This is to certify that the

dissertation entitled

Trip Expenditures of Recreational Boaters in Michigan

presented by

Hee Chan Lee

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Park, Recreation and Tourism Resources

Major professor

Date December 10, 1999

TRIP EXPENDITURES OF RECREATIONAL BOATERS IN MICHIGAN

By

Hee Chan Lee

A DISSERTATION

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

DOCTOR OF PHILOSOPHY

Department of Park, Recreation and Tourism Resources

1999

ABSTRACT

TRIP EXPENDITURES OF RECREATIONAL BOATERS IN MICHIGAN

By

Hee Chan Lee

This study estimated trip expenditures of registered pleasure boat owners in Michigan in 1998, tested for differences in measures of boating activity and trip spending across different storage segments, and estimated the regional flows of boater spending on trips by storage type. Data were collected through sample surveys of Michigan registered boat owners. An in-season survey was utilized to estimate boating activity and trip spending. Surveys were sent out in nine waves every week over the 1998 summer. At the end of the boating season, two distinct end-of-season surveys were conducted with smaller samples to evaluate potential nonresponse bias and use estimates from the in-season survey. The study developed methods to estimate both annual use and spending in a single survey. Annual use per boat was estimated by applying a logistic model to the average days of use obtained from the in-season survey. The average use estimated from the wave surveys was not statistically different than the average use estimated from the season-end survey.

A total of 652,000 active registered boats in Michigan logged an estimated 18.4 million days of boating in 1998. Boats averaged about 28 days of use. Owners of active registered boats spent an estimated $635 million on trips within Michigan in 1998. The total was divided $292 million on day trips and $343 million on overnight trips. A typical boater spent $23 a day on day trips and $60 a day on

overnight trips, averaging about $35 per day overall. Boaters keeping their boats at marinas spent $76 a day on boating trips, while at the other extreme boaters storing the boats at waterfront primary homes spent $20 a day. The test results showed that there were significant differences in both the levels and patterns of use and spending by storage segment. All northern regions were net gainers from boater trip spending and earned a net gain of $120 million in 1998. The South inland region showed the biggest net loss of boater dollars, as resident boaters in this region spent $78 million more outside the region than the region received. Out-of-state boaters spent $35 million in Michigan in 1998, mostly involving use of seasonal homes in the state. Refinements were made in methods used in previous boater surveys for handling of zeros and missing data in trip spending reports, and separating day and overnight trips. The composition of respondents was also compared to that of nonrespondents on characteristics that are relevant to trip spending to show no conclusive evidence of nonresponse bias.

ACKNOWLEDGEMENTS

I would like to thank Dr. Daniel J. Stynes, my academic advisor and dissertation chairman. He was instrumental in all facets of my research and study while at Michigan State University. Dr. Stynes has been a tremendous help in all stages of the project, from encouraging me to pursuing the topic, to directing the research design and data analysis, to carefully editing many drafts of the dissertation. Perhaps most important, he has always been willing to talk and to listen throughout the process.

Valuable contributions were also made by committee members. I am especially indebted to Dr. Edward M. Mahoney for many months of sincere dedication and valuable guidance during this study. I would also like to express my sincere appreciation to Dr. Donald F. Holecek and Dr. Larry A. Leefers for their valuable assistance, not only in terms of dissertation, but also in other aspects of my doctoral program as well.

I wish to thank the faculty members in the Department of Park, Recreation and Tourism Resources for their guidance and assistance during my program at MSU. Special thanks go to Dr. Betty van der Smissen for her help and encouragement during my time at MSU. Appreciation is also extended to Mr. Young Rae Kim for assistance rendered in preparation and distribution of the survey questionnaire and data coding, as well as his unending support and friendship.

Words can not express my appreciation and gratitude for the love, sacrifice, support, and encouragement so generously given by wife, Bock Hee. My two sons,

Seung Kon and Eui Kon, also demonstrated much patience and understanding over an extended period of time, when they did not receive the usual amount of attention and guidance from their father.

Finally, I would like to dedicate this dissertation to my parents, Sang Wu Lee and Jung Sook Choi and parents in law, Sang Doo Lee and Hye Soon Kim. Without their love and moral support, it would not have been possible for me to complete this study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

U.S. resident travelers spent $408 billion on transportation, lodging, meals, entertainment and recreation services, and incidental items within the U.S. in 1997 (Travel Industry Association of America, 1998). The 1997 spending accounted for 11 percent of all consumer spending in the U.S. However, the significance of recreation and tourism to the nation's economy is even greater than this figure represents because, for example, leisure travel involves considerable portions of consumer spending on transportation, housing, clothing, and food. Travel and tourism is the nation's largest export industry, third largest retail sales industry and one of the America's largest employer. It is in fact the first, second or third largest employer in 32 U.S. states (TIAA, 1998).

Estimating the expenditures on recreation and tourism within a state or region is an important component of comprehensive recreation and tourism planning. Estimating direct spending is a necessary first step to obtain a clearer picture of traveler's impact on state and local economies. Economic impact studies in recreation and tourism are undertaken to determine the effect of specific activities in a given geographic area on the income, wealth, and employment of that area's residents (Frechtling, 1994a). Estimates of traveler expenditures are often used to justify future developments and evaluate past management performance, as traveler spending has significant economic impacts on regions that attract more visitors.

While some expenditures on recreation and tourism can be estimated from existing secondary data, others can not. Boat purchases can be estimated using government data, but restaurant sales attributable to boaters are not available from the secondary data. The Consumer Expenditure Survey's estimate for spending of $116 billion on gasoline and oil in 1997 (U.S. Bureau of Labor Statistics, 1998) does not distinguish between spending on local auto transportation, on auto travel away from home, or fuel used in boats. Consequently, to estimate consumer expenditures on recreation and tourism requires multiple methods and sources.

Recreational boating is a major recreation and tourism activity throughout the U.S. In a nationwide survey, recreational boating was the eighth most popular sports activity, after fishing, in 1997 (National Sporting Goods Association, 1998). The National Marine Manufacturers Association (1998) estimated that recreational boaters in the U.S. spent roughly $19.3 billion on craft-related items and boat purchases in 1997, showing a substantial increase from $3.4 billion in 1970 and an increase of 9% over 1996. Spending on boating trips, which is generally well above the expenditures on craft-related items or boat purchases was not included in this figure. For example, in a 1981 Michigan boating survey (Stynes et al., 1983), the one billion of total spending was divided 66% for trip spending, 24% for craft-related spending, and 10% for boat purchases. In a 1995 California study (Rust and Potepan, 1997), the majority (69%) of the $2.5 billion of total spending fell into trip-related categories.

These figures represent not only the extent of participation in recreational boating in this country but also some measure of the impact these millions of boaters have on the economy. Because of the growth in boating and its related activities, many states are

concerned with providing public access and facilities for the boater. In many states in the U.S., recreational boating is linked to the states' economic development as boating generates a considerable amount of economic activity (Stoll et al., 1988). Recreational boating supports a variety of industries including boat builders, boat dealerships, marinas, repair services, and a wide range of retail sectors of the economy (Neely et al., 1998; Stynes et al., 1983).

Boating in Michigan is an especially important recreational activity with substantial spending and ties to various industries. Michigan ranked first among the 50 states in the amount spent on boat purchases in 1997 with $480 million being spent (NMMA, 1998). Michigan also led the nation in the number of registered watercraft in 1997, with 957,105 boats including pleasure and commercial craft (NMMA, 1998). The popularity of boating in Michigan is attributed to the relatively easy access to the state's Great Lakes waters, thousands of inland lakes, and thousands miles of rivers.

Surveying boat owners provides boating agencies and industries with information required to meet the needs of boaters. Boater expenditure surveys have been the key instruments for obtaining information to estimate spending and economic impacts of boating. A boater expenditure study provides information to assist government agencies as well as industry associations and boating businesses who need to develop product and marketing strategies. Information obtained from such surveys includes spending patterns of distinct user groups, location of boater spending, and determinants of boater expenditures.

Boater spending also reflects a wide spectrum of sociodemographic phenomena associated with boat owners, as a great deal of boating activity is associated with seasonal

homes, retirement in northern communities, and the like. Patterns of boater spending are influenced by craft type and size, storage type, and boater's socioeconomic characteristics. Estimating total boater spending requires that the number of craft and boat days be estimated. Amount spent on trips may not be reported accurately because of potential recall difficulties boaters may have. Estimating direct spending is necessary to estimate boater's impact on state and local economies. Boater spending thus affords a good vehicle for testing improvements in research methods, as well as recreation planning and management.

Problem Statement

Spending by boaters is divided into three major categories: 1) new and used boat purchases, 2) craft-related spending, and 3) trip-related spending (Stynes et al., 1983; Lipton and Miller, 1995). Craft-related spending includes expenditures for equipment, insurance, repair, storage of the boat, and other related items not directly associated with individual boating trips. Trip-related spending includes all spending in conjunction with boating trip, which is the variable cost of taking a trip. Trip-related spending includes expenditures on groceries, restaurant meals, auto and boat fuel, boating and other recreational gear purchased on trips, and other expenses incurred on boat outings.

Craft-related spending and spending on new and used boats can be estimated using a season-end survey. Boat owners are usually asked at the end of the season to report annual craft-related spending and spending on boats acquired in the previous year. Spending on new and used boat purchases may be also estimated from secondary data. Stynes et al. (1983) and Lipton and Miller (1995) estimated boater spending on new and

used boat purchases using sales taxes collected by state agencies. Because of the variety and variability of boating trips and expenditures, however, trip-related spending is more difficult to estimate. A year-end survey may not be appropriate to capture boater spending accurately because of recall biases on trip expenditures. Patterns of trip spending depend on a variety of trip patterns (e.g., day trips vs. overnight).

In a 1981 study in Michigan (Stynes et al., 1983) new and used boat purchases accounted for ten percent of the measured total boater spending. Trip and craft-related spending made up the remaining 90% of the total. Compared with craft-related spending, boaters spent more than two times as much on trip-related spending in 1981. Craft-related spending primarily directly accrues to boating industries while trip-related spending benefits a wide range of retail sectors of the economy. Trip-related spending, especially, has far reaching impacts on coastal communities, reaching many sectors of the local economy through both direct and indirect effects of boater spending.

The research problem presented by this study is to estimate trip expenditures of recreational boaters in Michigan in 1998. This is the first statewide study of boater trip expenditures in Michigan since 1981. The 1981 boating study (Stynes et al., 1983) provided a wealth of information about boating expenditures of Michigan registered boat owners, but left many unanswered questions about mainly the approach used to elicit boater expenditures. In addition to the need to update estimates of boater expenditures, there is a need for improved and more cost effective methods to estimate boater spending. Information on boater expenditures would provide a stronger basis for planning facilities and services and an indication of the spending impacts of recreational boaters on local economies.

Estimation of Boater Trip Expenditures

Boater trip spending is usually estimated through sample surveys because trip expenditures on boating can not be readily extracted from economic accounts. Given the dispersed nature of boating activity, it is difficult to obtain comprehensive estimates of use from on-site surveys. For most recreational boating activities household surveys are frequently used to estimate levels of activity, characteristics of trips, and spending. Given the convenient sampling frame offered by boat registrations, boater studies generally use mailed surveys where the sampling unit is the boat or boat owner. Unregistered small boats are generally not included in these studies.

Boater trip spending estimates are based primarily on self-reported data. An important issue in estimating traveler expenditures via survey is recall bias. Evidence indicating the presence of recall bias in expenditure estimates by travelers is abundant in traveler studies (Rylander et al., 1995; Stynes and Mahoney, 1989; Ellerbrock, 1981; Mak et al., 1977). The resolution of this spending estimation issue, however, has not received much attention from researchers studying boater expenditures. Generally, average expenditure estimates provided by sample of boats and trips are multiplied by the number of use days to yield estimates for total expenditures during the season. Errors in either will result in errors in estimates of total spending.

Season-end surveys have generally been used to collect both boat use and boater spending data. The preferred approach to estimate annual use seems to be an end-of-season survey. However, individual trip characteristics and expenditures can be measured more accurately during or shortly after the trip. This suggests an in-season survey to estimate trip spending (Stynes et al., 1983). Previous studies have frequently

used different surveys to estimate use vs. trip-related spending. For example, the 1981 study conducted by Stynes et al. (1983) employed a wave (survey) approach to estimate trip spending. Surveys were sent out in six waves during the season asking the boater to report trip spending for their most recent trip. Since annual use is not easily estimated in the middle of a boating season, the 1981 study used a season-end survey conducted in the previous year for days of use.

End-of-season surveys are problematic in estimating boater trip expenditures because of potential recall error. Designs that require both in-season and season-end surveys increase costs. To estimate both annual use and spending appropriately in a single survey has not been addressed in boating studies. Procedures are needed to extrapolate annual use from in-season surveys, to measure spending for a recent trip to reduce recall errors, and to sample in waves over the summer to capture seasonal variation in trips.

The 1981 Michigan boater expenditure survey did not clearly define what a trip was. This is problematic for boaters at waterfront homes who boat from their backyard. Waterfront home owners may consider a day of boating around home a "trip" or they may report a more extended outing where they stayed overnight or boated a greater distance from home. Boaters at seasonal waterfront homes may consider traveling from their permanent home to the seasonal home a "trip" or they may report a day outing for boating from the seasonal home. A speculation is that boaters would be more likely to report overnight or extended trips that may not be their most recent trips. This could be particularly the case when they are asked to report spending, as no "trip" spending is necessarily involved when boating from a waterfront home.

It could not be ascertained exactly how many respondents to the 1981 Michigan boater expenditures survey had missing spending data or reported no spending. The report was incomplete on this point and the original data were not available. The 1981 study assumed that blanks or missing values on boater trip expenditures were zero values. The present study improves on this by more clearly defining a "trip", making it easier to explicitly report no spending via a checkbox on the questionnaire, and by distinguishing between day outings and overnight trips.

Stratification by Types of Boat Storage

Individual segments are more clearly tied to particular management or marketing strategies. Disaggregating boaters into segments also makes it easier to track changes in spending that frequently are tied to a changing mix of boaters (Stynes, 1998). Many boating studies conducted in various states divide the boating fleet into distinct segments to describe and explain patterns of boating use and spending. This study stratifies boating use and spending by the type of boat storage, as the greatest variation among boaters is expected to occur across different types of storage.

The appropriate segmentation may depend upon the particular situation and application, but some of the key variables for classifying the boating market are clear. For general management and planning applications, craft type, boat length, and storage type appear to be the most useful segmentation variables, particularly storage. Discriminating between boats kept at waterfront sites and boats trailered from nonwaterfront homes is important to identify needs for access sites and launching facilities as well as for managing conflicts between these two groups (Stynes et al.,

1983). Boats stored at waterfront sites need to be further segmented into a marina group and boats stored at permanent or seasonal waterfront homes.

Stynes et al. (1995) argues that storage locations are the best predictors of where boats are used and explain the types and amounts of use. Wu (1995) classified boats into marina, second home, waterfront homes, and nonwaterfront homes as the basis for her models to estimate boating activity in Michigan at the county level. She argued that boating use and spatial patterns of use may be explained by storage. Further, use estimates by storage type better meet the information needs of public and private sector providers who frequently serve particular storage categories. Storage type tends to be correlated with craft size. Boats stored at non-waterfront sites are primarily smaller craft that can be trailered to launch sites, while marinas provide storage for larger power and sailboats.

Regional Flows of Boating Activity and Trip Spending

Estimating the flows of boating activity and spending among different regions of the state is important to support regional planning. To assess the regional economic effects of boater spending requires that local spending by resident boaters be distinguished from spending of non-local residents who are attracted to an area. A questionnaire must be designed for boaters to specify their spending between origin and destination to avoid potentially erroneous assumptions on the allocation of spending among regions. For example, Lipton and Miller (1995) assumed that while transportation and grocery expenditures occur in the county in which the boater lives, expenditures on

boat fuel and restaurant meals occur in the county where the boat is launched from, with some exceptions.

The 1981 Michigan boating survey (Stynes et al., 1983) distinguished trip spending between origin and destination to distribute boater spending among regions. However, the allocation of boater spending to different regions of the state required a number of simplifying assumptions because the 1981 survey did not distinguish boaters' residences from storage location. There will be some misassignments due to boats stored other than in the region of residence (e.g., boats stored at seasonal homes) This problem will tend to underestimate spending in coastal areas and northern regions where craft are often stored at second homes and marinas. Regionalization of trip spending, therefore, requires information concerning location of boat storage, as well as location of boat owner residence and boating use.

Storage segments are very useful to describe regional flows of boater spending. Regional planning can be helped by examining which non-local boater segment could contribute more to the region's economy. For example, a region may want to attract more boaters in a marina segment who spend more dollars than other segments, given the region's existing and potential carrying capacity.

Objectives

The objectives of this study are:

1. To estimate boater trip spending by storage segment in Michigan during the 1998 season,
2. To test for differences in measures of activity and trip spending across storage segments, and
3. To estimate regional net gains of boater trip spending by storage type and spending category,

Boater Trip Spending by Storage Segment

To estimate boating use and trip spending in Michigan, the study employed a wave approach, sending surveys to independent samples of boaters in nine waves during the boating season. Boat use and boater trip spending are hypothesized to vary based upon the type of boat storage. Storage types are facilities where boaters keep their boats during the season. Boat storage types are important because they are the best predictors of where boats are used and explain the types and amounts of use and spending. Storage type is correlated with craft size. Spending also varies between day and overnight trips. Spending profiles of boaters should be distinguished between these two types of trips in order to provide more accurate estimates of trip spending.

