# PECREATION RESEARCH MALL SURVEY TECHNIQUES: EFECTS OF SELF ADAHISTRATON AMD NON-RESPOMSE 

> Thesis for the Degree of M. S. MCHIGAN STATE UNVERSITY ALISON JEAN CLINTON IGO

> 1971


MAR 232001
102300

$$
106852001
$$

$$
111501
$$


#### Abstract

\title{ RECREATION RESEARCH MAIL SURVEY TECHNIQUES: EFFECTS OF SELF-ADMINISTRATION <br> AND NON-RESPONSE }

\section*{By}

\section*{Alison Jean Clinton Igo}


Natural resource land-managing agencies are becoming engaged in social science research as a means of assessing people's recreation needs, preferences, and behavior. Program development, funding, and resource allocation are based on the outcome of these studies, so it is important that their results be reliable.

One of the most popular techniques used in recreation research is the mail survey. In using this method to predict future recreation trends, however, it is important to be aware of the effect which non-response may have on the validity of mail questionnaire results. The purpose of this study was to examine the problem of non-response in two recreation surveys, the 1968 Boating Demand Study and the 1970 Snowmobile Study, both under the direction of the Recreation Research and Planning Unit, Department of Park and Recreation Resources at Michigan State University.

These studies were implemented by means of a mail questionnaire and follow-up interviews of both respondents and non-respondents in selected counties. Taking the data from these response groups, respondent interview data were compared with data from respondent interviewee mail returns, total mail returns, and non-respondent interviews in each county where a follow-up was done.

Comparisons were made on the basis of educational level, total family income, amount of recreational participation, and geographic location of boat or snowmobile use. Data on the first three variables were compared statistically, yielding no significant difference between any two response categories. Descriptive statistics were used to illustrate the geographical distribution of use by each group in Michigan counties.

On the basis of study results, it is possible to accept the hypothesis that there is no significant difference between respondents and non-respondents to either the 1968 Boating Demand Study or the 1970 Snowmobile Study. Therefore, predictions based on partial response to each can be assumed to provide a valid representation of the needs, preferences, and behavior of a given recreation population.

# RECREATION RESEARCH MAIL SURVEY TECHNIQUES: EFFECTS OF SELF-ADMINISTRATION AND NON-RESPONSE <br> <br> By <br> <br> By <br> Alison Jean Clinton Igo 

A THESIS

# Submitted to <br> Michigan State University <br> in partial fulfillment of the requirements <br> for the degree of 

MASTER OF SCIENCE

Department of Park and Recreation Resources

## ACKNOWLEDGMENTS

I am indebted to many people who helped me throughout this project. Grateful recognition is given Dr. Michael Chubb, the chairman of my master's committee and under whom $I$ worked as a research assistant while completing my graduate work. The directors of the studies providing data for this project, Mr. Paul Fiske and Mr. Louis Lanier, are also to be thanked for their information and advice.

Appreciation is also extended to the other members of my committee, Professor Sherilyn Zeigler, under whom I worked for a year; Professor Louis F. Twardzik; and Mr. Ronald Hodgson. Mr. Paul Risk, instructor, is also given thanks for his friendship and encouragement.

Computer programming and statistical advice from Mr. James Mullin and Dr. Dennis Gilliland are gratefully acknowledged. The Michigan Department of Natural Resources supported the 1968 Boating Demand Study and partially supported the 1970 Snowmobile Study; the use of data from these projects is greatly appreciated.
help of
Anne Mil
and Mrs.
and supp
many th

Deadlines could never have been met without the help of the unit staff, particularly Randalyn Godley and Anne Mills, and many thanks go to them.

A great deal of gratitude goes to my parents, Mr. and Mrs. Harry Igo, who have given continued encouragement and support throughout my education, and who have made so many things possible.
I.
II.
Chapter Page
I. INTRODUCTION AND PROBLEM STATEMENT ..... 1
Introduction. ..... 1
User Surveys as a Recreation Research Tool ..... 3
Mail Survey Technique. ..... 3
Non-response in Recreation Research Mail Surveys. ..... 5
Problem Statement and Objectives ..... 6
Assumptions ..... 7
Studies to Be Examined ..... 8
II. REVIEW OF RELEVANT STUDIES ..... 10
Findings of Respondent-Nonrespondent Comparisons ..... 11
How Non-respondents Differ ..... 12
Some Findings Suggest No Difference ..... 14
Methods Used in Other Studies ..... 16
Summary ..... 18
III. STUDIES SUPPLYING DATA FOR COMPARISON ..... 21
1968 Boating Demand Study ..... 21
1968 Study Questionnaire Design. ..... 22
Sample Selection. ..... 23
Study Implementation ..... 24
1970 Snowmobile Study. ..... 26
Snowmobile Questionnaire Design. ..... 27
Sampling Procedure ..... 28
Study Implementation ..... 28
Chapter Page
IV. ANALYSIS OF DIFFERENCES BETWEEN RESPONSE CATEGORIES ..... 31
Characteristics Chosen for Comparison ..... 31
Socio-economic Data ..... 31
Degree and Patterns of Participation. ..... 32
Response Categories Chosen for Comparison. ..... 33
Format and Use of Questions ..... 35
1970 Snowmobile Study. ..... 35
1968 Boating Demand Study ..... 37
Hypotheses ..... 41
Respondent Interview versus Respondent Interviewee Mail Returns ..... 42
Respondent Interviews versus Total Mail Returns. ..... 44
Respondent Interviews versus Non- respondent Interviews ..... 46
Techniques for Comparing Response Groups ..... 48
Education. ..... 51
Income ..... 52
Days of Boating or Snowmobiling ..... 53
Geographical Distribution ..... 54
V. RESULTS. ..... 57
Education ..... 57
1968 Boating Demand Study ..... 57
1970 Snowmobile Study. ..... 59
Summary ..... 59
Income ..... 61
1968 Boating Demand Study ..... 61
1970 Snowmobile Study. ..... 64
Summary ..... 65
$\qquad$
Chapter Page
Amount of Recreational Participation ..... 67
1968 Boating Demand Study ..... 67
1970 Snowmobile Study ..... 69
Summary ..... 69
Geographical Distribution of Participation ..... 72
VI. CONCLUSIONS ..... 81
Problems and Limitations of Study ..... 81
Interpretation of Results. ..... 82
Implications for Future Studies. ..... 84
SELECTED BIBLIOGRAPHY ..... 87
2.
3.
4.
5.
6.
7.
8.
9.

## LIST OF TABLES

Table Page

1. Mail Returns and Interviews by County, 1968 Boating Demand Study ..... 26
2. Mail Returns and Interviews by County. 1970 Snowmobile Study ..... 30
3. Comparison of Educational Level of Various Response Categories, 1968 Boating Demand Study. ..... 58
4. Comparison of Educational Level of Various Response Categories, 1970 Snowmobile Study ..... 60
5. Percentage of Survey Subjects from Different Response Groups in Various Income Categories, 1968 Boating Demand Study ..... 62
6. Comparison of Total Family Incomes of Various Response Groups, 1968 Boating Demand Study ..... 64
7. Comparison of Total Family Incomes of Various Response Groups, 1970 Snowmobile Study. ..... 66
8. Comparison of Amount of Boating of Various Response Groups, 1968 Boating Demand Study ..... 68
9. Comparison of Amount of Snowmobiling of Various Response Groups, 1970 Snowmobile Study. ..... 70

## LIST OF FIGURES

Figure ..... Page

1. Comparison of Geographic Location ofSnowmobile Use in Michigan Counties,Respondent Interviews versus RespondentInterviewee Mail Returns, Ingham County. . 74
2. Comparison of Geographic Location of Snowmobile Use in Michigan Counties, Respondent Interviews versus Total Mail Returns, Ingham County ..... 75
3. Comparison of Geographic Location of Snowmobile Use in Michigan Counties, Respondent Interviews versus Non-respondent Interviews, Ingham County ..... 76
4. Comparison of Geographic Location of Snowmobile Use in Michigan Counties, Respondent Interviews versus Respondent Interviewee Mail Returns, Kent County ..... 77
5. Comparison of Geographic Location of Snowmobile Use in Michigan Counties, Respondent Interviews versus Total Mail Returns, Kent County • . . . . . . . ..... 78
6. Comparison of Geographic Location of Snowmobile Use in Michigan Counties, Respondent Interviews versus Non-respondent Interviews, Kent County ..... 79

## CHAPTER I

## INTRODUCTION AND PROBLEM STATEMENT

## Introduction

Many natural resource land-managing agencies are becoming engaged in social science research. Realizing the potential importance of being able to quantify people's activities, interests, and attitudes, investigators have used results of these studies as a basis for establishing priorities and allocating millions of dollars and valuable natural resources.

Crucial decisions are made on the basis of survey results. For this reason, it is vitally important to insure that predictions based on them are as accurate as possible. Affecting the accuracy and reliability of social research are forms of bias not encountered in physical or biological research. Trees make easy survey subjects because they are stationary and their characteristics are quantifiable. A person, however, equipped with reasoning power and distinct personality and psychological traits, has within his power the right to determine whether or not he will answer personal questions asked of him in a survey.

Whenever a social science research project is undertaken, those who choose not to participate pose a problem. Do these people, known as "non-respondents," differ importantly from those who did respond to a particular survey? If they do, profiles based on data obtained from the latter will not present a true picture of the entire population being investigated. Consequently, predictions based on study results may be inaccurate and lead to a misallocation of funds and natural resources. It is essential, therefore, that the problem of non-response be examined by any discipline, agency, or group making use of survey research data. One type of administrator who relies heavily on survey results in formulating policies and programs is the recreation resource decision maker. Charged with providing leisuretime activities for an increasingly leisure-oriented society, recreation planners must be able to assess recreation needs and desires and make predictions regarding future recreation requirements of the public.

Faced with this challenge, planners are anxious to apply social science research techniques to the management of participation in recreational activities. Many of the tools available are sophisticated and refined. Are they reliable? One aspect of this question will be examined in this thesis; specifically, is non-response to recreation surveys a serious problem?

## User Surveys as a Recreation Research Tool

Recreation researchers have various avenues open to them as they investigate the types and amount of recreation activity in which people are participating. They can use the findings of other researchers, correlating such variables as income and recreation participation in the past and projecting future participation on the basis of estimates of future income levels. The demand for recreation can also be measured indirectly, by evaluating sales of recreation goods and "by-products," such as boat gasoline, fishing supplies and the like. Thirdly, investigators may take a direct approach to the problem, measuring exact participation by users, either at the recreation site itself or through household surveys conducted by mail or by means of personal interviews.

## Mail Survey Technique

Of the various off-site techniques, the mail questionnaire method has much to recommend it. Because it is much less expensive than personal or telephone interviewing and requires no additional staff, the mail survey technique permits broader coverage of the population in question for a given amount of funds. ${ }^{1}$ A much larger sample can be taken, which often increases the

[^0]precision of estimates made from the study data. In addition, the bias which can arise from the use of interviewers is avoided. Incompetent interviewers can cause responses to be slanted and inaccurate. Also, reluctance of the respondent to respond truthfully in a face-to-face interview presents itself as another potential source of bias. "Respondents have confidence in their anonymity and thus can have a greater sense of freedom to express views they think may be contrary to those held by the majority."1 Mail surveys, however, are by no means infallible as predictors of population preferences and needs. Inherent in them are sources of bias of potential importance; it is important to examine these, if one is to make reliable predictions on the basis of mail survey results.

