

A STUDY OF MULTIPLE
BOAT OWNERSHIP IN MICHIGAN

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ABSTRACT

A STUDY OF MULTIPLE BOAT OWNERSHIP IN MICHIGAN

By

Ronald Kaiser

This study is a portion of a much wider investigation of recreational boating demand being conducted for the Michigan Department of Natural Resources. The objectives of the study are to estimate and determine first; the number of unregistered boats owned by multiple boat owners; and second the number of multiple boat owners in Michigan; and third the factors which are connected with multiple boat ownership. The study was further designed to explore the usefulness of these factors in predicting future multiple boat ownership patterns.

A sample of 21,764 registered boat owners was drawn from a list of registered boat owners supplied by the Michigan Secretary of State's Office. The sample was stratified by county and also by length of registered boats and was selected on a random basis.

A detailed questionnaire was distributed to the boat owners in the sample. The questionnaire design requested information regarding (1) type and size of boats and motors used by boaters in the state; (2) boat storage, transportation methods and launching sites; (3) boating use during the 1968 season for different water bodies; (4) frequency

and type of use on the various water bodies; (5) origin and destination patterns; (6) numbers of boats owned; and (7) socio-economic characteristics of the boaters.

The data was expanded from survey sample information to statewide estimates by expressing the sample parameter as a percentage of population parameter data. The factors hypothesized as being connected with multiple boat ownership were tested by linear regression analysis.

Analysis of the data indicates that nearly 60 percent of the respondents owned only one boat and 40 percent of the respondents were multiple boat owners. The incidence of multiple boat ownership among registered boat owners appears to be greater in the northern counties of Michigan, while the greatest numbers of multiple boat owners are located in the southern, urban, counties of Michigan. A similar trend can be noted for the incidence and number of unregistered boats and owners.

The characteristics of multiple boat ownership identified as being significant, within specified levels, were age, income, education, and occupation of boat owners. Although significant, these parameters did not account for a great deal of variation around the mean of the dependent variable.

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Ronald Kaiser

A THESIS

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1. The first step in the process of identifying a problem is to recognize that a problem exists. This is often done by comparing current performance with a desired state or goal. Once a problem is identified, the next step is to define the problem more precisely. This involves determining the scope of the problem, the resources available, and the constraints that may be present. The third step is to analyze the problem to determine its causes. This can be done through a variety of methods, including brainstorming, fishbone diagrams, and the 5 Whys technique. The final step is to develop and implement a solution. This involves selecting the most appropriate solution, developing a plan, and then putting the plan into action. It is important to monitor the results of the solution and make adjustments as needed.

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5. The fifth step in the process of identifying a problem is to monitor the results of the solution and make adjustments as needed. This involves tracking the progress of the solution and comparing it to the desired state or goal. If the solution is not working, it may be necessary to make adjustments or develop a new solution.

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CHAPTER I

INTRODUCTION

Boating Growth

The growth of recreational boating in the United States and in Michigan has been phenomenal. In the 14 year period from 1950 to 1964, the number of recreational watercraft in the U. S. increased by nearly 120 percent.¹ The number of people boating has also increased. More than 41 million Americans went boating in 1967 compared to 38.5 million in 1964, an increase of 11 percent in the 3 year period.² The State of Michigan has experienced a similar trend and ranks in the top five states in the country in boat registrations and percentage of the total marine products market. Several factors have played a significant role in the growth of recreational boating as they have in the case of many other recreational activities.

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: National Association of Engine and Boat Manufacturers, and Outboard Boating Club of America, 1965, p. 8.

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

The increase in disposable income in the United States and Michigan undoubtedly accounts for a portion of this increase. The amount of discretionary time periods are increasing as the length of the work week decreases and the paid vacations and holidays increase. Changes in desires and preferences at the societal and cultural level are involved. This is one of the areas where assumptions are usually made that have little quantitative justification. This preference level change is partially indicated by the shift to family-oriented outdoor recreation characterized by large investments in convenience and comfort facilities for family groups. Technological advances in the boating industry and better marketing techniques have facilitated distribution of boats to a large segment of the population. The unique water resources of Michigan have also been a factor in this boating explosion. These are some of the interrelated factors which apparently account for part of this increase, along with other more numerous minor factors.

As both the number of people participating in boating activities and participation rates in terms of hours per user per year increase, the demand for more access sites, launching ramps, docking facilities, and marinas correspondingly increases. Providing for this demand is a difficult problem compounded by the embryonic stages of the statewide planning process. Basic data on recreational boating still is at a minimum with only two statewide

surveys of boating use being made up to this present study. These were the Michigan Outdoor Recreation Demand Study, 1964 Recreation Boating Survey;¹ and the 1966 Boating Needs Survey of the Michigan Waterways Commission.²

Statement of Problem

Cognizant of the need for current, basic, statewide data, the Waterways Commission of the Michigan Department of Natural Resources requested that the Recreation Research and Planning Unit, Department of Park and Recreation Resources, Michigan State University, undertake a new study of Michigan's recreational boating needs. This study was designed to provide data for RECSYS-SYMAP, a computer simulation model for statewide comprehensive planning. The overall project was divided into four phases. The gathering of data was the first phase. The computer simulation was another phase. An analysis of transportation methods and selected characteristics of owners transporting boats was the third. Lastly, an attempt was made to determine the characteristics of multiple boat owners and formulate a

¹Michigan State University, Department of Resource Development, Michigan Outdoor Recreation Demand Study (Lansing, Michigan: State Resource Planning Program, Michigan Department of Commerce, June 1966) Vol. II.

²Department of Conservation, Waterways Division, Transportation Predictive Procedures: Recreational Boating and Commercial Shipping (Lansing, Michigan, Department of Commerce, April 1967, Technical Report No. 9c).

predictive model for multiple boat ownership.

Two basic objectives guided the research on the fourth phase of the study: first, a need to estimate the number of unregistered boats owned by multiple boat owners and secondly, a desire to determine the factors which are connected with multiple boat ownership and explore their usefulness in predicting future multiple boat ownership patterns.

Hypothesis

The hypothesis of this study is that multiple boat ownership is positively related to selected socio-economic characteristics of boat owners and to the supply of boating opportunities. The independent socio-economic variables considered are: income, age, education, occupation, and family size. The supply of boating opportunities is defined, for the purpose of this study, as the amount of inland water per county plus the amount of Great Lakes water per county, if applicable, considered safe for the majority of boats under 20 feet in length.

The hypothesis expressed mathematically is:

$$Y_i = b_0 + b_1x_{1j} + b_2x_{2j} = \dots b_nx_{nj} + E.$$

Where: Y_i is the observed dependent variable, multiple boat ownership.

x_{1j} is the observed independent variables: socio-economic characteristics and supply of boating opportunity.

b_0 is the constant, the point where the line intersects the x-axis.

E is the observation of the random error term.

Definitions

The following are definitions of terms used in this study:

registered boat: (owner) The Michigan Legislature in 1958 enacted a law requiring all boats that are propelled by auxiliary mechanical power and operated on waters of the State be registered with the Michigan Secretary of State.

legally unregistered boats: Boats not powered by mechanical means but by oars or sail does not legally require registration. Often in this classification are boats that legally should be but for some reason are not registered. In this study, unregistered boats refers to legally unregistered boats.

multiple boat owner: A person owning two or more boats.

Significance of the Study

One of the goals of the study is to derive an estimate of the number of unregistered boats in Michigan owned by registered boat owners. Since the study was based on data from a sample of registered boat owners, this number will be only an approximation. The owners of many unregistered watercraft were not included in the sample;

however, since some boat owners owned both a registered boat and an unregistered boat, some relevant data was gathered from this sample. This data on unregistered watercraft owned by registered boat owners will be expanded to provide information on the probable number of unregistered watercraft per county and then expanded to give statewide estimates.

The data from this study will not yield any information on the amount of boating done in these unregistered boats. This was one of the constraints of the study questionnaire in that information on the use of a specific registered boat was sought. Data on the use of additional boats was not gathered. In an analysis of the 1965 boating survey, Chubb indicated that a controlled use of judgment was used in estimating that unregistered boats amount to some 15 percent of the total number of registered boats in each county and that they received two-thirds as much use as registered boats.¹

Although use figures for unregistered boats are not yet available, a more accurate estimate of the ratio of unregistered to registered boats per county can be obtained from this study. This information could be utilized for an estimation of boat use periods. The resultant use estimates could be used as input to the

¹Michael 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 Planning Program, Michigan Department of Commerce, December 1967, Technical Report No. 12), p. 129.

RECSYS-SYMAP simulation in the statewide comprehensive planning process, a major objective of the investigation presently being done by the Recreation Research and Planning Unit for the Waterways Commission.

The provision of data for the comprehensive planning of recreation is one of the goals of the survey. Hopefully this study will prompt further investigation of the characteristics of people owning more than one boat and the implications for planning boating facilities.

Review of Literature

The fact that the planning of statewide recreational boating facilities and related research in Michigan is in its infancy is illustrated by the limited amount of information concerning this topic. The boating chapter of the Michigan Outdoor Recreation Demand Study (MORDS) was the first general appraisal of recreational boating in Michigan.¹ The study found that 28 percent of the sample respondents were multiple boat owners and that 16 percent of all the respondents owned one or more unregistered boats.² This figure was then applied to the 1965 estimated total registered boat population of 308,002 and resulted in the estimate that these registered boat owners

¹Further discussion of the scope of the MORDS Recreational Boating Study can be found on page 10.3 of that report.

²Michigan State University, Department of Resource Development, Michigan Outdoor Recreation Demand Study, Vol. II, p. 10.11-10.12.

could be expected to have some 80,000 boats not requiring registration.¹ Only the percentage of respondents with one or more unregistered boats in the total statewide MORDS sample of registered boat owners was calculated. The report gave no breakdown of unregistered boat ownership on a county basis.

The second study of recreational boating in Michigan was the 1966 Boating Needs Survey by the Waterways Commission of the Michigan Department of Conservation.² This study was similar to the MORDS Survey in that it only reported the overall statewide percentage of multiple boat owners. However, it was significant and different in that it asked the respondents to list how many watercraft they owned. Analysis of these data indicated that 65 percent of the respondents owned only one boat and 35 percent of the respondents owned two or more craft.³ The findings of the two studies are similar; however, the 1966 study includes more unregistered craft and therefore higher multiple boat ownership.

Each of these studies reported percentage of multiple boat ownership but neither attempted to relate the characteristics or develop a possible predictive method for

¹Chubb, Outdoor Recreation Planning in Michigan by a System Analysis Approach, p. 129

²The Michigan Department of Conservation was renamed the Michigan Department of Natural Resources in 1968.

³Department of Conservation, Waterways Division, Transportation Predictive Procedures, p. 27.

determining multiple boat ownership. The present study will be focused on these aspects of multiple boat ownership and also on a more detailed estimate of unregistered watercraft on a county basis.

CHAPTER II

STUDY DESIGN

Methods of Survey Research

One of the basic functions of recreation planning is the forecasting of probable future recreational demand. To be able to relate the distribution of magnitude of future demand for recreational boating requires basic data regarding:

- (1) Participation rates.
- (2) Distribution and extent of current demand.
- (3) Socio-economic characteristics of users.
- (4) Use (purpose, type and amount of use.)
- (5) Relevant resource supply data.

When information such as this is gathered over a period of time, use trends become evident and can be utilized in forecasting future demand. Gathering this data is one of the principle purposes of recreation survey research.

A variety of methods can be employed for survey research. The more common methods used by recreation researchers are: (1) observation, (2) personal interviews, and (3) self-administered questionnaires. Each method has different requirements and yields different



quantities and qualities of data. A discussion of the advantages and disadvantages of each method is given by Crapo and Chubb.¹ The scope of each method and information desired should be carefully considered with regard to the research situation, before a method is selected. Consideration should be given to:

- (1) The type of information desired.
- (2) Characteristics of desired information.
- (3) The administrative framework within which the research is to be attempted. (The amount of funding, staff level and competence, and time period available for data collection and analysis should be evaluated.)
- (4) Alternatives or method combinations should be included in the decision process.²

Based upon these considerations and previous studies, the mailed questionnaire was the survey method decided upon by staff of the Waterways Division and the Recreation Research and Planning Unit. The study objectives required information that could be supplied only by the boaters after the boating season, thus eliminating the handout and early mail methods. Time and funding constraints precluded the use of observation and personal interview

¹Douglas Crapo and Michael Chubb, Department of Park and Recreation Resources, Recreation Research and Planning Unit, Recreation Area Day-Use Investigation Techniques, (East Lansing, Michigan: Technical Report No. 6, April, 1969), Chapter II.

²Ibid., p. 9-10.

methods. The mailed questionnaire had certain advantages and disadvantages for this study.

Advantages and Disadvantages of the Delayed Mailed Questionnaire

This method of survey research had these advantages for this study compared to those previously mentioned:

(1) It allowed a larger, more statistically reliable sample to be drawn.