Test for Differences in Boating Use and Spending across Storage Types

The characteristics of a segment must be distinguishable from those of other segments so that product or service offerings and appeals can be tailored to the segment's

unique characteristics. Differences in measures of trip and spending patterns, demographic characteristics of boaters, and boat-related factors are tested across storage segments. Comparing the segments provides insights into the most effective management and marketing strategies for boating business.

Regional Flows of Boater Trip Spending

To assess the economic effects of boater spending upon regions of the state requires the separation of local spending by resident boaters from the spending of non-local residents who are attracted to the area. Spatial distributions of boats and boat days by region and storage type are estimated to allocate boater trip spending to different regions. Storage segments are most useful to describe regional flows of boater dollars since boat storage is the best predictor of where boats are used and explain amounts of use and spending.

In summary, this study is designed to estimate boater expenditures on boating trips based on in-season surveys. To provide better descriptions for patterns of boater spending, the study stratifies boating use and spending by the type of boat storage. Tests for differences in measures of boating activity and trip spending are conducted across different storage segments. To support regional planning, the study also estimates the flows of boating activity and spending among different regions of the state.

Organization of the Study

The study consists of five chapters. The next chapter reviews previous travel expenditure studies, boating studies relating to boating use and boater spending, literature relating to modeling recreational use and spatial patterns of recreational uses. The third chapter describes the methods used to collect and analyze the data. Tests for nonresponse bias in the wave survey are also presented. The fourth chapter presents the results of the models to estimate boating use and trip spending in different storage segments, tests for the differences in measures of boating activity and spending, and estimates regional flows of boater spending. The fifth and final chapter provides an overview of the results and offers recommendation for improving the study.

CHAPTER 2

LITERATURE REVIEW

The literature relevant to this study of boater expenditures comes from four subject areas: 1) studies of traveler expenditures, 2) studies of boating use and expenditures, 3) relevant approaches for modeling recreational use, and 4) studies of spatial patterns of recreational boating in Michigan.

Studies of Traveler Expenditures

Estimating travel expenditures is a necessary first step to estimate the economic impact of nonresident travel to a state or region. Economic impact estimates are often used to justify future developments and monitor past management actions (Frechtling, 1994b). The large magnitude of impact that results from small errors in expenditure data suggests that methodologies used in gathering visitor data be examined and refined to ensure valid and reliable estimates. Researchers have long raised concerns about the accuracy of surveys that are commonly used to gather economic information (Deleeuw and Hox, 1988). These concerns are not always easily addressed since survey costs and immediate data requirements often drive travel research methodologies (Rogers, 1991).

Trip spending estimates in travel studies are based primarily on on-site or household surveys. On-site surveys of travelers are conducted while they are in the area under study. On-site surveys are superior to household surveys if one assumes decline in respondent recall as the time elapsed between expenditure and interview increases (Frechtling, 1994b). Given the dispersed nature of activities related to recreation and

tourism, however, it is difficult to obtain representative samples of visitors and trips from on-site surveys. The difficulty in projecting sample results to the total population is also not resolved in on-site survey method.

Household surveys are more frequently used to estimate levels of recreation and tourism activity and characteristics of trips than on-site surveys. Recall errors are a prime weakness of household surveys when used to estimate trip spending. A strength is that sampling frames for household surveys are readily available, and it is a simple matter to project sample results to the total population for absolute estimates, something on-site surveys do not readily permit (Frechtling, 1994b). Three basic modes of household surveys are mail surveys, telephone interviews, and face-to-face interviews.

The conduct of surveys in the household has been discussed elsewhere (Frechtling, 1994b; Babbie, 1992; Ferber, 1978). Mail surveys allow the largest sample size within a given budget and permit respondents to consider their answer carefully. On the other hand, mail surveys are the slowest of the three modes, have potential for recall bias, and produce the lowest response rates. Face-to-face interviews have the virtues of shorter elapsed time between interview and processing relative to mail and high response rates. The drawbacks of this mode are the high cost of interviewing and potentially poor interviewer supervision. Telephone surveys produce results more quickly and are superior in minimizing lag between interview and processing, but do not permit lengthy questions with many choices.

Travel spending estimates are based primarily on self-reported data (Howard et al., 1991). One of the main issues confronting tourism planners and researchers is how accurately travelers recall the expenditures related to their trips. Evidence indicates that

response error (the difference between actual and reported expenditures) may be substantial (Rylander et al., 1995; Stynes and Mahoney, 1989; Mak et al., 1977). In their comparison of travel expenditures derived from post-trip survey questionnaires and trip diaries, Mak et al. (1977) found that recall survey respondents significantly underestimated their expenditures relative to the diary. While the diary approach may have been biased, it appears that the shorter recall period helps better capture traveler expenditures.

Stynes and Mahoney (1989) found the post-trip recall estimate of respondents attending a national conference to be 20 percent less than the expenditure estimates provided by respondents during the conference. The conclusion was that recall errors in the post-trip survey lead to the underestimates of spending. Rylander et al. (1995) tested for the presence of recall bias in mailed survey questionnaires using data collected from visitors at recreation sites. In line with previous studies (Frechtling, 1987; Stynes and Chung, 1986; Ellerbrock, 1981), Rylander et al. (1995) indicated that recall bias was observed. They recommended procedures that obtain complete responses either during or immediately upon the completion of a respondent's trip.

In a study of the impact of the amount of elapsed time between an intercity trip and the report of the trip on reported trip volume, Meyburg and Brog (1981) found that the longer the elapsed time, the smaller the proportion of actual trips reported. For example, more that 4 percent of actual intercity trips were unreported six to nine months later, and 13 percent were unreported nine to twelve months after they occurred. It is fair to say that if there is underreporting of trips, there must be underreporting of total expenditures across trips.

The 1991 and 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (USDI, USFW, and UDBC, 1993; 1998) employed a wave analysis to reduce the recall period over which respondents had to remember their activities and expenditures on fishing, hunting, and wildlife-associated recreation. The 1991 and 1996 FHWARs conducted interviews about every four months. The previous FHWARs used a 12-month recall period which resulted in greater reporting bias (USDI, USFW, and UDBC, 1998). Research on recall bias found that the amount of activity and expenditures reported in the 12-month recall FHWAR was over-estimated in comparison with the amount reported in shorter recall periods (USDI, USFW, and UDBC, 1998).

However, expenditures made 3 or 4 months prior to a survey may be still more difficult for respondents to remember, than expenditures in the month immediately prior to a survey. Based on the on-going Consumer Expenditure Survey (CES), Nelson (1996) argued that recall biases on various consumer expenditure categories may lead to underreporting in the early months of each interview period. For example, only 24.5 percent of purchases of boys' and girls' footwear are reported as taking place three months prior to the interview, while 45.9 percent are reported as taking place in the most recent month. The author argues that because it is highly unlikely that people tailor their consumption patterns around their interview schedule, poor reporting seems to be the cause.

One other source of direct comparison between short and long recall period surveys is the U.S. Travel Data Center study of the 1973-1974 CES (1978). The CES, conducted by the U.S. Bureau of the Census, obtained expenditure information on travel purchases by personal interview once every three months over a two-year period. It was

estimated that U.S. residents spent an average of $2.7 billion on foreign travel per year during the survey period. The U.S. Department of Commerce Bureau of Economic Analysis (BEA) annually estimates U.S. travel spending in foreign countries using self-administered questionnaires distributed to returning residents, keeping the elapsed time between expenditures and report to a minimum. BEA estimated an annual average of $7.2 billion in consumer expenditures for foreign travel for 1972-1973. U.S. consumer spending on foreign travel, then, may have been underestimated by more than 60 percent through the CES because of recall bias associated with the long elapsed time between expenditures and interview (cited from Frechtling, 1994b).

Rylander et al. (1995) found that trip complexity interacted with the recall bias created by the passage of time in obtaining mailback questionnaires. Howard et al. (1991) documented a similar finding that recall accuracy is affected by two dimensions of travel time: both the elapsed time between the trip and post-trip data collection and the duration of the trip itself. Rylander et al. (1995) also found that groups with greater spending tended to report less accuracy. It would be fair to say that the more complicated spending items and larger spending amounts are subject to more recall bias than the less complicated items and smaller amounts.

Nonresponse bias has been a concern with mail questionnaires. Nonresponse bias, simply described, is the differences between the answers of respondents and nonrespondents. Nonresponse bias is especially a concern when low response rates are obtained (Stewart et al., 1993; Donald, 1960). This is especially true when the characteristics of the nonrespondents are substantially different from that of the respondents on characteristics of interest to the study. The low response rate in mail

surveys produces trip volume bias. There is evidence that nonrespondents to mail surveys tend to be less mobile in terms of the number of trips than respondents (Woodside and Ronkainen, 1984; Hunt and Dalton, 1983). Stewart et al. (1993) also found that nonrespondents were more likely to have lower trip spending.

Generally, the composition of respondents is compared to that of nonrespondents on characteristics that are relevant to the study in order to address whether nonrespondents are different from respondents (Lawton and Parasuraman, 1980). If no significant differences are observed between the two groups, the absence of nonresponse bias is inferred. If significant differences are observed, caution should be appended to the research conclusion to account for the possible bias, or the effects of nonresponse bias should be adjusted for accordingly (Lambert and Harrington, 1990; Armstrong and Overton, 1977; Daniel, 1975).

Few studies thoroughly assess the difference between nonrespondents and respondents in mail surveys. Many nonresponse analyses have been based on limited information available from secondary sources, samples of nonrespondents, or respondent-nonrespondent comparisons of demographic profiles (Becker, 1984). Note that this method does not directly test for nonresponse bias on the survey items, since the only inferences that may be substantiated concern the demographic, sociological, or performance characteristics themselves (Robert et al., 1970). This information may be of little value in determining the nonresponse bias associated with the key variables of the study, but can be useful when budget and/or time constraints preclude another follow-up mailing.

When information on nonrespondents is limited, nonresponse bias can be assessed using follow-up mailings assuming that late respondents are a reasonable substitute for nonrespondents and early and late respondent comparisons provide a reasonable approximation of true nonresponse bias (Ellis et al., 1970). Research support for these assumptions has been inconclusive within the tourism and recreation literature. Some studies have reported no significant differences between early and late respondents (Gitelson and Drogin, 1992; Dolsen and Machlis, 1991; Becker and Iliff, 1983; Hammit and McDonald, 1982). Others have reported significant differences between early and late respondents (Choi et al., 1992; Woodside and Ronkainen, 1984).

To identify the basis for these conflicting findings, Rylander et al. (1995) tested two hypotheses that late respondents (potential nonrespondents) are not different from nonrespondents and results of wave analysis are no different from respondent-nonrespondent comparisons. The authors concluded that the results of the follow-up scheme were quite different from the comparisons of respondents to nonrespondents. A nonresponse analysis based only on the three waves (one initial mail and two follow-ups) would have led to erroneous conclusion of no significant nonresponse bias in the sample, whereas significant differences between respondent s and nonrespondents were observed.

Lambert and Harrington (1990) suggested that samples be drawn from nonrespondents after the planned follow-up mailings are completed to determine the presence and direction of nonresponse bias. The authors recommended that a condensed version of the questionnaire that contains key variables derived from analysis of the first two follow-ups of questionnaires be sent to a sample of the nonrespondents for detection of bias. If bias is not detected, researchers have increased confidence in the conclusions.

If bias is detected, the effects of nonresponse bias should be estimated and adjusted for accordingly.

A variety of ways have been offered to deal with the potential problem of nonresponse bias. Armstrong and Overton (1977) reviewed estimating methods and described and tested the subjective and extrapolation techniques. An example of subjective estimates technique involved selecting a panel of experts or judges, having them identify survey items they believe to be subject to nonresponse bias, and state the direction of the bias based on at least two response waves. Using group consensus on the direction of the bias for selected items, valid predictions were reported (Armstrong and Overton, 1977).

Another approach to rectify nonresponse bias is to weight the sample results logically in order to adjust for nonresponse (Tanfer, 1993; Fuller, 1974). Statistical weighting techniques also have been developed and presented in the literature as especially useful when the response rate is not uniform across population subgroups (Mandell; 1974). In a 1994 boating study in Michigan (Stynes et al., 1995), weights were assigned for each boat size class, region and type to expand the final completed sample to the population of active registered watercraft. Others have developed statistical models to handle nonresponse in sample surveys (Kott, 1994).

The extrapolation methods, as presented by Filion (1976) and Churchill (1988), involves estimating the value of a population parameter by a linear extrapolation based on the cumulative response rate over successive waves of replies. The logic of the procedure is based on the purpose of surveys which is to estimate population figures while correcting for nonresponse bias, rather than to estimate nonresponse bias for its

own sake. A nonlinear extrapolation model was presented by Daniel (1975) in his review of ways to handle nonresponse in sociological surveys, and Zimmer (1956) developed an extrapolation model based upon the response-nonresponse probability function.

Studies of Boating Use and Spending

Many studies have investigated the spending patterns of boaters, usually for the purpose of documenting the economic impact of boating on community, region or a state (Stynes et al., 1983; Lipton and Miller, 1995; Neely et al., 1998). Since variation in boating activity and spending is great across distinct segments of boaters or boats, boating studies are usually based upon segmentation to help describe and explain patterns of boating use and spending. Distinct segments are also more clearly tied to particular management or marketing strategies. The appropriate segmentation may depend on the particular situation and application, but there exist some segmentation variables that have been commonly used in boating studies.

Warner (1974) found that craft type (motor vs. sail) and length of craft are most influential variables affecting boater expenditures using data collected from marina boaters in Michigan. In a 1981 Michigan boating study, Stynes et al. (1983) divided craft into four types of open, cabin, sail, and pontoon and open craft was again broken down into smaller and larger. The 1981 study also classified marina boats by type and length of craft. In a survey of Californian boat owners (Public Research Institute, 1996), boats were broken down into three size classes of under 16, 16-25, and over 25 feet, and boats under 16 feet were again divided into jet-propelled, sail, and other. A 1985 survey of Delaware registered boat owners (Falk et al., 1987) segmented boats by size class.

To reflect the particular geographical setting of Michigan boating, many Michigan boating studies (Recreation Resource Consultants, 1972, 1975; MDNR, 1979; Stynes and Safronoff, 1982) estimated boating use by the type of water body: Great Lakes and inland lakes. Use in inland lakes was further divided inland lakes and river/stream (Talhelm et al., 1988; Stynes et al., 1995). To assess the scope of recreational boating and the contribution of boater spending in Oregon, Neely et al. (1998) divided craft into registered recreational boats, commercial recreational boats, and nonregistered recreational boats. The inclusion of nonregistered boats was to describe the share of recreational boating activity taking place in nonmotorized craft such as inflatable rafts, kayaks, and drift boats.

Storage type has been advocated in recent boating studies as the basis for the primary segmentation of boats used in Michigan. Stynes et al. (1995) argued that storage locations are important because they are the best predictors of where boats are used and, along with boat size, explain the types and amounts of use. Wu (1995) classified boats into one of four segments: marina, second home, waterfront homes, and nonwaterfront homes as the basis for models that estimate county levels of boating use. In a 1994 Maryland boating study (Lipton and Miller, 1995), trip spending was broken down by various categories: whether the boat was trailered or kept in the water; whether it was a sailboat or powerboats; and by various size class within these groups.

Many boating studies surveyed in this section have used year-end surveys to collect trip spending data (e.g., Neely et al., 1998; Public Research Institute, 1996; Lipton and Miller, 1995; Falk et al., 1987; Sommerson, 1976; Warner, 1974). A potential problem with these studies is recall error. Thus, responses to expenditure categories are

likely only rough estimates. To overcome this problem, Stynes et al. (1983) employed a mailed survey sent out in six waves over the boating season to estimate per day trip spending more accurately. Boaters were asked to report personal trip expenditures on their most recent trip to reduce recall errors. Since annual days of use cannot be estimated directly from the wave surveys, however, the 1981 study used annual estimates of use obtained from a 1980 Michigan boater survey (Stynes and Safronoff, 1982).

Follow-up schemes are generally employed in boating surveys to achieve a higher response rate. Follow-up mailings and reminder post cards are frequently used. In a 1981 Michigan boating study (Stynes et al., 1983), follow-up mailings were sent to persons not responding within 10 days after the initial mailing. An additional follow-up mailing was sent if no response was received within 14 days after the first follow-up mailing. Multiple mailings provided a return rate of nearly 67%. In a more recent Michigan boating study (Stynes et al., 1995), a second complete mailing was sent by certified letter to all subjects who had not yet responded, three weeks later after the initial questionnaires were mailed by first-class mail. Around 2,000 responses were received within three weeks of the initial mailing and another 2,277 after the follow-up mailings for overall response rate of 70%.

In a 1995 Oregon boating survey Neely et al. (1998) implemented a four-part mailing procedure based on Salant and Dillman (1994). The mailing consisted of a cover letter, a questionnaire, and a reminder post card. Finally, a follow-up questionnaire was mailed to each addressee who had not yet submitted a completed survey. The Mailings were sent over the course of four successive weeks for overall response rate of 71%. In a 1994 Maryland boating survey (Lipton and Miller, 1995), a postcard was mailed

reminding boaters to return the survey forms, one week later after the initial mailing to obtain a 46% response rate. A second postcard was mailed two weeks later to nonrespondents, and new survey forms were sent to boaters who had not responded after another two weeks. After all follow-up mailings, overall response rate was 60%.

Only a few studies have estimated the regional distribution of boater expenditures to support regional planning of boating. The 1981 Michigan study (Stynes et al., 1983) allocated boater spending to different regions of the state. Trip spending was allocated to regions based upon travel patterns measured in the 1980 boater survey (Stynes and Safronoff, 1982). Average boater spending was split between the origin and destination region. These average spending figures per boat day were then multiplied by boat days from the origin-destination matrix of Stynes and Safronoff (1982) to yield a statewide spending origin-destination matrix for boat trip spending.