The most often asked and significant question with regard to the reliability of mail questionnaires is the matter of non-response. Frequently, conclusions are drawn by researchers on the basis of a small percentage of returns to a mail survey. Are these conclusions valid? The answer to this question lies in a comparison of the required data concerning those who did respond to a particular mail survey with those who did not. If respondents and non-respondents differ importantly in their demographic characteristics, interest in the topic under

[^1]stuày,
to repr
surveye
has a $p$
governm
to dete
in a gi
his wil
this ac
such a
for the
for a
high ar
felt
responc
ayencis
Gain 10
"neutra
game 1
${ }^{\text {recreat }}$
$\mathrm{resph}_{\mathrm{SO}}$
study, and the like, then the respondents cannot be said to represent a true picture of the population being surveyed.

## Non-response in Recreation Research Mail Surveys

It is possible that the problem of non-response has a particularly significant application to the work of government agencies attempting to survey their clientele to determine recreation behavior, needs, and desires.

It has been suggested that a participant's success in a given recreation activity may have a direct bearing on his willingness to respond to a questionnaire which covers this activity. If so, projections based on responses to such a survey may be exaggerated, because data tends to be for those who participated in the activity the most, not for a cross-section of the population which mirrors both high and low levels of use.

Sponsorship of recreation surveys is another factor felt to have a decided bearing on people's readiness to respond to them. Some recreation researchers in state agencies feel that surveys under their sponsorship often gain lower response than those under the auspices of a "neutral" university research team. They see fish and game laws as a possible source of antagonism from some recreationists, influencing those subjects not to respond. The question is: Are those who feel antagonistic
and disinclined to respond significantly different from those who are willing to share information with governmental recreation researchers?

## Problem Statement and Objectives

The applicability of social research methods to recreation research, in general, presents a problem worthy of investigation. More specifically, the use of a particular technique, the mail survey, by recreation planners delineates a problem which must be approached and solved, if recreation resource management is to be validly based on user-survey results.

The problem is two-fold. First of all, it is important to determine the effect of self-administration on the validity of predictions based on mail survey results. In other words, do data from mail survey respondents provide an adequate representation of the characteristics of the population under study? The second aspect of the problem concerns the matter of non-response. Do those who respond to a given survey differ markedly from those who did not respond? The purpose of this project is to approach these two questions through an analysis of data arising from two recreation research mail surveys.

## Assumptions

In the following analysis, a thorough comparison between various response groups is made; the test is not limited to a comparison only of respondent interviews with non-respondent interviews. This thorough comparison was made following the assumption that if non-respondent interviews are similar to respondent interviews, respondent interviews similar to the mail returns for those chosen for respondent interviews, and those select mail returns similar to the total mail returns, then the total mail responses can be considered representative of those who did not respond at all.

Two other assumptions had to be made, in order to accept the results of the study. These are as follows:

1. It is assumed that those people selected for personal interviews who were not at home are not markedly different from those who were interviewed and whose responses are used in the present comparison.
2. There is no proof that either the mail questionnaire or the personal interview is capable of obtaining the absolute truth about respondents' activities. The assumption is made that by comparing one with the other, an "averaging" process takes place which approaches the truth regarding an individual's true recreation behavior, needs, and desires.

## Studies to Be Examined

The problem of non-response can be approached most effectively through an analysis of the actual effect of non-response on a particular study or studies. Two projects undertaken by the Recreation Research and Planning Unit, Department of Park and Recreation Resources, at Michigan State University are well-suited to the necessary investigation. Both studies made use of the mail survey technique, followed by interviewing of a sample of both respondents and non-respondents. With data from these respondent categories available for comparison, the present study was undertaken to determine, for each project, if respondents answer mail survey questions differently than those asked in a personal interview and whether or not an important difference exists between the respondents and non-respondents to each survey.

One of the studies examined is that designed to measure 1968 participation in recreational boating in Michigan, undertaken by the Research Unit as part of a contract with the Waterways Commission, Michigan Department of Natural Resources. The second project investigated is a 1970 study of snowmobile use in Michigan, undertaken by the Unit in cooperation with the Michigan Department of Natural Resources, the United States Forest Service, and the City of Lansing Park and Recreation Department.
in each of
review rep
The purpos
findings
compare ma
significan
Chapter II

These studies, with the methods and findings from each, are discussed fully in Chapter III.

In order to approach the problem of non-response in each of these studies, it first becomes necessary to review reports of similar research undertaken elsewhere. The purpose of this literature survey is to examine the findings of these studies and the various methods used to compare mail survey respondents and non-respondents. The significant findings of the literature search follow in Chapter II.

## CHAPTER II

REVIEW OF RELEVANT STUDIES

In a methodological study such as this, the review of relevant literature has two aspects. First, findings of studies comparing respondents and non-respondents are important. Where differences between the two groups have been found, it is important to note which characteristics emerge as having given rise to the variance in most of the projects. If certain variables prove to be the source of the difference in a majority of studies, these then become the variables which should receive close scrutiny in a comparison of respondents and non-respondents to recreation research mail surveys.

The second topic of concern in reviewing other research on respondents and non-respondents is the actual methods used to compare the two groups. The application of any statistical technique requires that the assumptions of that technique be met. Insofar as these requirements can be satisfied, it is advisable to subject data to tests that are as refined as possible. Thus, differences will be not only measured and reported but weighed for their
importance. Mail survey non-respondents may differ to some degree from respondents, but the important question is whether the two categories differ enough to invalidate estimates and predictions based on information from the latter.

Related below, then, are findings felt to be important because of their consistency among studies comparing respondents and non-respondents to mail surveys. Following that is a report of the most frequently used methods of comparing the two.

Information for the following review has been drawn largely from journals of sociology, psychology, and marketing research. Because survey research techniques have generally not received much attention from recreation researchers, findings of investigators in other disciplines must be relied upon for guidance in approaching the problem.

## Findings of Respondent-Nonrespondent Comparisons

As pointed out in the introduction to this thesis, recreation research involves some unique factors which may result in a response from people who differ markedly from those who do not respond. For this reason, whether or not respondents and non-respondents to an educational survey differ markedly may be no indication of what the outcome might be in a recreation research project. Therefore, strictly relating the number of investigators who found a
significant difference, compared to those who found the groups homogeneous, is not appropriate here.

What is important, however, because of the consistency with which it appeared in this review, is the frequency with which particular characteristics were found to differ between respondents and non-respondents in various studies. In studies where parameters for the two groups were shown to differ, the same variables were repeatedly the source of the greatest variation, regardless of the discipline or subject with which the study was concerned. Because these variables are those which are most likely to exhibit variance in mail surveys, they become the most important basis for comparison in the present study.

## How Non-respondents Differ

Two characteristics which are mentioned most frequently by researchers as being different are education and interest in the survey topic. While many investigators have hypothesized other factors in addition, these two appear quite consistently in all studies where a comparison has yielded a significant difference.

An example is a study done by Suchman and McCandless of Columbia University. They conducted a mail survey in two waves and followed these with a telephone interview of non-respondents. The topic under study was participation in a child-training radio broadcast in Iowa.

When respondent and non-respondent data had been compared, the researchers wrote:

The influence of education is quite marked. . . . Whereas almost one out of every two of the respondents with a college education returned the questionnaire the first time, one out of every five with a highschool education and one out of every ten with a grammar school education did so. ${ }^{1}$

While educational level might appear more relevant in a study of child development programs than in a survey of boating or snowmobile participation, Franzen and Lazarfeld correlate education with response to mail surveys in general. The two state that, "mail questionnaires are answered more often by people who, due to their educational and occupational background, more easily express themselves in writing, and by people who are more interested in the topic under discussion." ${ }^{2}$

Interest in the topic of study is the second variable most frequently found to differ between respondents and non-respondents. Clausen and Ford, conducting repeated mail surveys of Army veterans, "found a higher response rate from those interested in the survey subject than from other veterans." ${ }^{3}$ A study of veterans'

[^2]educational plans, for example, brought "a much higher initial response from veterans planning to attend school or take training than from those not interested in utilizing the benefits for which they had applied earlier." Further, studies by these investigators lend additional support to the suggestion that educational levels and higher response rates are positively correlated. ${ }^{1}$

This degree-of-interest aspect, while measured for subject areas other than recreation, has important application for the boating and snowmobile studies examined herein. The major purpose of recreation research is to predict future needs and desires for recreation opportunities. If participation is, indeed, reported more frequently by those most interested, estimates and predictions may be too high, so newly built facilities may go unused.

## Some Findings Suggest

 No DifferenceThe group of studies represented by the examples above resulted in conclusions that some respondents and non-respondents are markedly different in some respects. It is important to note, however, that this difference does not always exist in a group of survey subjects.

For example, Robinson and Agisim, in a market research project on clothes buying habits, refute the

[^3]validity of the respondent-nonrespondent dichotomy. In a follow-up inquiry of non-respondents, questions designed to elicit reasons for non-response were included. Only 4.2 per cent of this group gave "Not Interested in Subject" as a reason for not replying. In contrast, 43.2 per cent indicated they had mislaid the questionnaire or simply overlooked answering it.

For the most part the non-replying group in this study was made up of people whose reasons for not replying were the result of "physical causes," such as neglect, loss, etc. There are no indications that non-responders were to any significant degree of a different type than responders. 1

The only conclusion one can reach after a review of findings in the respondent-nonrespondent area is that no definitive statement covering all disciplines can be made about the problem. Results vary from discipline to discipline, as constraints on survey subjects vary according to the topic under study. A generalization that can be made, however, is that where differences between the two groups are found, these differences very often are related to educational level and interest in the topic.

Had findings been consistent across the subject areas, investigation of mail questionnaires as a recreation research tool would still be necessary, as the work in this particular area is negligible compared to the

[^4]volume of investigations that has been undertaken in psychology, sociology, marketing, and education.

## Methods Used in Other Studies

As the current project is a methodological inquiry, the techniques used to compare respondents and nonrespondents are equally as important as the results of these studies. A review of the literature shows the use of several different techniques which vary in their degrees of sophistication. Among these are simple ratings of consistency, reporting of percentages, and use of the analysis of variance and critical ratio techniques.

The literature search reveals that the method most frequently used involves calculation of the percentages of respondents and non-respondents falling in given response categories for each question, followed by a comparison of these proportions using the chi-square technique.

Reid, an educational researcher, conducted a study of sample Ohio schools to measure their use of broadcast equipment. The project was implemented using 3,293 mail questionnaires and intensive telephone and special delivery follow-up of 87 of the study's 1,032 non-respondents. Defending his sample size, Reid points out,

In the polling of non-respondents it is not necessary to send questionnaires to all individuals or institutions that failed to answer the original questionnaire. A representative sample can be chosen, and if statistical precautions are
observed the responses from this smaller group can be interpreted as representative of the nonrespondents.l

Results of this study are useful, in that they show the importance of using techniques more refined than a simple comparison. A glance at some of the percentage comparisons does not reveal much divergence. For example, 71.3 per cent of the respondents indicated their schools made radios available to students, only 3.5 per cent more than the 67.7 per cent of the non-respondents who answered the same question affirmatively. This difference, however, was proven statistically significant at the . 05 level, using the chi-square test. ${ }^{2}$

A methodological study by McDonagh and Rosenblum also employed the chi-square test, but with different results from those reported above. ${ }^{3}$ The study is important because it goes one step further than other respondent-nonrespondent research up to that time. In addition to comparing mail returns and non-respondent interviews, these sociologists interviewed a sample of

[^5]of the
questior
random
who com

For pur
view in
questio
questic
catego
well

Th
re in
qu
Sc
th
th
liter
at ha
metho
mail respondents, comparing their interview answers with those they gave on the mail questionnaire.

A systematic random sample composing 20 per cent of the population under study was chosen and sent a questionnaire. When the response period was over, a random subsample of 10 per cent was selected from those who completed the questionnaire and those who did not. For purposes of comparison, key questions in the interview instrument were identical to those in the mail questionnaire.