(2) Stratified sampling could be readily adopted by this method.

(3) The geographically scattered sample population could be easily reached.

(4) Semi-skilled staff could handle the administrative duties in the preparation of the questionnaire for mailing.

(5) In-depth questions regarding boating use could be answered by the respondent after consulting with other members of the boating group.

(6) Respondents believe that their answers will remain anonymous.

This method also had disadvantages, the most important of which are:

(1) There were problems of recalling data. (The questionnaire requested data from the respondent concerning the 1968 boating season but was not mailed until the start of the 1969 season.)



(2) Lower response rates, unless follow-ups are conducted. (Short questionnaires usually have better rates of return, while the longer in-depth questionnaires have lower rates.)

(3) The answers to mailed questionnaires normally have to be accepted as final. (There is no opportunity to probe beyond the given answer or to clarify an ambiguous one.)¹

(4) Follow-ups for non-respondents were not possible due to the large sampling size which would require a complicated checking system beyond the budget of the study. The decisions as to the type of survey method will be discussed in a later publication of the Recreation Research and Planning Unit.

(5) Mailed questionnaires are often exposed to different types of bias resulting from: (a) the respondents' misunderstanding of the questions, resentment of interference in their personal affairs, or falsification for reasons connected with the subject of the survey; and (b) non-response to the questionnaire, which raises the problem of differences between respondents and non-respondents in the characteristics under investigation.²

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

²M. A. El-Badry, "A Sampling Procedure for Mailed Questionnaires," Journal of the American Statistical Association LI (1956) p. 209-227.



The problem of low response rates and the possible resulting bias was the biggest disadvantage. The methods used to evaluate the extent of this bias will be discussed in a later section of this chapter, entitled "Evaluation of Bias".

Design of the Questionnaire

The design of the questionnaire was based on the objectives of the survey. The primary purpose, as explained in previous sections, was to provide basic data to be used in state recreation planning. The basic data needed to fulfill the objectives concerned: types and size of boats and motors used by boaters in the state; boat storage, transportation, and launching; actual use during the 1968 season for different water bodies - inland or Great Lakes; frequency and type of use on the various water bodies; origin and destination patterns; in-state use by out-of-state boaters and out-of-state use by in-state boaters; boat ownership and socio-economic characteristics of state boaters.

The questionnaire and cover letter used for the 1968 Michigan Boating Needs Survey appears in Appendix A. The development of this design was a cooperative effort of the Recreation Research and Planning Unit and the Waterways staff and will be reported in detail in forthcoming publications of the Unit.

Question Type and Order

The arrangement and order of questions in a survey has an effect on response. The type of question - open-ended, precoded, or fixed alternative - yields a certain type of answer. Jackson found that response rates for fixed alternative questions were higher than for open-ended questions.¹ The staff of the 1968 study recognized these and other factors in the construction of the questionnaire.

The majority of the questions in the survey were fixed alternative or closed. Selltiz found that where the possible alternative replies are known and limited in number, the questions are more efficient.² The order of the questions proceeded from easily answered closed type to the more in-depth fixed alternative to the closed type regarding personal information.

The initial questions concerned type of power system and horsepower of the boat, where it was registered, where it was kept during the boating season and the method and frequency of transport of the boat. These questions were basically of the closed type. The first in-depth, fixed alternative question, concerning the county where the boat

¹Robert Jackson, "Differential Value of the Mailed Questionnaire and the Interview in a Follow-up Study of High School Graduates," Unpublished Ph.D. Dissertation, University of Wisconsin, 1959, p. 110.

²Claire Selltiz, et.al., Research Methods in Social Relations, (New York: Holt, Rinehart, and Winston, 1967), p. 262.

was launched from most and the type of facility used, was also on the first page. This question was designed to provide data for an analysis of boating destinations.

The second and third pages of the questionnaire asked for information concerning boating on inland lakes, Great Lakes, and out-of-state. The question regarding boating on inland and Great Lakes also asked the county and the activities, expressed in boating days, of most use. This was to determine the destinations for boat use on inland and Great Lakes waters and the types of boating activities and total boating use period on these waters, for use in later RECSYS-SYMAP simulation. The question regarding out-of-state boating furnishes data for analysis on the amount of out-of-state use generated by in-state boaters.

The following pages of the questionnaire contained fixed alternative and closed questions requesting information on boat ownership, origin of the boater, and socio-economic characteristics. The previous Michigan boating studies indicated a sizeable percentage of boat owners owned more than one boat. The question regarding boat ownership was designed to provide data for analysis on the number of multiple boat owners in Michigan and the number of unregistered boats owned by these boaters. The question regarding place of permanent residence and zip code is structured to provide information on the origins of boaters in the state. The socio-economic



characteristics of the boaters made up the final question asked of the respondent. The question asked information regarding age and sex of head of family and each member. size of family, occupation, family income, and education.

Coding of the Data

The data from the questionnaire was coded on mark sense optical scan forms. These forms were designed so that the information could be taken directly from the questionnaires and placed on the forms. The need to pre-code questions was significantly reduced by this procedure. The forms were then run through optical scanning equipment which transferred the information to computer punch cards.

Equipment limitations and questionnaire length necessitated the use of five mark sense forms and punch cards for each questionnaire. The specific data coded on each form from the questionnaire is as follows:

- Form I.
1. Type and horsepower of the boat.
 2. County where boats were registered and location of boat during the boating season.
 3. Method and frequency of transporting the boat.
 4. Use of the boat outside Michigan location.
 5. Number of boats owned.
 6. Length of boat.
- Form II.
1. County where boat was launched the most.
 2. Type of facility where launched.

3. Other counties of uses and facilities used for launching.

Form III. 1. Use of boat on Great Lakes.

2. County of use.

3. Activities boat was used for.

4. Number of days the boat was used on each activity.

5. Total days of boating on the Great Lakes.

Form IV. 1. Information on use of the boat on inland waters - same information as on Form III, only dealing with inland waters.

Form V. 1. County of residence of boater.

2. Zip code.

3. Socio-economic data.

The data cards punched by the optical scanner were then run through an IBM 407 Accounting Machine in order to obtain a listing that could be checked for errors. The errors were corrected so that the data deck information was the same as the information on the questionnaire. This procedure was used as a quality control check on the accuracy of the coding process and the coders. The data was then programmed for analysis on Michigan State University's CDC 3600 computer.

Sampling Procedures

The sample procedures of the two previous boating surveys in Michigan were studied. The 1966 study had advantages over the MORDS survey in that the sample was larger and was stratified by boat length as well as by

county. The MORDS Boating Survey stratified the sample only by county; 3 percent of boaters in each county were sampled.¹

The sample size for the 1968 study was determined by experience with the sample size and procedures of the 1966 Boating Needs Survey and by budgetary constraints. The latter eliminated the use of follow-up reminders to the respondents on the original questionnaire. Indications from the two previous studies and other sources were that a 38 percent response rate could be expected without the use of follow-up procedures. Realizing the limitations of the response rate in attempting to obtain 5,000 to 6,000 usable questionnaires, the Research Unit's statistician recommended a sample size of 21,764.

The Waterways Commission requested detailed information by boat length which necessitated stratifying the sample. The use of stratification, as indicated by Cochran, is a common technique and if intelligently used will nearly always result in a smaller variance for the estimated mean or total than is given by a comparable simple random sample.² Two other major considerations dictated the use of a stratified random sample: (1) The small number of boats in the over-20-foot class

¹Michigan State University, Department of Resource Development, Demand Study, Vol. II, p. 10.7.

²William Cochran, Sampling Techniques (New York: John Wiley & Sons, Inc., 1953). p. 76.

compared to the entire registered boat population. (Boats over 20 feet in length numbered 24,068 out of the total population of 438,017 registered boats according to the Secretary of State's Office. Complete random sampling would not yield adequate representation of boats over 20 feet in length.) (2) All the counties should be included in the sample, but some counties with a small number of registered boats would not be adequately represented in a simple random sample.

Relying on data concerning response rates for the 1966 study, the desirable stratified sample size for boats over 20 feet was determined to be approximately 10 percent of the total population or 2,406 out of 24,068 boats. Boats under 20 feet in length required a stratified random sample size of approximately 5 percent of the total population or 20,700 out of 413,949 registered boats. Problems in transferring registration tape information from one of the computer systems utilized by the Secretary of State's Office to the CDC 3600 used by Michigan State University resulted in some sample mortality. The final mailed sample contained 2,296 in the over 20 feet boat length strata and 19,468 in the under-20 strata, a relatively small loss.

The sample was also stratified by counties. In each county 10 percent of the registered boats over 20 feet and 5 percent of the registered boats under 20 feet were sampled. A detailed county breakdown of the mailed sample is contained in Appendix B.

The stratified sample was in fact a stratified random sample. Once the strata were determined, the computer was programmed to fill the sample cells by a random selection process. The following tables indicate the sample selections and returns from the 1966 Boating Needs Study and from this study. The response rate was approxi-

TABLE 1
SAMPLE SELECTIONS AND RETURNS -
1966 BOATING NEEDS SURVEY^a

Boat Size Class	No. of Regist. Boats	No. Ques. Mailed	No. of Usable Returns	% Usable Returns
20' or less	337,763	9444	3,643	38.6
Over 20'	21,139	4226	1,575	37.3
TOTAL	398,902	13670	5,218	38.1

^aDepartment of Conservation, Waterways Commission. Transportation Predictive Procedures, p. 19.

mately as anticipated with 5,647 questionnaires returned or a 25.9 percent response rate.

TABLE 2
1968 BOATING NEEDS SURVEY -
SAMPLE SELECTIONS AND RETURNS

Boat Size Class	No. of Reg. Boats	No. Ques. Mailed	No. of Ret. Used In Analysis	% Usable Returns	Ret. Used In Socio-Econ. Anal.
20' or less	413,949	19,468	5,049	25.9	4,376
20' and over	24,068	2,296	598	26.0	439
TOTAL	438,017	21,764	5,647	25.9	4,815

The discrepancy between number of returns used in socio-economic analysis and returns in the final analysis (columns 6 and 4 in Table 2) resulted from funding constraints and administrative organization. The counties of Wayne, Kent, and Macomb were represented by large numbers of returned questionnaires and to code all these returns was beyond the initial means of the Unit's staff and budget. These county returns were randomly sub-sampled and a smaller number were coded and run through the computer for analysis. At a later date, the remaining questionnaires were coded and utilized in the final analysis.

Evaluation of Bias

Designing a questionnaire to limit the extent of bias resulting from respondents' misunderstanding of the question is a difficult procedure, complicated by the human nature of the respondents. One of the more important sources of possible bias is non-response. Non-response in most cases arises from differences in the characteristics under investigation between respondents and non-respondents. Moser found that the greater the extent to which non-respondents differ from those who respond, the greater will be the bias from non-response.¹

Increasing the rate of response is the best method to reduce this possible source of bias. Crapo and Chubb

¹Moser, Survey Methods in Social Investigation, p. 128.

discuss the techniques by which this can be accomplished.¹ The problem of non-response bias could be eliminated entirely by obtaining 100 percent returns but then the study changes from a survey to a census. Even then, the achievement of "bias-free responses" from questionnaires and interviews is not certain.²

It should not be inferred that survey research is of no value due to possible bias from non-response. Moser is emphatic on this point: "it would be wrong to imply that non-response vitiates the scientific nature of sampling. Mail surveys included, it is usually possible to keep non-response down to a reasonable level and to estimate roughly what biasing effect it may have on the results."³

This 1968 Boat Needs Survey study design, recognizing the low response rates of mailed questionnaires without follow-ups, attempted to estimate not only the bias effect of non-response but also the possible bias introduced by misunderstanding of questions in the questionnaire by the respondents. A follow-up study design was formulated using the interview method of research as a control. Three

¹Crapo and Chubb, Recreation Area Day-Use Investigation Techniques, p. 27-31.

²Elwood Schafer, A Comparison of Four Survey Techniques Used in Outdoor Recreation Research. Unpublished Ph.D. Dissertation, Department of Forestry, Syracuse University, 1967, p. 13.

³Moser, Survey Methods in Social Investigation, p. 127.

counties were selected as the control group: Ingham county because of its urban orientation and Grand Traverse and Leelanau counties because of their supply of boating opportunity. The initial design called for a total of 200 interviews: 100 from Ingham county, of which 75 were non-respondents and 25 respondents; and 100 total from Grand Traverse and Leelanau, of which 75 were non-respondents and 25 respondents. The original design was altered after a consideration of the budget and staff. The following table illustrates the number of interviews used as a control in the final design.

