The dependent variable is the number of times a person transports his boat. The independent variables that will be tested are age, income, occupation, and education of the head of the family. The hypothesis for a linear equation stated mathematically is as follows:

$$Y = f(a) (x_1 + x_2 + x_3 + x_4) + E$$

where:

Y - is the observed dependent variable--the number of times a person transports his boat.

x_1 - x_4 - are the observed independent variables--a person's (head of the family) age, income, occupation and education.

a - is the point where the slope intersects the y axis.

E - is the random error observation.

The main objectives of this thesis are:

1. To give general description of socio-economic characteristics and boating behavioral patterns

of Michigan boaters who transport their boats in order to better understand the problem subject and assist in the identification of possible relationships.

2. To test the hypothesis stated above.

Definitions

Registered Boat: Any boat which is propelled by machinery, whether or not machinery is the principal source of power, must be registered with the Secretary of State in Michigan.¹ Therefore, the terms "motorboat" and "registered boat" are synonymous.

Boat Transporter: For purposes of this study any person who transports his boat either by a car top carrier or trailer and, (a) launches the craft at his destination or (b) stores it at the destination, will be termed a "boat transporter."

Review of Literature

At the present time, very little information exists about the characteristics of boaters at either a national, state or local level. Prior to the 1968 Recreational Boating Needs Survey, no study had been undertaken which attempted to analyse in detail the socio-economic

¹Michigan Department of State, Secretary of State's Office, Division of Vehicle and Watercraft Records, Michigan's Marine Safety Act, Act 303, Public Acts of 1967 (Lansing, Michigan: 1967).

characteristics of boaters in the State of Michigan. Existing imprecise and fragmentary data is no longer a reliable enough tool on which to base planning for future boating demand and the use of our land and water resources.

✓ The Outdoor Recreation Resources Review Commission's report of 1962 (ORRRC)¹ was the first major attempt to study many phases of natural resource based recreation on a national level. Because of the relatively small number of the respondents interviewed in Michigan, the raw ORRRC data for the State is not reliable for planning purposes within the State. The ORRRC reports present data on a regional basis and these results are not usually applicable in Michigan for planning purposes due to the State's unique distribution of natural resources. This is especially true in the case of boating because of the State's large inland and Great Lakes water resources. Finally, the data for the ORRRC studies was gathered in 1959 and 1960 and therefore is now considerably out-of-date.

The Michigan Outdoor Recreation Demand Study of 1966 (MORDS)² concerned itself very little with the relationship

¹Outdoor Recreation Resources Review Commission, Report of the Commission to the President and to the Congress, Outdoor Recreation for America (Washington, D.C.: U.S. Government Printing Office, 1962); and the twenty-seven volumes of individual reports. A detailed analysis of boating is given in Report No. 19, National Recreation Survey.

²Department of Resource Development, Michigan State University, Michigan Outdoor Recreation Demand Study, Technical Report No. 6 (Lansing, Michigan: State Resource Planning Program, Michigan Department of Commerce, June 1966).

between the incidence of transport and the socio-economic characteristics of those who transport their boats. The report stated that 73.9 per cent of the respondents transported their boat by trailer, 2.8 per cent used their car top for transportation and 22.9 per cent indicated that they transported their craft by some other means.¹ But there was no attempt to relate socio-economic characteristics to these frequency counts.

The 1966 Transportative Predictive Procedures study by the Michigan Waterways Commission² included tabulations of transportation frequency and methods by size of boat but did not gather data on the socio-economic characteristics of those who transported.

The amount and quality of research concerning the recreational use of resources has been increasing at a steady rate for several years now and much background information needed to conduct more sophisticated studies is being compiled. Many states are preparing detailed recreation plans including sections on recreational boating. However, most of these studies are concerned primarily with boating registration figures and average participation values. This thesis is an attempt to provide a more

¹Department of Resource Development, Michigan Outdoor Recreation Demand Study, p. 10.14

²Michigan Department of Conservation, Transportative Predictive Procedures, pp. 47-49.

detailed analysis of Michigan boaters who transport their craft as a contribution to understanding recreational boating and predicting future boating demand.

CHAPTER II

PROCEDURES

Selection of the Method

The data which will be analyzed in this thesis came directly from the 1968 Boating Needs Survey questionnaire. It is primarily a result of mailing 21,764 of these questionnaires to a stratified sample drawn from Michigan's 438,017 registered boat owners. A copy of the questionnaire and the accompanying cover letter, appear in Appendix A.

Methods of Survey Research

There are several methods that can be used in recreation research to collect data needed for an analysis of demand. Among these, the telephone interview, the observation interview, the observation method, and the personal interview were rejected as acceptable means for gathering the data. The limitations of staff, time and money were important in the decision not to select any of the above methods. (For a more complete discussion of the procedures for each of these methods, and their advantages and disadvantages, see Crapo and Chubb, Recreation Day-Use

Investigation Techniques.¹ Even though this study concerned state park day-use investigation techniques, it was felt by the Recreation Research and Planning Unit, that many of the findings concerning questionnaire design were pertinent to the development of a suitable questionnaire for the 1968 Boating Needs Survey.) After considering the experience of the Waterways Commission with the 1965 boating survey and reviewing several other studies, the mailed self-administered questionnaire was selected as the most suitable data gathering method.

Some of the advantages of the mailed questionnaire which were considered are: (1) A relatively small staff of comparatively untrained people can obtain data from a large sample of respondents. (2) Self-administered questionnaires tend to be less expensive per response than interview methods. (3) Respondents can retain a feeling of anonymity. (4) It permits data gathering over a large geographical area. It was felt that these advantages outweighed the disadvantages of which the following were the most important: (1) Self-administered questionnaires limit the depth and detail of questions. (2) There may be difficulty in obtaining an adequate response rate. (3) It may require an

¹Douglas M. Crapo and Michael Chubb, Recreation Day-Use Investigation Techniques: A Study of Survey Methodology, Recreation Research and Planning Unit, Technical Report No. 6 (East Lansing, Michigan: Department of Park and Recreation Resources, Michigan State University, April 1969).

extended period of time to obtain an adequate response.

(4) Bias may enter in the answers because of misunderstanding or falsifying of the information by the respondent.¹

There are three main methods of distributing self-administered questionnaires for a boating study of this type. They are: (1) handing out the questionnaires to boaters during the season; (2) a mailed questionnaire at intervals during the season; (3) a mailed questionnaire at the end of the season. The Waterways Commission and the Recreation Research and Planning Unit decided to use a mailed questionnaire at the end of the season with a large sample size and one mailing instead of a smaller sample and intensive follow-up procedures. It was planned to mail the questionnaire in early November 1969, immediately following the boating season. Because of delays in transferring boater registration information from the Secretary of State's Office to the Michigan State University Computer Laboratory tapes, the actual questionnaire was not mailed until late March; resulting in what can be termed a "delayed mail questionnaire." However, a delayed mail questionnaire survey gave the best results to Shafer and Hamilton when they compared four survey techniques used in outdoor

¹Crapo and Chubb, Recreation Day-Use Investigation Techniques, pp. 22-24.

recreation research in 1967¹ so the losses due to the late mailing may not have been significant.

Design of the Questionnaire

The questionnaire design started in the early fall of 1968. A series of draft questionnaires were prepared and reviewed by the Recreation Research and Planning Unit staff and by personnel from the Waterways Commission. A revised draft was tested by distributing it to fifty persons known to have boats who were employees of the Michigan Department of Natural Resources, Michigan State University, or St. Lawrence Hospital, Lansing, Michigan. Further revisions based on the problems and comments of these test respondents resulted in the final questionnaire design. In the final printed instrument, three types of questions are found: (1) closed questions, (2) fixed alternative questions, and (3) open-ended questions.

The questions proceeded from impersonal, easily answered questions to those requesting more personal information and ended with an open-ended question regarding boater complaints and problems. The first page was a motivational letter introducing the study. It was printed on a replica of Waterways Division stationery and asked the boat

¹Elwood L. Shafer, Jr. and John F. Hamilton, Jr., A Comparison of Four Survey Techniques Used in Outdoor Recreation Research, United States Forest Service Research Paper NE-86 (Upper Darby, Pennsylvania: N.E. Forest Experiment Station, 1967).

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owner for his cooperation in helping plan for Michigan's boating future (see Appendix A).