Respondents were asked a variety of socio-economic questions and comparisons made between the three response categories. The chi-square statistic in every case was well above the 5 per cent level set by the researchers.

There were no significant differences between the responses of the mail questionnaire and those of the interviewed respondents who had not answered the questionnaire. The nonrespondents did not seem to be so selective of some variables as many behavioral scientists assume. The findings of this study imply that researchers should have greater confidence in the questionnaire as an initial tool of research.l

## Summary

Results of these and other studies reviewed in the literature search have definite implications for the study at hand. The McDonagh and Rosenblum study above is methodologically sound and, therefore, provides a good

$$
1_{\text {Ibid. . p. }} 136 .
$$

## model for <br> of mail

may be f
a:fect $s$
asencies
responce
study, t
ent's in
have not
project
of respo
question
the sect
data is
he infe
responde
study.
designer
naire $d_{i}$
and non.
methodo.
model for the researcher interested in validating the use of mail questionnaires as a research tool.

Because it is strictly methodological, however, it may be free from the influence of certain factors which affect special-subject studies implemented by particular agencies. In other words, while respondents and nonrespondents are proven statistically similar in this study, the role of the investigator's image or respondent's interest in or commitment to the topic under study have not come into play as much as they might in a specific project undertaken by a government agency.

The optimal approach to making a useful comparison of respondents and non-respondents to recreation research questionnaires seems to be:

1. To select an ongoing research project, where the securing of accurate planning and policy formulation data is the major concern, and then
2. To implement the study in such a way that all the information necessary for a thorough investigation of respondent-nonrespondent differences becomes available.

This approach is the one adopted for the present study. Two current recreation research projects were designed and implemented so as to provide mail questionnaire data and interview responses from both respondents and non-respondents. This has permitted a thorough methodological examination of a practical survey situation
where interests, prejudices, and the like could cause distinctly different groups to respond or not respond. Chapter III describes the design and implementation of the two projects whose results were examined for implications concerning the use of the mailed questionnaire as a recreation research tool.

## CHAPTER III

## STUDIES SUPPLYING DATA FOR COMPARISON

No attempt has been made to compare characteristics of respondents to the 1968 Boating Demand Study with those who responded to the 1970 Snowmobile Study; only different respondent categories within each project have been tested. Still, the two studies make an interesting comparison. The projects were administered quite similarly; many identical questions appear in both. Both made use of interview follow-ups to obtain additional information on respondents and non-respondents.

There are differences, however, in sampling procedures and some of the other techniques used, as well as in final response rates. These differences are worthwhile to note and suggest possibilities for future research which compares various approaches to the implementation of mail surveys, once the reliability of the technique has been established.

## 1968 Boating Demand Study

The project examined herein is part of an even larger study of recreational boating in Michigan. The

Waterways Commission of the Michigan Department of Natural Resources has asked the Recreation Research and Planning Unit to develop a model which will predict the demand for boating opportunities in 1980 and beyond.

To identify trends in boating participation and test the accuracy of the model being formulated, studies of boaters and boating participation are being done at three-year intervals. The first project was undertaken by the Waterways Commission in 1966. Using data from that and the present study, factors affecting boating patterns are being "mapped" and examined for their effect. Based on these results, demand for recreational boating in the future will be forecast.

## 1968 Study Questionnaire Design

In consultation with the Waterways Division, Research Unit personnel devised a questionnaire felt to be best for seeking the desired information and eliciting a reasonably high response rate from survey subjects. To get the necessary comprehensive view of recreational boating in Michigan, the following topics were covered:

1. Types and sizes of boats and motors used by boaters in the state.
2. Boat storage, transportation, and launching data.
3. Actual use during the 1968 season for different water bodies--inland or Great Lakes.
4. Frequency and type of use on the various water bodies.
5. Origin and destination patterns.
6. In-state use by out-of-state boaters and out-ofstate use by in-state boaters.
7. Boat ownership and socio-economic characteristics of state boaters.l

The questionnaire was accompanied by a cover letter from the Waterways Commission director, making the study a good one with which to examine the question of possible non-response bias introduced when a state resource planning agency conducts a survey of recreationists.

## Sample Selection

All powered watercraft operated in the state must be listed with the Watercraft Registration Division of the Michigan Secretary of State Department. Consisting of 438,017 boaters in 1968, this list served as the population for the study.

In determining a sample size, an analysis of variance in boat-use periods generated by counties of origin (residence) of Michigan boaters was first undertaken, utilizing data obtained from the 1965 study of recreational boating in Michigan. Given this information, and the level of response obtained in the 1965 mail survey, it was decided to draw a sample of 21,600
$1_{\text {Ronald Kaiser, "A Study of Multiple Boat Owner- }}$ ship in Michigan" (unpublished Master's thesis, Michigan State University, 1970), p. 14.
boat owners from the 1968 boat registration records. The sample was stratified by boat length and by county of residence (origin) of boat owners.l

The samples were then drawn randomly within each stratum by the Michigan State University CDC 6500 computer.

## Study Implementation

By the latter part of May, 1969, all the questionnaires had been sent out. Because a follow-up check of respondents and non-respondents was anticipated, three control counties were chosen and treated specially. The three selected were Ingham County, for its urban orientation, and Grand Traverse and Leelanau counties, for their ample supply of boating opportunities. ${ }^{2}$

The questionnaires sent to survey subjects in these three counties used a special technique whereby the identity of the respondent could be determined even if the address on the first page was removed. As mail returns came in, they were matched with a master checklist listing all boaters sampled from the three areas. Following the response cut-off date, six weeks after the final mailing, all those on the master list who had not returned their questionnaires were classified as survey non-respondents.

[^6]2Kaiser, "Multiple Boat Ownership," pp. 23-24.

These non-respondents were listed on a new master chart, and a number was assigned to each.

Using a table of random numbers, a sample of 200 respondents and non-respondents was drawn, with the intention of interviewing 100 members of the combined categories in Ingham County and 100 of the same in Grand Traverse and Leelanau counties together. As the problem of non-response was the major interest in this follow-up, most of the interviewees, 75 per cent, were to come from the non-respondent category; 25 per cent of the follow-up was to be done on respondents to the survey. As illustrated by the table below, time and budget limitations did not allow for the completion of the desired number of interviews. ${ }^{1}$ Table 1 summarizes the number of mail returns received from each of the control counties and the number of interviews completed in each.

The same questionnaire used in the mail portion of the survey was used for the interviews, so that no bias due to different question ordering or wording would be introduced. The interviews were completed in August, 1969. Data was coded, keypunched, and analyzed cursorily for large percentage differences in characteristics between non-respondents and respondents and between respondents' answers to the mail questionnaire and to the subsequent personal interview. This examination showed only minor

[^7]TABLE 1.--Mail returns and interviews by county, 1968 Boating Demand Study

| County | Mail <br> Returns | Non-respondent <br> Interviews | Respondent <br> Interviews |
| :--- | :---: | :---: | :---: |
| Ingham | 216 | 34 | 13 |
| Grand Traverse | 64 | 36 | 20 |
| Leelanau | 35 | 15 | 2 |
| Total | 315 | 85 | $35^{\mathrm{a}}$ |

[^8]differences. Still, the overall mail response to the survey was only 29 per cent. Before making boating needs predictions on the basis of this study, it is important to examine these differences more carefully, subject them to statistical analysis, and obtain a sounder basis for concluding that the two groups are sufficiently alike to reinforce predictions made on the basis of partial response.

## 1970 Snowmobile Study

The 1970 Snowmobile Study has certain things in common with the boating demand study; they differ in some respects, however, and these differences hold implications for future use of mail surveys for recreation research. As the boating study antedated the snowmobile project, design of the latter benefitted from experience with the former.

The major difference in the two studies is in their response rates. Whereas only 29 per cent answered the boating study mail questionnaire, 72.3 per cent responded to the questions on snowmobiling. The reason for this difference is that two reminders were sent to late answerers in the latter case. The board spread of percentage returns to the two studies provides an interesting diversity of conditions under which to test the differences between respondents and non-respondents. If results are the same for both studies, conclusions about the representativeness of partial returns to mail surveys will be strengthened.

## Snowmobile Questionnaire Design

There are many similarities between the snowmobile and boating study questionnaires. The categories for which information was sought in the former are much like those described above, as this study, too, sought to obtain data from which future facility needs and recreation preferences might be predicted.

The questionnaire covered the following basic
areas:

1. Type, ownership, history, and horsepower of snowmobiles in respondent's household.
2. Counties of use and counties of origin for snowmobiling activity during the 1969-1970 season.
3. Activities, trips, distances covered, and companions on snowmobile trips.
4. Attitudes on snowmobile regulations.
5. Socio-economic data.

## Sampling Procedure

In April of 1970 , there were 128,093 snowmobiles registered with the Michigan Secretary of State. Budget constraints limited the maximum sample size possible to about 5,000, too small to permit a large enough sample in each county so that statistically reliable data would be obtained for every individual county of the state. The procedure finally selected was the following:

1. The state was divided into three regions, from which a total random sample of 5,133 snowmobilers was drawn.
2. Included in this sample were eight counties from each of which a sample of approximately 300 was drawn, hoping to receive responses from at least 200 survey subjects in each county. These large samples were included to get some statistically reliable countylevel data.

## Study Implementation

By the end of May, 1970, 5,133 questionnaires and cover letters were mailed out to snowmobile owners across the state. Reminder cards were mailed to late responders
on June l6th, and on June 25th, 2,616 questionnaires with a revised explanatory letter were mailed to those who still had not returned their questionnaires.

July l4th was designated as the cut-off date for responses, and no further returns were accepted for analysis after that time. A total of 3,705 questionnaires were returned, 3,641 of which proved to be usable. The percentage return rate, 72.3 per cent, was considerably higher than the 29 per cent achieved by the boating study. The follow-up reminders were undoubtedly responsible for this high response rate.

After all returns were in, samples of respondents and non-respondents were selected from Ingham and Kent counties, two of the eight counties where 300 questionnaires had been sent out. A different form from the mail questionnaire was used in the ensuing telephone interviews, but the wording of the questions remained the same. In the interview portion of the study, socio-economic data was not requested from those who had responded to the mail questionnaire.

Table 2 lists the number of mail returns received in the non-respondent control counties, and the number of telephone interviews completed in each.

The data for the mail returns was transferred to data processing punch cards. The interview data was tabulated by hand but not keypunched.

TABLE 2.--Mail returns and interviews by county, 1970 Snowmobile Study

| County | No. Reg. <br> Snowmo- <br> biles | Sample <br> Size | Usable <br> Mail <br> Returns | Non- <br> respondent <br> Interviews | Respondent <br> Interviews |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Ingham | 3,448 | 294 | 172 | 48 | 39 |
| Kent | 4,704 | 310 | 204 | 43 | 35 |
| Total | 8,152 | 604 | 376 | 89 | 74 |

The data from these two studies is available and lends itself with relatively few problems to a non-respondent-respondent comparison. How meaningful this comparison is depends on the handling of the data and how carefully it is analyzed. Included in Chapter IV is the rationale behind the selection of the characteristics chosen and techniques used in this study for measuring the differences between response categories.

# ANALYSIS OF DIFFERENCES BETWEEN 

## RESPONSE CATEGORIES

## Characteristics Chosen for Comparison

Socio-economic Data
The preliminary literature review of other studies comparing respondents and non-respondents revealed that certain socio-economic characteristics often give rise to differences between the two. Of these demographic factors, educational level is the one most often cited as the source of this difference. Therefore, education was felt to be an appropriate variable upon which to base a comparison of respondents and non-respondents to the Research Unit's boating and snowmobile studies.