TABLE 3
ACTUAL SAMPLE FOR TEST OF SURVEY BIAS

County	Interviews of Non-respondents	Interviews of Respondents
Ingham	34	13
Grand Traverse	36	20
Leelanau	15	2
TOTAL	85	35

The program for the study analysis was used on the control portion of the survey. This output was then analyzed for any gross biasing effects. The analysis was comparative in nature in that the results of the control for bias were matched with the original analysis to determine if there was a percentage difference between the figures. The findings of this analysis indicated that the percentage difference was minor.

Study Limitations

The limitations of the data from the questionnaire survey when used for the present study fall into two areas. The first area of limitation is in the structure of the questionnaire itself; and the second is in the survey sample.

The respondents (registered boat owners) were asked to list any other registered and unregistered boats owned by them or members of their immediate family. The question did not ask the respondent to specifically identify his unregistered boats but only to list any additional boats owned. This complicated the procedure used to identify registered and unregistered boats. After review of a number of the returned questionnaires, it was decided that any of the boats listed in response to this question that did not have a motor listed would be classified as unregistered. This is in accord with the definition of an unregistered boat expressed in Chapter 1 and with the requirements of the Secretary of State's Office regarding boat registration in Michigan.

The question of use generated by these additional boats was not included in the questionnaire. More precise data on the use of these boats would be helpful in reducing human judgments for the input data in the RECSYS SYMAP computer simulation. Data on activities and destinations of these boats would also increase the reliability of the information yielded by this method.

A limitation of the sample is the inclusion of only registered boat owners. The sample, compiled from data furnished by the Secretary of State's Office which contained only registered boat owners and is the only record on boat owners in Michigan. The computations of the present study, therefore, can only be based on this sample. The implication is that the total number of unregistered boats in the state cannot be accurately estimated since some unregistered boat owners do not own a registered boat, however, the total number of unregistered boats owned by registered boat owners can be estimated which will obviously be less than the size of the total unregistered boat fleet.

This partial data is useful for statewide planning in that it provides information, limited as it may be, for a more complete understanding of boating than if it were ignored. It also provides for estimation of unregistered boats on a county basis rather than the crude estimates used in the 1966 running of the computer model.¹

These limitations should not seriously invalidate the findings of this study. It will provide data to fill the information vacuum currently existing in statewide planning and will hopefully be used in that manner.

¹Supra, p. 129.

CHAPTER III

DATA ANALYSIS

INTRODUCTION

The next two chapters will be devoted to an analysis of the information gathered by the survey. Chapter III will involve an analysis of selected characteristics of boat owners. The presentation of material in this chapter will be in the following sequence: (1) Characteristics of single and multiple boat owners, (2) Analysis of the types of boats owned by multiple boat owners, (3) Distribution of multiple boat owners, and (4) Size and distribution of the unregistered boat fleet in Michigan. Chapter IV will involve the analysis of the determinants of multiple boat ownership; more specifically, it will be a description of the hypothesis testing procedures.

Characteristics of Single and Multiple Boat Owners

The income, age, and education characteristics of the respondents will be analyzed and compared with similar characteristics of the 1964 Boating Survey.¹ This will be a crude type of comparison for respondent

¹Michigan State University, Department of Resource Development, Demand Study, Vol. II, p. 10.8-10.11.

characteristics. Chapter IV will deal with the more specific relationships between characteristics.

Income of Respondents

The distribution of respondents by income categories is reported in Table 4. The majority of respondents (63.6 percent) fall in the total family income range of \$8,000 to \$24,999. The majority of respondents under the \$8,000 range have total family incomes from \$3,000 to \$7,999.

TABLE 4

DISTRIBUTION OF 1968 MICHIGAN BOATING NEEDS SURVEY
RESPONDENTS BY INCOME CATEGORIES

Total Family Income	Number	Percent
Under \$3,000	230	5.2
\$3,000 - 4,999	446	10.2
\$5,000 - 7,999	598	13.6
\$8,000 - 9,999	688	15.6
\$10,000 - 14,999	1,390	31.5
\$15,000 - 24,999	729	16.5
\$25,000 and over	328	7.4
TOTAL	4,409	100.0

In comparing this distribution to the income distribution observed in the 1964 MORDS Boating Survey, (Table 5) a dissimilar distribution is evident.

TABLE 5

DISTRIBUTION OF 1964 MICHIGAN OUTDOOR RECREATION
DEMAND STUDY BOATING SURVEY RESPONDENTS BY FAMILY
INCOME CATEGORIES ^a

Total Family Income	Number	Percent
Under \$3,000	168	4.9
\$3,000 - 5,999	500	14.7
\$6,000 - 7,999	754	22.1
\$8,000 - 9,999	674	20.1
\$10,000 - 14,999	810	24.7
\$15,000 and over	1117	13.2
TOTAL	3,405	100.0

^aMichigan State University, Department of Resource Development, Demand Study, Vol. II, p. 10.1.

The major distribution differences are illustrated in Table 6. Closer scrutiny is complicated by the lack of uniformity in classifying income ranges in the two studies.

TABLE 6

PERCENTAGE DISTRIBUTION OF RESPONDENTS TO 1964
AND 1968 STUDIES BY FAMILY INCOME CATEGORIES

Total Family Income	1964 Percentage	1968 Percentage
Under \$3,000	4.9	5.2
\$3,000 - 7,999	36.8	23.8
\$8,000 - 9,999	20.1	15.6
\$10,000 - 14,999	24.7	31.5
\$15,000 and over	13.2	23.7
TOTAL	100.0	100.0

It is the contention of this author that this dissimilar distribution can be explained by two major factors. (1) the different sampling techniques used in the surveys, and (2) the time periods (4 years) between the two surveys in which total family incomes increased.

The MORDS Boating Survey employed a randomly selected sample of boat owners. This sample was stratified by county but not by boat length. (For planning purposes in Michigan, boats are divided into two major classifications: those over 20 feet in length and those 20 feet or under in length.) Those boats over 20 feet in length comprise a smaller proportion of the total population than those 20 feet and under. The significance of this is that a random sample of all the boats would not yield an adequate response from the boat class over 20 feet in length. Other studies have found that income is closely related to the type of boat owned. The implication of this is that respondents with higher incomes own longer, more expensive boats; and that because of the random sampling methods employed by the MORDS Boating Survey, these boaters were not adequately sampled. Hence, lower numbers and percentages of respondents. Even if there is no major difference in response rates between income levels, as illustrated by the percent response by boat sizes in Tables 2, the numerical distribution of respondents will be less in those boat size classes and income classes. Therefore, as implied from Cochran,

stratification by boat size will nearly always result in a smaller variance for the estimated mean or total, in this case respondents by income distribution, than a comparable random sample.¹

Although no quantitative figures could be produced by this author relating to the increase of family incomes in the time period between the two surveys, it is intuitive that this has occurred.

A major part of this study is to determine the characteristics of multiple boat owners. The following table indicates the distribution of multiple boat owners by income categories in relation to the distribution of all respondents.

TABLE 7

DISTRIBUTION OF RESPONDENTS OWNING TWO OR MORE BOATS TO THE 1968 MICHIGAN BOATING NEEDS SURVEY BY INCOME CATEGORIES AND A COMPARISON WITH THE TOTAL DISTRIBUTION OF RESPONDENTS TO THE SURVEY

Distribution of Multiple Boat Owners			All Respondents	
Total Family Income	Number	Percent	Number	Percent
Under \$3,000	76	3.9	230	5.2
\$3,000 - 4,999	183	9.5	446	10.1
\$5,000 - 7,999	226	11.7	528	13.6
\$8,000 - 9,999	266	13.8	688	15.6
\$10,000 - 14,999	602	31.2	1,390	31.5
\$15,000 - 24,999	380	19.7	722	16.5
\$25,000 and over	197	10.2	328	7.4
TOTAL	1,930	100.0	4,409	100.0

¹Supra, p. 76.

The basic percentage distribution between the two is similar. The distribution for multiple boat owners above \$15,000 is higher (29.9 percent) than the distribution for all respondents (23.9 percent). The distribution of multiple boat owners under \$10,000 is less (38.9 percent) than the total for all respondents (44.5 percent). The greatest incidence of M.B.O. was in the \$10,000 - 14,999 income range, as was the distribution of all respondents.

Occupation of Respondents

The respondents were originally classified into 18 occupational categories; however, many of these categories contained a small number of respondents and were reclassified into the categories listed in Table 8.

The figures in this table show that nearly 60 percent of the respondents were employed in the professional or technical occupations. Of this percent, the skilled crafts category accounted for nearly 50 percent, or 26 percent of the total for all respondents. The second and third most indicated occupations were managerial and professional respectively, and the retiree category had a high proportion at 13.8 percent. The farm (1.7 percent) and service (4.6 percent) groups had very low indications.

The occupational distribution of multiple boat owners was almost identical with that for the total distribution of the respondent population. The two categories which differed by more than 3 percent were skilled craftsmen and managers (including elected officials.) The

DISTRIBUTION OF RESPONDENTS BY OCCUPATIONAL
CATEGORIES TO THE 1968 MICHIGAN BOATING NEEDS SURVEY^a

Distribution of Multiple Boat Owners All Respondents				
Occupation	Number	Percent	Number	Percent
Professional	321	16.6	687	15.6
Farmers	22	1.2	75	1.7
Managerial	421	21.8	791	18.0
Sales & Clerical	150	7.7	335	7.6
Skilled Crafts	441	22.9	1,149	26.0
Operative	129	6.7	325	7.4
Service	77	4.0	204	4.6
Labor	13	.7	31	.7
Housewife	7	.4	13	.3
Retired	271	14.0	606	13.8
Other	43	2.2	111	2.4
Refused	35	1.8	82	1.9
TOTAL	1,930	100.0	4,409	100.0

^aOccupational classes were derived from U. S. Census classifications.

distribution of multiple boat owners in the skilled crafts group was 3 percent less than in the same category for all respondents. In the managerial group, the distribution of multiple boat owners (21.8 percent) was almost 4 percent more than in the same category for all respondents.

These minor percentage variations are not particularly significant when the entire range is considered. Overall, the two distributions are similar. A conclusion of the MORDS which seems equally applicable in this case is that:

the average incomes associated with

the different occupation groups appear to affect the extent that these groups are represented among boat owners.¹

A comparison of occupational distributions between the two studies would be misleading because of the lack of definition of competence making up the MORDS occupational classifications.

Education of Respondents

In general, the educational attainment of boat owners responding to this survey does not vary significantly from that of the MORDS. The lack of uniformity between the two classification systems makes a more detailed comparison impossible. The educational classifications of the MORDS were 13-15 years and 16 plus, whereas this survey had the classifications indicated in Table 9.

The general trend of the two surveys, however, are substantiated by the results as indicated in Table 9.

In general, the author concludes that the findings of this survey with regard to socio-economic characteristics of registered boat owners are representative of the Michigan boating population because of the comparisons with the findings of the MORDS Boating Survey.

¹Michigan State University, Department of Resource Development, Demand Study, p. 10.11.

TABLE 9

DISTRIBUTION OF MICHIGAN BOATING NEEDS RESPONDENTS
SURVEY BY EDUCATIONAL CLASSES AND COMPARISON WITH
THE DISTRIBUTION OF RESPONDENTS TO
MORDS SURVEY^a

Education	% Distribution of Resp. to MBN Survey	% Distribution of Resp. to MORDS Survey
1-5	7.7	
6-8	10.7	10.0
9-12	16.8	17.6
13-16	21.1	23.9
17+	10.1	18.5
TOTAL	100.0	100.0

^aMichigan State University, Department of Resource Development, Demand Study, Vol. II, p. 10.21-10.22.

Boats Owned By Multiple Boat Owners

The previous studies of boating in Michigan have indicated percentages of multiple boat ownership but have neglected to show the types of boats owned as second, third, or fourth boats. The findings of the current survey with regard to types of boats owned by multiple boat owners in Michigan are presented in Appendix C.

The boats were classified into the following types: inboards, outboards, sailboats, canoes, inboard-outboards,¹ rowboats, and others. The 2,300 Michigan multiple boat owners in the sample owned a total of 4,562 additional

¹Inboard-outboards are boats with the engine contained in the boat, not mounted on the transom, with a drive system resembling in appearance an outboard system.

boats. The outboard type was most frequently listed, closely followed by the inboard. Outboards number 1690 and inboards 1520 for a total of 3210 or 70 percent of the boats owned by multiple boat owners. Sailboats, canoes, inboard-outboards, rowboats, and others comprise the remaining 30 percent of boats owned. One possible problem with the use of these findings is that these boats listed as additional may not be the primary boat in terms of boat use. The survey requested that the respondents provide information on boat use for the boat identified by registration number and length. (This information was on the address label of the questionnaire.) This problem may not be significant if we accept the assumption that the boats in the sample are unbiased representation of the boating fleet.

Distribution of Multiple Boat Ownership

The survey sample information was expanded by a ratio method¹ to statewide data concerning response rate ratios, number of multiple boat owners per county, and the percent of registered boat owners with unregistered watercraft. The expanded county and statewide information can be found in Appendix D.