Page two was a map of Michigan which was included to aid boat owners in filling out the questionnaire since several questions asked the respondent to name specific counties where his boat was launched or used. Page three was concerned with the type of power system, its horsepower rating, the place of storage during the boating season, whether or not the boat was transported, the means of transportation, the number of times it was transported, and the counties where the boat was launched most frequently.

The fourth and fifth pages of the study contained fixed alternative and closed questions. They concern the number of days the boater used the Great Lakes and inland lakes and streams in Michigan for boating and the amount of use in any Canadian Province or another state.

Page six and part of page seven involved personal information which was considered necessary for the forecasting of probable future demand for boating facilities. This information is important in this study when comparing transportation behavior patterns with socio-economic data. Age and sex of the family head, income and education level, are the areas with which the questions were concerned.

The remainder of page seven contained the one completely open-ended question pertaining to boating problems which was not coded for purposes of the 1968 Boating Needs

Survey, although most of the responses were read by the Director of the Waterways Commission.

Sampling Procedures

Selecting an appropriate sample structure for the 1968 Boating Needs Survey involved consideration of the level of accuracy desired, the time and money available, and the experiences encountered with two previous studies. The Michigan Outdoor Recreation Demand Study and the 1965 Boating Needs Survey both indicated that approximately 38 per cent return could be expected from a mailed self-administered questionnaire to a sample of registered boaters if no follow-up procedures were used to increase response. The respondent sample size of the 1965 Boating Needs Survey was determined to be adequate for analysis on a county by county basis, and thus was used as a model for the 1968 study. The decision was made, therefore, to mail out approximately 22,000 questionnaires to a stratified random sample of registered boat owners. In order to obtain adequate representation of the larger boats, 10 per cent of the population of registered boats over twenty feet in length was sampled while 5 per cent of these under twenty feet were included. Of the total mailed, 615 questionnaires were sent to out-of-state residents. A detailed county breakdown of the mailed sample by both county and boat size is given in Appendix B.

In order to obtain the data necessary to develop the sample, boat registration records from the Michigan Secretary of State's Office were obtained. These records list the type and size of registered boats by county and give the names and addresses of the owners. As of December 31, 1968 there were 438,017 boats registered in Michigan. The actual selection of the persons to receive the questionnaires was carried out by calculating the sampling interval necessary to produce the above mentioned percentages for each boat size class in each county. This required that 2,296 persons with boats over twenty feet and 19,468 with boats under twenty feet receive questionnaires. The computer was programmed to fill the sample cells by a random selection method.

Of the 21,764 questionnaires, approximately 5,700 or 26 per cent were returned. This was still felt to be an adequate sample even though it fell substantially below the 38 per cent which previous studies indicated could be expected to be returned from a large sample population.¹ Two-hundred and sixty-two of the 615 out-of-state users who received questionnaires, returned them and this was determined to be an acceptable level of return.

¹The lower response rate was probably due to a combination of factors such as the late mailing date, more difficult questions than in the 1964 and 1965 surveys, and the fact that survey research of this type is now less of a novelty in Michigan.

The counties of Wayne, Kent, and Macomb were represented by large numbers of returned questionnaires because of their large populations. Because of budget limitations and after consultation with a statistician and the Waterways Commission, an acceptable sample of the questionnaires returned from these counties were coded initially.¹ The following table indicates the number of registered boat owners for each category and the response rate of usable questionnaires.

TABLE 2
SUMMARY OF MAILED SAMPLE, RETURNS AND USABLE
QUESTIONNAIRES BY BOAT CLASS

Boat Size Classes	No. of Regist. Boats	No. of Mailed Quest.	No. of Usable Returns	% Usable Returns	Returns Used in Socio-Econ. Anal. ^a
20' or less	413,949	19,468	5,049	25.9	4,376
20' plus	24,068	2,296	598	26.0	439
TOTALS	438,017	21,764	5,647	25.9	4,815

^aQuestionnaires were not included in the analysis because, although the respondent filled in the information concerning his boat, he did not answer the socio-economic questions.

¹Personal interview with Mr. Paul Fiske, Instructor, Department of Park and Recreation Resources, Supervising the 1968 Boating Needs Survey.

Evaluation of Bias

According to Moser, non-response may be a problem in survey research because usually the persons who do not respond are different in some way from the ones who do. Even if the practice of interviewing 100 per cent of the persons selected to answer the questionnaire was used, the results would not be bias free. Moser found that bias from non-respondents will increase as their differences from the respondents become greater.¹ Some individuals think that any type of survey research is an invasion of their privacy and therefore their answers will undoubtedly be biased regardless of the interview method used. To check on the severity of bias present in this study, both due to non-response and the misunderstanding of questions, the mail questionnaires were followed-up by personal interviews in three sample counties. Ingham, Grand Traverse, and Leelanau Counties were selected because they offered a variety of urban and rural situations in two different geographical areas of lower Michigan. Time and available manpower were also important in selecting these counties as the ones in which personal interviews would be conducted.² Originally,

¹C. A. Moser, Survey Methods in Social Investigation (London: Heinemans Educational Books Limited, 1958), p. 177.

²Additional information on this and other aspects of the 1968 Boating Needs Survey will be given in subsequent Recreation Research and Planning Unit reports to the Waterways Commission.

it was planned to conduct 100 interviews in Ingham County and 100 distributed between Leelanau and Grand Traverse Counties. In Ingham, seventy-five were to be non-respondents and twenty-five respondents. The same proportions were to be used in the other 100 interviews. Because the funds available were limited and difficulty in scheduling interviews with some respondents was experienced, not all of the interviews were completed. Table 3 shows the actual distribution of these personal interviews.

To date, a detailed statistical analysis of the interview data has not been made. However, comparison of the data for those that did respond to the interview with those who responded to the initial questionnaire indicates that the information obtained was reliable.

TABLE 3

SAMPLE FOR TEST OF SURVEY BIAS

County	Number Expected To Be Interviewed	Number Actually Interviewed	Number of Respondents	Number of Non-respondents
Ingham	100	47	13	34
Grand Traverse	} 100 {	56	20	36
Leelanau		17	2	15
TOTAL	200	130	35	85

Coding of the Data

Information was taken from the questionnaires and placed on pre-printed optical scan forms. Copies of the optical scan forms are found in Appendix C. The information coded on each form was as follows:

1. Boat identification number, power system, county where the boat was registered, its storage location during the season, if it was transported, by what means it was transported, number of times it was transported, boat use out-of-state or in Canada, and additional boat types (lengths and horsepower).
2. Boat identification number, county where launched the most, what type of facility (city, county, township, state, federal, commercial, private, other), same for county of second-most launches, third-most launches, and all other launches.
3. Boat identification number, Great Lakes use, total days of use, county most used, purposes (trout/salmon fishing, other fishing, hunting, waterskiing, cruising, other), same for county of second-most use, third-most use, and all other use.
4. Boat identification number, inland lake use, total days of use, county most used, purposes (trout/salmon fishing, etc.).

5. Boat identification number, county of residence, zip code, age--head of family, sex--head of family, male ages, female ages, occupation, income, education.

Hypothesis Testing

Stepwise deletion of variables from a least squares equation was thought to be the most direct and least expensive method of analysis for this study. In stepwise deletion, an initial least squares equation is hypothesized using all of the independent variables. One variable is then deleted from the equation and a new least squares equation estimated. A second variable is deleted and the least square equation again recalculated. The procedure continues until a variable selected as a candidate for deletion meets one or more stopping criteria.¹ The stopping criteria for this routine was a minimum significance level of 5 per cent. (See Chapter IV for more detail.)

Limitations

The methods employed in data gathering were affected by certain circumstances which may limit, to some extent, the accuracy of the results.

¹Michigan State University, Agricultural Experiment Station, LSDEL: Stepwise Deletion of Variables from a Least Squares Equation, Statistical Services Description No. 8 (East Lansing, Michigan: 1969).

As mentioned previously, non-response was a problem. Obtaining every respondents cooperation is an impossibility when one employs a mailed questionnaire. The possibility of bias due to non-response will eventually be tested as part of the Recreational Boating Needs Study analysis.