In addition, total family income of the survey subjects was felt to be an important basis for comparison. If non-respondents possess markedly lower incomes than respondents, they are likely to participate less in recreational activities requiring a purchase of equipment and supplies, such as boating or snowmobiling. If this is the case, it is not valid to predict future participation
in these activities on the basis of response from higherincome survey subjects.

Degree and Patterns of Participation

The other parameters chosen for respondentnonrespondent comparisons were the amount of participation in boating or snowmobiling reported by each group, as well as the geographic distribution of this participation.

As stated previously, the degree of interest in the survey topic at hand has often been found to influence a subject's willingness or disinclination to respond to a mail questionnaire. This "degree of interest," when related to a recreation survey, may be reflected in the amount of time people spend engaged in a particular activity.

If respondents to the boating or snowmobiling studies are more "interested" than non-respondents, they may spend more time in these activities than the latter. If this is so, projections made on the basis of use reported by them will overestimate the amount of participation taking place across the entire boating and snowmobiling populations. The end result, obviously, is that more use will be predicted for the future than will actually take place and the Department of Natural Resources may spend more money than is necessary to accommodate the state's boaters and snowmobilers.

A more detailed comparison of participation by respondents and non-respondents, one which pinpoints the actual geographical location of use by each, is also desirable. For example, respondent data from a lower Michigan county may indicate a high interest in Upper Peninsula snowmobiling, causing a large portion of development dollars to go into trail construction in upper Michigan. If survey non-respondents from this same area do their snowmobiling closer to home, they may be met with inadequate facilities and maintenance because planners will have assumed that they, too, prefer to go north with their snowmobiles.

If the patterns of boating and snowmobiling use by respondents and non-respondents are the same, predictions made on the grounds of information from the former will be accurate and provide a sound basis for planning. Such a similarity cannot be assumed, however; data from both groups must be compared to give a reliable indication that their geographic preferences are the same.

## Response Categories Chosen <br> for Comparison

Both the Boating Demand Study and the Snowmobile Study provide interview data on respondents and nonrespondents from certain select counties. Differences or similarities in response groups from these counties will be assumed to represent those throughout the state.

Geographical differences in residence, then, will not present a possible source of respondent-nonrespondent differences in use and socio-economic status. Kent County respondents to the snowmobile study will be compared with Kent County non-respondents, and so forth.

Still, the process cannot be limited to a simple comparison of interview data from respondents and nonrespondents in their particular counties. It is not adequate to assume that respondent interview data accurately represents the data collected through the mail, which is the data from which predictions will be made. Two other questions must first be answered:

1. Did respondent interviewees give the same answers in personal interviews as they did on their mail questionnaires?
2. Do those respondents sampled for interviews adequately represent the total number of subjects returning their mail questionnaires, or is the data they provide significantly different from that of the total mail returns?

For each of the studies, then, where data is available, three sets of comparisons will be made. These are the following:

1. Interview data on respondents chosen for the follow-up will be compared with the information these same subjects gave on their mail questionnaires. These
comparisons will be known as "respondent interviews versus respondent interviewee mail returns."
2. Next, data from respondents' personal interviews will be compared with the data reported by the total number of mail questionnaire respondents in each county. These comparisons will be known as "respondent interviews versus total mail returns."
3. After the adequacy of the respondent interview data has been established, this data will be compared with personal interview data from non-respondents.

## Format and Use of Questions

## 1970 Snowmobile Study

Format of Questions.--The snowmobile questionnaire was designed to provide information in a variety of areas, two of these being socio-economic characteristics and amount and pattern of use. The particular questions used here for comparison are as shown on the following page.

Use of Questions.--These questions, designed for the mail portion of the study, were incorporated into the personal interview, as well. The questionnaire was not identical, however.

In the personal interviews, participation was measured for the three most frequently-used counties.

| 11 WHICH OF THE ANSWERS BELOW BEST INDICATES THE TOTAL YEARS OF EDUCATION COMPLETED BY THE HEAD |
| :--- |
| OF THE HOUSEHOLD? |
| $\square$ |

Question 11:

## Question 12:

Question 3:

3 WHICH COUNTIES DID YOU USE THE MOST FOR SNOWMOBILING DURING THE PAST WINTER? (Write in the
number of days on each line. NOTE: Count each day or part day spent snowmobiling in a county as ONE day.)

|  | County of most use | County of 2nd most use | County of 3rd most use | All other county use | Out of State use; name state or Prov. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| County name |  |  |  | , |  |
| No. of days of use |  |  |  |  |  |
| EXAMPLE |  |  |  |  |  |
| County name | Hext | Fake | Alpere |  | Onttren |
| No. of days of use | .27 | 12 | 2 |  | 1 |

Out-of-state use was not measured. This presented no real difficulty, since comparative use of Michigan counties for snowmobiling is the interest of the present study. The out-of-state use was subtracted from the mail return data and only in-state participation of respondents and non-respondents was compared.

A more serious problem arose from the fact that socio-economic data was not measured in the respondent interviews, if this information had already been obtained from the subject's mail questionnaire. This lack of respondent interview socio-economic reporting prevented a comparison of respondent interviews with the same respondents' mail returns or with the total mail returns. The most workable solution, then, was to compare nonrespondent interview information with data from total mail returns, incorporating the assumption that respondent interview data would have been consistent with respondents' mail returns and total mail returns.

Pattern and degree of use was covered in the respondent interviews, so these variables could still be subjected to the complete comparison most desirable.

1968 Boating Demand Study

Format of Questions.--The boating study, too, sought a variety of information on Michigan boaters. The socio-economic and use questions, somewhat similar to those in the snowmobile study appear on the following page.

10
in the table below, name the three great lakes or connecting waters counties where IHIS 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


| Totel <br> Days of <br> Boeting |  | 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) | $\begin{aligned} & \text { (No. } \\ & \text { Days) } \end{aligned}$ | (No. Days) | (No. Days) |
| 17 |  |  | manistee | 11 | 2 | 0 | 9 | 8 | 0 |
| County of most use: |  |  |  |  |  |  |  |  |
| $\begin{gathered} \text { County of } \\ \text { 2nd most use: } \end{gathered}$ |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| $\begin{aligned} & \text { Boating in "All } \\ & \text { Other" Counties: } \end{aligned}$ |  |  |  |  |  |  |  |  |

Question 10:
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.)
N

| USE OF THIS BOAT ON INLAND LAKES \& STREAMS |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Notef Count each part day spent boating as a full day. The nomber of days spent on specfic boating activities may not equal the totel number of days shown in the left-hand columin. |  |  |  | Count each paitay spent on <br> particular: boating sotivity <br> a full day for that activity. |  |  |  |  |
| Total <br> Days <br> of <br> Boeting |  | 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) |
| 18 |  |  | montmozency | 2 | 14 | 3 | 2 | 0 | 0 |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| Wata | Boating in "All ther" Counties: |  |  |  |  |  |  |  |  |

Question 12:

Use of Questions.--The questionnaire used for both respondent and non-respondent interviews was identical to that used for mailing, so no problems arose because of the rewording or omission of questions.

The implementation of the follow-up interviews, however, did create a special consideration. Due to limited funds and time, the desired number of interviews in the three follow-up counties--Ingham, Grand Traverse, and Leelanau--was not completed. This resulted, in some cases, in a small sample size available for comparison. To insure that results would still be valid in the present study, response groups in each county were compared for that county alone, then the interview results for all three counties were combined to allow for one test involving a relatively large sample of respondents and nonrespondents.

## Hypotheses

A systematic comparison of data from various response groups in different studies requires that specific hypotheses be formulated and tested. Each one below is stated in the form of a null hypothesis, or hypothesis of no difference. It is, from a theoretical standpoint, more convenient to test that two groups are equal rather than that they are different. ${ }^{l}$ Implied $1_{\text {Paul G. Hoel, Elementary Statistics }}$ (New York: John Wiley and Sons, 1967), p. 174.
in each hypothesis is an alternate hypothesis stating that there is a difference between response groups with respect to the variable in question.

The study moves through a comparison of various response categories as a means for validating, finally, the difference or similarity between respondents and nonrespondents. Accordingly, the hypotheses formulated are organized under the groups to be compared at each "level." The sub-hypotheses are those which will be tested specifically as a means of proving the more general major hypotheses. They are listed below in abbreviated form, including the study involved and the particular county in question.

## Respondent Interviews versus

Respondent Interviewee
Mail Returns
$H_{1}$ : There is no difference between answers recreation research respondents give to a question on educational level when completing mail questionnaires and those they give when replying to the same question in a personal interview.
$\mathrm{H}_{1 \mathrm{a}}$ : 1968 Boating Demand Study--Ingham County.
$H_{l b}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$H_{1 c}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties combined.
$\mathrm{H}_{2}$ : There is no difference between answers recreation research respondents give to a question regarding total family income when completing mail questionnaires and those they give when replying to this same question in a subsequent personal interview.
$\mathrm{H}_{2 \mathrm{a}}$ : 1968 Boating Demand Study--Ingham County.
$H_{2 b}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$\mathrm{H}_{2 \mathrm{C}}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties combined.
$H_{3}$ : There is no difference between mean days of recreational participation indicated by respondents when completing a mail survey question on that topic and when replying to a personal interview question on the same subject.
$\mathrm{H}_{3 \mathrm{a}}$ : 1968 Boating Demand Study--Ingham County.
$H_{3 b}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$H_{3 c}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties combined.
$H_{3 d}$ : 1970 Snowmobile Study--Ingham County.
$\mathrm{H}_{3 \mathrm{e}}$ : 1970 Snowmobile Study--Kent County.
$\mathrm{H}_{4}$ : There is no difference between the geographical distribution of participation indicated by respondents when completing a mail survey question on that topic and when replying to a personal interview inquiry on the same subject.
$\mathrm{H}_{4 \mathrm{a}}$ : 1968 Boating Demand Study--Ingham County. $\mathrm{H}_{4 \mathrm{~b}}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$\mathrm{H}_{4 \mathrm{c}}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties combined.
$H_{4 d}: 1970$ Snowmobile Study--Ingham County.
$\mathrm{H}_{4 \mathrm{e}}$ : 1970 Snowmobile Study--Kent County.

Respondent Interviews versus Total Mail Returns
$\mathrm{H}_{5}$ : There is no difference between the educational level of recreation research mail survey respondents chosen for a follow-up interview and that of the total sample returning mail questionnaires.

$$
\mathrm{H}_{5 \mathrm{a}}: 1968 \text { Boating Demand Study--Ingham County. }
$$

$H_{5 b}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$H_{5 c}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties combined.
$H_{6}$ : There is no difference between the total family income of recreation research mail survey respondents chosen for a follow-up interview and that of the total sample returning mail questionnaires.
$H_{6 a}$ : 1968 Boating Demand Study--Ingham County. $H_{6 b}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$H_{6 c}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties combined.
$\mathrm{H}_{7}$ : There is no difference between mean days of participation indicated by recreation research mail survey respondents chosen for a follow-up interview and those indicated by the total sample returning mail questionnaires.
$\mathrm{H}_{7 \mathrm{a}}$ : 1968 Boating Demand Study--Ingham County.
$\mathrm{H}_{7 \mathrm{~b}}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$\mathrm{H}_{7 \mathrm{c}}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties combined.
$\mathrm{H}_{7 \mathrm{~d}}$ : 1970 Snowmobile Study--Ingham County.
$\mathrm{H}_{7 \mathrm{e}}$ : 1970 Snowmobile Study--Kent County.
$\mathrm{H}_{8}$ : There is no difference between the geographical distribution of participation indicated by recreation research mail survey respondents chosen for a follow-up interview and that indicated by the total sample returning mail questionnaires.
$\mathrm{H}_{8 \mathrm{a}}$ : 1968 Boating Demand Study--Ingham County.
$\mathrm{H}_{8 \mathrm{~b}}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$\mathrm{H}_{8 \mathrm{C}}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties combined.
$H_{8 d}: 1970$ Snowmobile Study--Ingham County.
$\mathrm{H}_{8 \mathrm{e}}$ : 1970 Snowmobile Study--Kent County.