To determine counties having a greater concentration of boating expenditures than others, the Maryland study (Lipton and Miller, 1995) allocated spending among counties. Since the questionnaire did not ask about spending location, the authors had to make several assumptions about the county where the spending occurred. They assumed that expenditures on some items such as transportation to launch site and groceries occur in the county in which the boater lives. Expenditures on other items such as boat fuel and dry storage were assumed to occur in the county where the boat launch from. However, if boaters indicated that they went ashore during their boat trip in a county other than the starting county, lodging and restaurant meals were allocated to the county where shore-based purchases were made.

Boater spending is generally divided into three major categories: 1) new and used boat purchases, 2) craft-related spending, and 3) trip-related spending (Stynes et al., 1983; Lipton and Miller, 1995). Craft-related spending includes expenditures for equipment, insurance, repair, storage of the boat, and other related items not directly associated with individual boating trips. Trip-related spending includes all spending related to boating trip such as expenditures on groceries, restaurant meals, auto and boat fuel, and boating and other recreational gear purchased on trips. Spending on boats and craft-related items primarily accrues to boating industries, while trip-related spending benefits a wide range of retail sectors of the economy.

Trip-related spending is generally greater than the expenditures on craft-related items or boat purchases. Stynes et al. (1983) estimated that Michigan's registered boat owners spent over one billion dollars on boating in 1981. Trip-related spending made up 66%, while craft-related spending accounted for 24% of the total. New and used boat purchases accounted for 10% of the measured spending. A Maryland study (Lipton and Miller, 1995) estimated annual boater spending at about $1 billion in 1993. Trip- and craft-related spending were $438 million (43%) and $428 million (42%), respectively. New and used boat sales accounted for $144 million (14%). In a California study, Rust and Potepan (1997) estimated that trip- and craft-related spending amounted to $2.5 billion in 1995. The majority of this spending fell into trip-related categories (69%). Neely et al. (1998) estimated that Oregon's registered boat owners for recreational purpose spent $858 million during the 1995 boating season. About 50% of the total was spent on boat purchases, while trip- and craft-related spending made up 35% and 15% of the total, respectively.

Forecasting Recreation Use

Forecasting plays an important role in most organizations since virtually all planning and decision-making must rely on assumptions about the future (Stynes, 1982a). Choosing a particular forecasting model is a complex decision. In comparing the relative performance of different forecasting techniques, Makridakis (1986) noted that no study has shown a clear superiority of one method over another and there is not any single method which consistently outperformed the remaining methods. Fildes and Lusk (1984) and Witt and Witt, (1995) also argued that the "best" method from the various forecasting competitions is seldom identified. It seems clear that results relating to the relative performance of different forecasting techniques cannot be generalized from other industries to tourism and recreation.

Forecasting methods are usually divided into qualitative and quantitative techniques. Qualitative methods directly incorporate human judgement, while quantitative methods generally employ formal mathematical models. When quantitative models are difficult to apply to situations where variables are hard to quantify and relationships are poorly understood, qualitative techniques are often used (Stynes, 1982b). The Delphi method of forecasting is the qualitative method that have attracted the most attention in the tourism and recreation literature (Moutinho and Witt, 1995; Kaynak and Macaulay, 1994; Var, 1984). This technique obtains expert opinion about the future through questionnaire surveys of a group of experts in the field and is particularly useful for long-term forecasting.

Two of the most widely used quantitative methods to forecast recreation and tourism use are time-series analysis and causal models. Time-series methods estimate

use by extrapolating from use counts, such as visitor days, recreation occasions, permits ,or some other measures of participation. The method determines future values for a single variable through a process of identifying a relationship for past values of the variable (Witt and Witt, 1992). A problem with forecasting by extrapolation is that any alteration in the trend is likely to generate poor forecasts, as it presupposes that the factors which were the main cause of growth in the past will continue to be the main cause in the future.

The lack of good time series data in outdoor recreation has restricted the use of the time series method primarily to simple trend extension (Stynes, 1982b). Selection of an appropriate functional form must be based upon an examination of the historical pattern in the data series and assumptions about the growth process. Various functional forms in time-series methods are surveyed in Witt and Witt (1992). Linear functions assume use grows at a constant rate over time. Exponential functions assume the rate of growth in use is directly related to the number of use. Both exponential and linear functions are unbounded and can lead to absurd results if projections are made too far into the future.

Logistic functions conform more closely to growth processes where constraints to growth or saturation effects are encountered. In the logistic model, growth starts out slowly, increases to maximum growth rate, and then slows down again, eventually approaching a saturation level (Stynes, 1982b). Product life cycle curves follow the logistic trend with an eventual decline at the end of the cycle (Howard and Crompton, 1980). Stynes and Szcodronski (1980) found that for long-range projections many recreation activities follow trends similar to the product life cycle. In simple trend

extension, forecasters must use their judgement in deciding how far into the future a given forecasting model may accurately project. Simple trend extension is generally not recommended for forecasting more than five years into the future (Stynes, 1982b).

There are a number of more sophisticated time series methods which can be found in Archer (1980), Wheelwright and Makridakis (1980), and Frechtling (1996). Evidence shows that simple time-series models seem to perform as well as complex time-series models in forecasting tourist arrivals (Chan et al., 1999; Chan, 1993). Choy (1984) suggested that time-series methods are more likely to perform better than causal models for projection of two years or less. For long-range forecasts, causal models may give better forecasts.

Causal models forecast future recreation use by identifying relationships between use and a set of demographic, socioeconomic, and environmental variables. These relationships are usually identified via econometric analyses and then applied to forecasts of the independent variables to predict future levels of recreation use (Stynes, 1982a). A major advantage of the causal approach is that it explicitly takes into account the impact on demand of changes in the causal variables. An additional advantage with causal forecasting is that it provides several statistical measures of the accuracy and significance of the forecasting equations (Witt and Witt, 1992). Causal models, however, require considerable user understanding in order to develop the correct relationships, and therefore is generally more difficult to use that time-series methods (Witt and Witt, 1992).

Spatial Patterns of Recreational Boating in Michigan

Five major studies that provided a description of the spatial patterns of recreational boating use in Michigan were conducted by Michigan Waterway Division (1965), Chubb and Chubb (1975), Stynes and Safronoff (1982), Talhelm et al. (1988), and Stynes et al. (1995). These studies estimated boating origin-destination patterns using surveys where boaters reported the number of days and location they boated during the season. The findings from these studies provide information on the spatial distribution of boating use. The basic spatial patterns of boating use and flow of recreational boats have been fairly stable over the years.

The studies showed that: 1) boats registered in southeastern Michigan counties generate the majority of boat days in the state, 2) boating opportunities and resources are unevenly distributed across the state, 3) the Upper Peninsula, northern Lower Peninsula, coastal counties and lake areas provide relatively more boating opportunities and thus attract a greater share of boat days from outside the regions, 4) the majority of boat days in southern Michigan counties are accounted for by boats registered in the county or nearby counties, and 5) a comparatively high percentage of boat days in northern Michigan counties are accounted for by boats registered in southern counties.

The 1994 Michigan boating survey (Stynes et al., 1995) provides the most current information on statewide boating use at the county level. The 1994 study adjusted the registration counts by size and county to reflect where boats are stored during the boating season since registration statistics are a misleading indicator of the location of use. Distinct allocation schemes were used to allocate boats within each region and segment to individual counties. For example, boats in Great Lakes marina segments were

distributed according to the county's share of seasonal marina slips in the region. Finally, various boat use parameters estimated by segment from the survey were applied to the distribution of boats by segment for each county.

Stynes et al. (1995) argued that this approach yields much more reliable estimates at the county level than would be obtained through direct cross tabulations of variables by county using the survey data set which are as seen in the previous studies. Boats stored in southeast and inland south regions generate about half of Michigan boat days, and these regions receive 45% of boat days. Northeast and northwest regions received 17% of total boat days and generated about 15% of total boat days in Michigan. An evident south-to-north pattern was found as boat owners residing in the southern part of the state stored their boats in northern counties.

Spatial patterns of recreational boating were also estimated using a model. The RECSYS (Michigan Recreation System) was one of the earliest attempts to model recreational travel flows for use in planning purposes. RECSYS predicts the spatial distribution of recreation demand by simulating the movement of recreation users from origin areas to destinations over the highway travel network (Ellis, 1964). This simulation model assumes that recreational trips to a destination from any origin is some function of a time-distance factor and the attractiveness at the destination. Using RECSYS and boating use data from the 1965 survey (MWD, 1965), Chubb (1967) predicted use at various destinations. Compared with the 1965 survey, Chubb found that the RECSYS simulation retained a 19% standard deviation.

Using the 1994 Michigan boating survey, Wu (1995) developed a system of models for estimating boating use in Michigan counties. The system of models consists

of boat allocation, trip generation and trip distribution models. Registered boats were classified into four different storage segments. Boats in each storage segment are then allocated to the counties where they are stored using a set of allocation models. A trip generation model is used to predict number of boat days in the county of storage. Then those boat days are distributed to the destination counties by trip distribution models for boats at each storage segment.

CHAPTER 3

METHODS

Data for this study were collected through sample surveys of registered boat owners. An in-season survey was utilized to estimate boating activity and trip spending during the 1998 summer. Surveys were sent out in nine waves every week over the summer. At the end of the boating season, two distinct end of season surveys were conducted with smaller samples to evaluate potential nonresponse bias and use estimates from the in-season survey. The boat registration file was used as the sampling frame to adjust the sample to known population characteristics, and to expand estimates from the sample to active boating fleet.

The methods chapter will detail the procedures used to collect and analyze the data presented in this study. The chapter is divided into four sections: 1) sampling design, 2) measurement, 3) data analysis, and 4) end-of-season surveys. The first three sections deal with survey methods and procedures for data analysis associated with the in-season survey. Survey methods, survey response rates, and weighting procedures related to the two season-end surveys are discussed in the fourth sections. Survey response rates, weighting procedures, and test for nonresponse bias for the wave survey will be presented in the results chapter.

Sampling Design

The study population consists of all recreational watercraft with valid Michigan registrations as of July 1, 1998. The computer file of registered watercraft maintained by

Michigan's Secretary of State provides a convenient sampling frame although it includes some expired registrations and a number of boats that were inactive in 1998. After all non-pleasure boats and expired registrations were deleted from the file, a total of 751,012 pleasure craft with valid Michigan registrations in 1998 were obtained and used as the sampling list. The sampling list contains the name and address of the boat owner, county of registration, length of boat, and make of craft.

The population was stratified by five boat size classes and nine sampling regions (Table 1). This stratification follows that of the 1994 study (Stynes et al., 1995) except for the inclusion of personal watercraft (PWC) as a separate category and the merging of two Upper Peninsula regions into a single region. Boat size strata are boats less than 16 feet, 16 to 20 feet, 21 to 28 feet, and greater than 28 feet. PWC are separated as a fifth "size" strata. Boats less than 16 feet account for 43% of the total pleasure craft with valid registrations, followed by boats 16 to 20 feet (33%). PWC and boats 21 to 28 feet contribute equally (11%) to the total fleet. Boats larger than 29 feet account for 3% of the total. Sampling regions are mapped in Figure 1. The study intentionally oversampled larger craft and regions with smaller population sizes to have adequate subsamples to make estimates by size class and region.

A sample of 3,300 boats was selected using a systematic sampling procedure with random start for each stratum (Table 2). The sampling unit is the boat, not the boat owner. Boaters owning more than one registered boat were asked to report only for the boat that was sampled. The length and make of the boat were printed on the mailing label to identify the boat for which the survey was requesting information. By matching

Table 1. Michigan Registered Boats by Region of Registration & Boat Size: 1998

	SIZE OF BOAT (FEET)						
	PWC	< 16' [a]	16 - 20'	21 - 28'	29' +	TOTAL	%
Southeast Michigan	35,448	81,535	86,136	37,325	10,647	251,091	33%
Southwest Michigan	11,237	63,800	42,887	10,240	1,549	129,713	17%
West Central Michigan	12,579	48,017	32,093	8,880	2,407	103,976	14%
Thumb Region	9,545	39,851	30,321	9,775	1,493	90,985	12%
Northeast Michigan	1,843	14,558	9,288	2,801	173	28,663	4%
Northwest Michigan	3,448	30,843	18,089	5,283	847	58,510	8%
Straits	1,326	11,351	6,360	2,156	369	21,562	3%
Upper Peninsula	2,076	19,146	8,037	1,708	267	31,234	4%
Out of State	4,155	13,564	12,214	3,894	1,451	35,278	5%
TOTAL	81,657	322,665	245,425	82,062	19,203	751,012	100%
%	11%	43%	33%	11%	3%	100%	

a. Excludes PWC's.

survey responses with the registration information, it can be verified that subjects reported for the boat that was sampled.

Surveys were sent out in nine waves. The first mailing to 900 registered boat owners was sent on July 24, 1998. Subsequent mailings were sent to groups of 300 subjects each week starting on August 3, August 10, August 17, August 24, August 31, September 7, September 14, and September 21, 1998, respectively. Mailings were stopped after September 20 because recreational boating activity in Michigan declines significantly with the approach of cool weather. Mailings each week were sent out in three micro-waves (i.e., Monday, Wednesday, and Friday) to avoid over-representing weekday or weekend trips in the subjects' report of their "most recent trips". A total of 3,300 questionnaires were sent (Figure 2).

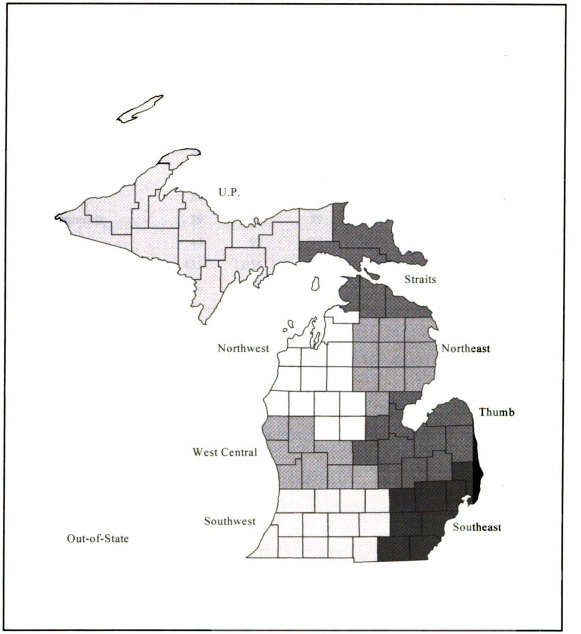

Figure 1. Sampling Regions of Michigan

Table 2. Distribution of the Sample by Region of Registration & Boat Size

	SIZE OF BOAT (FEET)						
	PWC	< 16' [a]	16 - 20'	21 - 28'	29' +	TOTAL	%
Southeast Michigan	83	210	153	131	102	679	21%
Southwest Michigan	49	145	101	93	45	433	13%
West Central Michigan	51	135	102	64	51	403	12%
Thumb Region	47	122	96	59	48	372	11%
Northeast Michigan	38	75	52	53	22	240	7%
Northwest Michigan	58	130	111	75	46	420	13%
Straits	26	58	49	37	24	194	6%
Upper Peninsula	39	88	59	52	36	274	8%
Out of State	44	92	70	43	36	285	9%
TOTAL	435	1,055	793	607	410	3,300	100%
%	13%	32%	24%	18%	12%	100%	

a. Excludes PWC's.

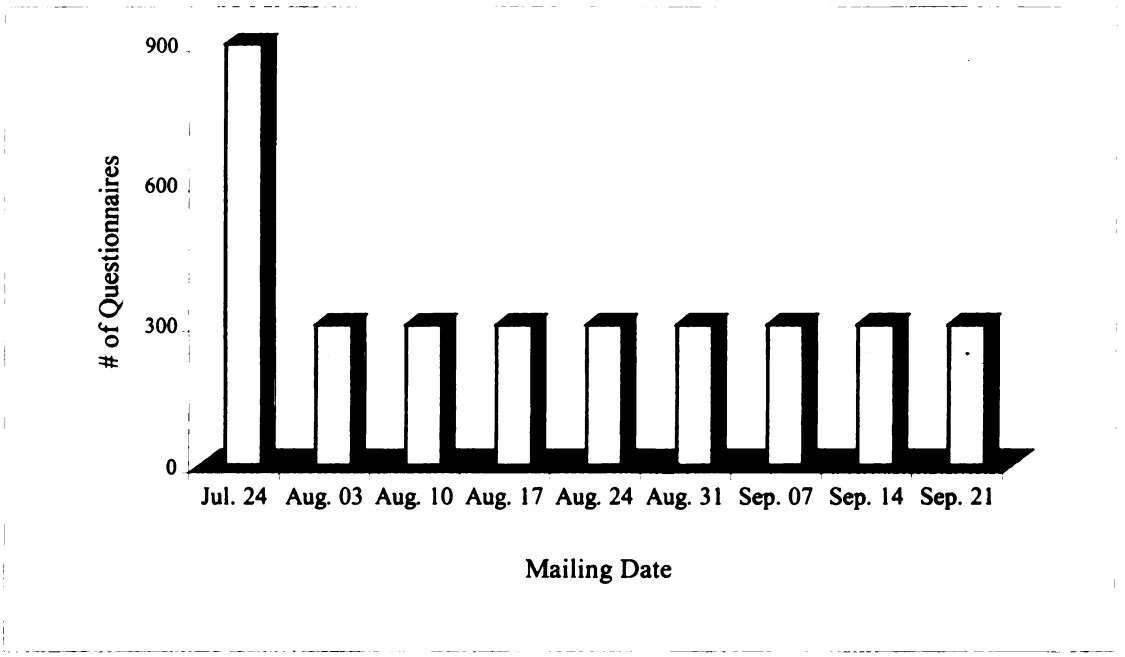

Figure 2. Schedule of Mailings for the Wave Surveys

Follow-up mailings were not made to reduce survey costs and to avoid over-representing late season trips. The same sampling proportions by region of registration and size class were used for each mailing to yield representative samples in each wave, after weighting. As the primary purpose of the surveys was to obtain spending estimate for a recent trip and to estimate boating use up to each point in time, it was important to obtain a sample representative not just of boats, but also of trips throughout the season. Follow-ups surveys would bias the sample more toward end-of-season trips. While this bias could be handled by an additional weighting procedure, the added cost of follow-ups were not justified in terms of potential improvement in the estimates.