Ten per cent of these who did return the questionnaire refused to fill in the socio-economic information requested. This eliminated much of the information needed for the analysis section of the study. Only frequency counts of the actual boating data can be produced from questionnaires filled out in this manner. Questionnaires without the socio-economic data were not included in analysis of these variables.

Probably the most significant limitations was that several of the questions did not produce the desired information. Question six only analyzed two methods of transportation and it is indicated in a later chapter of this thesis that a substantial per cent of boat transporters may use a different method than either a trailer or a car top. Question eight on page three was intended to be an extremely important part of the boating behavior analysis since it would yield information concerning the number of times boats were launched and the counties in which launching took place at various types of facilities. The majority of people answered by merely placing an "X" under the type of facility used instead of numerals indicating the number of times

launched at that type of facility. As a result, this question could not be coded. Respondents also found that completion of questions ten, twelve, and thirteen was difficult primarily because of their complexity. However, interviews of respondents in the three test counties did not indicate serious errors in answering these questions.

The results of the study are limited to information gathered from persons who returned the questionnaire or were selected for a personal interview, and not the entire boating population. It is also restricted to registered boat owners only.¹

Analysis of data began in April 1970, and results pertaining to boat transportation are expressed in the succeeding chapters.

¹It is estimated that Michigan has more than 57,000 boats which legally do not require registration. Kaiser, "Multiple Boat Ownership," p. 73.

CHAPTER III

SELECTED CHARACTERISTICS OF BOAT TRANSPORTERS

Analysis of Frequency Count Data

In this chapter, the following topics will be examined:

1. Comparison of the characteristics of all boat owners (respondents to the 1968 Boating Needs Survey) and of those boat owners who transport their craft, by examining occupation, income, age, and education of the head of the family.
2. Analysis of the storage methods used by the boat transporter. This includes examining certain socio-economic characteristics associated with selected storage places.
3. Analysis of the length and frequency of transportation of boats carried on car tops and by trailers.
4. Expansion of the number of persons transporting boats from the sample data to statewide county by county estimates.

Comparison of the characteristics of the respondents to the 1968 Boating Needs Survey to the characteristics of

respondents in previous studies conducted in Michigan will not be included here since this topic was previously discussed by Kaiser.¹

Characteristics of "All" Boat Owners Compared
to Characteristics of Boat Transporters

Occupation of Respondents

The occupation given by the respondents in question eighteen were originally coded in eighteen separate occupational classifications based on the system used by the United States Bureau of Census. It was felt by the author and the Recreation Research and Planning Unit, that for purposes of this and other related studies, these eighteen original classes could be combined into twelve categories. Several of the original eighteen classifications contained extremely small numbers of respondents and therefore analysis might be more satisfactory if some were combined. The following indicates the combination process.

<u>Original Coding Classifications</u>	<u>New Classifications Used in Analysis</u>
1. Professional	1. Professional
2. Farmers	2. Farmer; Farm Laborers
3. Managers	3. Managers
4. Clerical	4. Clerical; Sales
5. Sales	5. Skilled Craftsmen

¹Kaiser, "Multiple Boat Ownership," Chapter 3.

<u>Original Coding Classifications</u>	<u>New Classifications Used in Analysis</u>
6. Craftsmen	6. Operative
7. Operative	7. Service; Household
8. Household	8. Labor; Other Factory
9. Service	9. Housewife
10. Farm Laborers	10. Retiree
11. Laborers	11. Other (Student; Military; Unemployed)
12. Student	12. No response to question
13. Housewife	
14. Retiree	
15. Military	
16. Unemployed	
17. Other; Factory	
18. No response to question	

The figures in Table 4 compare the occupational categories of non-transporters with those of the respondents who transported boats. The values show that 22.2 per cent of the total non-transporters to the survey fall into the "managers" category. The next most significant occupational class was that of "retirees" with 18.7 per cent. "Professionals" and "skilled craftsmen" also recorded significant percentages with 18.2 per cent and 16.5 per cent respectively. "Labor" and "housewives" had the smallest percentages with .8 per cent and .4 per cent.

TABLE 4

COMPARISON BY OCCUPATION CATEGORIES OF NON-TRANSPORTERS
TO BOAT TRANSPORTERS IN THE 1968 MICHIGAN
BOATING NEEDS SURVEY^a

Occupation	Non-Transporters		Boat Transporters	
	Number	Per Cent	Number	Per Cent
Professional	259	18.2	428	13.7
Farmer	17	1.1	58	1.9
Managers	316	22.2	475	15.2
Clerical	102	7.1	233	7.5
Skilled Craftsmen	235	16.5	914	29.2
Operative	39	2.7	286	9.2
Service	37	2.6	167	5.3
Labor	11	.8	20	3.1
Housewife	11	.7	2	.1
Retiree	266	18.7	340	10.9
Other	102	7.1	9	.3
No Response	24	1.6	58	3.6
TOTALS	1,419	100.0	2,990	100.0

^aOf the socio-economic questions in the questionnaire, age, occupation, and education refer to only the head of the family. Income refers to total family income; not just that of the family head.

In general, boat transporters had a similar distribution of occupational classifications. The same occupational classifications which recorded the highest percentages for the non-transporters, were found to exhibit the greatest per cent ranking for respondents who transported their craft; although in a different order. "Skilled craftsmen" recorded the greatest percentage with 29.2 per cent. This is 12.7 per cent higher than the same category for non-transporters and 7 per cent greater than the highest rating (22.2%) of a non-transporter occupational classification. (Kaiser also experienced a similar trend in examining the occupational distribution of multiple boat owners.)¹ Managers with 15.2 per cent and professionals with 13.7 per cent were the next highest categories, although they dropped 7 per cent and 5 per cent respectively from their class rating of non-transporters. The occupational group entitled "other" (including students, military, and unemployed) experienced a drop of 6.8 per cent while the "retiree" category fell 7.8 per cent. When the entire range is considered, these differences are probably not very significant.

¹Kaiser, "Multiple Boat Ownership," page 33.

Education of Respondents

Education was divided into the five categories listed in Table 5 for both the 1968 Boating Needs Survey and this analysis of boat transporters.

In general, the level of education did not vary significantly between non-transporters and boat transporters. Nearly 50 per cent of both categories had at least started high school and more than 33 per cent had at least one year of education past high school.

Income of Respondents

Comparisons of the number of respondents in the seven income classifications (Question 19) is made in Table 6. It was evident that the largest class of persons for both non-transporters and the boat transporters was in the \$10,000 to \$14,999 range. (Kaiser also found this to be true with 31.2 per cent of multiple boat owners represented in that category.)¹ Boat transporters were found to have smaller percentages in both the above \$15,000 category and the range below \$10,000.

The distribution of income shows that 20.9 per cent of boat transporters had incomes of greater than \$15,000 while 29.5 per cent of the non-transporters were contained in the same income category. There was only a 2.4 per cent

¹Kaiser, "Multiple Boat Ownership," page 31.

TABLE 5

EDUCATION DISTRIBUTION FOR NON-TRANSPORTERS AND BOAT
TRANSPORTERS IN THE 1968 BOATING NEEDS SURVEY

Education	Non-Transporters		Boat Transporters	
	Number	Per Cent	Number	Per Cent
1-5	141	8.2	231	7.4
6-8	216	12.6	302	9.6
9-12	714	41.6	1,553	49.7
13-16	414	24.2	766	24.5
16+	228	13.3	275	8.8
TOTALS	1,713	100.0	3,127	100.0

TABLE 6

INCOME DISTRIBUTION FOR NON-TRANSPORTERS AND BOAT
TRANSPORTERS IN THE 1968 BOATING NEEDS SURVEY

Income	Non-Transporters		Boat Transporters	
	Number	Per Cent	Number	Per Cent
Less than \$3,000	122	7.9	108	3.7
\$3,000 - \$5,999	192	12.5	254	8.8
\$6,000 - \$7,999	207	13.4	391	13.6
\$8,000 - \$9,999	187	12.1	501	17.4
\$10,000 - \$14,999	372	24.2	1,018	35.4
\$15,000 - \$24,999	279	18.1	450	15.6
\$25,000 and over	175	11.4	153	5.3
TOTALS	1,534	100.0	2,875	100.0

difference in the totals of income below \$10,000 for the two respondent breakdowns.