## Respondent Interviews versus

 Non-respondent Interviews$H_{9}$ : Respondents to recreation research do not possess different levels of education than do nonrespondents.
$\mathrm{H}_{9 \mathrm{a}}$ : 1968 Boating Demand Study--Ingham County.
$H_{9 b}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$H_{9 c}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties.
$H_{9 d}: 1970$ Snowmobile Study--Ingham County.
$\mathrm{H}_{9 \mathrm{e}}$ : 1970 Snowmobile Study--Kent County.
$\mathrm{H}_{10}$ : Respondents to recreation research mail questionnaires do not possess different total family incomes than do non-respondents.
$\mathrm{H}_{10 \mathrm{a}}$ : 1968 Boating Demand Study--Ingham County.
$\mathrm{H}_{10 \mathrm{~b}}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$H_{10 c}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties combined.
$H_{10 d}: 1970$ Snowmobile Study--Ingham County.
$\mathrm{H}_{10 \mathrm{e}}: 1970$ Snowmobile Study--Kent County.
$\mathrm{H}_{11}$ : Respondents to recreation research mail surveys do not account for different amounts of recreational participation than do non-respondents.
$H_{1 l a} 1968$ Boating Demand Study--Ingham County.
$\mathrm{H}_{11 \mathrm{~b}}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$H_{11 c}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties combined.
$H_{11 d}: 1970$ Snowmobile Study--Ingham County.
$\mathrm{H}_{11 \mathrm{e}}$ : 1970 Snowmobile Study--Kent County.
$\mathrm{H}_{12}$ : There is no difference in the geographical distribution of recreational participation of respondents and non-respondents to recreation research mail surveys.
$H_{12 a}$ : 1968 Boating Demand Study--Ingham County.
$\mathrm{H}_{12 \mathrm{~b}}$ : 1968 Boating Demand Study--Grand Traverse and Leelanau counties.
$\mathrm{H}_{12 \mathrm{C}}$ : 1968 Boating Demand Study--Ingham, Grand Traverse, and Leelanau counties combined.
$H_{12 d}: 1970$ Snowmobile Study--Ingham County.
$\mathrm{H}_{12 \mathrm{e}}$ : 1970 Snowmobile Study--Kent County. Techniques for Comparing Response Groups

The objective in testing each of the hypotheses above is to determine whether the two response groups in question are, in statistical language, "from the same
population." Saying that two sample groups are from the same population is to indicate that they possess the same parameters, or characteristics. They are homogeneous, to a certain degree, in their socio-economic characteristics and behavior patterns.

When trying to determine whether a difference exists between two populations--the samples of respondents and non-respondents in this case--the researcher is faced with two possible sources for variations between the two. The first source, called sampling variability, arises from the chance factor involved in drawing a sample. Two observations may well be from the same population and be different to a degree. The second source of variation, however, is more important. Two observations may exhibit different properties because they are, in actuality, from populations with different parameters.

The present purpose in comparing respondents and non-respondents to recreation research mail questionnaires is the latter. Are they members of two populations with significantly different parameters, or do both come from the same universe and have similar socio-economic characteristics and recreational use patterns?

The hypotheses formulated assert that the two groups being compared are not different, that they are from the same population. The next step is to determine the most applicable procedure to follow in testing the
subhypotheses that will prove or disprove these major premises.

Three types of hypothesis testing are possible. One tests a sample result against something that is already known--last year's result, characteristics of a given control group, and the like. The second type compares the means or proportions of two groups to see if a significant difference exists between them. The third form of hypothesis testing, at which stage such techniques as analysis of variance or chi-square must be employed (they may be used in either of the first two cases, as well, but are not required), tests the difference between classes or means in a multi-class situation or one involving several populations.

In the present project, two considerations played the major role in determining which techniques were most appropriate and feasible for comparing respondents and non-respondents. The first determinant was, as it is in any statistical analysis, the type of data collected. The second consideration, arising when a researcher makes use of data collected earlier and by another researcher, is the way in which questions were asked, how the data was coded, and the format used to transfer the information to computer card decks. With these two constraints in mind, methods for comparing data on the four variables in question were selected. The computer work was done by the division of Applications Programming at the Michigan

State University Computer Center. ${ }^{1}$ The methods selected for comparisons based on each variable selected are explained below.

## Education

The data on educational levels of the different response categories was judged best suited to the second type of hypothesis testing explained above, where the means of two samples are compared to see whether or not they originated from the same population.

The data for some of the response groups under study had already been coded and punched on computer cards. The years of education completed were coded directly so that, for example, 12 years of education was punched as a 12 on the appropriate card. This made the data suited to a comparison of means, for the mean educational level of each response group could be computercalculated from the cards and a comparison made. Data from response groups not yet tabulated was coded and key punched and the analysis made.

In comparing respondent-nonrespondent mean educational levels, two steps are involved. First the researcher must determine the amount of variance between the two which can reasonably be assumed to have arisen
${ }^{1}$ Statistical advice was given by Dr. Dennis Gilliland, Department of Statistics, Michigan State University. Programming was done by Mr. James Mullin and Mr. Hwang T. Lin, Division of Applications Programming, Computer Center, Michigan State University.
by chance, from sampling variability. This involves a decision regarding the confidence limits to be set. In this case, a decision was made to include 95 per cent of the population when allowing for sampling variability. Thus, a . 05 level of significance was set.

Secondly, the researcher hypothesizes that $\mu_{1}-\mu_{2}=0$ (that there is no difference between the two means). Some leeway is available, however; the difference may be within a certain range of " 0 " and still be an acceptable deviation. If the difference extends beyond this range, the limits of which are imposed by the .05 significance level, the hypothesis that there is no difference must be rejected.

This comparison of means, then, was carried out by the computer, using data decks from the boating and snowmobile studies. Results of these and the tests below are reported in the section following this one.

## Income

The test deemed most appropriate for comparing total family income of respondents and non-respondents was the chi-square test. The family income of survey subjects was not transferred directly to computer cards; rather, a number was assigned to each income category, and this code was punched on the cards. It was not possible, then, to calculate mean or median income. It was necessary, instead, to compare the percentage of
respondents falling in each of several income categories. This resulted in a multi-class comparison of two populations, a situation calling for chi-square analysis.

It is necessary, if results of statistical applications are to be reliable, to meet the assumptions of each test. One assumption of the chi-square test is that each category, or "cell," has at least five observations in it. In some cases, particularly that of the boating study interviews, a small sample size made it impossible to achieve this frequency.

For this reason, some income categories were combined, or collapsed, to provide for a cell frequency of 5 in each case. The analysis, then, was one comparing "high" and "low" income categories to see if a similar percentage of respondents and non-respondents fell in each. Again, a . 05 level of significance was selected, so that the hypothesis in question would be accepted or rejected with 95 per cent confidence that the test was valid.

## Days of Boating or Snowmobiling

Comparing the amount of recreational participation by respondents and non-respondents called for a comparison of means, as was done in the case of the education question. The analysis was done with a desk calculator, so that the absolute number of days could be extracted from each questionnaire and recorded. For
each response group, mean days of snowmobiling or boating was calculated. The allowable difference between these means was calculated using the following formula:

$$
\sigma \bar{x}_{1}-\bar{x}_{2}=\sqrt{\frac{s_{1}^{2}}{n_{1}}+\frac{s_{2}^{2}}{n_{2}}}
$$

where:

1. $\bar{x}_{1}$ and $\bar{x}_{2}$ represent mean snowmobile or boater days of each response group, respectively.
2. $\sigma \bar{x}_{1}-\bar{x}_{2}$ equals the standard deviation of the means of the two response groups.
3. $n_{1}$ and $n_{2}$ represent the sample size of each response group.

If the means are perfectly equal, their difference would be "0." Even if they are not perfectly equal, however, they can be considered similar with 95 per cent confidence, if $\bar{x}_{1}-\bar{x}_{2}$ does not exceed $1.96\left(\sigma \bar{x}_{1}-\bar{x}_{2}\right) .^{1}$ This similarity was tested for each "set" of comparisons in question.

Geographical Distribution
In the case of the geographical distribution of boating and snowmobiling in Michigan counties, descriptive statistics were employed to compare the activities of
$1_{\text {Hoel }}$ Elementary Statistics, pp. 172-76.
respondents and non-respondents. The data collected on each group was summarized in the form of percentage of days spent in each county. These percentages were recorded on maps of Michigan counties, to give a visual representation of the difference or similarity in location of respondents' and non-respondents' boating or snowmobiling.

It was hoped that the research might go one step further, to make statistical inferences similar to those made about education, income, and amount of use. The appropriate technique, a form of statistics known as multi-variate analysis, assumes that the data takes on a normal distribution--that there is, in other words, a reasonable number of observations in each cell. The large number of Michigan counties, eighty-three in all, combined with relatively small samples of respondents and non-respondents, would have required collapsing the counties to make three or four regions, negating the purpose of the comparison, i.e., to get an indication of the reliability of the data on a county-by-county basis.

After consultation with personnel in the Department of Statistics and the Computer Center Division of Applications Programming, it was deemed best to just record and compare the amount of participation for the series of response groups by plotting percentages on maps of the state. Through this method, similarities are easily seen and, more important, large discrepancies can
readily be noted. If it is seen that, for example, Kent County non-respondents to the snowmobile study have a decidedly different pattern of participation, a closer examination of use in that area may be advisable before funds are allocated for facilities or trail development.

## CHAPTER V

RESULTS

Results of the various comparisons of response groups, leading up to final evaluations of the similarity of respondents and non-respondents, are reported below. They are grouped according to study under the variable which was the basis of comparison in each case.

## Education

1968 Boating Demand Study
The Research Unit staff felt it important to guard against possible bias introduced by different geographical locations of residence, to compare respondents from a given county with non-respondents from only that county. As stated previously, however, limited time and funds prevented the completion of all the respondent follow-up interviews in the 1968 Boating Demand Study, leaving a small sample of respondent interviews for comparison. To assure statistical reliability, therefore, counties were compared on an individual basis first, then combined for an overall test. Table 3 illustrates the results of these

TABLE 3.--Comparison of educational level of various response categories, 1968 Boating Demand Study

|  | $\begin{gathered} \text { Sample } \\ \text { Size } \end{gathered}$ | Mean Yrs. Educ. | $\begin{aligned} & \mathbf{F}^{\mathbf{a}} \\ & \text { Stat. } \end{aligned}$ | Prob. of Sign. |
| :---: | :---: | :---: | :---: | :---: |
| Ingham |  |  |  |  |
| $\begin{aligned} & \text { Resp. Int.b vs.c } \\ & \text { Resp. Int. Mail } \end{aligned}$ | 13 13 | $\begin{aligned} & 11.80 \\ & 12.63 \end{aligned}$ | 0.44585 | . 512 |
| $\begin{aligned} & \text { Resp. Int. vs. } \\ & \text { Total Mail } \end{aligned}$ | 13 222 | $\begin{aligned} & 11.80 \\ & 12.78 \end{aligned}$ | 0.65005 | . 421 |
| Resp. Int. vs. Non-resp. Int.e | $\begin{aligned} & 13 \\ & 32 \end{aligned}$ | $\begin{aligned} & 11.80 \\ & 11.61 \end{aligned}$ | 0.02634 | . 872 |
| $\begin{aligned} & \text { Grand Traverse \& } \\ & \text { Leelanau } \end{aligned}$ |  |  |  |  |
| Resp. Int. vs. <br> Resp. Int. Mail | $\begin{aligned} & 20 \\ & 20 \end{aligned}$ | $\begin{aligned} & 11.78 \\ & 11.77 \end{aligned}$ | 0.00011 | . 992 |
| Resp. Int. vs. Total Mail | $\begin{aligned} & 20 \\ & 99 \end{aligned}$ | $\begin{aligned} & 11.78 \\ & 12.22 \end{aligned}$ | 0.25372 | . 616 |
| Resp. Int. vs. Non-resp. Int. | $\begin{aligned} & 20 \\ & 48 \end{aligned}$ | $\begin{aligned} & 11.78 \\ & 12.44 \end{aligned}$ | 0.62748 | . 432 |
| $\begin{aligned} & 3 \text { Counties } \\ & \text { Combined } \end{aligned}$ |  |  |  |  |
| Resp. Int. vs. <br> Resp. Int. Mail | 33 33 | $\begin{aligned} & 11.79 \\ & 12.10 \end{aligned}$ | 0.14182 | . 708 |
| Resp. Int. vs. Total Mail | $\begin{array}{r} 33 \\ 321 \end{array}$ | $\begin{aligned} & 11.79 \\ & 12.63 \end{aligned}$ | 1.14866 | . 233 |
| Resp. Int. vs. Non-resp. Int. | 33 70 | $\begin{aligned} & 11.79 \\ & 12.10 \end{aligned}$ | 0.22455 | . 637 |