The percent distribution of multiple boat ownership to total boat ownership is illustrated by Figure 1 on page 39.

¹Expansion method explained in Appendix D.

There appears to be no specific trend; however, a higher percentage of multiple boat ownership is indicated for the counties in the northern lower peninsula of Michigan. This could be misleading if one assumes that the greatest number of multiple boat owners are in this region. Actually, the opposite is true: the gross number of multiple boat owners is highest in the urbanized counties of Michigan due to the greater number of boat owners in those counties. Table 10 and Figure 2 on page 40, illustrates this trend. These counties may have a lower percentage of multiple boat ownership, but because of the large numbers of registered boats the number of multiple boat owners is also larger.

Size and Distribution of the Unregistered Boating Fleet

This estimation is based upon a sample of registered boat owners and as such is probably an underestimate of the total unregistered boat population of Michigan. The statewide projections for the number of unregistered boats by county are illustrated in Appendix D. The percent distribution of unregistered boat owners per county and the number of unregistered boats per county by quintiles are illustrated by the Figures 4 and 5 on pages 42 and 43. A comparison of percentage and numerical distribution of unregistered boats by counties is illustrated in Table 11.

TABLE 10

A COMPARISON OF GREATEST PERCENT DISTRIBUTION OF MULTIPLE
BOAT OWNERS WITH GREATEST NUMERICAL DISTRIBUTION OF MULTIPLE
BOAT OWNERS IN MICHIGAN BY COUNTIES OF RESIDENCE

Counties with Greatest No. of Regist. Boats		Counties with Greatest % of MBO		Counties with Greatest No. of MBO	
County	Number	County	Percent	County	Number
Wayne	68,405	Cass	77	Wayne	23,911
Oakland	36,922	Mackinac	69	Oakland	14,797
Kent	24,087	Gladwin	69	Kent	11,320
Genesee	23,409	Emmet	68	Genesee	10,065
Macomb	22,279	Crawford	67	Macomb	6,684
Ingham	13,351	Alcona	66	Ingham	6,542
Kalamazoo	11,793	Baraga	64	Kalamazoo	5,668
Jackson	10,280	Presque Isle	63	Cass	5,270
Saginaw	10,108	Delta	62	Jackson	4,523
Muskegon	8,882	Otsego	60	Saginaw	4,144

TABLE 11

A COMPARISON OF GREATEST PERCENT DISTRIBUTION OF UNREGISTERED
BOAT OWNERS WITH GREATEST NUMERICAL DISTRIBUTION OF UNREGIS-
TERED BOAT OWNERS IN MICHIGAN BY COUNTIES OF RESIDENCE

Counties with Greatest No. of Regist. Boats		Counties with Greatest % of Unregist. Boats		Counties with Greatest No. of Unregist. Boats	
County	Number	County	Percent	County	Number
Wayne	68,405	Kalkaska	40	Wayne	8,209
Oakland	36,922	Mackinaw	35	Oakland	5,179
Kent	24,087	Manistee	34	Kent	4,095
Genesee	23,409	Crawford	33	Genesee	3,227
Macomb	22,279	Emmet	32	Ingham	1,870
Ingham	13,351	Lapeer	29	Muskegon	1,776
Kalamazoo	11,793	Presque Isle	28	Saginaw	1,617
Jackson	10,280	Lake	27	Kalamazoo	1,533
Saginaw	10,108	Wexford	26	Ottawa	1,419
Muskegon	8,882	Benzie	22	Berrien	1,144

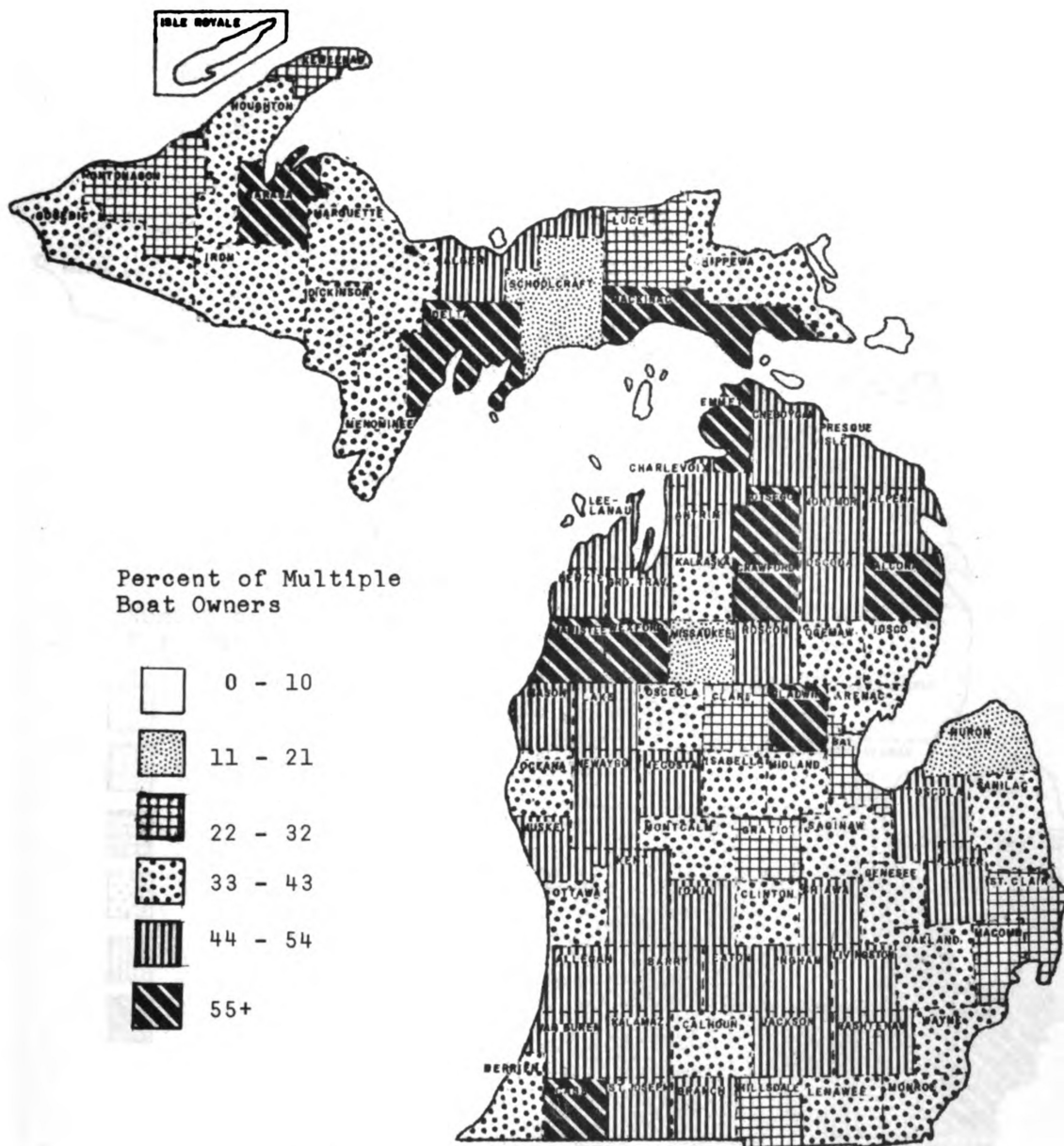


Figure 1.--Percentage Distribution of Multiple Boat Owners by County as Reported by Respondents to the 1968 Michigan Recreation Boating Needs Survey

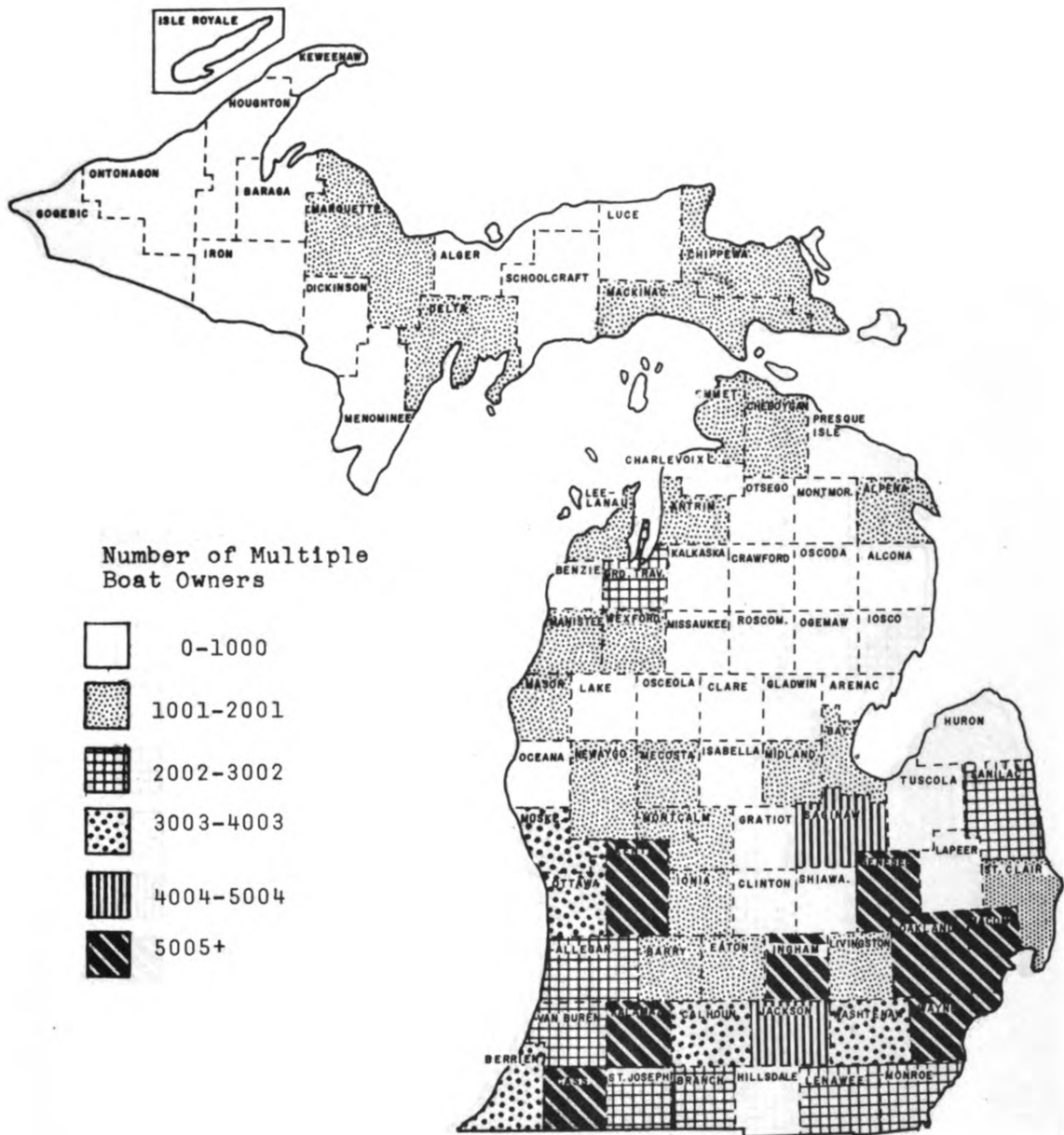


Figure 2.--Numerical Distribution of Multiple Boat Owners by County as Reported by Respondents to the 1968 Michigan Recreation Boating Needs Survey