Measurement

A self-administrated instrument was chosen for this study. A business reply return address was printed on the questionnaire. The questionnaire was four pages long in booklet form (Appendix A), similar to those used in previous boater surveys. The questionnaire was developed by making adjustments to the 1981 (Stynes et al., 1983) and the 1994 (Stynes et al., 1995) Michigan boater survey instruments. A map presenting Michigan's 83 counties was inserted in the booklet to help respondents identify the counties where they stored and used their boats. A cover letter accompanying the questionnaire explained the survey, noted that participation was voluntary and explained procedures for assuring confidentiality of the responses. Questionnaires were numbered to keep track of the dates the questionnaires were sent out, and to match survey responses with the registration information.

Variables Measured

The variables measured by the questionnaire fall into five groups (Table 3).

1) **Boat characteristics** are used to form subgroups for which spending is estimated. Information on where the boat is kept during the boating season and the use of marinas and launching facilities is required to construct storage segments. Boat length and type of boat are also important to describe boats. To estimate the number of active boats, a question related to inactive boat is added.

2) **Boating use** "so far" in 1998 is asked to estimate annual days of use per boat. Boating use is broken down into total days of boating, days on Great Lakes waters, and additional days not underway. Boating use on Great Lakes waters is defined as any days the boat was underway on the Great Lakes and connecting waterways, including lakes and rivers that provide access to the Great Lakes. Additional use is defined as days the boat was in the water but used at the dock.

3) **Information on the most recent boating occasion** is necessary to describe boating patterns. Length of stay is required to convert spending to a per day basis, and to split spending between day trips and overnight. Boating destination is reported by county and body of water. Party size is also reported.

4) **Boater trip spending** is asked for the most recent trip. A checkbox is included to measure whether or not any spending occurred on the trip. Trip spending is estimated in eleven categories to identify which sectors of the economy benefit from boater spending. The spending questions split trip spending between "near home-within 20 miles" and "away from home" to estimate the flows of boater spending among regions.

Table 3. Variables Measured in the Wave Survey

Variable	Questionnaire Number
1. INFORMATION ABOUT BOAT	1 - 7
Number of boats owned, Craft type, Length, Years owned, County where boat is kept, Type of storage facility (permanent residence, cottage or second home, public marina, commercial marina, owned space in marina or dockaminium, yacht/boat club, and other), Location of storage facility (a waterfront site with access to the Great Lakes, an inland lake waterfront site, a river or stream waterfront site, and a nonwaterfront site), Type of facility during the non-boating season, Boat inactive.	
2. USE of BOAT	8 – 9
Days used, Days used on the Great Lakes, Days not underway.	
3. MOST RECENT BOATING OCCASION	10 – 15
Descriptions of the most recent boating occasion, Date of the occasion, County of use, Great Lakes use, length of stay, Party size.	
4. SPENDING ON THIS MOST RECENT OCCASION	16 - 17
Whether or not to spend, Spending on Boat fuel, Temporary dockage, Launch fee, Repair & maintenance spending related trip, Marine supplies, Restaurant, Groceries, Auto gas, Shopping, Recreation, and Other expenses, Spending evaluation.	
5. CRAFT OWNER INFORMATION	19 – 23
County, State, and Zipcode of residence, Age of owner, Household size, Level of income, County of seasonal home.	

5) **Boater characteristics** are used to describe boat owners who registered their boats in Michigan. Variables are age of boat owner, level of income, years boat owned, household size, whether the boater owns a seasonal second home, and residence location.

Handling of Zeros and Missing Data

Previous surveys have encountered difficulties in distinguishing missing spending data from no spending. A speculation is that boaters would be more likely to report overnight or extended trips that may not be their most recent trips. This could be particularly the case when they are asked to report spending, as no trip spending is necessarily involved when boating from a waterfront home. The questionnaire was designed to clearly define what a trip was and to make it easier to explicitly report no spending via a checkbox (Figure 3).

16. Did you spend any money on this boating occasion? ☐ YES ☐ NO (skip to question 18)

↓

16a. If Yes, please report how much money you spent within each of the following categories. Report spending near your permanent or seasonal home in the first column and spending away from home (more than 20 miles from home) in the second column. If you are boating from a waterfront home, report spending on any items bought specially for this outing (e.g. boat gas, groceries etc.). If boating away from home, report all expenses on this trip.

SPENDING ON YOUR MOST RECENT BOATING OCCASION
(enter zero if you did not spend anything in a particular category)

	NEAR HOME	AWAY FROM HOME
BOAT EXPENSES		
Boat Fuel and oil	$_____	$_____
Temporary dockage	$_____	$_____
Pump-out & launch fees	$_____	$_____
Repair and maintenance	$_____	$_____
Marine supplies	$_____	$_____
PERSONAL EXPENSES		
Restaurant meals and drinks	$_____	$_____
Groceries & take out food & drink	$_____	$_____
Auto gas and oil	$_____	$_____
Shopping & souvenirs	$_____	$_____
Recreation & entertainment	$_____	$_____
Other expenses	$_____	$_____

Figure 3. Spending Questions

Missing values related to expenditure variables require special attention. Average spending estimates can be quite sensitive to how missing data are treated. To handle this problem, the study employed a filter question asking the boater to answer "yes" or "no" to a question of whether spending occurred or not before reporting the amounts spent. This procedure is expected to separate out zero expenditures from missing values by assuming that a "no" on the checkbox (# 16) and blanks on the second questions (# 16a) indicate true zeros, and blanks on the first and also blanks on the second questions indicate missing values.

Of the 394 respondents who left the spending question (16a) blank, 368 (93%) checked "no" to question 16. Only 26 (7%) of the respondents left both 16 and 16a blank (Table 4). These were treated as missing and eliminated from the spending analysis.

Table 4. Missing and Zero Responses to Spending Question

	SPEND ANY MONEY ON THIS OUTING ?			
	Yes	No	Blank	TOTAL
SPENDING REPORTED				
Non-zero reports	492	22 [a]	63	577
Blank	0	368	26	394
TOTAL	492	390	89	971

a. Twenty two respondents who reported "no" spending on their most recent trips wrote "$0" on the second question.

Data Analysis

The returned questionnaires were coded as they were received using an Access program designed for data entry. Ranges were specified to define valid responses for each variable in the file. Based on this procedure, the probability of entry/coding errors could be reduced. Extensive and time-consuming procedures for data cleaning were followed to check illogical response values.

The questionnaire for the wave survey asked about the most recent trip. Five boaters who reported more than 30 days on the most recent boating outing were eliminated from the spending analysis. Respondents spending more than $2,000 a trip or more than $500 a day (17 cases) were also eliminated from the spending analysis as analysis showed that these trips are very unique and severely impact (20% more per day spending when included) on mean spending. Some boaters apparently reported annual dockage expense instead of the temporary dockage fee. If a dockage fee was greater than $30*number of nights on this outing, it was replaced with zero (26 cases).

The study defines a boat day as any day or portion of a day spent actually in the water under power or sail. The questionnaire also asked to report days of additional use at the dock or mooring without being underway. The additional days were not included as a boat day because there was no evidence indicating that an additional day was involved in actual boating activity. Around 20% of active registered boats in Michigan reported that their boat was involved in at least one day of additional use "so far". However, only 0.4% of the total fleet reported that the boats were used at the dock or mooring without getting underway on the most recent trips.

Formation of Storage Segment

Boats were assigned to one of four segments based on "type of storage facility" (permanent residence, cottage or second home, public marina, commercial marina, owned space in marina, and yacht club) and "type of storage location" (Great Lakes waterfront, inland lake waterfront, river or stream waterfront, and nonwaterfront sites). Boats kept at "other" types of storage facilities, and cases with missing storage information are excluded from the classification. The resulting segments are (1) marina: boats stored at one of public marina, commercial marina, owned space in marina, and yacht club, (2) waterfront primary home: boats stored at permanent residence located in waterfront sites (3) waterfront seasonal home: boats kept at cottage or second homes located in waterfront sites, and (4) nonwaterfront home: boats stored at cottage, second homes, or permanent residence located in nonwaterfront sites.

Estimation of Boater Trip Spending by Storage Segment

For a given segment, total trip spending per boat is computed as: days of use per boat * spending per day = days on day trips * average spending on day trips + days on overnight trips * per day spending on overnight trips. Total trip spending for each storage segment is then obtained by multiplying the total trip spending per boat by the number of active boats for the given segment. Total trip spending for each storage segment is then summed over the segments to yield statewide total spending. Note that spending is split between spending on days and overnight trips to apply distinct spending profiles to each type of boating trip and provide more accurate estimates of trip spending.

The parameters that must be estimated are the average days of use per boat and the average per day spending on boating trips.

A boat day is defined as any day or portion of a day spent actually in the water under power or sail. Annual days of use can not be obtained directly from the wave surveys as boaters were asked to report activity in mid-season. Annual use per boat was estimated by extrapolating from in-season estimates to year-end totals. Average days of use "so far" in the year were estimated for the fleet as a whole at nine points during the summer. A logistic curve was fit to these nine points to estimate a relationship between days of use and the point in season where use was measured..

Test for Measures of Variables across Storage Types

Differences in boating activity and spending across the four storage types were tested. The variables selected to test boating activity included boat days, Great Lakes boat days, percent of overnight trips, boat days per trip, and type of boating destination between the Great Lakes and inland lake. The variables associated with spending on trip included percent of trips with no spending, average spending per trip, and spending per day. Statistical tests were also applied to test for differences in boat owner- and boat-related variables (age, number of boats, household income, seasonal home ownership, craft type, size of boat, years of boat owned, storage location). One-way ANOVA was employed to test interval-level variables (those for which means are compared), while χ^2 tests were calculated for nominal-level variables (those where distribution of responses were compared).

Estimation of Regional Flows of Trip Spending

In assessing the economic effects of boater trip spending upon region of the state, spending of non-local residents who are attracted to the area must be identified. The net gains and losses to each region of the state from boater spending can be estimated based on boater origin-destination patterns and the per day spending estimates. Boaters who live in region A and boat in region B represent a loss of dollars to region A and a gain to region B. The net flows for any region R are computed by estimating (1) spending by origin (region of residence) = all spending on boating trips by residents of region R and (2) spending by destination region = all boater trip spending that takes place in region R. The difference between the two is the net gain or loss to the region. Notice that local boater spending (spending by boaters on trips within the region where they live) is included in both the origin and destination spending estimates and cancels out when the two are subtracted.

Spending by origin region is estimated by multiplying the number of active craft registered in the region by the average days per boat and then the average spending per boat day. This calculation is carried out separately for each storage segment to capture regional differences in the numbers of craft, days of use, and spending across storage segments. Similarly, spending by destination region is computed for each storage segment from the estimates of boat days taking place in each region. Boat days within the region are multiplied by the average spending per day for each segment. For boaters on trips originating from outside the region, only spending "away from home" is included. Their "near home" spending is allocated to the region where they live. For boating activity from within the region both the "near home" and "away from home"

spending is included. For boaters using seasonal homes, the "near home" spending is allocated to the region where the boat is stored, i.e., the region where the seasonal home is located.

This procedure takes into account differences in use patterns and spending across storage segments, but assumes no regional variation in either the average days of use or per day spending within a given storage segment. Regional flows are also computed for individual spending categories (food, gas, etc.) capturing which items tend to be bought at home or at boating destinations.

The procedure to estimate the regional flows of boater spending can be operationalized as follows. Total trip spending by origin is calculated by the following equation:

(1) $ORIGIN_i^k = r_i^k * d_i * s_i$,

where

$ORIGIN_i^k$ = trip expenses by boaters in storage segment i who live in region k,

r_i^k = number of boats in segment i owned by residents of region k,

d_i = average days of use of boats in segment i, and

s_i = average spending per day for segment i.

Spending by destination is composed of spending "near home" by residents of the region and spending "away from home" by boater from other regions. For boaters in the seasonal home segment, "near home" spending is assumed to take place in the region where the boat is stored. For spending by residents of the region:

(2) $DESTR_i^k = r_i^k * d_i * s_i^1$,

where

$DESTR_i^k$ = trip spending by residents in storage segment i in residence region k,

r_i^k = number of boats in segment i owned by residents of region k,

d_i = average days of use of boats in segment i, and

s_i^1 = average "near home" spending per day for segment i.

For spending occurred in destination region:

(3) $DESTD_i^k = D_i^k * s_i^2$,

where

$DESTD_i^k$ = spending occurred in destination region k by boater in storage segment i.

D_i^k = number of total use days of segment i in destination region k, and

s_i^2 = average "away from home" spending per day for segment i.

Total spending of storage segment i by destination region k is expressed as:

(4) $DEST_i^k = DESTR_i^k + DESTD_i^k$.

The regional flow of boater trip spending for a given segment i is the difference between $DEST_i^k$ and $ORIGIN_i^k$:

(5) $NETGAIN_i^k = DEST_i^k - ORIGIN_i^k$.

A negative value of $NETGAIN_i^k$ means that region k is a contributor of boating trip dollars to other regions in the state for segment i, whereas a positive value indicates that the region benefits from trip purchases by boaters in segment i who live in other regions, including out-of-state.

Regional net gains of boater dollars for spending category j, $NETGAIN_j^k$, is expressed as follows:

(6) $$NETGAIN_j^k = r^k * d * s_j^1 + D^k * s_j^2 - r^k * d * s_j, \qquad s_j = s_j^1 + s_j^2,$$

where

r^k = number of boats owned by residents of region k,

d = average days of use of boats,

D^k = number of total use days in destination region k,

s_j^1 = average "near home" spending per day for spending category j,

s_j^2 = average "away from home" spending per day for spending category j, and

s_i = average spending per day.

Regional flows of boater monies in different spending categories can help to identify which sectors of the region's economy benefit from boater spending.

End of Season Surveys

Two separate year-end surveys were employed to evaluate nonresponse bias (nonrespondent survey) and to compare the in-season use estimates with the end-of-season survey (independent survey). The same format and questions were used for these two surveys and the questionnaire was condensed by selecting the variables associated with boat and boater characteristics and boating use (Appendix B). Questionnaires were numbered to match survey response with the registration information. For the independent survey, this procedure especially was necessary to design follow-up mailing to those who not responded.

Nonrespondent Survey

For the nonrespondent survey a total of 500 boats were taken from boaters not responding to the wave surveys by October 1. The samples were selected from the 1,530 nonrespondents who were included in the first through seventh waves of the in-season survey. Mailings to nonrespondents were sent on October 12, 1998. The year-end survey of 500 nonrespondents resulted in a total of 82 responses for a response rate of 16 percent. Twelve boat owners indicating that their boats were not used in Michigan waters in 1998 were omitted to result in a sample of 70 boats for the analysis used to test nonresponse bias (Table 5).

Independent Survey

Another independent sample of 500 boats was sampled from the population of 751,012 recreational craft with valid Michigan registration. Mailings to this sample were sent on October 12, 1998. Follow-up mailings were sent to persons not responding within three weeks after the initial mailing to increase the response rate. This survey resulted in 201 responses out of 500 samples for a response rate of 41 percent. This response rate was slightly higher than the in-season survey, and substantially higher than the nonrespondent survey. Twelve boat owners (6%) reported that their boats were not used in Michigan waters in 1998 (Table 5). Deleting these inactive boats resulted in a sample of 189 active boats to estimate annual days of use per boat.

The two end-of-season samples were combined to estimate days of use. A total sample of 259 active boats were obtained from the two end-of-season surveys. The distribution of the sample by boat size and region is presented in Table 6. In the same

Table 5. Survey Response Rate (Season-end Surveys)

	Nonrespondent Survey			Independent Survey		
	N	% Total	% Deliverable	N	% Total	% Deliverable
Total Questionnaires Mailed	500	100.0%		500	100.0%	
Not Deliverable	0	0.0%		9	1.8%	
Delivered	500	100.0%	100.0%	491	98.2%	100.0%
Returned Surveys	82	16.4%	16.4%	201	40.2%	40.9%
Active Boats	70	14.0%	14.0%	189	37.8%	38.5%
Inactive Boats	12	2.4%	2.4%	12	2.4%	2.4%
Nonresponse	418	83.6%	83.6%	290	58.0%	59.1%

Table 6. Sample of Active Boats by Region & Boat Size (Season-end Surveys)

	SIZE OF BOAT (FEET)						
	PWC	< 16'	16 - 20'	21 - 28'	29' +	TOTAL	%
Southeast Michigan	4	5	15	12	9	45	17%
Southwest Michigan	2	6	8	9	7	32	12%
West Central Michigan	4	6	11	6	8	35	14%
Thumb Region	3	2	9	5	7	26	10%
Northeast Michigan	2	6	7	6	2	23	9%
Northwest Michigan	0	8	11	8	10	37	14%
Straits	0	3	6	2	2	13	5%
UP	2	5	4	5	4	20	8%
Out of State	3	7	11	3	4	28	11%
TOTAL	20	48	82	56	53	259	100%
%	8%	19%	32%	22%	20%	100%	

Table 7. Weights for Active Registered Boats (Season-end Surveys)

	SIZE OF BOAT (FEET)				
	PWC	< 16'	16 - 20'	21 - 28'	29' +
Southeast Michigan	8,656	13,033	5,129	2,901	1,123
Southwest Michigan	5,488	8,498	4,788	1,061	210
West Central Michigan	3,072	6,396	2,606	1,381	286
Thumb Region	3,108	15,924	3,009	1,824	203
Northeast Michigan	900	1,939	1,185	435	82
Northwest Michigan	-	3,081	1,469	616	80
Straits	-	3,024	947	1,006	175
UP	1,014	3,060	1,795	319	63
Out of State	1,353	1,549	992	1,211	344

manner as for the in-season survey, weights were applied to adjust the active sample to the active population of registered watercraft in 1998 (details in the result chapter) (Table 7).