${ }^{\text {a }}$ Statistic giving degree of significance of test.
$\mathrm{b}_{\text {Respondent }}$ Interviews.
${ }^{C}$ Respondent Interviewee Mail Returns.
$\mathrm{d}_{\text {Total }}$ Mail Returns.
$\mathbf{e}_{\text {Non-respondent }}$ Interviews.
analyses. None of the tests, as shown by the last column, proved significant at the .05 level or below.

## 1970 Snowmobile Study

The comparison of educational levels of snowmobile response categories was, due to a lack of data, limited to an evaluation of the differences between non-respondents and total mail returns. This prevents a check on possible bias introduced by the interviewing procedure or the mail questionnaire. A later analysis, that of amount of snowmobile use, evaluates respondent interviews in addition to these two categories. No difference is indicated there, so it is assumed this comparison of educational levels is valid. Table 4 reports the results of the test. None of the comparisons, once again, proved a significant difference at the . 05 level.

## Summary

The results of the analysis of educational levels of various response groups shows no significant difference in any of the cases tested. None of the tests showed even as much as a one-year difference in the means of the groups being compared; the highest probability of significance was . 233 (or 77 per cent), not close to . 05 (or 95 per cent). The other statistics were even farther away from significance. Based on five tests, the conclusion is that there is no significant difference in the educational

TABLE 4.--Comparison of educational level of various response categories, 1970 Snowmobile Study

| County and | Sample | Mean Yrs. | F | Prob. |
| :--- | :---: | :---: | :---: | :---: |
| Comparison | Size | Educ. | Stat. | of Sig. |

Ingham
Total Mail vs.
172
Non-resp. Int.
46
12.53
12.18
0.57012
.451

Kent

| Total Mail vs. | 204 | 12.46 | 0.52699 | .469 |
| :--- | ---: | ---: | ---: | ---: |
| Non-resp. Int. | 43 | 11.60 |  |  |

levels of respondents and non-respondents in either of these studies and, projecting these findings, in recreation research mail surveys of similar populations.

## Income

1968 Boating Demand Study
The comparison of total family income of boating study subjects was done twice. The first table below, Table 5, indicates only the percentage of survey subjects falling into each income category. Following that is a statistical comparison, using the chi-square test, of people in "high" and "low" income categories. These categories were created by the collapsing of the questionnaire categories, done in order to raise the frequency of observations in each cell to at least five.

Taking Table 5 at face value, there seem to be many differences in income levels between response groups. In Ingham, for example, almost 30 per cent of study nonrespondents earn between $\$ 3,000$ and $\$ 6,000$, while only 7 per cent of the respondents to the mail questionnaire have an income this low. This result would seem to be support for the contention that people with higher incomes are more likely to respond to mail surveys. It is important to remember, however, that because the sample size for the non-respondent interviews is small, only nine people would have to be in this category to arrive
TABLE 5.--Percentage of survey subjects from different response groups in various income categories, 1968 Boating Demand Study

| County and Response Group | Income Categories (in thousands) |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Under \$3 | $\begin{gathered} \$ 3 \text { to } \\ \$ 8 \end{gathered}$ | $\begin{gathered} \$ 6 \text { to } \\ \$ 8 \end{gathered}$ | $\$ 8$ to $\$ 10$ | $\begin{gathered} \$ 10 \text { to } \\ \$ 15 \end{gathered}$ | $\begin{gathered} \$ 15 \text { to } \\ \$ 25 \end{gathered}$ | \$25 \& Over |
| Ingham |  |  |  |  |  |  |  |
| Resp. Int. | 10.0\% | 10.0\% | 10.0\% | 30.0\% | $20.0 \%$ | 20.0\% | $0.0 \%$ |
| Resp. Int. Mail | $7.7 \%$ | 0.0\% | $23.1 \%$ | $23.1 \%$ | 30.76\% | 15.38\% | $0.0 \%$ |
| Total Mail | $1.1 \%$ | $7.0 \%$ | $8.1 \%$ | $18.3 \%$ | $38.2 \%$ | $22.6 \%$ | $4.8 \%$ |
| Non-resp. Int. | $0.0 \%$ | $29.6 \%$ | 18.5\% | 18.5\% | 11.1\% | $14.8 \%$ | $7.4 \%$ |
| Grand Traverse |  |  |  |  |  |  |  |
| \& Leelanau |  |  |  |  |  |  |  |
| Resp. Int. | $7.1 \%$ | 0.0\% | 28.6\% | 14.3\% | 28.6\% | 14.38 | 7.18 |
| Resp. Int. Mail | $10.5 \%$ | 21.18 | 5.38 | $21.0 \%$ | 26.38 | 5.38 | 10.58 |
| Total Mail | $11.0 \%$ | 19.08 | $17.0 \%$ | $21.0 \%$ | $19.0 \%$ | $6.0 \%$ | 6.0\% |
| Non-resp. Int. | 6.9\% | 13.78 | 10.3\% | $17.2 \%$ | 31.0\% | $6.9 \%$ | 13.88 |
| 3 Counties |  |  |  |  |  |  |  |
| Combined |  |  |  |  |  |  |  |
| Resp. Int. | 8.3\% | $4.16 \%$ | 20.8\% | 20.8\% | $25.0 \%$ | $16.7 \%$ | $4.1 \%$ |
| Resp. Int. Mail | $9.4 \%$ | 12.58 | $12.5 \%$ | 21.9\% | 28.18 | $9.4 \%$ | $6.3 \%$ |
| Total Mail | $3.6 \%$ | 10.0\% | $10.4 \%$ | $18.9 \%$ | 33.38 | 18.58 | 5.22\% |
| Non-resp. Int. | 3.68 | 21.4\% | 14.3\% | $17.9 \%$ | $21.4 \%$ | 10.78 | 10.78 |

at a figure suggesting that $\mathbf{~} 30$ per cent of all nonrespondents have an income below $\$ 6,000$, a number significantly different from the rest of the boating population." The table does give a good breakdown of where survey subjects fall with regard to income, but it should not be taken as a statistical measure of differences in response groups.

To arrive at a conclusion that is statistically reliable, the categories were collapsed and compared, giving the results tabulated in Table 6. The right-hand column in the table indicates that none of the comparisons are significant at the .05 level. A good example of the value of statistical testing, however, is given by the respondent interview-total mail return comparison for Ingham County. A comparative glance at the percentage of subjects in these two groups falling in each income category indicates a difference between the two. A statistical comparison, however, proves that the difference is not a significant one and supports the assumption that the difference arose by chance, as a function of sampling variability, and that the respondent data does provide an adequate representation of the characteristics of all those returning their mail questionnaires.

1970 Snowmobile Study
As mentioned previously, because no socio-economic data was collected in the respondent interviews, the

TABLE 6.--Comparison of total family incomes of various response groups, 1968 Boating Demand Study

| County and Comparison | \% of Low Income Subjects ${ }^{\text {a }}$ | \% of High Income Subjects ${ }^{\text {b }}$ | $x^{2}$ | Prob. of Sig. |
| :---: | :---: | :---: | :---: | :---: |
| Ingham |  |  |  |  |
| Resp. Int. vs. <br> Resp. Int. Mail | $\begin{aligned} & 60.0 \% \\ & 53.8 \% \end{aligned}$ | $\begin{aligned} & 40.0 \% \\ & 46.28 \end{aligned}$ | . 087 | . 7679 |
| $\begin{aligned} & \text { Resp. Int. vs. } \\ & \text { Total Mail } \end{aligned}$ | $\begin{aligned} & 60.0 \% \\ & 34.4 \% \end{aligned}$ | $\begin{aligned} & 40.0 \% \\ & 65.6 \% \end{aligned}$ | 2.707 | . 0999 |
| Resp. Int. vs. Non-resp. Int. | $\begin{aligned} & 60.0 \% \\ & 66.78 \end{aligned}$ | $\begin{aligned} & 40.0 \% \\ & 33.38 \end{aligned}$ | . 142 | . 7060 |
| Grand Traverse |  |  |  |  |
| \& Leelanau |  |  |  |  |
| Resp. Int. vs. <br> Resp. Int. Mail | $\begin{aligned} & 50.08 \\ & 57.98 \end{aligned}$ | $\begin{aligned} & 50.0 \% \\ & 40.18 \end{aligned}$ | . 203 | . 6526 |
| Resp. Int. vs. Total Mail | $\begin{aligned} & 50.0 \% \\ & 68.38 \end{aligned}$ | $\begin{aligned} & 50.08 \\ & 31.78 \end{aligned}$ | 1.676 | . 1954 |
| Resp. Int. vs. Non-resp. Int. | $\begin{aligned} & 50.08 \\ & 48.38 \end{aligned}$ | $\begin{aligned} & 50.0 \% \\ & 51.7 \% \end{aligned}$ | . 011 | . 9156 |
| $\frac{3 \text { Counties }}{\text { Combined }}$ |  |  |  |  |
| Resp. Int. vs. <br> Resp. Int. Mail | $\begin{aligned} & 54.28 \\ & 56.38 \end{aligned}$ | $\begin{aligned} & 45.8 \% \\ & 43.8 \% \end{aligned}$ | . 024 | . 8767 |
| $\begin{aligned} & \text { Resp. Int. vs. } \\ & \text { Total Mail } \end{aligned}$ | $\begin{aligned} & 54.28 \\ & 43.08 \end{aligned}$ | $\begin{aligned} & 45.8 \% \\ & 57.0 \% \end{aligned}$ | 1.114 | . 2913 |
| Resp. Int. vs. Non-resp. Int. | $\begin{aligned} & 54.28 \\ & 57.18 \end{aligned}$ | $\begin{aligned} & 45.8 \% \\ & 42.9 \% \end{aligned}$ | . 060 | . 8058 |

$a_{\text {Income of }}$ under $\$ 3,000$ to $\$ 9,999$.
$\mathrm{b}_{\text {Income of }} \$ 10,000$ to $\$ 25,000$ and above.
Calculation indicating significance of test.
comparison of incomes was limited to one of non-respondents with the total mail questionnaire returns. Income categories were collapsed to insure that at least five observations would fall in each of the categories, thereby meeting the assumptions for the chi-square test. The analysis, then, compared members of response groups with under $\$ 10,000$ total family income with those having an annual income of over $\$ 10,000$, as was done in the boating study. The results are shown in Table 7 .