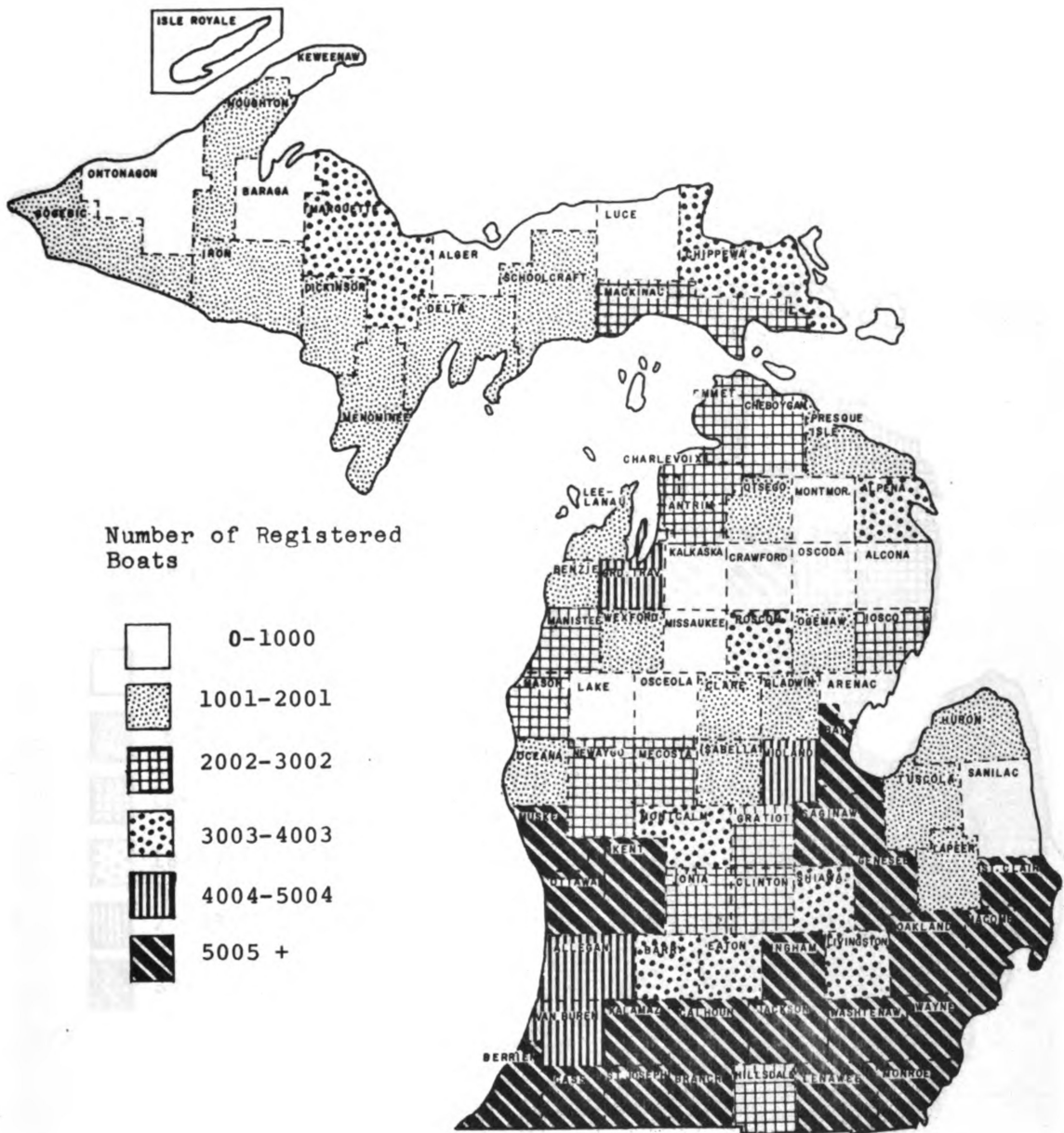


Figure 3.--Number of Registered Boats by County as Reported by Respondents to the 1968 Michigan Recreation Boating Needs Survey

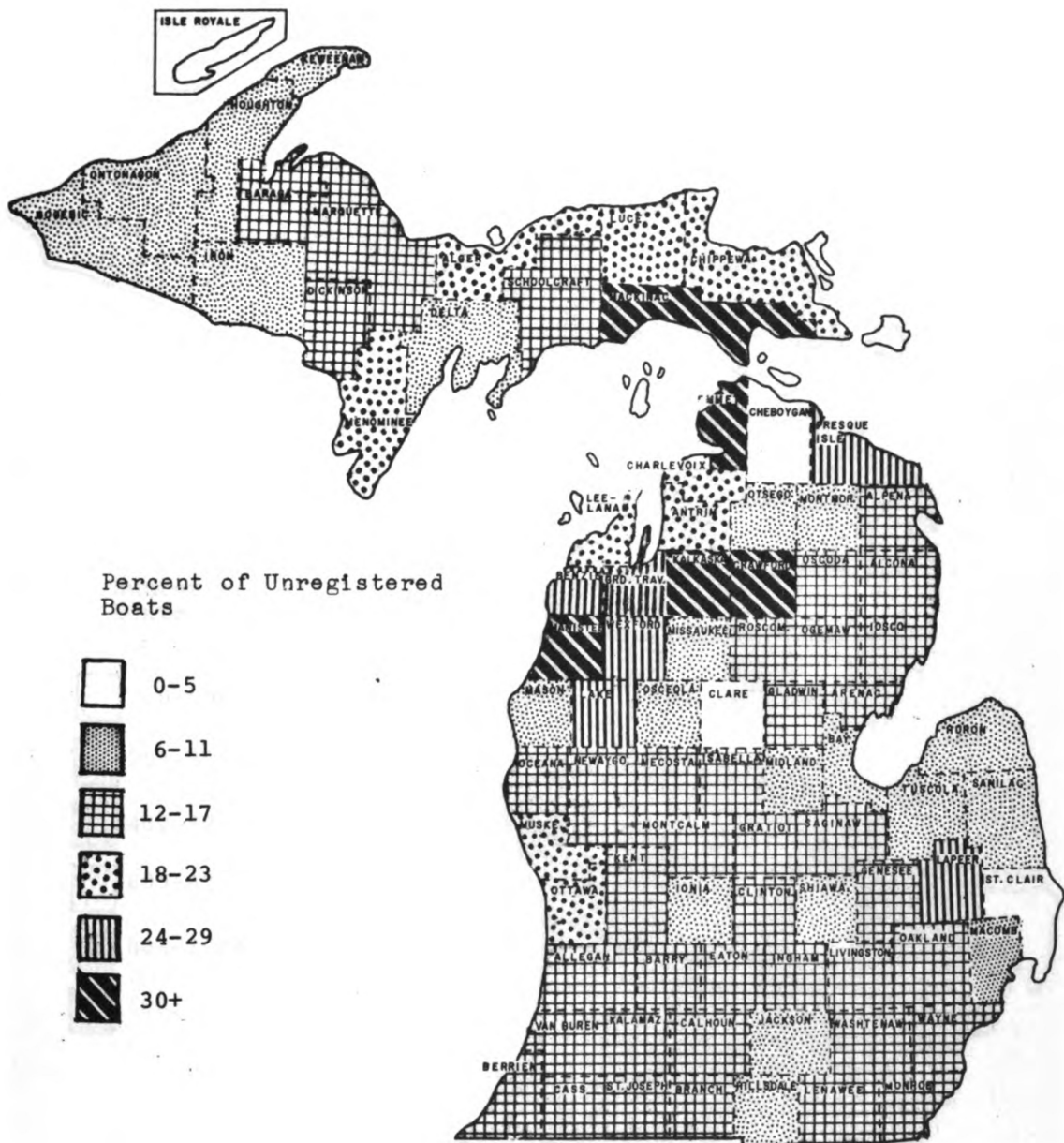


Figure 4.--Percentage Distribution of Unregistered Boats by County as Reported by the Michigan Secretary of State

Figure 5.--Number of Unregistered Boats by County as Reported by Respondents to the 1968 Michigan Recreation Boating Needs Survey

CHAPTER IV

ANALYSIS AND RESULTS

The hypothesis of this study, discussed in Chapter I, is that multiple boat ownership is related to selected socio-economic characteristics and the supply of boating opportunity. The hypothesis is a statement regarding the parameter value that will be accepted or rejected on the basis of a statistical test.¹ This study employed a linear regression procedure for testing the hypothesis. This method of analysis has certain advantages over other methods. Manderscheid found that a linear regression model is useful not only for identifying the independent variables exerting an influence on the dependent variable but also for estimating the effects of independent variables on a dependent variable.² Use of this technique for testing the hypothesis has the advantage that only can those socio-economic and supply characteristics which exert a significant influence on multiple boat ownership

¹A parameter is a characteristic which helps describe the population being investigated.

²Lester Manderscheid, An Introduction to Statistical Hypothesis Testing, Revised Syllabus for Agricultural Economics 867, Michigan State University, East Lansing, Winter, 1969.

be identified but the extent of their influence can be estimated.

Statistical Model

One of the aims of regression analysis is to find an equation expressing the relationship between the dependent variable Y and the independent variable X. A mathematical model is a method of representing this relationship and is usually divided into two broad types: a linear function and a non-linear function. Equations that have coefficients raised to powers other than the first, or are combined by multiplication or division are non-linear. Equations that have coefficients combined by subtraction or addition and are raised only to the first power are classified as linear.

The mathematical model selected in this analysis was linear and was as follows:

$$Y_{\text{MBO}} = B_0 + B_1x_1 + B_2x_2 \dots B_nx_n$$

where:

Y_{MBO} = conditional probability of the respondent owning two or more boats

x_1 = age of the head of the family

x_2 = total family income

x_3 = educational attainment of head of family

x_4 = size of family

x_5 = occupation of head of family

x_6 = units of boating opportunity per county of residence¹

Procedures and Results

The supply of "boating opportunity per county" data was punched on computer cards. This supply data was linked to the survey data by the following procedure. Respondent information to the survey was identified by a code obtained from the county of residence of the respondent. (For example, all the respondents residing in Alcona County - 01 - were ordered into the classification identified by the number 010001.) The computer input card containing boating supply data was linked to the survey data from a specific county by coding it with that county's identification number. This supply card was combined with the five other cards per respondent from the survey and was recorded on a magnetic tape.²

A least squares deletion (LSDEL) computer program was used for the regression analysis.³ This routine is a multiple regression program that utilizes a stepwise deletion of variables to calculate an initial least

¹Michigan Department of Conservation, Recreation Resource Planning Division, "Michigan Lake Frontage 1965" unpublished computer print out dated October 26, 1966 quoted in Michael Chubb, Outdoor Recreation Planning in Michigan by a Systems Analysis Approach: Part III, op.cit., p. 150-152.

²The production of the survey punch card decks has been described in Chapter II.

³Michigan State University, Agricultural Experiment Station, LSDEL: Stepwise Deletion of Variables from a Least Squares Equation. (East Lansing, Michigan: Statistical Services Description No. 8, November 1967), p. 1.

squares equation. The independent variable that least reduces the variance around the mean of the dependent variable is the deleted and a new equation is estimated. A second independent variable is deleted following the same criteria. This procedure continues until a variable meets the stopping criteria. A 5 percent significance level was specified as the stopping criteria.

The data for this part of the study (hypothesis testing) was prepared for the LSDEL routine by computer programmers at Michigan State University's Computer Center. The program was run on the University's CDC 3600 computer.

The statistics on transformed variables and simple correlations are illustrated in Appendix E. The independent variables and related statistics that were identified as being significant in the final equation are also listed in this Appendix.

Interpretation of Results

The independent variables deleted by the LSDEL routine and identified as not significant at the specified level were the supply of boating opportunities and the size of the boaters family. It would seem that supply of boating opportunity would be a significant variable, however, the manner by which the data was used could be faulty. Instead of linking supply at the origin with the data it may have been more significant to relate cottage ownership to multiple boat ownership. This may have given a better indication of supply of boating opportunity than

an enumeration of acres of water per county. The wording of the questionnaire negated the possibility of this method of linking boating opportunity with multiple boat ownership.

The independent variables of age, income, education, and occupation were found to be significant at the 5 percent level. The R^2 (coefficient of determination which estimates the percentage of variance in the dependent variable that is explained by changes in the independent variable) for the final equation was .029. This would seem to indicate that these variables, although significant, explain approximately 3 percent of the variance leaving 97 percent to be explained by other factors. The unexplained factors comprising the remaining variance could be identified with further study. As one would suspect, these variables are related to other factors not directly within the socio-economic characteristics currently tested. Such factors as, public access to boating waters, cottage ownership, methods of transportation and recreational uses of water could affect multiple boat ownership. To attempt to identify the significance of these factors without quantifiable data would be difficult.

The identification of other characteristics and their inclusion into the linear model could possibly raise the coefficient of determination. It would appear that the

range of variables affecting multiple boat ownership is large and that more study is needed in this area.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This study was guided by two basic objectives: a need to estimate the number of unregistered boats owned by multiple boat owners, and secondly a desire to determine the factors which are connected with multiple boat ownership and explore their usefulness in predicting future multiple boat ownership patterns. This second objective was expressed as the primary hypothesis of the study. The basic data for the study was provided by a questionnaire survey of registered Michigan boat owners. The data gathered consisted of socio-economic characteristics of state boaters, boat ownership; types and sizes of boats and motors used by boaters in the state; boat storage; transportation and launching; boating preferences for different water bodies-inland and Great Lakes; frequency and type of use; origin and destination patterns; in-state use by out-of-state boaters; and out-of-state use by in-state boaters.

The survey sample information regarding boat ownership was expanded by a ratio method to statewide data concerning number of multiple boat owners and the number of unregistered boat owners and boats. The socio-economic characteristics of boaters, together with a supply of

boating opportunity, were then related to multiple boat ownership by means of a least squares procedure.

The conclusions of the study are outlined below.

Conclusions

1. The distribution of respondents by selected socio-economic characteristics (income, age, and education) was similar to the distribution of the 1964 Boating Survey. The distribution by income and occupational classes of respondents owning two or more boats compared to single boat owners was also very similar.

2. Analysis of the data indicates that 59 percent of the respondents owned only one boat and 41 percent owned two or more boats. This figure, when applied to the 1968 tabulated registered boat total yields an estimate of some 180,000 boat owners that can be classified as probable multiple boat owners.