Age of Respondents

The age categories used in the initial frequency counts for the 1968 Boating Needs Survey were not the same as the breakdowns used for this thesis because of the detail which it was felt was needed concerning the age groups of boat transporters. The age classes analyzed in the 1968 Boating Needs Survey are: (1) ages one to thirty; (2) thirty-one to sixty; and (3) age sixty and over. The use of these broad age categories would not yield the specific data that was desired by the author. Table 7 illustrates the ages for non-transporters and for the boat transporter when the broad age breakdowns used in the 1968 Boating Demand Survey were utilized.

TABLE 7

AGE DISTRIBUTION FOR NON-TRANSPORTERS AND FOR BOAT
TRANSPORTERS IN THE 1968 BOATING NEEDS SURVEY

Age	Non-Transporters		Boat Transporters	
	Number	Per Cent	Number	Per Cent
1-30	74	4.3	306	9.8
31-60	1,094	63.8	2,352	75.2
60 and over	545	31.8	469	15.0
TOTALS	1,713	100.0	3,127	100.0

The author felt that since 75.2 per cent of the transporters fell in the age group range of thirty-one to sixty years old, more detail was needed for this group. It was also felt that it would be important to know if there were any noticeable divisions or trends in the other two broad age classifications. Table 8 illustrates what was found.

This more detailed table gave the author a clearer picture of what age groups were actually doing the majority of the transporting. The findings were not anticipated since both of the age groups forty-one to fifty and fifty-one to sixty did more transporting than the youngest

TABLE 8

AGE DISTRIBUTION OF BOAT TRANSPORTERS FOR
THE 1968 BOATING NEEDS SURVEY

Age	Number	Per Cent	Average Number of Times Boat is Transported
1-20	71	2.3	11.0
21-30	235	7.5	19.3
31-40	619	19.8	14.9
41-50	951	30.4	13.1
51-60	782	25.0	11.2
61-70	369	11.8	9.6
70 and over	100	3.2	6.7
TOTALS	3,127	100.0	12.7

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respondent group. The opposite, although not fully anticipated because of the greater number of "heads of the household" appear in the higher age groups, was expected at the author's first appraisal. The age group thirty-one to sixty also contains the great majority of the boat owners and therefore even if the older group is not averaging as many trips carrying a boat per respondent as the younger group, it probably has a greater impact on the resources. These averages will be examined in more detail in a subsequent section of this chapter.

Summer Storage Method and the Boat Transporter

The Boat Transporter

For purposes of the 1968 Boating Needs Survey and this thesis, it was felt that examining differences in the location of boat storage during the season might provide valuable insights concerning boat transporter behavior. Therefore, the following in-season storage classes were used in the questionnaire (see Question 4):

1. "At my permanent home, which is not on a lake or river."
2. "At waterfrontage located at my permanent home lot."
3. "At a commercial marina-berth."
4. "At a summer cottage."
5. "At a publicly-owned marina."

6. "At a boat or yacht club."

7. "Other (specify)."

Comparisons of data concerning storage place with similar data from the Michigan Outdoor Recreation Demand Study could not readily be made since the categories used in that investigation were not the same and could not be combined in a way which would make comparison possible.

The author and Recreation Research and Planning Unit staff decided comparison would be limited to the calculation of percentage figures. Table 9 provides this information.

TABLE 9

PER CENT OF TRANSPORTERS AND NON-TRANSPORTERS BY SUMMER
BOAT STORAGE TYPE AND AVERAGE NUMBER OF
TIMES TRANSPORTED

Storage Type	Per Cent of Non-Transporters	Per Cent of Boat Transporters	Average Number of Transportations
Home; No Water	11.1	64.8	16.5
Home; On Water	30.3	6.8	5.2
Commercial Marina	8.2	3.0	4.9
Cottage	42.2	18.0	5.7
Public Marina	1.0	0.8	3.2
Yacht Club	1.6	0.6	3.2
Other	5.1	5.0	8.3
TOTALS	100.0	100.0	12.7

Of the non-transporters, 11.1 per cent stored their craft during the season at their permanent home which was not located adjacent to a water body, and of the transporters, 64.8 per cent used the same storage place. While 30.3 per cent of the respondents who did not transport their boat stored their boat at their permanent home located on the water, only 6.8 per cent of the total boat transporters were contained in this category. Eighteen per cent out of a total of 42.2 per cent of the non-transporters transported their boat from a cottage where the boat was stored. Finally, even though there was a small percentage (1.6) of the non-transporters who stored their boat at a yacht club, 0.6 per cent of the transporters were found in this category. It can be speculated that the majority of these people own larger, more expensive craft and stored them at a yacht club all year.

Summer Storage Types

In order to obtain a more detailed impression of transportation patterns, three of the storage methods were examined more closely. Table 10 indicated that 55.1 per cent of all the respondents to the 1968 Boating Needs Survey transported their craft. These persons transported their boats an average of 12.8 times a year per capita. It was suspected by the author and proven by the analysis, that certain persons transport their boats more often than others. Of the 2,279 persons storing their boat at their

TABLE 10

TRANSPORTERS BY SELECTED SUMMER STORAGE TYPE
FOR THE 1968 BOATING NEEDS SURVEY

	All Respond- ents	Boat Transporters by Selected Storage Types			1966 Totals All Respondents ^b
		St. Type #1 ^a	St. Type #2 ^a	St. Type #4 ^a	
Number of Respondents	5647	2279	937	1660	5209
Number that Transported	3127	2027	215	562	2510
% that Transported	55.1	88.9	22.9	33.8	48.2
Ave. No. of Times Boat Transported	12.8	16.5	5.2	5.7	^c

^a#1 is a permanent home not on water; #2 is a permanent home on water; and #4 is a summer cottage.

^bMichigan Department of Commerce, Transportative Predictive Procedures, p. 47.

^cPersonal interview with Mr. Michael Dale Freed, Staff Member, Waterways Division, Michigan Department of Natural Resources. It is impossible to give an accurate number of times a boat was transported in 1965 because the only questionnaire classifications of frequency were "regular" and "occasionally" rather than a numerical count.

permanent residence, not located on water, 2,027 or 88.9 per cent transported their craft an average of 16.5 times per year. This is 3.7 trips more than the average transporter makes in a year. This is understandable since normally these individuals must transport their craft to enjoy

water recreation. However, it is significant that 11.1 per cent of these respondents did not transport their boats during the season and hence apparently did not use them.

The next largest category was that of persons who stored their boat at a summer cottage. Nearly 34 per cent of these boat owners transported their craft an average of 5.7 times per year. This is to be expected since many of these persons probably own their own cottage and do most or all of their boating there. In many cases, they store their boats at the cottage and do not have to transport them at all. Therefore a smaller percentage of these people must have found transporting their boat a necessity.

Persons who own waterfront property were found to transport their boat less since most of the water oriented recreation engaged in by this group would take place at their home. Just 22.9 per cent of people owning a home located on water transported their boats in 1968; and they did so an average of only 5.2 times. Other more permanent storage facilities require an individual to transport his boat a fewer number of times on an average as indicated in Table 9.

The Transportative Predictive Procedures study indicated that 48.2 per cent of the respondents transported their craft.¹ This is 6.9 per cent less than the 1968

¹Michigan Department of Commerce, Transportative Predictive Procedures, p. 47.

value so the boating fleet is becoming more mobile. An estimate such as this must be examined carefully before any accurate comparison can be made. In 1965, the questionnaire was aimed at the boat used most frequently, while in the 1968 survey the questionnaire was keyed to a particular boat whether or not it was the craft used most often. Therefore, an estimate of 6.9 is conservative and a true measure may indicate that the actual increase may be higher.

Socio-Economic Characteristics by Summer Storage Class

Storage types 1, 2, and 4 will be briefly examined and compared to selected socio-economic characteristics in this section.

Occupation and Summer Storage Class

Table 11 contains figures comparing the occupational classes by storage type. The most obvious trend was that boat owners in all occupational categories utilizing storage type 1, transported their boats more on an average per capita than do people in storage types 2 and 4. Respondents in nearly every occupational category, storing their boat at a cottage, transported their craft more on an average than those respondents who stored their boat at their residence which was located adjacent to the water. The occupational classes of "operatives" (class 6) and "other" (class 11) were the exceptions.