Both non-respondent and mail respondent populations have a much greater percentage of high-income than lowincome members. The fact that this is reflected consistently in both groups, however, makes it possible to accept the hypothesis that there is no significant difference in the total family incomes of respondents and nonrespondents to the snowmobile study.

## Summary <br> Statistical comparisons of data from both the snowmobiling and boating studies reveal no significant differences between the incomes reported by respondents on their mail returns and in their interviews; between the incomes reported by respondents and those of the total number returning questionnaires; and, finally, between the incomes of respondents and non-respondents.

TABLE 7.--Comparison of total family incomes of various response groups, 1970 Snowmobile Study

| County and <br> Comparison | \% of Low <br> Income <br> Subjects | \% of High <br> Income <br> Subjects | $x^{2}$ | Prob. <br> of <br> Sig. |
| :--- | :---: | :---: | :---: | :---: |

Ingham

| Non-resp. Int. | $17.1 \%$ | $82.8 \%$ |  |  |
| :--- | :--- | :--- | :--- | :--- |
| vs. Total Mail | $22.9 \%$ | $77.0 \%$ | .561 | .4539 |

Kent

| Non-resp. Int. | $32.1 \%$ | $67.9 \%$ | 1.104 | .2934 |
| :--- | :--- | :--- | :--- | :--- |
| vs. Total Mail | $23.0 \%$ | $76.9 \%$ |  |  |

## Amount of Recreational Participation

## 1968 Boating Demand Study

To evaluate the differences in boating participation of different response groups, a comparison was made of the mean number of days of Great Lakes and inland boating done by each. The results of these tests are reported below. $\bar{x}_{1}$ and $\bar{x}_{2}$ denote the mean days of participation of the two groups, respectively, being tested. The answer to $\bar{x}_{1}-\bar{x}_{2}$ measures the actual difference in these means. To test the significance of this difference at the .05 level, the standard deviation of the difference was multiplied by $\pm 1.96$, covering 95 per cent of the samples. No significant difference was shown if this figure exceeded the actual difference in means. Had the actual difference been larger than this figure, it would have been significant, indicating that survey non-respondents do more or less boating than do respondents. Results of this test are tabulated in Table 8.

A look at the first two columns in the table gives a ready indication of how close the amount of participation reported by each group actually is. The next-to-the-last column is an indicator of how much leeway was available before the difference in means would have fallen outside the acceptable range and indicated a

TABLE 8.--Comparison of amount of boating of various response groups, 1968 Boating Demand Study

$\bar{x}_{1}^{a} \quad \bar{x}_{2}^{b} \quad \bar{x}_{1}-\bar{x}_{2} \quad$| $\pm 1.96 \sigma$ |
| :---: |
| $\bar{x}_{1}-\bar{x}_{2}$ |$\quad$| Signifi- |
| :---: |
| cant? |

## Ingham

Resp. Int. vs. 27.5
Resp. Int. Mail
Resp. Int. vs.
27.5

Total Mail
$29.82 .25+12.8$
no
Resp. Int. vs.
27.5

Non-resp. Int.
23.34 .24
$+13.8$
no
Grand Traverse
\& Leelanau
Resp. Int. vs. 31.8
Resp. Int. Mail
Resp. Int. vs.
Total Mail
Resp. Int. vs.
Non-resp. Int.
31.8
31.8

3 Counties
Combined
Resp. Int. vs. 30.1
Resp. Int. Mail
Resp. Int. vs. 30.1
Total Mail
Resp. Int. vs.
30.1

Non-resp. Int.
27.4
38.56 .69
$\pm 13.9$
no
$34.9-3.05$
$\pm 18.3$
no
$\mathrm{a}_{\text {Mean }}$ boating days of first groups in comparison.
$b_{\text {Mean boating days of second group in comparison. }}$
significant difference. The actual differences did not approach this level; they are clearly not significant.

## 1970 Snowmobile Study

The same calculations as those described above were used to assess possible differences in snowmobiling participation by those who did and did not respond to this study. The results of these comparisons follow boating study results and are reported in Table 9.

The respondent interview-respondent interviewee mail return comparison reveals a consistent discrepancy in the number of days of snowmobiling reported. The interview data shows a higher degree of participation than that reported in the mail questionnaires from the same people. This difference gives some support to the suggestion by some researchers that because of a biasing influence introduced by the presence of an interviewer, subjects will inflate their answers in a personal interview. The important factor, however, is whether or not this difference is large enough to make respondent interviews a poor representation of all those who replied to a survey. The difference is not significant here, so that the respondent interviews can be considered valid for a comparison with non-respondent interviews.

## Summary

This test is perhaps the most significant one of the study. Many comparisons of respondents and

TABLE 9.--Comparison of amount of snowmobiling of various response groups, 1970 Snowmobile Study

| County and <br> Comparison | $\bar{x}_{1}$ | $\bar{x}_{2}$ | $\bar{x}_{1}-\bar{x}_{2}$ | $\pm .96 \sigma$ <br> $\bar{x}_{1}-\bar{x}_{2}$ | Signifi- <br> cant? |
| :--- | :--- | :--- | :--- | :--- | :--- |

## Ingham

Resp. Int. vs. 38.1
Resp. Int. Mail $29.68 .47 \pm 11.01$ no
Resp. Int. vs. 38.1
Total Mail
$38.0 .03 \pm 10.15$
no
Resp. Int. vs.
38.1
40.1 -2.06 $\pm 14.32$
no

Kent
Resp. Int. vs.
27.5

Resp. Int. Mail
Resp. Int. vs.
Total Mail
27.5

Resp. Int. vs.
27.5

Non-resp. Int.
$23.34 .24 \pm 13.88$ no
non-respondents to mail surveys have found the latter's lack of interest in the topic to be a major cause for non-return. If the amount of recreational activity in which subjects participate can be considered directly representative of this degree of interest, a comparison of the activity of respondents and non-respondents shows no difference.

For recreation planners allocating development funds, assessing the total statewide amount of participation in an activity becomes the most crucial task. Sample surveys of recreationists are valuable only if their results can be projected to be descriptive of the entire population. For this reason, non-response, if it indicates a lower amount of participation, creates a serious bias. The foregoing test of participation by various response groups shows that, in fact, there is no significant difference in this participation; respondents to the boating and snowmobile studies can be accepted as being representative of all participants in these two activities. More generally, we can accept the hypothesis that there is no significant difference between respondents and non-respondents to similar recreation mail surveys in their amount of participation in a given activity.

## Geographical Distribution of Participation

Going one step beyond a measurement of the amount of participation is an analysis of the specific location, county-by-county, of recreationists' activities. The technique most suited to making this evaluation, as stated earlier, is multi-variate analysis. Such a comparison would likely be possible if one were examining respondents and non-respondents from every county in the state. Only one county was under study at a time, however, in the present project. Since most of the use in each case took place in this county, the number of responses in each category was not evenly distributed and did not approximate a normal distribution, thereby failing to meet one of the assumptions of the multi-variate technique. If one were to use this analysis, the low cell frequency would have required so much collapsing of counties that the results would not have been a meaningful indicator of use on an individual county basis.

For a sample of this size, therefore, where use is concentrated mostly in one or two counties, the use of descriftive statistics is more appropriate. While not allowing for a statistically significant comparison, this technique does illustrate the exact distribution of use and allows for a reasonable comparison.

Employing this method, each questionnaire was coded for the respondent's days of use in each county. Total days of use for one response group were divided
into the total use per county by this group, arriving at the percentage of their recreation days which were spent in each county. These figures were transferred to maps of the state, each one comparing two response groups.

Maps illustrating the distribution of 1968 boating use in Michigan were not made. Due to the small number of follow-up interviews completed, it is difficult to arrive at an adequate representation of boating use patterns across the state.

Maps illustrating the patterns of snowmobile use across the state could be made, as a larger sample of survey respondents and non-respondents was interviewed. This larger sample size provides a more reliable representation of actual use by the different response groups, making a visual comparison more valuable than it would be in assessing respondent-nonrespondent differences in the boating study.

Following the same order of comparison used in the tables, the snowmobile maps are in order by county. For each county there is a series of three maps making three comparisons--of respondent interviews versus respondent interviewee mail returns; respondent interviews versus total mail returns; and respondent interviews versus non-respondent interviews.

Results of the snowmobile comparisons show a fairly uniform distribution of use by each group and,


Figure 1.--Comparison of geographic location of snowmobile use in Michigan counties, respondent interviews versus respondent interviewee mail returns, Ingham County.


Figure 2.--Comparison of geographic location of snowmobile use in Michigan counties, respondent interviews versus total mail returns, Ingham County.


Figure 3.--Comparison of geographic location of snowmobile use in Michigan counties, respondent interviews versus non-respondent interviews, Ingham County.


Figure 4.--Comparison of geographic location of snowmobile use in Michigan counties, respondent interviews versus respondent interviewee mail returns, Kent County.


Figure 5.--Comparison of geographic location of snowmobile use in Michigan counties, respondent interviews versus total mail returns, Kent County.


Figure 6.--Comparison of geographic location of snowmobile use in Michigan counties, respondent interviews versus non-respondent interviews, Kent County.
more significantly, no more than a 10 per cent difference in use of any county by two different response groups. The larger sample size was undoubtedly a factor. In addition, the snowmobile questionnaire was designed so that use by county was measured in one question and days of specific activities in another. This simpler format resulted in a more nearly complete set of responses with which to make comparisons.

The result of this analysis of geographical distribution of respondent-nonrespondent use by county is worthwhile for the percentage comparison it allowed. While the breakdowns cannot be taken as statistically rigid in inferring differences or similarities, they do give an idea that the use patterns of various response groups are fairly similar.

This study has made use of much data from two studies and several response groups. The statistical comparisons become quite detailed, but their results are vitally important for those who must justify allocation of dollars and resources for a recreational activity on the basis of partial response to a mail survey of its participants. The findings of the present comparisons are synthesized and their meaning interpreted in the final chapter.

## CHAPTER VI

CONCLUSIONS

## Problems and Limitations of Study

Final results of this respondent-nonrespondent comparison must be interpreted in the light of problems encountered in making the comparison. Findings, especially those that are unexpected, are sometimes better understood if there is a thorough picture of the constraints involved.

The most obvious limits placed on the implementation of this project and the use of its findings are those inherent in the use of one researcher's data by another researcher. One of the chief limitations, for example, was the small sample size of boatint study respondents interviewed. Had the respondent-nonrespondent comparison been done immediately, perhaps more funds could have been allocated and a larger sample size gained.

Another problem was encountered because of certain slight differences in the data collected on different response groups. The major example of this limitation is illustrated by the data collection on snowmobile survey respondents, where no socio-economic data was
collected in the follow-up interview. It seems advantageous, if possible, to use identical questionnaires in both mail and face-to-face data collection, so that the only possible biases entering can be assumed to have arisen from the method used to implement the questionnaire, rather than from differences in question working or ordering which are discrepancies within the instrument itself.

## Interpretation of Results

The results of this study are summarized by the following statements:

1. There is no difference in the educational level of respondents and non-respondents in either the 1968 Boating Demand Study or the 1970 Snowmobile Study.
2. There is no difference in total family incomes of respondents and non-respondents in either the 1968 Boating Demand Study or the 1970 Snowmobile Study.
3. There is no difference in the amount of recreational participation by respondents and nonrespondents in either the 1968 Boating Demand Study or the 1970 Snowmobile Study.
4. There appears to be no real difference in the geographical distribution of recreational participation by respondents and non-respondents in the 1970 Snowmobile Study. Respondents and non-respondents to the 1968 Boating Demand Study, particularly those in certain Great

Lakes counties, show similarities in their choice of destination for recreational boating although a small sample size prevents the drawing of a final conclusion in this regard.