3. There appears to be a greater incidence of multiple boat ownership in the counties in the northern lower peninsula of Michigan. The greatest numbers of multiple boat owners are not located in the northern rural counties but are in the urbanized counties of southern Michigan.

4. Outboards and inboards comprise 70 percent of the total boats owned by multiple boat owners. Sailboats, canoes, inboard-outboards, rowboats and others comprise the remaining 30 percent owned.

5. The analysis indicates that 12 percent of the respondents owned one or more unregistered boats. It is therefore estimated that registered boat owners in Michigan have nearly 60,000 additional watercraft not requiring registration.

6. The percentage and numerical distribution of unregistered boat owners is similar to that of multiple boat ownership. The percentage distribution of unregistered boats is the greatest in the northern counties of the lower peninsula of Michigan, however, the largest numbers of unregistered boats are in the urbanized southern counties of Michigan.

7. The characteristics of multiple boat ownership identified as being significant at the .95 level of confidence were age, income, education, and occupation. Although they were statistically significant, they did not account for a great deal of the variation around the mean of the dependent variable. The coefficient of determination (R^2) for the final equation was .029. A model to accurately predict multiple boat ownership in Michigan must include other variables in addition to those of a socio-economic character.

Recommendations

1. The phenomena of multiple boat ownership is in need of further research. Emphasis should be placed on identifying the factors which account for multiple boat ownership and their significance. Further study is also

needed to determine the best statistical method that can be utilized for the identification of these factors.

2. The data gathering techniques employed should answer the following types of questions. Of the boats owned, which boat is the primary one in terms of gross amount of use? What is the total amount of use of each boat owned and the type of use? This type of information would identify not only primary and secondary boats but would indicate the amount of use generated by each.

3. The 1968 Boating Needs Study did not ask the respondent to specifically identify the boats not requiring registration. So the absence of an indication that a boat had a mechanical propulsion system was used as an indicator that it probably did not require registration. Positive identification of unregistered boats was not determined by this study. If the data obtained from future studies is to be utilized in the "RECSYS-SYMAP" approach to planning, then the amount and type of use generated by unregistered boats should be determined.

4. The estimation of the size of the unregistered boating fleet in Michigan was based upon a sample drawn from registered boat owners and as such results in an under-estimation of the total size of the fleet. Methods and procedures need to be devised to include in future studies a sample of unregistered boat owners who do not own registered boats. For planning and other purposes, it is desirable that all watercraft should be registered.

Investigation of the administrative and political feasibility of the establishment of this procedure should be instigated.

5. The decision makers in the recreation field of resource management should be more aware of the methods and techniques of planners. Conversely, planners should be concerned with devising, interpreting and utilizing quantitative methods to provide reliable data for decision makers. If unreliable processes are used and the ensuing data is furnished to decision makers, less than desired provision for recreation opportunity results.

APPENDICES

APPENDIX A

MICHIGAN RECREATIONAL BOATING NEEDS QUESTIONNAIRE



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

GEORGE ROMNEY, Governor

DEPARTMENT OF NATURAL RESOURCES

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WATERWAYS COMMISSION

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LEONARD H. THOMSON
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Stevens T. Mason Building
Lansing, Michigan 48926
373-0626

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 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	Other fishing	Hunting	Water skiing	Cruising	Other	
		(No. Days)	(No. Days)	(No. Days)	(No. Days)	(No. Days)	(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	Other fishing	Hunting	Water skiing	Cruising	Other	
		(No. Days)	(No. Days)	(No. Days)	(No. Days)	(No. Days)	(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 ☐ \$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:

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slightly textured appearance and some minor discoloration or shadows, suggesting it might be a scan of a physical document. There is no handwriting or other markings on the page.

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

COUNTY BREAKDOWN OF MAILED
AND RETURNED SAMPLE

APPENDIX B
COUNTY BREAKDOWN OF MAILED SAMPLE

COUNTY	BOAT LENGTHS					Total
	12' or Less	12' - 20'	20' - 30'	30' - 40'	40' and Over	
1	7	33	0	0	0	40
2	16	28	2	0	0	46
3	94	100	12	0	0	206
4	31	122	11	0	0	164
5	31	76	5	0	0	112
6	4	24	0	0	0	28
7	5	34	2	0	0	41
8	66	90	8	0	0	164
9	63	163	23	9	3	251
10	17	66	3	0	0	86
11	165	227	23	1	0	416
12	81	177	8	0	0	266
13	188	175	28	5	2	398
14	114	190	15	2	0	321
15	23	69	10	1	0	103
16	20	100	6	1	0	127
17	18	109	10	1	1	139
18	34	32	5	0	0	71
19	33	65	5	0	0	103
20	4	17	2	0	0	23
21	32	75	1	1	1	110
22	42	46	0	0	0	88
23	68	112	6	0	0	186
24	27	66	8	0	0	101
25	372	788	58	8	2	1,228
26	15	34	2	0	0	51
27	23	62	5	0	0	90
28	54	161	9	2	0	226
29	26	50	3	0	0	79
30	45	72	6	0	0	123

APPENDIX B (Con'd)

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	485
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	58	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 (Con'd)

COUNTRY	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	353
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	1,388	348	60	21,764

APPENDIX B BOAT OWNERS BY COUNTY OF RETURNED SAMPLE

COUNTY OF RESIDENCE	BOAT LENGTH										TOTAL
	LESS THAN 12	12 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 - 79	80 - 89	90 - 99	
1	.064	16	.460	1	.200	0	0.000	0	0.000	0	.31875
2	.255	5	.144	0	0.000	0	0.000	0	0.000	0	.15038
3	1.656	27	.776	4	.800	0	0.000	0	0.000	0	1.00939
4	.255	31	.891	4	.800	0	0.000	0	0.000	0	.69063
5	1.983	19	.546	0	0.000	0	0.000	0	0.000	0	.63751
6	.127	8	.230	0	0.000	0	0.000	0	0.000	0	.17790
7	.127	8	.230	1	.200	0	0.000	0	0.000	0	.19479
8	.955	38	1.092	4	.800	0	0.000	0	0.000	0	1.00939
9	1.217	46	1.322	2	.400	4	4.545	0	0.000	0	1.25738
10	.127	16	.460	0	0.000	0	0.000	0	0.000	0	.31875
11	.701	91	2.414	11	2.200	0	0.000	1	10.000	0	2.01877
12	.828	48	1.380	1	.200	0	0.000	0	0.000	0	1.09793
13	3.121	51	1.466	4	.600	2	2.273	0	0.000	0	1.87710
14	1.338	41	1.178	3	.600	1	1.136	0	0.000	0	1.15874
15	0.000	30	.802	4	.800	0	0.000	0	0.000	0	.60209
16	.510	20	.575	0	0.000	0	0.000	0	0.000	0	.49584
17	.191	21	.604	2	.400	0	0.000	0	0.000	0	.46642
18	.446	13	.374	1	.200	0	0.000	0	0.000	0	.37188
19	.992	19	.546	0	0.000	0	0.000	0	0.000	0	.53438
20	0.000	5	.144	1	.200	0	0.000	0	0.000	0	.10625
21	.573	25	.710	0	0.000	0	0.000	0	0.000	0	.60209
22	.637	15	.431	0	0.000	0	0.000	0	0.000	0	.44271
23	1.529	38	1.092	0	0.000	0	0.000	0	0.000	0	1.09793
24	.573	24	.690	5	1.000	0	0.000	0	0.000	0	.67292
25	5.732	27	5.950	18	3.600	2	2.273	0	0.000	0	5.61860
26	.191	12	.345	1	.200	0	0.000	0	0.000	0	.20334
27	.318	14	.432	2	.400	0	0.000	0	0.000	0	.37188
28	1.243	30	1.121	5	1.000	1	1.136	0	0.000	0	1.33135
29	.191	11	.314	2	.400	0	0.000	0	0.000	0	.28334
30	.637	16	.460	3	.600	0	0.000	0	0.000	0	.51355
31	.225	27	.776	4	.800	0	0.000	0	0.000	0	.61080
32	.064	14	.402	1	.200	1	1.136	1	10.000	0	.31875
33	5.159	129	3.708	11	2.200	1	1.136	0	0.000	0	3.63129
34	.828	24	.690	1	.200	0	0.000	0	0.000	0	.67292
35	.637	15	.431	0	0.000	0	0.000	0	0.000	0	.44271
36	.701	11	.314	0	0.000	0	0.000	0	0.000	0	.38959
37	.510	21	.604	1	.200	0	0.000	0	0.000	0	.53126
38	2.675	49	1.083	9	1.800	1	1.136	0	0.000	0	2.14273
39	4.777	87	2.501	8	1.600	0	0.000	0	0.000	0	3.61645
40	9.000	5	.144	0	0.000	0	0.000	0	0.000	0	.08954
41	6.879	145	4.108	15	3.000	1	1.136	1	10.000	0	4.78130
42	9.000	4	.114	0	0.000	0	0.000	0	0.000	0	.07083
43	.322	5	.144	0	0.000	0	0.000	0	0.000	0	.13279
44	.446	20	.575	1	.200	0	0.000	0	0.000	0	.49584
45	.637	21	.694	4	.800	0	0.000	0	0.000	0	.61080

APPENDIX B (Con'd)

COUNTY OF RESIDENCE	BOAT LENGTH										TOTAL
	LESS THAN 12	12 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100	
46	1	1	1	1	1	1	1	1	1	1	63
47	1	1	1	1	1	1	1	1	1	1	57
48	1	1	1	1	1	1	1	1	1	1	57
49	1	1	1	1	1	1	1	1	1	1	57
50	1	1	1	1	1	1	1	1	1	1	57
51	1	1	1	1	1	1	1	1	1	1	57
52	1	1	1	1	1	1	1	1	1	1	57
53	1	1	1	1	1	1	1	1	1	1	57
54	1	1	1	1	1	1	1	1	1	1	57
55	1	1	1	1	1	1	1	1	1	1	57
56	1	1	1	1	1	1	1	1	1	1	57
57	1	1	1	1	1	1	1	1	1	1	57
58	1	1	1	1	1	1	1	1	1	1	57
59	1	1	1	1	1	1	1	1	1	1	57
60	1	1	1	1	1	1	1	1	1	1	57
61	1	1	1	1	1	1	1	1	1	1	57
62	1	1	1	1	1	1	1	1	1	1	57
63	1	1	1	1	1	1	1	1	1	1	57
64	1	1	1	1	1	1	1	1	1	1	57
65	1	1	1	1	1	1	1	1	1	1	57
66	1	1	1	1	1	1	1	1	1	1	57
67	1	1	1	1	1	1	1	1	1	1	57
68	1	1	1	1	1	1	1	1	1	1	57
69	1	1	1	1	1	1	1	1	1	1	57
70	1	1	1	1	1	1	1	1	1	1	57
71	1	1	1	1	1	1	1	1	1	1	57
72	1	1	1	1	1	1	1	1	1	1	57
73	1	1	1	1	1	1	1	1	1	1	57
74	1	1	1	1	1	1	1	1	1	1	57
75	1	1	1	1	1	1	1	1	1	1	57
76	1	1	1	1	1	1	1	1	1	1	57
77	1	1	1	1	1	1	1	1	1	1	57
78	1	1	1	1	1	1	1	1	1	1	57
79	1	1	1	1	1	1	1	1	1	1	57
80	1	1	1	1	1	1	1	1	1	1	57
81	1	1	1	1	1	1	1	1	1	1	57
82	1	1	1	1	1	1	1	1	1	1	57
83	1	1	1	1	1	1	1	1	1	1	57
84	1	1	1	1	1	1	1	1	1	1	57
85	1	1	1	1	1	1	1	1	1	1	57
86	1	1	1	1	1	1	1	1	1	1	57
87	1	1	1	1	1	1	1	1	1	1	57
88	1	1	1	1	1	1	1	1	1	1	57
89	1	1	1	1	1	1	1	1	1	1	57
90	1	1	1	1	1	1	1	1	1	1	57
TOTAL	1570	8479	500	48	10	10	10	10	10	10	5647

APPENDIX C

NUMBER OF MULTIPLE BOAT OWNERS
AND TYPES OF BOATS OWNED BY
COUNTY OF RETURNED SAMPLE

APPENDIX C

NUMBER OF MULTIPLE BOAT OWNERS, TYPES OF BOATS OWNED BY COUNTY OF
RETURNED SAMPLE.