CHAPTER 4

RESULTS

Survey response rate, weights, and test for nonresponse bias for the wave surveys are presented first in this result chapter. Corresponding to the three objectives of the study, the results are presented in three sections. In section two, total days of use and trip spending are estimated on a statewide basis and also by storage segment. Four storage segments are constructed. Sampling errors for spending estimates are reported. The estimates of annual days of use from the wave survey are compared to those from the year-end survey. In section three, differences in the variables associated with spending and use, demographics, and boat-related characteristics across storage segments are tested. In section four, regional flows of boater trip spending are estimated for ten subregions of the state. Spatial distributions of boat and boat days are estimated. The regional flows are presented by storage segment and spending category.

Survey Responses, Weights, and Nonresponse Bias

Survey Response Rate

A total of 1,170 responses out of 3,300 samples were received by October 30, 1998 (Table 8). The response rate was 34.3 percent of the deliverable surveys (1.7 percent of mailings were returned as undeliverable). About 10 percent (113 responses) of the boat owners returning usable surveys indicated that their boat was not used in Michigan waters in 1998. Another 27 boaters indicated that they did not wish to participate in this survey and 2 boaters returned blank surveys. After omitting inactive

Table 8. Survey Response Rate

	TOTAL QUESTIONNAIRE MAILED		
	N	% of Total	% of Deliverable
Total Questionnaires Mailed	3,300	100.0%	
Not Deliverable	57	1.7%	
Delivered	3,243	98.3%	100.0%
Returned Surveys	1,113	33.7%	34.3%
Active Boats	971	29.4%	29.9%
Inactive Boats	113	3.4%	3.5%
Non-usable Questionnaire	29	0.9%	0.9%
Nonresponse	2,130	64.5%	65.7%

craft and unusable returns, a sample of 971 boats are available for the analyses.

Rates of response are slightly lower than average in southeastern Michigan and the Upper Peninsula and slightly higher in three northern regions in Michigan (Table 9). Owners of smaller boats less than 16 feet including PWC were less likely to respond than owners of boats greater than 16 feet. Weighting procedures adjust for differences in response rates, as well as the different sampling rates in each strata.

Weights

Because the sample was drawn disproportionately across regions and size categories and the response rate was not uniform across regions and size class, weights are needed to adjust the final sample of completed boater surveys to the population. Completed sample sizes range from 198 in southeastern Michigan to 71 in the straits region (Table 10). Weights are calculated by dividing the number of active boats by

region and size categories in the population by the corresponding cell counts in completed samples. A total of 751,012 pleasure craft were registered in 1998 in Michigan. This number, however, includes unknown number of boats that were inactive in 1998. Thus, total number of active boats that were involved in any day of boating activity must first be estimated to obtain appropriate weights.

Table 9. Response Rates by Region of Registration & Boat Size

	Mailings	Returns	Undeliverable	Response Rate [a]
SAMPLING REGION				
Southeast Michigan	679	202	8	30%
Southwest Michigan	433	142	2	33%
West Central Michigan	403	134	5	34%
Thumb Region	372	124	8	34%
Northeast Michigan	240	94	7	40%
Northwest Michigan	420	157	11	38%
Straits	194	75	4	39%
UP	274	82	4	30%
Out of State	285	103	8	37%
BOAT SIZE CLASS				
PWC	435	87	8	20%
< 16'	1,055	259	15	25%
16 - 20'	793	346	20	45%
21 - 28'	607	258	9	43%
29' +	410	163	5	40%
TOTAL	3,300	1113	57	34%

a. Response rate = return / (mailings - undeliverable).

Table 10. Completed Sample of Boats by Region of Registration & Boat Size

	SIZE OF BOAT (FEET)						
	PWC	< 16'	16 - 20'	21 - 28'	29' +	TOTAL	%
Southeast Michigan	13	44	62	46	33	198	18%
Southwest Michigan	6	38	44	33	20	141	13%
West Central Michigan	10	28	49	27	19	133	12%
Thumb Region	12	24	30	31	19	116	11%
Northeast Michigan	9	18	22	32	8	89	8%
Northwest Michigan	12	36	51	34	22	155	14%
Straits	5	19	19	18	10	71	7%
UP	10	23	20	16	14	83	8%
Out of State	9	19	40	16	14	98	9%
TOTAL	86	249	337	253	159	1,084	100%
%	8%	23%	31%	23%	15%	100%	

Active Boats

Respondents reported whether the boat has been put in the water in Michigan in 1998. Inactive craft are defined as boats that had not been put in the water in Michigan as of the survey date. Boaters that had not used their boat at the time being asked were assumed to be unlikely to use it by end of the season. About a tenth of all boaters returning a survey indicated they had not yet used the boat (Table 11). The percentage of boats that were inactive ranged from 20 percent for boats under 16 feet in length to 2 percent for personal watercraft.

A raw (unweighted) rate of activity for each size class was applied to the number of registered craft to yield a population of active craft. The rate of inactivity by size class in Table 11 was applied to the number of registered boats in the corresponding size in

Table 1. About 99,000 boats out of 751,000 registered craft in Michigan were estimated to be inactive in 1998, 13 percent of all registered boats in Michigan in 1998. Consequently, the number of active boats was estimated to be 651,623 (Table 12).

Table 11. Percentage of Registered Boats Inactive (Sample) [a]

	Inactive Boats	Active Boats	Total Returns	% Inactive
PWC	2	84	86	2%
< 16'	50	199	249	20%
16 - 20'	36	301	337	11%
21 - 28'	17	236	253	7%
29' +	8	151	159	5%
TOTAL	113	971	1,084	10%

a. Figures in the last column represent unweighted percentages. Assumes that rate of inactivity within size classes does not vary by region.

Table 12. Registered Boats Inactive in 1998 (Population)

	Inactive Boats	Active Boats	Total Boats	% Inactive
PWC	1,899	79,758	81,657	2%
< 16'	64,792	257,873	322,665	20%
16 - 20'	26,218	219,207	245,425	11%
21 - 28'	5,514	76,548	82,062	7%
29' +	966	18,237	19,203	5%
TOTAL	99,389	651,623	751,012	13%

Weights for Active Boats

The distribution of boats in the population by size and county of registration is known, so the study can adjust for the disproportionate sampling to provide estimates that will represent the active registered boating fleet as a whole. Weights are assigned for each boat size class and region to expand the final completed active sample to the active population of registered watercraft. These weights are derived by dividing the cell counts in Table 13 by the number of completed active surveys in each corresponding category from Table 14. Resulting weights are presented in Table 15. Total numbers of active boats are then obtained by applying these weights to the completed active sample. This procedure yields a population of 652,000 active pleasure craft with valid registrations. The sample matches the active boat population by region of registration and size.

Table 13. Active Boats by Registration Region & Boat Size (Population)

	SIZE OF BOAT (FEET)						
	PWC	< 16'	16 - 20'	21 - 28'	29' +	TOTAL	%
Southeast Michigan	34,624	65,163	76,935	34,817	10,111	221,649	34%
Southwest Michigan	10,976	50,989	38,306	9,552	1,471	111,293	17%
West Central Michigan	12,286	38,375	28,665	8,283	2,286	89,895	14%
Thumb Region	9,323	31,849	27,082	9,118	1,418	78,790	12%
Northeast Michigan	1,800	11,635	8,296	2,613	164	24,508	4%
Northwest Michigan	3,368	24,650	16,157	4,928	804	49,906	8%
Straits	1,295	9,072	5,681	2,011	350	18,409	3%
UP	2,028	15,301	7,178	1,593	254	26,354	4%
Out of State	4,058	10,840	10,909	3,632	1,378	30,818	5%
TOTAL	79,758	257,873	219,207	76,548	18,237	651,623	100%
%	12%	40%	34%	12%	3%	100%	

Table 14. Sample of Active Boats by Region & Boat Size

	SIZE OF BOAT (FEET)						
	PWC	< 16'	16 - 20'	21 - 28'	29' +	TOTAL	%
Southeast Michigan	12	37	56	45	32	182	19%
Southwest Michigan	5	32	39	29	20	125	13%
West Central Michigan	10	22	45	27	19	123	13%
Thumb Region	12	16	27	30	19	104	11%
Northeast Michigan	9	14	20	29	6	78	8%
Northwest Michigan	12	30	44	31	19	136	14%
Straits	5	15	19	17	10	66	7%
UP	10	18	15	14	12	69	7%
Out of State	9	15	36	14	14	88	9%
TOTAL	84	199	301	236	151	971	100%
%	9%	20%	31%	24%	16%	100%	

Table 15. Weights for Active Registered Boats

	SIZE OF BOAT (FEET)				
	PWC	< 16'	16 - 20'	21 - 28'	29' +
Southeast Michigan	2,885	1,761	1,374	774	316
Southwest Michigan	2,195	1,593	982	329	74
West Central Michigan	1,229	1,744	637	307	120
Thumb Region	777	1,991	1,003	304	75
Northeast Michigan	200	831	415	90	27
Northwest Michigan	281	822	367	159	42
Straits	259	605	299	118	35
UP	203	850	479	114	21
Out of State	451	723	303	259	98

Weights for Boat Owners

When describing boat owners as compared to boats, the sample must be adjusted for multiple boat ownership. The 652,000 active boats were owned by 458,000 boat owners. Boaters owning more than one registered boat would have a greater chance of being selected in the sample than owners of a single boat, so cases were weighted inversely to the number of boats owned. About 70 percent of the boat owners having at least one active boat registered in Michigan in 1998 own single boats, while 23 percent own two boats and 8 percent more than two (Table 16).

Table 16. Boat Ownership by Number of Boats Owned [a]

Number of Boats Owned	%	Number of Owners
1 boat	69%	316,281
2 boats	23%	103,340
3 boats	6%	28,219
4 or more boats	2%	9,859
SUM	100%	457,698

a. Unit of analysis in this table is the boat owner. The sample of boats was weighted inversely to the number of boats owned by each respondent.

Test for Nonresponse Bias

As use and spending varies considerably with boat size and storage, and possibly region (e.g., shorter season up north), the existence of nonresponse bias in these variables would threaten the external validity of survey results. Since weights were applied to

adjust the final sample to the known region and boat size distribution in the population of active craft, nonresponse bias would not be a problem for these variables. For example, PWC's had lower response rates, but this bias is corrected in weighting. The weights also should correct for nonresponse bias in storage, as storage is closely related to boat size. The remaining biases after weighting are likely to be related to inactivity and bias in spending estimates due to possible biases in reporting of the most recent trips.

While the survey explicitly clarified inactive craft in the questionnaire, it is likely that owners of inactive boats were less likely to return the survey. This would bias the estimates of the number of active craft upward, which would inflate overall use and spending estimates. The sample from the season-end survey of non-respondents was compared to the sample of respondents in the wave surveys. A hypothesis tested is that key variables of respondents are no different from those of nonrespondents. The χ^2 test was used to identify differences between respondents and nonrespondents. The selected variables compared are inactivity, boat type, age of boat owner, number of boats owned, household income, and seasonal home ownership in Michigan (Table 17). The variables are all ordinal-level.

There are no significant differences between the respondents and the nonrespondents in any of the variables selected for the test. The null hypothesis of no difference between respondents and nonrespondents can not be rejected at the 0.01 level of significance. As a result, the test provides no conclusive evidence of nonresponse bias.

Since the number of nonrespondents is small, the statistical tests for nonresponse bias still may only compare late or reluctant respondents to early respondents.

Table 17. Differences between Respondents & Nonrespondents

	Respondents	Nonrespondents	χ^2	*P* value
INACTIVITY RATE	N=1,084	N=82	χ^2=1.41	0.235
% of Boat Inactive	10.4%	14.6%		
TYPE OF BOAT	N=962	N=53	χ^2=7.36	0.195
Inboard [a]	32.5%	35.8%		
Outboard	29.9%	35.8%		
Sail	8.7%	15.1%		
Pontoon	15.7%	7.5%		
Canoe/row	4.4%	1.9%		
PWC	8.7%	3.8%		
AGE OF BOAT OWNER	N=971	N=70	χ^2=5.42	0.367
younger than 41	16.6%	17.1%		
41 – 50	24.8%	32.9%		
51 – 60	26.1%	28.6%		
61 – 65	10.8%	4.3%		
66 – 70	9.1%	8.6%		
older than 70	12.7%	8.6%		
BOATS OWNED	N=796	N=62	χ^2=1.24	0.539
1	45.7%	43.5%		
2	32.8%	29.0%		
3 or more	21.5%	27.4%		
HOUSEHOLD INCOME	N=870	N=58	χ^2=5.29	0.381
under $20,000	6.0%	1.7%		
$20,000-$39,999	17.8%	13.8%		
$40,000-$59,999	19.4%	29.3%		
$60,000-$99,999	32.3%	34.5%		
$100,000-$149,999	12.8%	10.3%		
over $150,000	11.7%	10.3%		
SEASONAL HOME IN MI	N=967	N=68	χ^2=0.48	0.488
yes	66.5%	70.6%		

a. In/Outboard is included.

Respondents were directly compared to the population as an alternative for determining nonresponse bias. Since the sample of respondents is weighted to reflect differential sampling rates across region and boat size categories, the variable of boat type was compared between the respondents and the population. Note that this method does not directly test for nonresponse bias on the survey item. The distribution of boat types for the population was directly computed from all 751,012 recreational boats with valid Michigan registration in 1998 and compared to that of the respondents (Table 18). The result shows that there is a fairly close agreement between the two distributions, indicating no nonresponse bias on this variable.

The extent of the bias in reporting of spending related to recent trips is unknown. The procedures employed in this study likely reduced this bias, but did not eliminate it. If longer trips with larger spending were more likely to be reported, spending estimates will be biased upward. Trips might be better represented if they were directly sampled via on-site survey, although problems in obtaining representation across the wide range of potential boating sites would likely create even greater potential for bias.

Table 18. Comparison of Boat Type between Sample and Population

	Sample	Population
Inboard [a]	22%	22%
Outboard	42%	43%
Sail	4%	5%
Pontoon	10%	10%
Canoe/Row	9%	9%
PWC	12%	11%
Number of Observations	971	751,012

a. In/Outboard is included.

Storage Segment, Boat Owners, and Boats

Storage Segment

Four storage segments were constructed based on "type of storage facility" and "type of storage location". Boats are classified first based on the type of storage facility (Table 19). The majority (64%) of the fleet are stored at permanent homes and 26% are kept at seasonal homes including cottages. Only 7% of the total registered boats are kept at marinas including yacht/boat club. Boats are also classified by the type of storage location. The majority of the fleet are stored at nonwaterfront sites (43%) or inland lakes waterfront sites with no Great Lakes access (39%). Boats stored at waterfront sites with access to the Great Lakes account for 16% of the total craft registered in Michigan.

Table 19. Boat Classification by Storage Facility & Location

Type of Boat Storage by Facility and Location	%
TYPE OF FACILITY	
Permanent residence	63.8
Cottage or second home	25.7
Public marina	1.4
Commercial marina	2.5
Owned space in marina	0.8
Yacht/boat club	1.8
Other	3.9
	100.0
TYPE OF LOCATION	
A waterfront site w/ access to the Great Lakes & connecting waters	15.6
An inland lake waterfront site (no Great Lakes access)	39.3
A river or stream waterfront site (no Great Lakes access)	2.2
A nonwaterfront site	42.9
	100.0

a. The sample of boats was weighted to the number of active boats registered in Michigan.

The resulting segments are marina, waterfront primary home, waterfront seasonal second home, and nonwaterfront home (Table 20). Forty-two percent of the fleet registered in Michigan are stored at nonwaterfront sites. Boats kept at waterfront primary and seasonal second homes account for 28% and 23%, respectively. Boats kept at marina account for 7% of the total fleet.

Table 20. Distribution of Storage Segments for Sample and Population [a]

	Sample		Population	
	Number of Boats	%	Number of Boats	%
Marina	166	18.0	44,758	6.9
Waterfront Primary Home	263	28.5	180,964	27.8
Waterfront Seasonal Home	208	22.6	151,030	23.2
Nonwaterfront Home	285	30.9	274,871	42.2
SUM	922	100.0	651,623	100.0

a. Case with missing storage facility or storage location information were excluded from the analysis, but population estimates were adjusted to yield the total number of registered active boats within each segment.

Descriptions for Boat Owners

Boat owners' socioeconomic characteristics are compared among the different storage segments (Table 21). Boat owners are considerably older than Michigan's population and have significantly higher incomes. The median age of boat owners is 50

and the median household income is just over $60,000 a year. Sixty-five percent of all boat-owing households have no children residing in the household. About 70% of the boat owners own a single boat, while 23% own two boats and 8% more than two. Approximately 30% of boat owners own seasonal homes.