How may recreation planners, especially the Michigan Department of Natural Resources, interpret these results? The overall conclusion which arises is that there is no significant difference in respondents and non-respondents to two recreation studies. Because two different studies and populations were examined with the same results it seems the more general conclusion can be drawn that there is no significant difference between the socio-economic characteristics and use patterns of respondents and non-respondents to recreation research mail surveys of similar populations.

The contention has long been that predictions made on the basis of partial returns may not be reliable. Certainly much of the literature in education, psychology, and marketing would indicate that this is true. In another area, that of recreation, these findings in other disciplines may not apply. The present study indicates that only a percentage of response is necessary to draw conclusions about basic socio-economic characteristics and broad use patterns of a population of recreationists. For predictions regarding these variables, the Boating Demand Study, with a response rate of only 29 per cent
appears to be equally as valid as the Snowmobile Study, with its 70 per cent response, though the possibilities for comparison in the boating study were not as full as they might have been.

The implication seems to be that study funds, rather than being spread out to cover a wide range of the population, could be concentrated into the careful design and adequate pre-testing of a survey instrument which is then used on a relatively small portion of the universe under study (the necessary sample size depending on the variance of the data and the amount of detail and breakdown required in the analysis). Information on a relatively small percentage of survey subjects will be adequate, but only if the questionnaire and sampling procedures employed are as systematic and free of bias as possible. It appears this is where funds and efforts should be concentrated, rather than on trying to achieve a high response rate from a large majority of recreationists.

## Implications for Future Studies

When making recommendations for future studies of this type, it is necessary to discuss the study on which the comparison will be made. Project leaders anticipating a respondent-nonrespondent evaluation should design their studies to include as large a sample of follow-up
interviews as possible. Once again, follow-up questionnaire foremat should be identical to that used in the mail survey.

Some additional comparisons might be useful, as well. To ascertain the need for specific programming, it would be useful to know if non-respondents use their equipment for different purposes or activities than respondents. The multi-variate analysis suggested for the county comparison in this study would be useful, but it is important to remember that a very large sample will be required to reach the necessary cell frequency, if several activities are under scrutiny. Another possible means of evaluation would be a comparison of the proportion of respondent and non-respondent use accounted for by each individual activity.

Another very important comparison would be one of attitudes toward laws and regulations. Respondent support for desired legislation cannot validly assumed to represent the feelings of the entire population, unless nonrespondents' attitudes are enumerated and compared with them.

More research is necessary before it can be said unequivocably that non-respondents create no source of bias in making predictions about future recreation needs. This study, however, because it examines four variables in two different studies gives very definite support to
the premise that recreation planners can justifiably allocate dollars and resources for recreation on the basis of partial response to recreation research mail surveys.

## SELECTED BIBLIOGRAPHY

## Books

Burton, Thomas L., and Noad, P. A. Recreation Research Methods. Birmingham, England: University of Birmingham, Centre for Urban and Regional Studies, 1968 .

Champion, Dean J. Basic Statistics for Social Research. Scranton, pa.: Chandler Publishing Co., 1970.

Downie, N. M., and Heath, R. W. Basic Statistical Methods. New York: Harper and Row, 1965.

Dunn, S. Watson. Advertising: Its Role in Modern Marketing. New York: Holt, Rinehart and Winston, Inc., 1969.

Handy, Rollo. Methodology of the Behavioral Sciences: Problems and Controversies. Springfield, III.: Charles C Thomas, 1964.

Hansen, Morris, H.; Hurwitz, William N.; and Madow, William G. Sample Survey Methods and Theory. New York: John Wiley and Sons, Inc., 1953.

Hoel, Paul G. Elementary Statistics. New York: John Wiley and Sons, Inc., 1967.

Jahoda, Marie; Deutsch, Morton; and Cook, Stuart W. Research Methods in Social Relations. New York: Dryden Press, 1951.

Jonsson, Carl Otto. Questionnaires and Interviews. Stockholm: Swedish Council for Personnel Administration, 1957.

Kish, L. Survey Sampling. New York: John Wiley and Sons, 1967.

## Articles

Baur, E. Jackson. "Response Bias in a Mail Survey." Public Opinion Quarterly, XI (Winter, 1947-1948), 594-600.

Cannell, Charles F., and Fowler, Floyd J. "Comparison of a Self-Enumerative Procedure and a Personal Interview: A Validity Study." Public Opinion Quarterly, XXVII (Summer, 1963), 251-64.

Clausen, John A., and Ford, Robert N. "Controlling Bias in Mail Questionnaires." Journal of the American Statistical Association, XLII (December, 1947), 497-511.

Donald, Marjorie N. "Implications of Nonresponse for the Interpretation of Mail Survey Data." Public Opinion Quarterly, XXIV (Spring, 1960), 99-114.

Edgerton, H. A.; Britt, S. H.; and Norman, R. D. "Objective Differences Among Various Types of Respondents to a Mailed Questionnaire." American Sociological Review, XII (1947), 435-44.

Ford, Neil M. "Consistency of Responses in a Mail Survey." Journal of Advertising Research, IX (December, 1969), 31-33.

Hansen, Morris H., and Hurwitz, William N. "The Problem of Nonresponse in Sample Surveys." Journal of the American Statistical Association, XLI (December, 1946), 517-29.

Labovitz, Sanford. "Criteria for Selecting a Significance Level: A Note on the Sacredness of .05." American Sociologist, III (August, 1968), 220-22.

Lehman, Edward C., Jr. "Tests of Significance of Partial Returns to Mail Questionnaires." Rural Sociology, XXVIII (September, 1963), 284-89.

McDonagh, Edward C., and Rosenblum, A. Leon. "A Comparison of Mailed Questionnaires and Subsequent Structured Interviews." Public Opinion Quarterly, XXIX (Spring, 1965), 131-36.

Magrabi, Frances M.: King, Marcia P.; and Mead, Meredith J.
"Gathering Economic and Demographic Data by
Mailed Questionnaire." Quarterly Bulletin of the
Michigan Agricultural Experiment Station, Michigan
State University, XLIX (August, 1966), 77-89.

```
Mayer, Charles S., and Pratt, Robert W., Jr. "A Note on Non-response in a Mail Survey." Public Opinion Quarterly, XXX (Winter, 1966-1967), 634-46.
Nuckols, Robert C. "Personal Interview Versus Mail Panel Survey." Journal of Marketing Research, I (February, 1964), 11-16.
```

Reid, Seerley. "Respondents and Non-respondents to Mail Questionnaires." Educational Research Bulletin, XXI (April, 1942), 87-96.

Reuss, Carl F. "Differences Between Persons Responding and Not Responding to Mail Questionnaires." American Sociological Review, VIII (1943), 433-38.

Robinson, R. A., and Agisim, Philip. "Making Mail Surveys More Reliable." Journal of Marketing, XV (April, 1951), 415-24.

Shuttleworth, F. K. "Sampling Errors Involved in Incomplete Returns to Mail Questionnaires." Psychological Bulletin, XXXVII (1940), 437.

- "A Study of Questionnaire Technique." Journal of Educational Psychology, XXII (December, 1931), 652-58.

Sprowls, R. Clay. "Sample Sizes in Chi-Square Tests for Measuring Advertising Effectiveness." Journal of Marketing Research, I (February, 1964), 60-64.

Stanton, Frank. "Notes on the Validity of Mail Questionnaire Returns." Journal of Applied Psychology, XXIII (1939), 95-104.

Suchman, Edward A., and McCandless, Boyd. "Who Answers Questionnaires." Journal of Applied Psychology, XXIV (1940), 758-69.

Vincent, Clark E. "Socio-Economic Status and Familial Variables in Mail Questionnaire Responses." American Journal of Sociology, LXIX (May, 1964), 647-53.

Williams, Allan F., and Wechsler, Henry. "The Mail Survey: Methods to Minimizing Bias Owing to Incomplete Response." Sociology and Social Research (July, 1970), 533-35.

Young, R. A.; Holland, I. I.; and Gilmore, A. R. "Getting Better Returns from Mail Questionnaires." Journal of Forestry (November, 1970), 723-24.

## Reports

Crapo, Douglas, and Chubb, Michael. Recreation Area
Day-Use Investigation Techniques. East Lansing:
Department of Park and Recreation Resources,
Michigan State University, January, 1969.

## Unpublished Material

Cajucom, Edilberto Zalvdea. "Michigan Summer Trail Users: A Pilot Study of User Patterns and Characteristics." Unpublished Ph.D. dissertation, Michigan State University, 1971.

Fiske, Paul. "An Analysis of Interregional Variation in Recreational Boating in Michigan." Study plan submitted to the Department of Resource Development, Michigan State University, 1971.

- "Boating Demand and RECSYS-SYMAP Simulation Techniques." Paper presented at the Recreation Research Review, Michigan State University, 1969.

Kaiser, Ronald. "A Study of Multiple Boat Ownership in Michigan." Unpublished Master's thesis, Michigan State University, 1970.

Manderscheid, Lester V. "An Introduction to Statistical Hypothesis Testing." Department of Agricultural Economics, Michigan State University, 1969.

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

## Other Sources

Fiske, Paul. External Affairs Coordinator, Institute of Natural and Environmental Resources, University of New Hampshire. Personal Interview, Michigan State University, February, 1971.

Lanier, Louis. Associate Professor, Department of Recreation Administration, University of Alberta, Canada. Notes on 1970 Snowmobile Study, Michigan State University, 1970.

Miracle, Gordon. Professor, Department of Advertising, Michigan State University. Personal interview, February, 1971.

Yang, Charles. Professor, Department of Communication, University of Illinois. Class notes from Advertising Research, Michigan State University, 1969.

Zeigler, Sherilyn K. Assistant Professor, Department of Advertising, Michigan State University. Personal interview, Michigan State University, February, 1971.


[^0]:    ${ }^{1}$ Douglas Crapo and Michael Chubb, Recreation Area Day-Use Investigation Techniques (East Lansing: Department of Park and Recreation Resources, Michigan State University, January, 1969), pp. 22-23.

[^1]:    $l_{\text {Ibid. . p. }} 23$.

[^2]:    $1_{\text {Edward A. Suchman }}$ and Boyd McCandless, "Who Answers Questionnaires?" Journal of Applied Psychology, XXIV (1940), 760.
    ${ }^{2}$ R. Franzen and P. F. Lazarfeld, "Mail Questionnaires as a Research Problem," Journal of Psychology, XX (1945), 294.
    ${ }^{3}$ John A. Clausen and Robert N. Ford, "Controlling Bias in Mail Questionnaires," Journal of the American Statistical Association, XLII (December, 1947), 506.

[^3]:    ${ }^{1}$ Ibid.. p. 506.

[^4]:    $l_{\text {R. A. Robinson }}$ and Philip Agisim, "Making Mail Surveys More Reliable," Journal of Marketing, XV (April, 1951), 418.

[^5]:    ${ }^{1}$ Seerley Reid, "Respondents and Non-respondents to Mail Questionnaires," Educational Research Bulletin, XXI (April, 1942), 95.
    ${ }^{2}$ Ibid., p. 92 .
    $3_{\text {Edward C. McDonagh and A. Leon Rosenblum, "A }}$ Comparison of Mailed Questionnaires and Subsequent Structured Interviews," Public Opinion Quarterly, XXIX (Spring, 1965), 131-36.

[^6]:    $1_{\text {Paul }}$ Fiske, "Boating Demand and RECSYS-SYMAP Simulation Techniques" (paper presented at the Recreation Research Review, Michigan State University, East Lansing, Michigan), p. 4.

[^7]:    ${ }^{1}$ Paul Fiske, personal interview held in February, 1971.

[^8]:    a Ronald Kaiser, "A Study of Multiple Boat Ownership in Michigan" (unpublished Master's thesis, Michigan State University, 1970), p. 24.