County	Number MBO	PRCT	Inbds	Otbds	Slbt	Canoe	I/O	Rabt	Other	Total	Non Power Boats				
											Slbt	Canoe	Rabt	Other	Total
1	1	.488	6	7	0	1	0	5	2	21	0	0	2	1	3
2	4	.163	4	3	0	0	0	3	0	10	0	0	2	0	2
3	26	1.052	23	22	1	5	1	8	2	62	1	5	3	0	9
4	18	.733	14	14	1	0	0	6	1	40	1	0	5	0	6
5	16	.651	14	15	0	0	1	7	0	37	0	0	7	0	7
6	4	.163	1	6	0	0	0	0	0	7	0	0	0	0	0
7	7	.285	6	9	0	1	0	0	0	16	0	1	0	0	1
8	30	1.221	25	32	3	4	0	4	4	72	1	4	3	0	8
9	18	.733	6	17	1	1	0	0	2	27	1	1	0	2	4
10	8	.326	4	5	0	2	0	2	1	14	0	2	0	0	4
11	42	1.705	22	26	4	4	1	13	4	74	4	2	9	0	15
12	31	1.262	37	19	2	3	0	22	5	88	2	3	5	0	10
13	46	1.872	21	19	3	2	0	24	8	77	3	2	9	0	14
14	51	2.076	16	21	1	1	0	8	13	60	1	1	4	4	10
15	16	.651	11	10	1	0	0	7	4	33	1	0	4	1	6
16	15	.611	10	4	1	0	2	13	0	30	1	0	0	1	2
17	10	.407	8	6	0	4	0	2	2	22	0	3	1	1	5
18	6	.244	4	0	0	0	0	7	0	11	0	0	1	0	1
19	12	.488	9	8	0	2	0	6	1	26	0	2	2	1	4
20	4	.163	0	1	0	2	0	1	0	4	0	0	0	0	0
21	13	.525	6	7	2	4	0	3	2	24	0	3	0	0	3
22	10	.407	10	10	0	3	0	1	1	25	0	3	0	0	3
23	29	1.180	15	19	2	4	0	8	4	52	2	4	3	0	9
24	26	1.052	16	13	2	2	1	5	12	51	2	2	3	5	12
25	135	5.405	72	96	16	16	0	31	14	245	15	15	11	3	44
26	11	.448	4	4	0	1	0	4	2	15	0	1	1	0	2
27	7	.245	5	5	1	1	0	2	0	14	1	1	0	0	2
28	32	1.302	31	24	1	8	0	9	6	79	1	7	6	2	16
29	5	.204	4	3	0	2	0	0	2	11	0	2	0	0	2
30	9	.366	10	5	0	1	0	6	2	24	0	1	2	0	3
31	14	.570	12	13	1	1	0	1	1	29	0	1	0	1	2
32	2	.081	3	2	0	0	0	0	0	5	0	0	0	0	0
33	105	4.274	69	104	15	8	2	13	7	216	12	7	9	6	34
34	17	.602	15	13	0	1	0	5	0	32	0	0	4	0	4
35	10	.407	7	7	0	1	0	1	2	19	0	0	1	3	4
36	9	.366	13	9	0	0	0	3	3	27	0	0	2	0	2
37	13	.525	7	7	1	3	0	3	1	22	1	2	2	0	5
38	53	2.157	40	30	5	3	0	17	12	107	5	3	3	0	11
39	82	3.337	59	82	5	6	1	20	4	177	5	6	11	0	22
40	2	.081	2	0	0	0	0	2	1	5	0	0	2	0	2
41	125	5.082	76	92	14	12	2	30	2	228	13	9	16	0	38
42	1	.041	0	1	0	0	0	0	0	1	0	0	0	0	0
43	5	.204	1	1	0	0	0	5	0	7	0	0	3	0	3
44	13	.525	8	2	2	3	0	4	3	22	2	2	2	2	8
45	19	.773	13	21	1	0	1	1	0	37	0	0	1	0	1

APPENDIX C. (Con'd)

County	Number MBO	PRCT	Inbds	Otbds	Slbt	Canoe	I/O	Rwbt	Other	Total	Non power Boats					Total
											Slbt	Canoe	Rwbt	Other		
46	26	1.058	30	20	4	1	0	8	6	69	4	0	4	1	4	9
47	26	1.058	31	23	1	5	1	10	4	75	1	3	3	0	7	7
48	3	.122	0	3	0	0	0	0	0	3	0	0	0	0	0	0
49	20	.814	21	19	0	0	0	10	0	50	0	0	10	0	10	10
50	73	2.971	30	61	4	3	0	22	6	126	3	1	9	2	15	15
51	10	.467	9	8	3	1	0	2	1	24	3	1	1	1	6	6
52	18	.733	15	7	2	6	1	2	0	33	0	5	2	0	7	7
53	13	.448	0	6	2	2	0	0	0	19	1	1	0	0	2	2
54	13	.529	8	9	1	0	0	1	6	25	0	0	0	0	0	0
55	6	.244	4	5	2	2	0	0	0	13	2	1	0	0	3	3
56	26	1.058	16	22	3	3	0	3	4	51	2	2	2	0	6	6
57	1	.641	0	1	0	0	0	0	0	1	0	0	0	0	0	0
58	24	.977	21	24	1	2	2	6	0	56	1	2	5	0	8	8
59	16	.651	13	16	2	1	0	4	0	36	1	1	1	0	3	3
60	7	.285	4	8	0	0	0	1	3	16	0	0	1	0	1	1
61	53	2.157	23	37	12	11	2	6	0	91	8	10	5	0	23	23
62	19	.773	12	11	1	3	0	3	3	33	1	1	1	1	5	5
63	197	8.018	121	162	19	31	5	37	5	380	18	24	23	2	67	67
64	7	.285	7	9	0	0	0	0	0	16	0	0	0	0	0	0
65	9	.366	6	3	1	1	0	5	1	17	1	1	1	0	3	3
66	7	.285	2	8	0	0	0	0	0	10	0	0	0	0	0	0
67	8	.326	9	10	1	1	0	1	0	22	1	0	1	0	2	2
68	3	.122	3	5	0	0	0	0	0	8	0	0	0	0	0	0
69	6	.244	6	5	0	0	0	0	0	12	0	0	0	0	0	0
70	53	2.157	43	48	11	6	0	14	0	122	9	6	9	0	24	24
71	9	.366	10	9	1	0	0	5	0	25	0	0	4	0	4	4
72	27	.805	31	19	1	2	0	16	4	73	1	2	3	0	6	6
73	64	2.605	37	55	7	9	3	12	0	123	6	8	10	0	24	24
74	6	.244	2	2	0	1	0	4	0	9	0	0	2	0	2	2
75	2	.041	4	2	0	0	0	2	0	8	0	0	0	0	0	0
76	23	.936	14	10	0	4	0	12	3	43	0	3	0	0	3	3
77	23	.936	16	24	0	1	1	2	0	44	0	1	2	0	3	3
78	39	1.547	23	17	1	1	0	29	6	77	1	1	9	0	11	11
79	14	.570	3	7	0	2	0	3	1	16	0	2	0	0	2	2
80	27	1.099	21	11	2	2	0	22	2	60	2	2	5	0	9	9
81	61	2.483	50	32	2	10	1	36	6	137	2	7	8	2	19	19
82	237	9.442	122	148	21	22	2	72	16	403	15	15	39	3	72	72
83	13	.529	7	6	1	1	0	8	6	25	0	2	2	2	6	6
Totals	2300		1520	1690	192	248	30	665	217	4562	158	199	308	47	712	712

APPENDIX C. (Con'd)

County	Number MBO	PRCT	Inbds	Otbds	Slbt	Canoe	I/O	Rwb	Other	Total	Non power Boats					Other	Total
											Slbt	Canoe	Rwb	Other			
46	26	1.058	30	20	4	1	0	8	6	69	4	0	4	1	4	1	9
47	26	1.058	31	23	1	5	1	10	4	75	1	3	3	0	0	0	7
48	3	.122	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0
49	20	.814	21	19	0	0	0	10	0	50	0	0	10	0	0	0	10
50	73	2.971	30	61	4	3	0	22	6	126	3	1	9	2	2	15	15
51	10	.407	9	8	3	1	0	2	1	24	3	1	1	1	1	6	6
52	18	.733	15	7	2	6	1	2	0	33	0	5	2	0	0	7	7
53	13	.448	0	6	2	2	0	0	0	19	1	1	0	0	0	2	2
54	13	.529	8	9	1	0	0	1	6	25	0	0	0	0	0	0	0
55	6	.244	4	5	2	2	0	0	0	13	2	1	0	0	0	3	3
56	26	1.058	16	22	3	3	0	3	4	51	2	2	0	0	0	6	6
57	1	.041	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
58	24	.977	21	24	1	2	2	6	0	56	1	2	5	0	0	8	8
59	16	.651	13	16	2	1	0	1	4	36	1	1	1	0	0	6	6
60	7	.285	4	8	0	0	0	1	3	16	0	0	0	0	0	0	0
61	53	2.157	23	37	12	11	2	6	0	91	8	10	5	0	0	23	23
62	19	.773	12	11	1	3	0	3	3	33	1	1	1	1	1	5	5
63	197	8.018	121	162	19	31	5	37	5	380	18	24	23	2	2	67	67
64	7	.285	7	9	0	0	0	0	0	16	0	0	0	0	0	0	0
65	9	.366	6	3	1	1	0	5	1	17	1	1	1	0	0	3	3
66	7	.285	2	8	0	0	0	0	0	10	0	0	0	0	0	0	0
67	8	.326	9	10	1	1	0	1	0	22	1	0	1	0	0	2	2
68	3	.122	3	5	0	0	0	0	0	8	0	0	0	0	0	0	0
69	6	.244	6	5	0	0	0	1	0	12	0	0	0	0	0	0	0
70	53	2.157	43	48	11	6	0	14	0	122	9	6	9	0	0	24	24
71	9	.366	10	9	1	0	0	5	0	25	0	0	0	0	0	4	4
72	27	.805	31	19	1	2	0	16	4	73	1	2	3	0	0	6	6
73	64	2.625	37	55	7	9	3	12	0	123	6	8	10	0	0	24	24
74	6	.244	2	2	0	0	0	4	0	9	0	0	2	0	0	2	2
75	2	.081	4	2	0	0	0	2	0	8	0	0	0	0	0	0	0
76	23	.936	14	10	0	4	0	12	3	43	0	3	0	0	0	3	3
77	23	.936	16	24	0	1	1	2	0	44	0	1	2	0	0	3	3
78	39	1.587	23	17	1	1	0	29	6	77	1	1	9	0	0	11	11
79	14	.570	3	7	0	0	0	3	1	16	0	2	0	0	0	2	2
80	27	1.099	21	11	2	2	0	22	2	60	2	2	5	0	0	9	9
81	61	2.483	50	32	2	10	1	36	6	137	2	7	8	2	2	19	19
82	257	9.442	122	148	21	22	2	72	16	403	15	15	39	3	3	72	72
83	13	.529	7	6	1	1	0	8	6	25	0	2	2	0	0	4	4
Totals	2300		1520	1690	192	248	30	665	217	4562	158	199	308	47		712	712

APPENDIX D

EXPANSION ESTIMATES OF UNREGISTERED AND MULTIPLE BOAT OWNERSHIP

APPENDIX D

Method of Expanding Sample Data to Statewide Estimates

The estimates concerning statewide information on the percentage and number of multiple boat owners and unregistered boats per county was obtained by expanding the sample data to total population estimates.

Response Rate Ratio's

The ratio was obtained by dividing the number of registered boats per county by the number of usable sample returns from that county. (For example, Alpena County had 3,278 registered boats and 39 usable returns, $3278/39$, for a $84/1$ response rate ratio.)

Number of Multiple Boat Owners

This estimate was derived by multiplying the total number of registered boats in the county by the percent of multiple boat ownership in the county. (To illustrate, Alpena had a multiple boat ownership percentage of 46 multiplied by 3278 registered boats, or 3278×46 , for a total of 1508 multiple boat owners.)

Percent of Multiple Boat Owners

The percentage of multiple boat ownership per county was estimated by dividing the number of multiple boat owners per county in the sample by the number of respondents

per county in the sample. (Alpena County had 18 multiple boat owners divided by 39 total respondents, $18/39$, for a percentage of multiple boat ownership of 46.

Number of Unregistered Boats

The number of unregistered boats owned by registered boat owners per county was estimated by multiplying the percentage of unregistered boats in the county by the number of registered boats. (Alpena County had 3278 registered boats and an unregistered boat percentage of 15, $3278 \times .15$, for a total of 492 unregistered boats.)

Percentage of Unregistered Boats

The percentage of unregistered boats owned by registered boat owners per county was estimated by dividing the total number of unregistered boats in the sample by the number of sample respondents. (Alpena County had 6 unregistered boats and 39 respondents $6/39$, for a percentage of 15).