Owner characteristics vary significantly with type of boat storage. Age, number of boats, household income, and seasonal home ownership differ significantly across storage types at the 0.01 level. Around 45% of the boat owners in waterfront seasonal home segment are over 60 years of age, compared with 20% of boat owners storing their boats at nonwaterfront home. Almost half of the boat owners who keep the boats at waterfront homes own more than one boat, while only 20% of the boaters in marinas and nonwaterfront homes possess more than one boat. Boat owners in marina segment have the highest incomes, followed by boaters storing their boats at waterfront homes. The average numbers of children and adults in the household also differ among the segments at the 0.05 level.

Boat-related Characteristics

The active registered fleet is made up mostly of smaller craft (Table 22). About 85% of all active boats are 20 feet or less in length. Only 3% of registered craft are over 28 feet. More than 40% of all registered boats are outboards, followed by inboards (including in/outboard) which takes up 22% of the fleet. PWC makes up 12% of the fleet and pontoon 10%. More than 50% of the registered active boats have been owned 5 years or less, while 8% of the boats have been owned more than 20 years. More than 80% of boats are kept at inland lakes waterfront or nonwaterfront sites. Boats stored at

waterfront sites with access to the Great Lakes account for 16% of the fleet. Only 2% of active registered boats are kept at river or stream waterfront sites.

Boat type and size vary significantly with type of boat storage. All measured boat characteristics are significantly different among the segments at the 0.01 level except years of boat ownership. About 65% of boats kept at nonwaterfront sites are less than 16 feet long, including PWC. More than three fourths of boats kept at marinas are longer than 20 feet and 17% of boats at waterfront primary home are larger than 20 feet. Almost 60% of boats at marinas are inboards (or in/outboard), while 60% of boats stored at nonwaterfront sites are outboards. Pontoon and outboard boats are used most popularly by boat owners in waterfront primary home. About 83% of boats stored at marina are connected with the Great Lakes, while more than three fourths of boats at waterfront homes are located in inland lakes.

Table 21. Boat Owner Characteristics by Storage Segment: 1998 [a]

	Total	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	F or χ^2	P Value
			column percent				
AGE OF BOAT OWNER	N=922	N=166	N=263	N=208	N=285	χ^2=65.97	0.000
younger than 41	25%	20%	19%	7%	35%		
41 – 50	26%	28%	21%	25%	28%		
51 – 60	20%	20%	27%	24%	16%		
61 – 65	11%	17%	9%	23%	7%		
66 – 70	7%	7%	7%	9%	7%		
older than 70	10%	7%	16%	12%	7%		
	100%	100%	100%	100%	100%		
CHILDREN IN HOUSE	N=922	N=166	N=263	N=208	N=285	χ^2=21.07	0.049
0	65%	62%	67%	70%	63%		
1	12%	15%	14%	14%	10%		
2	14%	16%	11%	12%	17%		
3	6%	6%	8%	2%	7%		
4 or more	2%	1%	1%	1%	3%		
	100%	100%	100%	100%	100%		
ADULTS IN HOUSE	N=922	N=166	N=263	N=208	N=285	χ^2=20.97	0.031
1	12%	21%	9%	14%	10%		
2	74%	73%	80%	69%	72%		
3	10%	1%	6%	12%	12%		
4 or more	5%	5%	5%	5%	5%		
	100%	100%	100%	100%	100%		
NUMBER OF BOATS	N=756	N=137	N=212	N=172	N=235	χ^2=81.11	0.000
1	69%	78%	51%	52%	81%		
2	23%	17%	36%	34%	14%		
3 or more	8%	5%	12%	14%	5%		
	100%	100%	100%	100%	100%		
HOUSEHOLD INCOME	N=828	N=149	N=240	N=177	N=262	χ^2=88.43	0.000
under $20,000	8%	8%	7%	3%	10%		
$20,000-$39,999	19%	11%	17%	19%	22%		
$40,000-$59,999	21%	11%	14%	22%	26%		
$60,000-$99,999	33%	39%	45%	26%	30%		
$100,000-$149,999	12%	22%	9%	16%	11%		
over $150,000	6%	10%	7%	14%	2%		
	100%	100%	100%	100%	100%		
SEASONAL HOME (MI)	N=918	N=165	N=263	N=205	N=285		
yes	29%	11%	9%	89%	18%	F=219.4	0.000

a. Unit of analysis in this table is the boat owner. The sample of boats was weighted inversely to the number of boats owned by each respondent.

Table 22. Boat Characteristics by Storage Segment: 1998 [a]

	Total	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	χ^2	*P* Value
			column percent				
SIZE OF BOAT	N=922	N=166	N=263	N=208	N=285	χ^2=505.9	0.0000
PWC	12%	3%	14%	13%	12%		
< 16'	41%	9%	34%	36%	53%		
16 - 20'	33%	12%	35%	41%	31%		
21 - 28'	12%	45%	15%	10%	5%		
29' +	3%	31%	2%	0%	0%		
	100%	100%	100%	100%	100%		
TYPE OF BOAT	N=919	N=166	N=262	N=206	N=285	χ^2=558.5	0.0000
Inboard	5%	25%	7%	4%	2%		
In/Outboard	17%	33%	16%	21%	12%		
Outboard	42%	12%	28%	37%	59%		
Sail	4%	20%	4%	7%	1%		
Pontoon	10%	7%	21%	14%	1%		
Canoe or Row	9%	0%	11%	4%	11%		
PWC	12%	3%	14%	13%	12%		
	100%	100%	100%	100%	100%		
YEARS OWNED	N=922	N=166	N=263	N=208	N=285	χ^2=14.89	0.2481
Less than 3	23%	24%	21%	18%	27%		
3 to 5	29%	27%	34%	24%	28%		
6 to 10	24%	24%	25%	26%	21%		
11 to 20	17%	18%	12%	22%	16%		
More than 20	8%	7%	8%	10%	8%		
	100%	100%	100%	100%	100%		
STORAGE LOCATION	N=922	N=166	N=263	N=208	N=285	χ^2=1,236	0.0000
Great Lakes	16%	83%	18%	23%	0%		
Inland lakes	40%	12%	77%	76%	0%		
River or stream	2%	5%	5%	2%	0%		
Nonwaterfront site	42%	0%	0%	0%	100%		
	100%	100%	100%	100%	100%		

a. Unit of analysis in this table is the boat. The sample of boats was weighted to the number of active boats registered in Michigan.

Statewide Boating Use and Spending (Objective 1)

Estimation of Boating Use by Storage Segment

Boating use is defined as the number of days a boat was underway in Michigan waters in 1998. Annual days of use per boat is distinguished between day and overnight trips. It was assumed that a day trip and a one night trip involve 1 boat day, while overnight trips of two or more nights, the same numbers of boat days as the nights is assumed. Total boat use is estimated by multiplying the average days of use per boat in 1998 by the total number of active craft registered in Michigan.

Annual Boating Use

Annual days of use can not be obtained directly from the wave surveys, as boaters were asked to report activity in mid-season. Days of use were measured up to the time the boater was surveyed. Procedures were needed to extrapolate from the mid-season use estimates to season-end totals. Average days of use "so far" in the year were estimated at nine points during the summer. The average use per boat in 1998 can be estimated by extrapolating from these nine data points to the end of the season. A logistic curve was used to estimate a relationship between days of use and the point in season when use was measured.

The logistic function is well suited to the growth processes where constraints to growth or saturation effects are encountered at the beginning and end of the time period. In the logistic model growth starts out slowly, increases to a maximum growth rate, and then slows down again, eventually approaching some upper limit. Boating activity in Michigan starts slowly during June and then increases rapidly during July and early

August, falling again as the end of the boating season approaches in late August and early September.

The nine waves, covering nine weeks during the survey period from July 24 to September 20, provide nine points of the average days of use from the beginning of the survey to each point in time (Figure 4). The average use days grew from 18 as of July 24 to about 30 days by end of the season (Table 23). Since no measures were made for early season use, it is important to select an appropriate starting point that should be added to the existing data points in order for the logistic model to reflect the beginning of the season. A knowledge of the use patterns during the season needs to be combined with the nine empirical observations. The beginning of the season was assumed to be May 15. The logistic equation is estimated with ten points by adding a zero for May 15.

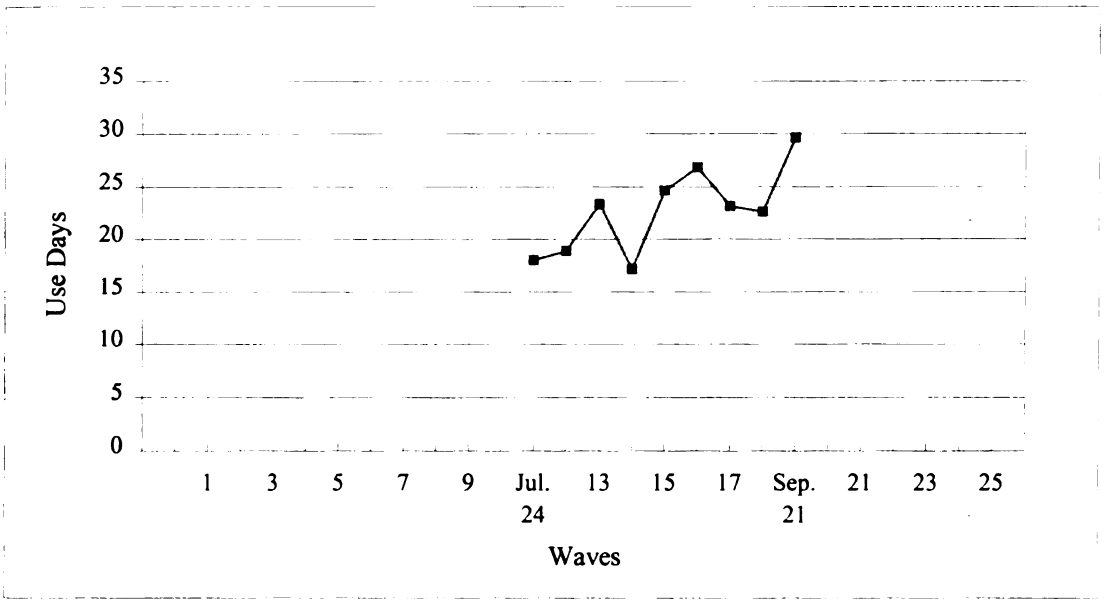

Figure 4. Average Days of Use by Wave During the Summer

Table 23. Average Use Days and 90% Confidence Intervals by Wave

Wave	Lower Bound	Mean	Upper Bound
1	16.1	18.0	19.9
2	15.9	18.9	21.8
3	19.1	23.3	27.5
4	13.7	17.2	20.7
5	20.0	24.6	29.2
6	22.1	26.8	31.6
7	19.4	23.1	26.8
8	18.3	22.5	26.8
9	25.2	29.7	34.1
Overall	20.8	22.0	23.3

The logistic function is expressed as follows:

$$(7) \qquad \hat{d}_t = \frac{1}{k + (ab)^t},$$

where t is time and $\hat{d}_t$ is the estimate of use days at time t. The parameters that should be estimated are k, a, and b. One of the parameters (b) in the parenthesis should be restricted as being less than 1. A saturation level is determined by $1/k$. The inflection point of the logistic curve can be obtained from the following calculation: inflection = $\log_e (e^a / b)$, where e is the exponential. The function is nonlinear in the parameters and therefore must be estimated using a nonlinear estimation procedure. The model was estimated with the data in Table 23.

The estimated logistic equations for annual boating use fit the data quite well in terms of the goodness of fit measures based on the *t*-values on the coefficients and *R*-squares (Table 24). The saturation level is 28.4 days ($1/k = 1/0.035$). The inflection point is 7.5 days [$\log_e (e^a / b) = \log_e (e^{5.509} / 0.130)$] and the corresponding wave is 7 (Figure 5). The average use per boat in 1998, $\hat{d}$, can be estimated by extrapolating the logistic curve to the end of the season. The annual use estimate of boat days can be estimated by selecting an appropriate end-date and plugging this end-date into the model. The end of the season was set at October 19 ($t = 23$) and the corresponding average days of use was 28.2 days per boat:

$$(8) \qquad \hat{d}_{23} = \frac{1}{0.035 + (5.509 * 0.13)^{23}} = 28.2 .$$

Table 24. Results of Logistic Models for Annual Use Days [a]

	Lower Bound		Mean		Upper Bound	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
k	0.042	11.33	0.035	12.80	0.030	15.22
a	5.367	9.51	5.509	8.68	5.359	10.85
b	0.135	8.79	0.130	8.57	0.132	10.59
R^2	0.981		0.985		0.987	

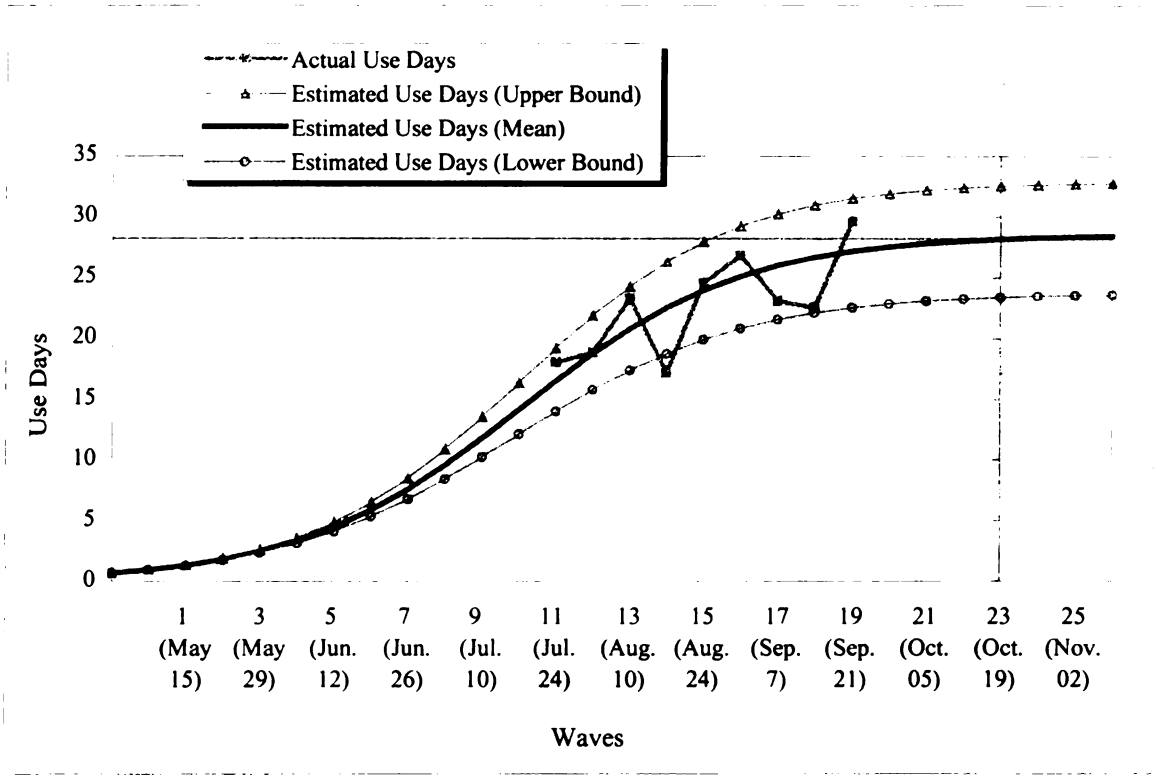

Figure 5. Logistic Estimates of Boat Days

Logistic curve should be not sensitive to ending date as the curve becomes asymptotic in this range. To determine whether the ending date was chosen appropriately, the variation around the end-point chosen is reported (Table 25). The estimates of annual days of use do not vary with further selection of ending dates, showing result is not sensitive to this choice. The upper and lower bounds around the average use estimate, which were estimated using the 90% confidence intervals on the sample average use "so far", are also depicted in Figure 5. It, however, should be noted that these intervals around the mean are quite conservative due to two error sources from

Table 25. Variation of Annual Days of Use with Ending Dates

Alternative for Ending Date	Upper Bound	Mean	Lower Bound
22 (Oct. 13)	32.4	28.1	23.3
23 (Oct. 20)	32.6	28.2	23.4
24 (Oct. 27)	32.7	28.3	23.5
25 (Nov. 03)	32.7	28.4	23.6
26 (Nov. 10)	32.8	28.4	23.6

the sampling error related to upper and lower bounds of the data used for the model and the errors related to econometric specification.

Boating Use by Storage Class

The annual days of use for each storage segment is obtained by computing the ratio of the projected annual average for all boats to the sample average use "so far" (weighted mean on sample). This ratio is applied to each subgroup mean to extrapolate to the end of season. This procedure assumes that the temporal patterns of use over the season do not vary significantly by storage class and the samples for each storage class are distributed evenly over waves. The even distribution by storage segment over waves was achieved by using matched samples and there were no significant differences in response patterns by storage class (See Appendix C). The expansion factor (E) of 1.28 was obtained from the following equation:

$$(9) \qquad E = \frac{\text{Projected Average Use}}{\text{Sample Average Use}} = \frac{28.2}{22.0} = 1.28$$

Average days of use vary substantially with storage segments, from 32 days for marina boats to 15 days for boats stored at nonwaterfront homes (Table 26). The annual use by segment is estimated by multiplying the average use by segment *i* obtained from the in-season survey by the expansion factor, *E*:

(10) $\hat{d}_i = d_i * E$,

where

$\hat{d}_i$ = annual estimate of use days per boat in segment *i*,

d_i = annual days of use per boat obtained directly from the in-season survey, and

E = expansion factor.

Total days of use for *i*th segment is calculated by multiplying the annual use estimate per boat for segment *i* by the total number of active boats in segment *i*.