TABLE 11
NUMBER, PER CENT OF GROUP AND AVERAGE TRANSPORTATION RATE PER CAPITA

Occu- pation ^a	Storage Type 1 (Home, no water)				Storage Type 2 (Home, on water)				Storage Type 4 (Cottage)		
	No. of Trans.	% of Total Trans.	Ave. No. of Trans.		No. of Trans.	% of Total Trans.	Ave. No. of Trans.		No. of Trans.	% of Total Trans.	Ave. No. of Trans.
1	265	13.1	15.2		78	13.1	4.3		84	14.9	5.5
2	46	2.3	13.2		1	.5	2.0		7	1.2	4.8
3	262	12.9	16.2		32	14.9	5.1		114	20.3	5.3
4	138	6.8	17.6		24	11.2	4.8		49	8.7	5.4
5	650	32.1	18.2		54	25.2	6.8		128	22.8	6.8
6	207	10.2	16.7		16	7.5	6.0		41	7.3	4.9
7	111	5.5	17.1		7	3.3	4.8		36	6.4	4.9
8	62	3.1	19.5		5	2.3	2.0		20	3.5	8.0
9	1	.1	6.0		0	0.0	0.0		1	.2	0.0
10	207	10.2	12.1		37	17.3	4.4		60	10.7	4.7
11	7	.4	23.8		1	.5	4.0		1	.2	2.0
12	67	3.3	14.5		9	4.2	4.2		20	3.6	4.4
TOTALS	2,023	100.0	16.5		214	100.0	5.2		561	100.0	5.7

^aSee Table 4.

"Skilled craftsmen" (occupational class 5) accounted for the greatest per cent of the total transporters for each of the storage types examined. This class also transported their craft more than the average for each summer storage type.

An extremely small per cent of the total transporters were composed of "farmers and farm laborers," "housewives," and "other" in all storage classes. "Skilled craftsmen" accounted for the greatest percentages of the total transporters in every storage class tested.

Education and Summer Storage Class

Table 12 indicates several very interesting observations. It seems that more people with greater than a high school education in the 1968 Boating Needs Survey sample, own either a home adjacent to water or store their craft at a cottage. This is possibly a result of a fact illustrated in Table 13 that these individuals earned greater incomes and could probably afford homes adjacent to water or own a summer cottage.

Table 12 indicates that 26.0 and 25.8 per cent of people who stored their boats at storage categories numbers 2 and 4 respectively, have had at least one year of education past high school. The percentage of people who stored their boats at a home not located on the water and having at least one year of education past high school is

TABLE 12

NUMBER, PER CENT OF GROUP AND AVERAGE TRANSPORTATION RATE PER CAPITA
BY EDUCATION AND SUMMER STORAGE TYPE

Edu- cation in years	Storage Type 1 (Home, no water)			Storage Type 2 (Home, on water)			Storage Type 4 (Cottage)		
	No. of Trans.	Ave. No. of Trans.	% of Total Trans.	No. of Trans.	Ave. No. of Trans.	% of Total Trans.	No. of Trans.	Ave. No. of Trans.	% of Total Trans.
1-5	154	12.8	7.6	21	2.8	9.8	37	5.5	6.6
6-8	209	13.5	10.3	15	2.7	7.0	49	5.7	8.7
9-12	1,052	17.4	51.9	99	5.6	46.0	262	6.8	46.6
13-16	468	17.6	23.1	56	6.1	26.0	145	3.8	25.8
16+	144	13.7	7.1	24	4.9	11.2	69	5.3	12.3
TOTALS	2,027	16.5	100.0	215	5.2	100.0	562	5.7	100.0

TABLE 13

NUMBER, PER CENT OF GROUP AND AVERAGE TRANSPORTATION RATE PER CAPITA
BY INCOME AND SUMMER STORAGE TYPE

Income	Storage Type 1 (Home, no water)				Storage Type 2 (Home, on water)				Storage Type 4 (Cottage)			
	No. of Trans.	Ave. No. of Trans.	% of Total Trans.		No. of Trans.	Ave. No. of Trans.	% of Total Trans.		No. of Trans.	Ave. No. of Trans.	% of Total Trans.	
Less than \$3,000	74	11.2	3.9		3	4.9	4.0		16	3.4	3.1	
\$3,000-\$5,999	178	15.4	9.5		23	4.3	11.6		30	4.4	5.8	
\$6,000-\$7,999	293	18.9	15.7		17	2.5	8.6		49	7.4	9.4	
\$8,000-\$9,999	373	17.5	19.9		24	6.7	12.1		68	7.7	13.1	
\$10,000-\$14,999	655	16.9	35.0		66	5.0	33.3		197	5.3	37.9	
\$15,000-\$24,999	245	15.4	13.1		45	5.9	22.7		100	6.0	19.2	
\$25,000 and over	49	16.6	2.6		15	4.0	7.6		60	3.6	11.5	
TOTALS	1,867	16.8	100.0		198	5.0	100.0		520	5.7	100.0	

23.1. Similar comparisons were noticed among persons who had more than sixteen years of education when a cross check was made to Table 13.

The nine to twelve years education group represented the largest percentage simply because the majority of the respondents were from this group (Table 5). In general, the percentage rates for particular storage categories by education follow that of the total sample (Table 5).

Another interesting fact which is indicated in Table 12, is that the average rate of transportation dropped off more rapidly for the cottage storage class than for the other two classifications which were examined.

Income and Summer Storage Class

There are understandably fewer persons in categories 2 (at waterfrontage located at my permanent home lot) and 4 (at a summer cottage) that store their boats consistently when comparing income with storage type. The income range \$10,000 to \$14,999 as reported in Table 6, had the greatest per cent of both the non-transporters and of the boat transporters. This same trend holds true when Table 13 is examined in detail. It also shows that as income rises for a given storage category above the \$14,999 bracket, there are proportionately a greater per cent of the total boat transportation population who own waterfrontage or a cottage.

Of the respondents, 49.0 per cent of those utilizing storage type 1 were found to have incomes of less than \$10,000. Only 36.3 and 31.4 per cent of those who stored their boats at their home located on the water or at a cottage respectively, had incomes in this same bracket.

Age and Summer Storage Class

In general, the findings illustrated in Table 14 do not vary significantly from the results of all boat transporters by age found in Table 8. The minor per cent differences are not particularly important when the entire range is considered.

Analysis of Boat Class and the Method of Transportation by Frequency of Transport in the 1968 Boating Needs Survey

The boat classes used in Table 15 are the standard planning breakdowns used by the Waterways Commission and are as follows: Class 1, boats less than twelve feet in length; Class 2, boats twelve feet to twenty feet in length; Class 3, boats twenty feet to thirty feet in length; Class 4, boats twenty feet to forty feet in length; and, Class 5, boats forty feet in length and over.

When Tables 15 and 16 were compared, several trends were revealed. Of the boat owners who transported their craft by trailer (transportation Type 1), 78 per cent appeared in boat class 2 (twelve feet to twenty feet), while the per cent of car top transporters (transportation Type 2)

TABLE 14

NUMBER, PER CENT OF GROUP AND AVERAGE TRANSPORTATION RATE PER CAPITA
BY AGE AND SUMMER STORAGE TYPE

Age	Storage Type 1 (Home, no water)				Storage Type 2 (Home, on water)				Storage Type 4 (Cottage)			
	No. of Trans.	Ave. No. of Trans.	% of Total Trans.		No. of Trans.	Ave. No. of Trans.	% of Total Trans.		No. of Trans.	Ave. No. of Trans.	% of Total Trans.	
1-20	46	13.2	2.3		2	6.5	.9		14	5.1	2.4	
21-30	174	22.9	8.6		20	10.2	9.3		14	6.4	2.5	
31-40	433	18.5	21.4		41	6.3	19.1		86	5.4	15.3	
41-50	595	17.3	29.3		52	3.6	24.2		205	5.9	36.5	
51-60	489	14.5	24.1		56	4.9	26.0		149	6.0	26.5	
61-70	230	12.4	11.3		34	4.3	15.8		72	5.3	12.8	
70 and over	60	8.7	2.9		10	3.2	4.6		22	2.9	3.9	
TOTALS	2,027	16.5	100.0		215	5.2	100.0		562	5.7	100.0	