APPENDIX D

EXPANSION ESTIMATES ON UNREGISTERED AND MULTIPLE BOAT OWNERSHIP

County	Response Rate Ratio	Number of M.B.O.'s/Cty.	Percent of M.B.O.'s/Cty.	Unregist. Boats per County	% of Unregist. Boats/Cty.
Alcona	39/1	474	66%	121	17%
Alger	98/1	390	111	195	22
Allegan	77/1	2015	46	700	16
Alpena	84/1	1508	116	192	15
Antrim	89/1	1067	115	174	20
Arenac	61/1	243	40	91	15
Baraga	63/1	441	64	97	11
Barry	65/1	1957	53	517	14
Bay	78/1	1385	25	332	6
Benzie	91/1	721	111	361	22
Berrien	77/1	3255	37	1144	13
Branch	85/1	2622	50	839	16
Calhoun	81/1	3669	43	1109	13
Cass	104/1	5270	77	1027	15
Charlevoix	60/1	984	47	377	18
Cheboygan	94/1	1415	54	105	4
Chippewa	121/1	1194	38	597	19
Clare	67/1	408	23	70	5
Clinton	81/1	880	31	336	13
Crawford	92/1	371	67	183	33
Delta	54/1	1133	62	164	9
Dickinson	65/1	654	40	196	12
Eaton	59/1	1708	47	545	15
Emmet	60/1	1537	68	723	32
Genesee	74/1	10065	43	3227	14
Gladwin	72/1	794	63	150	13
Gogebic	92/1	639	33	104	10
Grand Traverse	75/1	2423	50	1211	25
Gratiot	132/1	656	31	275	13
Hillsdale	94/1	847	31	273	10
Houghton	57/1	800	10	120	6
Huron	79/1	155	11	141	10
Ingham	61/1	6275	47	1903	15
Ionia	74/1	1265	45	303	11

APPENDIX D (Con'd)

County	Response Rate Ratio	Number of M.B.O.'s/Cty.	Percent of M.B.O.'s/Cty.	Unregist. Boats per County	% of Unregist. Boats/Cty.
Iosco	85/1	855	40	342	16
Iron	89/1	801	41	175	9
Isabella	54/1	745	43	242	17
Jackson	85/1	4523	44	925	9
Kalamazoo	69/1	5660	48	1533	13
Kalkaska	144/1	288	40	288	40
Kent	89/1	11320	47	3372	14
Keweenaw	49/1	49	25	20	10
Lake	58/1	289	45	174	27
Lapeer	69/1	891	46	562	29
Leelanau	54/1	1024	54	380	20
Lenawee	88/1	2264	41	773	14
Livingston	63/1	1648	46	430	12
Luce	70/1	207	27	153	20
Mackinaw	73/1	1470	69	746	35
Macomb	96/1	7129	32	1337	6
Manistee	128/1	1279	59	758	35
Marquette	66/1	1170	35	468	14
Mason	100/1	1105	48	207	9
Mecosta	80/1	1045	52	302	15
Menominee	91/1	547	43	267	21
Midland	73/1	1876	43	436	10
Missaukee	78/1	81	13	62	10
Monroe	87/1	2093	40	680	13
Montcalm	79/1	1262	39	485	15
Montmorency	66/1	464	54	69	8
Muskegon	75/1	3997	45	1776	20
Newsygo	71/1	1359	53	359	14
Oakland	76/1	14797	40	5179	14
Oceana	71/1	497	41	181	15
Ogemaw	46/1	411	39	137	13
Ontonagon	31/1	217	32	55	8
Osceola	46/1	368	38	97	10
Oscoda	68/1	203	50	60	15
Otsego	113/1	673	60	113	10
Ottawa	59/1	3050	43	1019	20
Presque Isle	94/1	840	64	381	29
Roscommon	76/1	1682	54	467	15
Saginaw	65/1	4144	41	1617	16

APPENDIX D (Con'd.)

County	Response Rate Ratio	Number of M.B.O.'s/Cty.	Percent of M.B.O.'s/Cty.	Unregist. Boats per County	% of Unregist. Boats/Cty.
St. Clair	89/1	1881	28	269	4
St. Joseph	67/1	2613	46	739	13
Sanilac	58/1	302	33	101	11
Schoolcraft	97/1	165	13	165	13
Shiawassee	63/1	1464	46	191	6
Tuscola	63/1	889	17	132	7
Van Buren	80/1	2169	47	738	16
Washtenaw	66/1	3905	48	1129	15
Wayne	107/1	24625	36	7527	11
Wexford	83/1	1094	57	499	26
TOTAL		180656		57157	

APPENDIX E

STATISTICS ON TRANSFORMED VARIABLES

APPENDIX E

STATISTICS ON TRANSFORMED VARIABLES

LABEL	VAR	MINIMUM VALUE	MAXIMUM VALUE	MEAN	STANDARD DEVIATIONS	SUM	SUM OF SQUARES	SQUARED DEVIATION FROM THE MEAN	SUM OF
TRANSPOR	1	0.00000	99.00000	7.44628	13.2424984	30217.00000	936455.00000	711450.78800	
AGE	2	0.00000	1.00000	0.43371	0.4956474	1760.00000	1760.00000	996.66831	
AGE	3	7.00000	85.00000	49.50296	12.037876	200883.00000	10531805.00000	587502.46451	
INCOME	15	1.00000	7.00000	4.37851	1.5846929	17768.00000	87730.00000	9932.00621	
EDUC	16	2.00000	12.00000	12.43470	3.0297675	50460.00000	664696.00000	34241.19468	
FAM SIZE	17	1.00000	11.00000	3.44283	1.7163423	13971.00000	60051.00000	11951.23432	
OCCUPATN	18	1.00000	3.00000	1.71735	0.6801526	6969.00000	13845.00000	1876.79867	
INC-OCCU	19	1.00000	21.00000	11.85288	4.3839404	48099.00000	648261.00000	78149.17187	
M SUPPLY	20	700.00000	124591.70000	17458.06459	17464.0368662	7084826.09961	2474188461760.0000	1237354911936.0000	

SIMPLE CORRELATIONS

LABEL	VAR	TRANSPOR	AGE	INCOME	EDUC	FAM SIZE	OCCUPATN	INC-OCCU	M SUPPLY
TRANSPOR	1	1.00000							
AGE	2	-0.11504	1.00000						
INCOME	15	-0.21713	0.08277	1.00000					
EDUC	16	-0.04228	0.10632	-0.31498	1.00000				
FAM SIZE	17	-0.02771	0.07024	-0.22031	0.41119	1.00000			
OCCUPATN	18	0.10923	0.01032	-0.45506	0.29807	-0.12583	1.00000		
INC-OCCU	19	0.00692	-0.05888	0.39222	-0.50650	-0.38472	-0.25508	1.00000	
M SUPPLY	20	-0.04415	0.10673	-0.27610	0.99103	0.38013	-0.27713	-0.38674	1.00000
		0.00390	-0.02170	0.03876	-0.0194	0.00051	-0.00481	-0.11565	1.00000
		1	2	3	15	16	17	18	20

STEP 1

APPENDIX E (Con'd)

MINIMUM ERROR MEAN SQUARE CRITERION MET,
RESULTS REQUESTED EVERY ITERATION,

AOV FOR OVERALL REGRESSION

	SUM OF SQUARES	DEG OF FREEDOM	MEAN SQUARE	F	SIG
REGRESSION (ABOUT MEAN)	30,77219279	6	5,12869880	21,5099	<0.0005
ERROR	965,89611672	4051	0,23843400		
TOTAL (ABOUT MEAN)	996,66830951	4057			

OBSERVATIONS

4058

STANDARD ERROR OF ESTIMATE
0,40829704

MULTIPLE CORR COEFS
R BAR 2
0,0294 0,1716

VAR	REGRESSION COEFFICIENTS	STD. ERRORS OF COEFFICIENTS	BETA WEIGHTS	STD. ERRORS OF BETAS	TB	FB	SIG	PARTIAL CORR COEFS	R2 DELETES
CONSTANT	-0,09500934	0,07033812	0,15856	0,01843	-1,3508	1,8245	0,173	0,13393	0,01318
AGE	0,00653073	0,00075925	0,10864	0,01922	8,6015	73,9865	<0,0005	0,08849	0,02323
INCOME	0,03441519	0,00608680	0,03987	0,01745	5,6541	31,9664	<0,0005	0,03587	0,02963
EDUC	0,00522282	0,00285545	0,03447	0,01769	2,2843	2,2182	0,021	0,03080	0,02997
FAM SIZE	0,00995371	0,00510506	-0,04199	0,01916	1,9482	-3,7957	0,049	-0,03442	0,02973
OCCUPATN	-0,03060021	0,01396141	-0,01632	0,01562	-2,1918	4,8039	0,027	-0,01641	0,03061
W SUPPLY	-0,00000046	0,00000044			0,1045	1,0910	0,297		

STEP 2

APPENDIX E (Con'd)

VARIABLE DELETED BY CRITERION 1 WAS X(20) W SUPPLY

W SUPPLY
20

VARIABLES IN ORDER DELETED

RESULTS REQUESTED EVERY ITERATION,

ADV FOR OVERALL REGRESSION

	SUM OF SQUARES	DEG OF FREEDOM	MEAN SQUARE	F	SIG
REGRESSION (ABOUT MEAN)	30.51205819	5	6.10241164	25.5931	<0.0005
ERROR	966.15625131	4052	0.23843935		
TOTAL (ABOUT MEAN)	996.66830951	4057			

OBSERVATIONS

4058

STANDARD ERROR OF ESTIMATE
0.48830252

VAR	REGRESSION COEFFICIENTS	STD. ERRORS OF COEFFICIENTS	BETA WEIGHTS	STD. ERRORS OF BETAS	R BAR	R BAR 2	MULTIPLE CORR COEFS	R BAR	R BAR 2	TB	F8	SIG	PARTIAL CORR COEFS	R2 DELETES
CONSTANT	-0.10475370	0.06971749	0.15778	0.01842	0.1715	0.0294	0.0294	0.1715	0.0294	-1.5025	2.2576	0.129	0.13337	0.01306
AGE	0.00649856	0.00075863	0.11128	0.01905	0.0294	0.0294	0.0294	0.0294	0.0294	8.5661	72.3784	<0.0005	0.09139	0.02245
INCOME	0.03525095	0.00603405	0.03924	0.01744	0.0294	0.0294	0.0294	0.0294	0.0294	5.8420	34.1290	<0.0005	0.03531	0.02940
EDUC	0.00641902	0.00285375	0.03373	0.01768	0.0294	0.0294	0.0294	0.0294	0.0294	2.2493	9.0595	0.023	0.02996	0.02974
FAM SIZE	0.00974170	0.00510508	-0.04070	0.01912	0.0294	0.0294	0.0294	0.0294	0.0294	1.9082	3.6414	0.053	-0.03342	0.02953
OCCUPATH	-0.02966032	0.01393254	-0.04070	0.01912	0.0294	0.0294	0.0294	0.0294	0.0294	2.1269	4.5320	0.031	-0.03342	0.02953

STEP 3

APPENDIX E (Con'd)

VARIABLE DELETED BY CRITERION 1 WAS X(17) FAM SIZE

VARIABLES IN ORDER DELETED

N SUPPLY FAM SIZE
20 17SIGNIFICANCE CRITERION MET,
RESULTS REQUESTED EVERY ITERATION,

ADV FOR OVERALL REGRESSION

	SUM OF SQUARES	DEG OF FREEDOM	MEAN SQUARE	F	SIG
REGRESSION (ABOUT MEAN)	29,64381316	4	7,41095329	31.0608	<0.0009
ERROR	967,02449635	4053	0,23859474		
TOTAL (ABOUT MEAN)	996,66830951	4057			

OBSERVATIONS

4058

STANDARD ERROR OF ESTIMATE
0,48846161

VAR	REGRESSION COEFFICIENTS	STD. ERRORS OF COEFFICIENTS	BETA WEIGHTS	STD. ERRORS OF BETAS	TB	FB	SIG	PARTIAL CORR COEFS	R2 DELETES
CONSTANT	-0,04801418	0,06307938			-0,7612	0,5794	0,453		
AGE	0,00594420	0,00070104	0,1432	0,01702	8,4792	71,6961	<0,0005	0,13202	0,01253
INCOME	0,03710872	0,00595694	0,1175	0,01881	6,2295	32,8067	<0,0005	0,09739	0,02845
EDUC	0,00619485	0,00285226	0,03787	0,01744	2,1719	4,7172	0,028	0,03410	0,02861
OCCUPATN	-0,03030357	0,01393300	-0,04158	0,01912	-2,1749	2,7304	0,028	-0,03414	0,02861

APPENDIX F

COUNTY IDENTIFICATION CODE

APPENDIX F

County Identification Code

01	Alcona	42	Keweenaw
02	Alger	43	Lake
03	Allegan	44	Lapeer
04	Alpena	45	Leelanau
05	Antrim	46	Ienawee
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	Mecosta
14	Cass	55	Menominee
15	Charlevoix	56	Midland
16	Cheboygan	57	Missaukee
17	Chippewa	58	Monroe
18	Clare	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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