Table 26. Average Days of Use "so far" by Storage Segment

	Projected ($\hat{d}_i$)	Mean (d_i)	Standard Deviation	Standard Error	% Error [a]
Marina	40.5	31.62	28.92	2.27	12%
Waterfront Primary Home	38.8	30.30	28.99	1.81	10%
Waterfront Seasonal Home	29.2	22.77	21.37	1.50	11%
Nonwaterfront Home	18.7	14.59	13.48	0.81	9%
OVERALL	28.2	22.02	22.86	0.76	6%

a. Percent of sampling errors at the 90% confidence interval.

Boating Use between Day vs. Overnight Trips

Boaters were asked to report expenditures on the most recent boating occasion. For boaters whose most recent trips were day trips, the spending they reported is per day spending, whereas for boaters whose most recent trips were overnight trips, the spending reported is for the entire trip. Since boaters reported spending on a trip basis, but use was estimated on a boat day basis, a conversion factor is needed to convert spending on trips to a per day basis. The procedures for the conversion can be described using the following formulas.

First, total days of use per boat for a given segment *i* can be defined as follows (suppressing *i* for brevity hereafter until it is necessary):

$$(11) \quad D = \left[t_d * 1 + (1 - t_d) * a\right] * T,$$

where for a given segment *i*

D = total boat days of use per boat during the season,

T = total number of trips per boat during the season,

t_d = percent of trips that are day trips ($1-t_d$ = percent that are overnight trips), and

a = average length of stay on overnight trip (note that boat day for a day trip is 1.0).

The parameters, D, t_d, and a, in equation (11) can be estimated from the survey for each segment. Solving equation (11) for T:

$$(12) \quad T = \frac{D}{t_d + (1 - t_d) * a}.$$

The percent of days on day trips and overnight trips can be calculated as:

$$(13\text{-}1) \quad p_d = \frac{T * t_d}{D},$$

(13-2) $p_o = \frac{T*(1-t_d)*a}{D}$,

where for a given segment *i*

p_d = percent of days on day trips and

p_o = percent of days on overnight trips.

The parameters used to compute days on day and overnight trips for each storage segment are presented in Table 27. For example, for the fleet as a whole, the annual use per boat was 28.2 (D). Annual trips per boat were divided 92% day trips (t_d) and 8% overnight trips (1-t_d). An average length of stay on overnight trip was 5.1 days. Plugging these values into equation (12) yields: $T = D/[t_d+(1-t_d)*a] = 28.2/[92\%+8\%*5.1] = 21.2$. The percents of days on day trips and on overnight trips may be computed as: $p_d = T*t_d/D = 21.2*92\%/28.2 = 69\%$, $p_o = T*t_d/D = 21.2*8\%*5.1/28.2 = 31\%$. The same procedure is used to calculate trips for each storage segment.

Table 27. Boating Use by Storage Segment: 1998

	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	TOTAL
Annual Days of Use per Boat (D)	40.5	38.8	29.2	18.7	28.2
Boat Days per Overnight Trip (a)	5.8	4.5	3.8	5.4	5.1
Percent of Day Trips (t_d)	78%	98%	95%	75%	92%
Percent of Overnight Trips (1-t_d)	22%	2%	5%	25%	8%
Annual Trips per Boat (T)	19.7	36.3	25.6	8.9	21.2
Days on Day Trips (p_d)	38%	92%	84%	36%	69%
Days on Overnight Trips (p_o)	62%	8%	16%	64%	31%
	100%	100%	100%	100%	100%

Fleet Totals

Annual use of 28.2 days per boat was multiplied by 652,000 active pleasure craft with valid Michigan registrations in 1998 to yield a total of 18.4 million boat days in Michigan in 1998 (Table 28). Dividing the total boat days by an average boat days per trip of 1.3 yields a total of 13.8 million boating trips in 1998. About 12.7 million (92%) of them were day trips and 1.1 million (8%) were overnight trips. Total boat days on overnight trips is 5.7 millions (5.1 boat days per overnight trip times 1.1 million overnight trips).

Table 28. Summary of Boating Activity by Storage Segment: 1998

	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	TOTAL
Number of Boats (000's)	45	181	151	275	652
(%)	(7%)	(28%)	(23%)	(42%)	(100%)
Average Days of Use per Boat	40.5	38.8	29.2	18.7	28.2
Total Boat Days (000's)	1,813	7,023	4,404	5,136	18,376
(%)	(10%)	(38%)	(24%)	(28%)	(100%)
Total Boat Trips (000's)	883	6,573	3,900	2,436	13,792
(%)	(6%)	(48%)	(28%)	(18%)	(100%)
Total Trips on Day Trips (000's)	690	6,445	3,719	1,829	12,683
Total Trips on Overnight Trips (000's)	193	128	181	607	1,109
Total Days on Day Trips (000's)	690	6,445	3,719	1,829	12,683
Total Days on Overnight Trip (000's)	1,123	578	685	3,306	5,692
Day Trips	78%	98%	95%	75%	92%
Overnight Trips	22%	2%	5%	25%	8%
	100%	100%	100%	100%	100%
Days on Day Trips	38%	92%	84%	36%	69%
Days on Overnight Trips	62%	8%	16%	64%	31%
	100%	100%	100%	100%	100%

Boats stored at nonwaterfront homes accounted for 42% of active craft in 1998. However, the greatest contributor of boat days to the statewide total was boats stored at waterfront primary home, making up 38% of the total days of use. Boats stored at marinas were the most active as they averaged 41 days of use per boat, divided as follows: 38% on day trips and 62% on overnight trips. Boats kept at nonwaterfront homes were least active averaging 19 boat days per boat, but their distribution of boat days between day and overnight trips was similar to that of marina boats. Boats stored at waterfront primary and seasonal homes averaged 39 and 29 days in 1998, respectively. These boats took a much higher percentages of day trips (92% and 84% for waterfront primary and seasonal homes, respectively).

Boats stored at waterfront permanent homes were the greatest contributor to total trips. They accounted for 48% of the total, followed by waterfront seasonal home segment which took 28% of the total trips. Ninety-two percent of all boating trips involved a day trip. Compared with boats stored at waterfront homes, those stored at marinas and nonwaterfront sites are less likely to involve a day trip. Seventy-eight percent of trips by marina boats and 75% of trips by nonwaterfront boats were day trips, whereas more than 95% of the trips by boats stored at waterfront primary and seasonal homes were day trips.

Comparison of Wave vs. End-of-Season Surveys on Use Estimates

In this section the wave survey is evaluated. For the representativeness of each of the nine wave surveys, the sampling ratios by boat size class and region of the subsample being sent at each wave were exactly the same as those of the overall sampling scheme.

To test if the composition of any wave survey is significantly different from other wave surveys on characteristics of interest, F-ratio and χ^2 test are used. A hypothesis of no differences among the wave surveys for a given variable is tested. The variables tested are: boat length and type, storage type, and the characteristics associated with trip and spending. If the variables are not significantly different over the wave surveys, one would say that the surveys are representative. The results indicate that for all the key variables there are no significant differences across the nine wave surveys (Appendix C). Each wave survey was representative.

Boaters averaged 28.2 days on the water in 1998. The annual days of use was estimated from the wave surveys using the logistic curve. Since estimating annual boat days is essential to estimating total spending accurately, it is important to know if the annual use estimate is in fairly close agreement with annual days of use estimated from a season-end survey. Total use days per boat were also estimated from the end of season survey. The approach is to compare the confidence intervals for mean use days estimated from the wave surveys and season-end survey, respectively. One can conclude that the two estimates of use days are not statistically different, if the confidence intervals overlap.

From the year-end survey, boaters averaged 30.3 days per boat on Michigan's water during the 1998 season (Table 29). The mean value for the season-end survey is larger than the average use derived from the logistic curve (28.2). Based on the 90 percent confidence intervals, however, the mean use days estimated from the season-end survey is not significantly higher than average use estimated from the wave surveys, as the confidence intervals overlap. The results indicate that the wave approach was

Table 29. Mean & 90% Confidence Intervals on Use Estimates

	Days of Use from Wave Surveys [a]	Days of Use from Season-End Survey [b]
Upper Bound	32.6	33.3
Mean	28.2	30.3
Lower Bound	23.4	27.3

a. Since the logistic models were applied to the data set which includes mean days of use and confidence intervals on them, the logistic estimates around the mean may not be symmetric. Because of two error sources from upper and lower bounds of the data used for the model and the econometric specification itself, the resulting confidence interval around the mean would be very conservative.

b. The sample of boats was weighted to number of total active boats. Standard errors thus were computed using the standard deviations from the sample weighted and the number of cases.

successful in estimating annual days of use. The estimate from the season-end survey, however, is also subject to error.

Estimation of Boater Trip Spending by Storage Segment

Average Trip Spending

An average trip spending per boat day may be computed as a weighted average of the average spending per day on day trips and overnight trips. Trip spending per day per boat for segment *i* on spending category *j* is estimated using the following equation:

(14) $\overline{m}_{ij} = p_{di} * m_{dij} + p_{oi} * m_{oij}$,

where

$\overline{m}_{ij}$ = spending per boat day in spending category *j* by segment *i*,

m_{dij} = spending per boat on day trips in spending category *j* by segment *i*,

m_{oij} = spending per boat on overnight trip in category *j* by segment *i*, and

p_{di}, p_{oi} = percents (weights) of days on day and overnight trips in segment *i*.

Statewide trip spending by recreational boaters is obtained by summing M_{ij} over segment i's and spending category j's:

$$(15) \quad M = \sum_{j=1}^{J} \sum_{i=1}^{I} \overline{m}_{ij}, \qquad i = 1, 2, 3, 4, \quad j = 1, 2, \ldots, 11,$$

where M is total statewide trip spending by registered boaters in Michigan during the 1998 boating season.

The average registered boater spent $975 on boating trips in 1998. Spending varied from $788 for boaters storing their boats at waterfront primary home to $3,087 for marina boaters (Table 30). A typical boater spent $35 a boat day in 1998. Boaters storing their boats at marinas spent $76 a boat day which is more than two times as much on trip spending comparing with an average boater. Boaters storing their boats at nonwaterfront sites spent $44. Boaters boating from waterfront seasonal homes spent $29 per day. Boaters boating from waterfront primary homes spent $20 a day. A typical boater spent $23 a day on day trips and $60 a day on overnight trips. The highest spending per day was for trips involving overnight stays by marina boats ($91 per day), whereas the least spending per day was $15 on day trips by boats stored at waterfront primary homes.

Sampling errors for estimates of trip expenditures are also reported. Sampling error depends on the size of the sample and the degree of variation in the population. How close a sample estimate is to the population value can be determined by confidence intervals. Errors were reported using 90% confidence intervals. This means that the true figure will lie within plus or minus this tolerance of the reported mean with a 90% confidence level. That is, based upon sampling error alone, there is a 10 percent chance the true spending figure will lie outside of this confidence interval.

Table 30. Average Trip Spending by Storage Segment & Type of Trip (Summary)

	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-Waterfront Home	TOTAL
(1) PER BOAT PER DAY TRIP SPENDING FOR DAY TRIPS					
Mean	52.6	15.0	27.7	30.8	23.1
Lower Bound [a]	37.8	10.9	20.8	25.7	20.0
Upper Bound [a]	67.4	19.1	34.6	35.9	26.2
% Sampling Error [a]	28%	28%	25%	17%	13%
(2) PER BOAT PER DAY TRIP SPENDING FOR OVERNIGHT TRIPS					
Mean	90.7	79.0	36.9	51.4	60.2
Lower Bound	75.6	51.1	15.4	40.4	52.2
Upper Bound	105.8	106.9	58.4	62.4	68.2
% Sampling Error	17%	35%	58%	21%	13%
(1+2) PER BOAT PER DAY SPENDING (WEIGHTED AVERAGE OF TWO TRIPS)					
Mean	76.2	20.3	29.1	44.1	34.6
Lower Bound	64.8	16.0	22.5	39.3	31.6
Upper Bound	87.6	24.6	35.7	48.9	37.6
% Sampling Error	15%	21%	23%	11%	9%
TOTAL $ PER BOAT PER YEAR	3,087	788	849	823	975

a. Sampling errors for estimates of trip expenditures are reported with a 90% confidence level.

For the fleet as a whole, sampling error of trip expenditures is 9%, indicating that the population mean of boater trip expenditure is contained in the interval $32 to $38 at the 90% confidence level. Estimates for particular segments are subject to larger errors due to the smaller sample sizes. A spending estimate for boaters staying overnight launched from their seasonal waterfront homes has the largest errors of 58%, followed by sampling errors for overnight users in waterfront permanent homes (35%). Except for these two groups, trip spending errors within particular segments are all less than 30 percent. Spending of nonwaterfront segment on day trips marina group on overnight trips has the smallest errors of 17%, respectively.

The error structure changes somewhat for segments by trip type and storage. Sampling errors for estimates of trip expenditures between day and overnight trips, however, are the same. For most applications, these levels of accuracy appear to be adequate. Efforts to reduce recall errors and related problems would appear to be more useful than increasing sample sizes. Trip spending here was estimated on a per boat day rather than an annual or trip basis. Standard errors were computed using standard deviations of population means and square roots of case numbers (Appendix D).

Food constitutes 37% of the trip spending, divided 21% for groceries and 16% for restaurant (Figure 6). Boat fuel accounts for 26% of the total, followed by auto gas which takes up 9% of the boater trip budget. Maintenance expense associated with boating trips contributes 7% of boater trip spending. Average trip spending by various spending categories are reported in Appendix E.

Average trip spending can also be summarized on the basis of where spending occurred- near home or away from home (Table 31). The $35 per day spent on boating trips was divided evenly between spending near home and more than 20 miles from home. Boaters storing their boats at a marina or nonwaterfront home spent more money away from home (73% and 68%, respectively), whereas boaters who boated from waterfront homes spent more near home (75% and 81%, respectively). Average trip spending by various spending categories are reported in Appendix E. While boaters purchased more boat fuel near home than away from home, their spending on food was divided evenly between near and away from homes. Food was the largest item for boats stored at a marina, waterfront seasonal home, or nonwaterfront site, while boats kept at waterfront primary home spent more money on boat fuel.

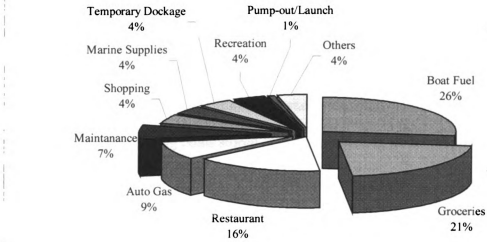

Figure 6. Boater Trip Spending by Spending Category: 1998

Table 31. Average Trip Spending by Storage & Spending Location (Summary)

	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	TOTAL
AVERAGE SPENDING PER DAY					
$					
(1) "Near Home" Spending	20.5	15.2	23.7	14.2	17.5
(2) "Away Form Home" Spending	55.7	5.1	5.4	29.9	17.1
(1+2) Average Spending on Trip	76.2	20.3	29.1	44.1	34.6
%					
"Near Home" Spending	27%	75%	81%	32%	51%
"Away Form Home"	73%	25%	19%	68%	49%
	100%	100%	100%	100%	100%

Total Trip Spending

Total trip spending was estimated by multiplying spending per boat day by the number of boat days. Boaters with registered boats in Michigan spent an estimated $635 million on trips in Michigan waters in 1998 (Table 32). Boats stored at nonwaterfront sites accounted for 36% ($226 million) of the statewide total. The rest of the total was divided about equally among boats stored at marinas, waterfront primary homes, and waterfront seasonal homes.

Table 32. Total Trip Spending by Storage Segment & Type of Trip: 1998

	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-Waterfront Home	Total
(1) TOTAL TRIP SPENDING FOR DAY TRIPS ($ MILLIONS)					
Subtotal	36.3	96.9	102.9	56.3	292.4
Percent of Spending by Segment	12%	33%	35%	19%	100%
(2) TOTAL TRIP SPENDING FOR OVERNIGHT TRIPS ($ MILLIONS)					
Subtotal	101.9	45.6	25.3	169.9	342.7
Percent of Spending by Segment	30%	13%	7%	50%	100%
(1+2) TOTAL STATEWIDE SPENDING ON TRIPS ($ MILLIONS)					
Total	138.2	142.5	128.2	226.2	635.1
Percent of Spending by Segment	22%	22%	20%	36%	100%
Trip Spending by Trip Type ($ MILLIONS)					
Trip Spending on Day Trips	36.3	96.9	102.9	56.3	292.4
Trip Spending on Overnight Trips	101.9	45.6	25.3	169.9	342.7
	138.2	142.5	128.2	226.2	635.1
Trip Spending by Trip Type (%)					
Trip Spending on Day Trips	26%	68%	80%	25%	46%
Trip Spending on Overnight Trips	74%	32%	20%	75%	54%
	100%	100%	100%	100%	100%

Forty-six percent of trip spending is on day trips and 54% on overnight trips. Of the $292 million spent on day trips, boaters who stored their boats at waterfront homes spent $208 million, divided about equally between primary and seasonal homes, whereas boaters who kept their boats at marinas spent only $36 million. Of the $342 million on overnight trips, however, boaters who kept their boats at waterfront primary and seasonal homes accounted for only $71 million, while boaters who stored their boats at nonwaterfront homes spent $170 million. Boaters who kept the boats at marinas spent $102 million on overnight trips. Total trip spending by spending category is reported in Appendix F.

Total spending on boating trips is also reported by where the spending occurred in Appendix F. The total spending of $635 million was divided about evenly between trip spending near home and away from home. The distribution of spending between the two spending locations varies across storage types, but is in a fairly close agreement with the distribution between day trips and overnight across storage segments. Day users spend more near home and overnight boaters spend more money away from home. Boats stored at marinas and nonwaterfront homes spent more money away from home (73% for marina boats and 68% for boats in nonwaterfront homes). On the contrary, boats stored at waterfront homes spent far less away from home.