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TABLE 15

BOAT CLASSES BY PER CENT AND FREQUENCY OF TRANSPORT
WHEN THE METHOD OF TRANSPORT IS A TRAILER

Freq. of Transport	Boat Transporters by Trailer				
	Class 1	Class 2	Class 3	Class 4	Class 5
Less than 5	16.3	72.8	10.0	0.3	0.0
5-10	17.5	80.9	1.3	0.2	0.0
11-15	15.7	82.1	2.1	0.0	0.0
16-20	14.5	83.9	1.5	0.0	0.0
20 and over	19.3	79.7	0.8	0.0	0.0
TOTALS	17.0	78.0	4.7	0.1	0.0

TABLE 16

BOAT CLASSES BY PER CENT AND FREQUENCY OF TRANSPORT
WHEN THE METHOD OF TRANSPORT IS A CAR TOP

Freq. of Transport	Boat Transporters by Car Top				
	Class 1	Class 2	Class 3	Class 4	Class 5
Less than 5	63.4	36.0	0.4	0.0	0.0
5-10	65.9	33.5	0.5	0.0	0.0
11-15	66.6	33.3	0.0	0.0	0.0
20 and over	72.8	26.3	0.8	0.0	0.0
TOTALS	67.6	31.9	0.4	0.0	0.0

which fell into the same class was only 31.9 per cent. The less than twelve feet category of transportation Type 2 yielded 67.6 per cent; compared with only 17.0 in the same class of transportation Type 1. Therefore, many transporters with smaller boats hauled them on their automobile, while more of the twelve feet to twenty feet boats were transported by trailer. Trailer transporters of boats greater than twenty feet in length amounted to 4.7 per cent of the total. Only 0.4 per cent of car top transporters moved a boat of greater than twenty feet in length.

More than 79 per cent of the persons who trailered a boat more than twenty times per year, appeared in boat class 2 (twelve feet to twenty feet) while only 26.3 per cent of the sample transported a boat of greater than twelve feet in length more than twenty times by car top. This general trend was found to exist when comparing this class of boat with the frequency of transport. Considering smaller boats (less than twelve feet in length), the opposite is true with a much higher per cent (72.8) of the persons transporting their craft more than twenty times in a year using a car top as compared to a trailer (19.3). Again, a general trend can be easily identified in this boat class. When the total boat transporting population is considered, 75.1 per cent transported their craft by a trailer and 24.8 per cent used a car top carrier. These figures may be useful to the Waterways Commission when planning future launching sites.

Table 17 shows the percentages of respondents in each frequency of transportation class by method of transport. Only 17.4 per cent of the total boat transporters move their craft more than twenty times per year; while more than twice as many, 37.3 per cent, transport their boat fewer than five times annually.

TABLE 17
FREQUENCY OF TRANSPORTATION FOR TRAILER,
CARTOP AND ALL TRANSPORTERS

Freq. of Transport	Trailer Transporters	Car Top Transporters	Total Boat Transporters
Less than 5	38.8%	32.9%	37.3%
5-10	21.9	26.5	23.0
11-15	11.7	14.4	12.4
16-20	9.9	8.8	9.6
20 and over	17.5	17.1	17.4
TOTALS	99.8	99.7	99.7

Expansion of the Number of Persons Trans-
porting Boats to Statewide Values
by County

The method of expansion and the expansion figures appear in Appendix D.

When the projected number of persons by county that transport their boat were compared to the per cent of the boat owners by county who transport their boat, several

interesting facts were apparent. Although it is not within the scope of this thesis to give detailed reasons for these trends, they will be briefly examined. The counties of Clinton, Eaton, and Ingham present an interesting comparison. In Clinton and Eaton, 60.6 and 60.9 per cent respectively of the registered boat owners transported their craft in 1968, while in Ingham only 49.3 per cent of the boat owners moved their craft by either car top or trailer in 1968.

Wayne County recorded 68 per cent of the boat owners transporting their craft. This figure may seem rather high when compared to other counties in this area of the State. Macomb County experienced only 50.9 per cent and Oakland a per cent of 56.9 who transported their boats.

Other high and low values recorded in Appendix D must be examined carefully because in some counties the sample may include a relatively small number of persons transporting their boats which may be too small to justify a statistically reliable comparison.

CHAPTER IV

HYPOTHESIS TEST ANALYSIS

Introduction

The hypothesis of this thesis was that the number of times a person (registered boat owner) transports his boat is related to certain socio-economic characteristics.

The method employed in the test of this hypothesis was a linear regression analysis and is expressed as follows:

$$Y = a + b_1 P_I + b_2 P_O + b_3 P_E + b_4 P_A + E$$

where: Y - is the dependent variable of how many times a person transports his boat.

a - is the point where the slope intersects the y axis.

b_1 - b_4 - is the slope of the line.

P_I - is the total family income.

P_O - is the occupation of the head of the family.

P_E - is the education of the family head.

P_A - is the age of the head of the family.

E - is the per cent of error determined in the analysis.

The outcome of a regression test utilizing a linear model, is that the relative importance which each independent variable has in determining the dependent variable (Y) can be estimated. All of the independent variables are tested and ranked according to their influence and given a per cent rating as to their importance in determining the dependent variable.

The author arranged with the Michigan State University Computer Laboratory to use the least squares deletion (LSDEL) computer routine to test the above mentioned regression model. The program was discussed in Chapter 2. The minimum level of significance (stopping criteria) for the hypothesis test was set at 5 per cent. Therefore, the confidence level was determined to be 95 per cent.

In choosing a 5 per cent significance level, two considerations were examined. First, two statisticians from the Application Programming section of Michigan State University's Computer Laboratory were consulted concerning this matter. It was decided that using a 10 per cent significance level would not predict at a low enough level and therefore much of the data would be left unexplained in the model test results.

Secondly, a 5 per cent level of significance is used in the majority of social science research. It was felt by the computer center staff, after considering the

model and the variables that were to be tested, a 95 per cent confidence interval (.05 level of significance) would yield more accurate results and provide the best test of the given regression.

Results

All of the independent variables tested were found to be significant at the 5 per cent level (see Appendix E). None were deleted by the regression analysis. The F test (regression from the mean divided by the error)¹ which relates the independent variables to the dependent variable was determined to be 69.0 at 5 per cent significance. Testing at a significance of .05 for a population of greater than 4,000 indicates that what is said concerning the respondents at .05 per cent significance, even though it be a small per cent of the total variance of the independent variable, will be true nearly 100 per cent of the time.

Age of the family head and total family income were both significant to the .05 level. These were the variables having the greatest significance level and therefore the ones least likely to be deleted from a regression equation testing the independent variable of the number of times a person transports his boat. Education and occupation of the

¹Michigan State University, Agricultural Experiment Station, LS: Least Squares (East Lansing, Michigan: 1969), Statistical Services Description No. 7, page 32.

family head were found to have significance levels of .048 and .002 respectively (see Appendix E). Education was therefore nearest to be deleted from the equation, being only .002 per cent from exceeding the .05 stopping criteria level set for this regression.

The value of R^2 (proportion of the sum of squared deviations from the mean of the dependent variable accounted for by the independent variables)¹ was determined to be .064 for the final model analysis. Therefore, the four variables of total family income, age, education, and occupation of the head of the family accounted for only 6.4 per cent of the variance. This leaves 93.6 per cent to be explained by other variables.

It can be assumed that further study will identify other variables which determine the number of times a person transports his boat, and therefore make it possible to raise the coefficient of determination.

¹Michigan State University, LS: Least Squares, page 7.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The research problem investigated in this thesis was a real one, because it dealt with an actual situation and has provided facts which can be utilized by the Waterways Commission. Analysis of the data indicates that 55.1 per cent of the respondents in the 1968 Boating Needs Survey, transported their boat an average of 12.8 times per year per capita. The remaining 44.9 per cent of the respondents indicated that they did not transport their craft in 1968. Of the transporters, it was shown that 75.1 per cent used a trailer and 24.8 per cent used a car top for transporting their craft. When these figures are expanded to give estimates of statewide values, it is indicated that a total of approximately 236,500 persons transport their boats of which about 177,400 do so by trailer and 59,100 carry their boat on top of a vehicle.

Of the boat owners who transported their craft by trailer, 78 per cent of the craft appeared in the boat class of twelve feet to twenty feet in length. Boats less than twelve feet in length were transported most frequently on top of a vehicle and accounted for greater than 67 per

cent of this transportation method totals. Nearly 7 per cent more of the boating population were found to be transporting their boats in 1968 as compared to the 1965 totals and therefore, the boating fleet is becoming more mobile in Michigan. This figure was explained in a previous chapter.

Of the total sample of boat transporters analyzed in this thesis, the majority were found to be "skilled craftsmen" with at least a ninth grade education, earning between \$10,000 and \$14,999 per year, and between forty-one and fifty years of age.

The hypothesis has been supported by the foregoing analysis. It was determined that there are significant relationships between the number of times registered boat owners transport their boats and the selected socio-economic characteristics of age, occupation, and education of the family head and the total family income.

All of the independent variables tested were found to be valid indicators of the dependent variable at the 5 per cent level of significance. Therefore, none of the independent variables were deleted from the regression analysis.

The small percentage of the variance which is accounted for by the four independent socio-economic variables, indicate that further research in the area of recreational boat transportation is needed. Such research should be aimed at not only analyzing the characteristics of the

transporter, but also include investigation of such relationships for various origins and destinations. This thesis analyzed the entire State and the results may therefore have masked important relationships due to an "averaging out process" among the counties. Selected counties could be isolated and analyzed to determine if there are trends which this thesis failed to examine.

To improve research in this area, other means of transporting craft besides the two classes used in this thesis should be examined. The 1966 Michigan Outdoor Recreation Demand Study report indicated that 22.9 per cent of the State's boat owners transported their boat by some other means than a trailer or car top.¹ The author therefore was not able to analyze an important segment of the boat transportation population because the question only had two categories.

Another point which may improve future research in this area would be to test other socio-economic or other kinds of variables which may be involved in recreational boating research. This will help reduce the 93.6 per cent of the variance which is unaccounted for in this thesis. A study of this type might be best accomplished by selecting samples of high, medium, and low transportation users and

¹Michigan State University, Department of Resource Development, Michigan Outdoor Recreation Demand Study, p. 10.14. Other methods could be, in the back of a truck, inside a station wagon, or inside a recreational vehicle.

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then interviewing them, analyzing their characteristics and determining their similarities and differences.

Finally, outdoor recreation research must become a sophisticated science, especially in Michigan, where so much of the economy is dependent on these types of activities for progress.

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SELECTED BIBLIOGRAPHY

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APPENDICES

APPENDIX A

1968 MICHIGAN RECREATIONAL BOATING
NEEDS QUESTIONNAIRES

STATE OF MICHIGAN



GEORGE ROMNEY, Governor

DEPARTMENT OF NATURAL RESOURCES

RALPH A. MACMILLAN, Director

NATURAL RESOURCES COMMISSION

HARRY H. WHITELEY

Chairman

CARL T. JOHNSON

E. M. LAITALA

ROBERT C. McLAUGHLIN

AUGUST SCHOLLE

ROBERT J. FURLONG

Secretary to the Commission

WATERWAYS COMMISSION

CHARLES A. BOYER

Chairman

VOLMAR J. MILLER

Vice Chairman

LEONARD H. THOMSON

ROBERT F. KING

FREDERICK O. ROUSE, JR.

Stevens T. Moser Building
Lansing, Michigan 48226
373-0126

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
Director



KW:jaw
Enclosures



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 Marine 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	Other fishing	Hunting	Water skiing	Cruising	Other	
		(No. Days)	(No. Days)	(No. Days)	(No. Days)	(No. Days)	(No. Days)	
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—					
		Trou/Salmon fishing	Other fishing	Hunting	Water skiing	Cruising	Other
		(No. Days)	(No. Days)	(No. Days)	(No. Days)	(No. Days)	(No. Days)
EXAMPLE 18	Macomb County	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

☐ \$6,000 to \$7,999

☐ \$10,000 to \$14,999

☐ \$25,000 and over

☐ \$3,000 to \$5,999

☐ \$8,000 to \$9,999

☐ \$15,000 to \$24,999

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:

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THANKS FOR YOUR HELP!

If you accidentally 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 B

SUMMARY OF NUMBER OF BOATING DEMAND STUDY
QUESTIONNAIRES MAILED BY COUNTY OF
REGISTRATION AND BOAT LENGTH

APPENDIX B

SUMMARY OF NUMBER OF BOATING DEMAND STUDY QUESTIONNAIRES MAILED
BY COUNTY OF REGISTRATION AND BOAT LENGTH

COUNTY	12' or less	12' - 20'	20' - 30'	BOAT LENGTHS			40' and Over	Total
				12' - 30'	30' - 40'	40' and Over		
1	7	23	0	0	0	0	0	40
2	16	28	2	0	0	0	0	46
3	94	100	12	0	0	0	0	206
4	31	122	11	0	0	0	0	164
5	31	76	5	0	0	0	0	112
6	4	24	0	0	0	0	0	28
7	5	34	0	0	0	0	0	41
8	66	90	0	0	0	0	0	164
9	63	163	20	9	0	3	0	261
10	17	66	3	0	0	0	0	86
11	165	227	23	1	0	0	0	416
12	81	177	8	0	0	0	0	266
13	183	175	28	5	2	2	0	398
14	114	190	15	2	0	0	0	321
15	23	69	10	1	0	0	0	103
16	20	100	6	1	0	0	0	127
17	18	109	10	1	0	1	0	139
18	34	32	5	0	0	0	0	71
19	33	65	5	0	0	0	0	103
20	4	17	2	0	0	0	0	23
21	32	75	1	1	0	1	0	110
22	42	45	0	0	0	0	0	88
23	69	112	5	0	0	0	0	186
24	27	66	8	0	0	0	0	101
25	372	788	58	8	2	2	0	1,223
26	15	34	2	0	0	0	0	51
27	23	62	5	0	0	0	0	90
28	54	161	9	2	0	0	0	226
29	26	50	3	0	0	0	0	79
30	45	72	6	0	0	0	0	123

APPENDIX B --Continued

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COUNTY	BOAT LENGTHS						Total
	12' or Less	12' - 20'	20' - 30'	30' - 40'	40' and Over		
31	19	76	12	1	0		108
32	8	45	8	2	0		63
33	237	369	28	4	0		638
34	52	66	5	0	0		123
35	27	77	4	0	0		108
36	35	57	1	0	0		93
37	28	53	3	0	0		84
38	202	256	25	2	0		435
39	269	283	33	5	0		590
40	13	17	2	0	0		32
41	470	635	77	12	2		1,205
42	0	8	1	0	0		9
43	12	16	0	0	0		28
44	41	53	1	0	0		95
45	16	59	14	0	0		89
46	62	163	13	3	0		241
47	78	88	14	0	0		180
48	12	25	1	0	1		39
49	11	85	16	0	1		113
50	172	728	309	53	5		1,267
51	18	48	4	0	0		70
52	77	93	5	2	0		177
53	21	75	5	2	0		103
54	42	53	3	0	0		98
55	24	21	4	0	0		49
56	53	126	20	0	0		204
57	10	22	1	0	0		33
58	68	178	36	7	1		290
59	72	61	4	0	0		140
60	21	18	1	0	1		41
61	150	255	28	4	1		438
62	54	80	2	1	0		137
63	541	1,019	157	47	8		1,772

APPENDIX B--Continued

COUNTY	BOAT LENGTHS					Total
	12' or Less	12' - 20'	20' - 30'	30' - 40'	40' and Over	
64	19	48	2	0	1	70
65	24	22	1	0	0	47
66	13	23	3	1	0	40
67	28	18	1	0	0	47
68	9	7	0	0	0	16
69	22	23	3	0	0	48
70	103	188	36	7	3	337
71	19	41	2	0	0	62
72	19	127	15	0	0	161
73	141	346	38	6	0	531
74	43	224	83	9	4	363
75	131	121	17	1	0	270
76	16	30	2	1	0	49
77	18	36	0	0	0	54
78	56	104	6	0	0	166
79	21	57	5	2	2	87
80	103	112	7	0	0	222
81	154	232	29	4	0	419
82	738	2,171	472	130	18	3,529
83	37	51	2	2	0	92
84	141	411	51	9	3	615
Total	6,505	12,963	1,888	348	60	21,764

APPENDIX C

OPTICAL SCAN SHEETS

[illegible]

[illegible]

[illegible]

[illegible]

APPENDIX D

EXPANDED ESTIMATES OF THE NUMBER OF BOAT
TRANSPORTERS BY COUNTY

APPENDIX D

EXPANDED ESTIMATES OF THE NUMBER OF BOAT TRANSPORTERS BY COUNTY

The expansion factor was determined by dividing the number of registered boats in a county by the number of questionnaires used in the socio-economic analysis (see Table 2, p. 19).

The estimate of the number of persons transporting the boats statewide by county was determined by multiplying the number of registered boats of a particular county by the per cent of the registered boats that are transported from that county. (For example, Wayne County's 68,405 registered boats were multiplied by the per cent of Wayne County's transporters who were included in the sample (68.0) to yield an estimate of 38,307 persons that transported their craft from Wayne County's registered boat population.)

The per cent of boat transporters by county is determined by dividing the number of people that transport their boat for a selected county by the number of registered boat owners in the same county.

APPENDIX D--Continued

County	Expansion Factors	Number of Persons Trans- porting Boats	Percent of Boat Boat Owners Who Transport
Alcona	33/1	356	50.0
Alger	98/1	594	66.7
Allegan	77/1	2935	66.7
Alpena	84/1	1967	60.0
Antrim	89/1	1020	43.2
Arenac	61/1	267	44.4
Baraga	63/1	441	63.6
Barry	65/1	1551	42.1
Bay	78/1	3712	67.1
Benzie	91/1	901	55.5
Berrien	77/1	6422	72.8
Branch	85/1	2097	40.3
Calhoun	81/1	5632	66.0
Cass	104/1	2601	37.9
Charlevoix	60/1	984	47.0
Cheboygan	94/1	891	34.5
Chippewa	121/1	1917	61.5
Clare	67/1	787	56.5
Clinton	81/1	1578	60.6
Crawford	92/1	183	33.3
Delta	54/1	1206	65.7
Dickinson	65/1	981	60.0
Eaton	59/1	2217	60.9
Emmet	60/1	1243	55.3
Genesee	74/1	14045	59.7
Gladwin	72/1	644	56.2
Gogebic	92/1	1296	66.7
Grand Traverse	75/1	2665	54.7
Gratiot	132/1	1607	76.5
Hillsdale	94/1	1612	58.6
Houghton	57/1	800	40.0
Huron	79/1	551	38.9
Ingham	61/1	6542	49.3
Ionia	74/1	1434	51.3
Iosco	85/1	1282	60.0
Iron	89/1	879	45.4
Isabella	54/1	1091	63.3
Jackson	85/1	5243	51.2
Kalamazoo	69/1	6250	52.6

APPENDIX D--Continued

County	Expansion Factors	Number of Persons Trans- porting Boats	Percent of Boat Boat Owners Who Transport
Kalkaska	114/1	288	40.0
Kent	89/1	16860	70.5
Keweenaw	49/1	195	100.0
Lake	58/1	354	54.5
Lapeer	69/1	1317	67.8
Leelanau	54/1	702	37.1
Lenawee	88/1	3479	63.5
Livingston	63/1	1254	35.0
Luce	70/1	275	36.4
Mackinaw	73/1	213	10.3
Macomb	96/1	11362	50.9
Manistee	128/1	1408	64.7
Marquette	66/1	2172	64.7
Mason	100/1	1497	65.2
Mecosta	80/1	1447	72.0
Menominee	91/1	636	50.0
Midland	73/1	2486	56.7
Missaukee	78/1	155	25.0
Monroe	87/1	3401	65.6
Montcalm	79/1	2361	73.1
Montmorency	66/1	396	46.1
Muskegon	75/1	6040	68.3
Newaygo	71/1	1077	41.7
Oakland	76/1	21085	56.9
Oceana	71/1	788	64.7
Ogemaw	46/1	454	43.5
Ontonagon	31/1	433	63.8
Osceola	46/1	601	61.9
Oscoda	68/1	336	83.3
Otsego	113/1	566	50.0
Ottawa	59/1	4229	60.2
Presque Isle	94/1	473	35.7
Roscommon	76/1	903	29.3
Saginaw	65/1	5761	57.0
St. Clair	89/1	3361	50.0
St. Joseph	67/1	3068	53.8
Sanilac	58/1	603	66.0
Schoolcraft	97/1	547	42.8
Shiawassee	63/1	1400	43.5
Tuscola	63/1	757	40.0
Van Buren	80/1	2907	62.7
Washtenaw	66/1	3742	46.4
Wayne	107/1	38307	56.4
Wexford	83/1	1305	68.0
TOTALS		236,529	55.1

APPENDIX E

STATISTICAL REGRESSION ANALYSIS
COMPUTER RUN

APPENDIX E

STATISTICAL REGRESSION ANALYSIS COMPUTER RUN

DEPENDENT VARIABLE--X(1) TRANSPOR

SIGNIFICANCE CRITERION MET,

MINIMUM ERROR MEAN SQUARE CRITERION MET;

RESULTS REQUESTED EVERY ITERATION.

AOV FOR OVERALL REGRESSION

SUM OF SQUARES	DE: OF FREEDOM	MEAN SQUARE	F	SIG
REGRESSION (ABOUT MEAN)	4	11363.43473411	69.0135	<0.0005
ERROR	4037	164.65524356		
TOTAL (ABOUT MEAN)	4041			

OBSERVATIONS

4342 R2 0.0640 R BAR 2 1.0631 R BAR 0.2512 STANDARD ERROR OF ESTIMATE 12.83180594

VAR	REGRESSION COEFFICIENTS	STD: ERRORS OF COEFFICIENTS	BETA WEIGHTS	STD: ERRORS OF BETAS	TB	F8	SIG	PARTIAL CORR COEFS	B2 DELETES
STANT	25.44966335	1.57811178	-0.27301	1.01675	15.1657	229.9971	<0.0005		
ONE	-0.30092358	0.01845532	-0.09474	1.01856	16.2388	265.5856	<0.0005	-0.24845	0.00243
ONE	-0.71842212	0.15736723	-0.03366	1.01725	-4.5653	20.8416	<0.0005	-0.07167	0.05217
ONE	-0.15321762	0.07849265	0.005798	1.01882	-1.9320	3.8103	0.048	-0.03071	0.06812
UPATN	1.13001095	0.36676785			3.0810	9.4925	0.002	0.04843	0.06150

RESIDUALS

(UNRESTRICTED LEAST SQUARES)

CE Y = X(1) ESTIMATED Y Y - ESTIMATE) Y

SUM Y 30099.00000000 SUM RES -0.00000000

SS(Y - MEAN Y) 710166.95719910 SS RES 664713.21026172

APPENDIX F

COUNTY CODING IDENTIFICATION NUMBERS

APPENDIX F

COUNTY CODING IDENTIFICATION NUMBERS

01	Alcona	42	Keweenaw
02	Alger	43	Lake
03	Allegan	44	Lapeer
04	Alpena	45	Leelanau
05	Antrim	46	Ionia
06	Arenac	47	Livingston
07	Baraga	48	Luce
08	Barry	49	Mackinac
09	Bay	50	Macomb
10	Benzie	51	Manistee
11	Berrien	52	Marquette
12	Branch	53	Mason
13	Calhoun	54	Macosta
14	Cass	55	Menominee
15	Charlevoix	56	Midland
16	Cheboygan	57	Missaukee
17	Chippewa	58	Monroe
18	Claire	59	Montcalm
19	Clinton	60	Montmorency
20	Crawford	61	Muskegon
21	Delta	62	Newaygo
22	Dickinson	63	Oakland
23	Eaton	64	Oceana
24	Emmet	65	Ogemaw
25	Genesee	66	Ontonagon
26	Gladwin	67	Osceola
27	Gogebic	68	Oscoda
28	Grand Traverse	69	Otsego
29	Gratiot	70	Ottawa
30	Hillsdale	71	Presque Isle
31	Houghton	72	Roscommon
32	Huron	73	Saginaw
33	Ingham	74	Sanilac
34	Ionia	75	Schoolcraft
35	Iosco	76	Shiawassee
36	Iron	77	St. Clair
37	Isabella	78	St. Joseph
38	Jackson	79	Tuscola
39	Kalamazoo	80	Van Buren
40	Kalkaska	81	Washtenaw
41	Kent	82	Wayne
		83	Wexford

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