Differences in the contribution of each storage segment to the number of boats, days of use, and trip spending are depicted in Figure 7. Boats stored at nonwaterfront homes make up 42% of the fleet, but account for smaller percentages of boating activity and spending. Marina boats are the smallest contributors to the statewide fleet and boating activity, but constitute the second largest portion of total trip spending.

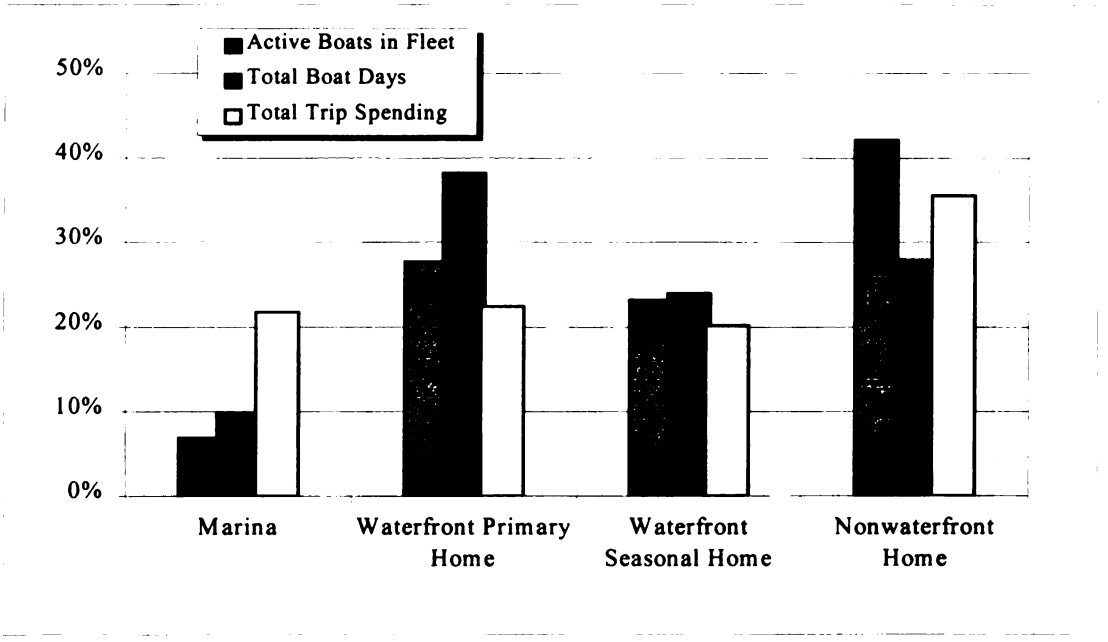

Figure 7. Boats, Boating Use & Trip Spending by Storage: 1998

Comparing to boating activity and the fleet, boats launched from waterfront primary home make up a smaller contribution to boater spending on trips. Boaters boating from waterfront seasonal homes account for same percentages of each to the fleet, boating activity, and spending.

Handling of Zeros and Missing Values on Trip Spending

The differences in spending patterns between day and overnight trips can be partly explained by the difference in percent of boaters not spending money on their most recent trip between the two types (Table 33). About 45% of all trips involved no spending. The difference in spending, however, is significant between two types of

Table 33. Percent of Boaters Spending Nothing on Recent Trip by Trip Type

	Total	Day Use	Overnight Trip	*t*-ratio	*P* Value
TRIP SPENDING	N=921	N=764	N=157		
Boat Fuel	51.1%	56.9%	17.1%	8.38	0.000
Temporary Dockage	97.1%	99.1%	85.1%	13.04	0.000
Pump-out & Launch	93.2%	94.9%	83.0%	11.59	0.000
Repair & Maintenance	95.7%	97.5%	85.4%	5.50	0.000
Marine Supplies	90.5%	92.6%	78.4%	6.48	0.000
Restaurant	81.4%	87.4%	46.1%	16.62	0.000
Groceries	69.5%	78.2%	18.2%	15.84	0.000
Auto Gas	73.7%	80.9%	31.2%	12.79	0.000
Shopping	94.4%	99.3%	65.9%	16.64	0.000
Recreation	93.7%	97.4%	72.3%	11.10	0.000
Other Expenses	91.6%	94.2%	76.3%	6.76	0.000
TOTAL	44.6%	50.7%	8.7%	10.73	0.000

boating trips at the 0.01 level. Less than 9% of overnight trips involved no spending, while more than 50% of day trips involved no spending. Day trips are less likely to require any trip expenses, as day users are more likely to boat near home.

Boaters on day trips were less likely to spend money on shopping, temporary dockage, repair, or recreation. For day trips, spending on boat fuel takes place most frequently (43%), followed by spending on groceries (22%) and auto gas (19%). Boaters away from home to stay overnight spend money on boat fuel (83%) and groceries (82%) most frequently, followed by auto gas (69%) and restaurant meals (54%).

The likelihood of spending money on a particular trip is also significantly different across the segments at the 0.01 level (Table 34). More than 60% of the boaters who stored their boats at waterfront homes spent nothing on their most recent trip, while

Table 34. Percent of Boaters Spending Nothing on Recent Trip by Storage Type

	Total	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	*F*-ratio	*P* Value
TRIP SPENDING	N=894	N=148	N=259	N=206	N=281		
Boat Fuel	52.3%	44.5%	63.0%	66.4%	38.5%	16.79	0.000
Temporary Dockage	97.0%	87.3%	99.3%	99.5%	95.6%	13.67	0.000
Pump-out & Launch	93.3%	84.2%	95.9%	99.2%	89.6%	24.38	0.000
Repair & Maintenance	96.0%	95.5%	98.6%	97.0%	93.7%	1.58	0.193
Marine Supplies	91.4%	81.2%	95.3%	93.5%	89.1%	8.66	0.000
Restaurant	81.9%	55.4%	92.1%	90.4%	74.4%	38.35	0.000
Groceries	70.6%	42.9%	90.7%	80.6%	56.0%	42.04	0.000
Auto Gas	74.6%	61.5%	95.3%	88.0%	55.5%	59.64	0.000
Shopping	95.0%	82.0%	98.6%	99.5%	92.1%	23.86	0.000
Recreation	93.8%	91.8%	97.6%	97.1%	89.7%	5.27	0.001
Other Expenses	91.5%	90.8%	98.0%	98.1%	83.6%	18.50	0.000
TOTAL	45.9%	30.4%	61.0%	62.6%	28.9%	37.45	0.000

only 30% of the boaters keeping their boats at marinas and nonwaterfront homes spent nothing. The result indicates that boaters who store their boats at waterfront homes may more likely take their boats out without incurring any expenses on a particular boating occasion. Spending frequencies on auto gas and food differ most significantly. Marina boaters are more likely to purchase food, while boaters from nonwaterfront homes are more likely to buy fuel.

The results indicate the importance of identifying the types of trips and obtaining a representative sample of boating trips when estimating spending. Boaters still may have been more likely to report overnight trips and more extended outings, but the procedures adopted to handle zeros and missing values on trip expenditures in this study likely reduced the bias associated with trip spending reports.

Test of Differences in Use and Spending by Storage Segments (Objective 2)

Michigan's registered boating fleet were divided into four segments: marina, waterfront primary home, waterfront seasonal home, and nonwaterfront home. Spending estimates were reported for each segment. Differences in boating activity and spending across storage types are tested using one-way ANOVA for interval-level variables and χ^2 test for nominal-level variables. The null hypothesis is that the population means or distributions are all equal. Variables associated with trip and spending are compared across the segments.

While all measures reported were estimated from the weighted sample, F and χ^2 values were computed using the sample unweighted. Alternatively, F value can be calculated based on the sums of squares for between- and within-groups obtained from the sample weighted and the within-group degrees of freedom obtained by subtracting the number of subgroups from the number of cases. Another alternative for F statistics can be obtained by multiplying F value computed directly from the weighted sample by the ratio of the number of cases to the number of population. Outcomes of these three approaches are identical.

Boating Activity by Storage Segment

Average boat days, Great Lakes boat days, and percent of overnight trips all differed across storage types significantly at the 0.01 level (Table 35). On average, boats kept at marinas (41 days) and waterfront primary homes (39 days) are used more frequently than boats kept at waterfront seasonal homes (29 days) and nonwaterfront sites (19 days). About 80% of the days by boats at marinas (33 days) occur on Great Lakes,

Table 35. Boating Activity by Storage Segment: 1998

	Total	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	*F*	*P* Value
BOATING ACTIVITY							
Boat Days per Boat	N=902	N=163	N=257	N=202	N=280		
	28.2	40.5	38.8	29.2	18.7	*F*=30.90	0.000
GL Days per Boat	N=911	N=163	N=259	N=206	N=283		
	7.4	32.7	4.4	5.0	6.5	*F*=78.16	0.000
% Overnight Trip	N=903	N=161	N=257	N=206	N=279		
	8%	22%	2%	5%	25%	*F*=39.51	0.000

while only 10% of the days by boats at waterfront primary home (4 days) take place in inland lakes. More than 20% of the trips by boats kept at marina and nonwaterfront homes are overnight trips, while less than 5% of the trips by boats stored at waterfront homes are overnight.

Distance traveled to destination or storage location is important in describing trip expenditures as boaters are more likely to stay overnight and spend more on longer trips. The variables associated with distances (from home to destination, from storage to destination, and from home to storage) differ significantly among storage types at the 0.01 level (Table 36). Boats stored at nonwaterfront sites are transported greater distances (69 miles) to the locations where they are used than boats kept in other types of storage. In general the locations where boats are kept and used are similar for boats stored at marinas and waterfront homes.

Table 36. Distance Traveled and Body of Water Used by Storage Segment: 1988

	Total	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	F or χ^2	P Value
DISTANCE TRAVELED (one way distance miles)							
Home to Destination	N=812	N=151	N=258	N=138	N=265		
	75.8	54.7	28.5	149.7	78.2	F=100.0	0.000
Storage to Destination	N=902	N=165	N=258	N=205	N=274		
	45.7	28.8	31.2	27.0	69.1	F=74.84	0.000
Home to Storage	N=827	N=150	N=263	N=138	N=276		
	57.7	47.2	31.5	150.5	35.9	F=212.4	0.000
BODY OF WATER USED	N=901	N=162	N=257	N=202	N=280	χ^2=251.1	0.000
Great Lakes Only	22%	76%	16%	17%	19%		
Inland Lakes Only	62%	18%	76%	73%	53%		
Both GL and IL	17%	6%	8%	10%	28%		
	100%	100%	100%	100%	100%		

Great Lakes craft tend to be larger than craft used on inland lakes, suggesting some likely differences in spending patterns. The majority of boats use either Great Lakes (22%) or inland waters (62%) exclusively. Seventeen percent of boats use both Great lakes and inland waters. Boaters' choices of destinations vary significantly with type of boat storage. For boats kept at marinas, the majority of boats (76%) use Great Lakes exclusively, while the majority of boats at waterfront homes use inland waters exclusively (76% for primary homes and 73% for seasonal homes). More than a half of boats stored at nonwaterfront sites are used on inland waters solely. Less than 10% of boats stored at marinas and waterfront homes, respectively, use both Great Lakes and

inland waters, while 28% of boats kept at nonwaterfront homes use both Great Lakes and inland waters.

Boater Trip Spending by Storage Segment

The variables associated with spending on trip (percent of boaters spending nothing on their most recent trip, spending per trip, and spending per day) differ significantly with different storage types at the 0.01 level (Table 37). Approximately 30% of boats at marinas and nonwaterfront sites reported no spending on their most recent trips, whereas more than 60% of boats stored at waterfront primary and seasonal homes spent no money on the most recent trips. Marina boaters spend more money per trip than boat owners in other storage categories. Owners of boats stored at marinas spend $156 per trip, followed by owner of boats at nonwaterfront sites who spend $93 per trip. At the other extreme owners of boats kept at waterfront primary homes spent $22 on an average boating outing.

Table 37. Trip Spending by Storage Segment: 1998

	Total	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	*F*	*P* Value
% Zero Spending on Trips	N=894	N=148	N=259	N=206	N=281		
	46%	30%	61%	63%	29%	*F*=37.45	0.000
Spending per Trip	N=915	N=163	N=262	N=206	N=284		
	$46	$156	$22	$33	92.9	*F*=27.12	0.000
Spending per Day	N=909	N=161	N=261	N=205	N=282		
	$35	$76	$20	$29	$44	*F*=26.86	0.000

Regional Distribution of Boater Trip Spending (Objective 3)

To assess the economic effects of boater trip spending on regions of the state, flows of money into and out of each region must be estimated. Spending by non-local residents who are attracted to the area is of interest. The net contribution of boater spending to each region can be determined by subtracting the amount of spending by boaters living there from the amount of spending occurring in the region as a boating destination. This procedure omits trip spending within the region by boaters who live there.

Spatial Distribution of Boats and Boating Use

The questionnaire asked boaters to report their spending "near home" and "away from home". To allocate boater spending to different regions of the state, three functional regions are identified: (1) the origin region where the boater lives, (2) the storage region where the boat is stored, and (3) the destination region in which the boat is used. Storage type is the basis for assigning spending to one of these functional regions. For boats stored at a marina, primary waterfront home, or non-waterfront home, spending "near home" is assumed to occur in the region where boaters live. Spending "away from home" is assumed to occur in the destination region. For boats kept at seasonal homes, near home spending is assigned to the storage region and spending away from home is assigned to the destination region.

Michigan's ten boating regions are shown in Figure 8. The regions include six coastal regions, two inland regions, two Upper Peninsula regions. The boating regions were adapted from Stynes and Safronoff (1982) to separate inland and coastal counties

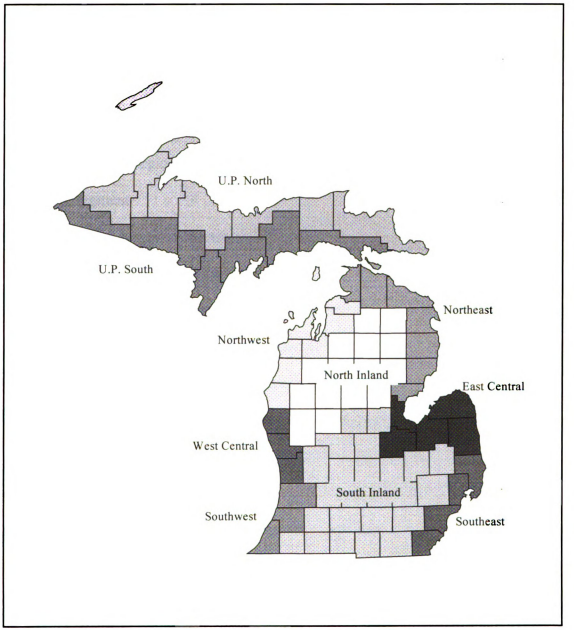

Figure 8. Boating Regions in Michigan

and capture broad flows from inland to coastal areas and from south to north. The net gain of boater spending to a region can be defined as the difference between boater trip spending occurring within the region and total spending on boating trips of boaters who reside in the region. To allocate the spending among regions where trip purchases occurred and among regions of boater residence, the number of boats by residence regions and storage regions and total boat days by destination region must be estimated by storage segment.

The 1998 survey instrument asked for both the county where the boat was kept and where the boater lived during the boating season. Distributions of boats by region of boater's residence (region of boat storage for seasonal home segment) and storage type were estimated directly from the weighted sample (Table 38). The questionnaire also asked for the county where the boat was used most recently, as well as for the total number of days the boat was used in Michigan waters "so far". Distributions of boat days by region of destination and storage type were also directly estimated from the weighted samples. This assumes that the distribution of use based on county the boater used most recently is representative of overall use and the temporal patterns of use over the season do not vary significantly for a given storage segment.

Nearly 50% of total registered boats in Michigan are owned by boaters living in the south inland region of Michigan. More than 70% of the boats kept at marinas are owned by boaters living in southeast and south inland of Michigan. More than 20% of the boats stored at waterfront seasonal homes are operated by out-of-state boaters. The south inland region is also used most frequently by boaters, making up 40% of the total boat days. For boats stored at marinas southeast Michigan is used most frequently (38%).

Table 38. Distributions of Boats and Boat Days by Region & Storage: 1998

	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	Total
BOATS BY RESIDENCE REGIONS (000's)					
Southeast	16 (37%)	17 (10%)	26 (17%)	32 (12%)	92 (14%)
East Central	2 (5%)	2 (1%)	11 (7%)	16 (6%)	31 (5%)
Northeast	1 (1%)	10 (6%)	2 (1%)	9 (3%)	22 (3%)
Northwest	1 (3%)	13 (7%)	1 (1%)	12 (4%)	28 (4%)
West Central	3 (6%)	3 (2%)	4 (2%)	11 (4%)	21 (3%)
Southwest	3 (6%)	11 (6%)	2 (2%)	10 (4%)	27 (4%)
South Inland	15 (34%)	100 (55%)	61 (40%)	139 (50%)	314 (48%)
North Inland	0 (1%)	15 (8%)	3 (2%)	22 (8%)	41 (6%)
South UP	1 (1%)	1 (1%)	2 (1%)	7 (3%)	10 (2%)
North UP	0 (1%)	7 (4%)	7 (4%)	11 (4%)	26 (4%)
Out of State	2 (5%)	0 (0%)	33 (22%)	5 (2%)	40 (6%)
Total Boats	45 (100%)	181 (100%)	151 (100%)	275 (100%)	652 (100%)
BOATS BY STORAGE REGIONS (000's)					
Southeast	20 (44%)	18 (10%)	5 (3%)	25 (9%)	67 (10%)
East Central	2 (6%)	2 (1%)	5 (3%)	16 (6%)	26 (4%)
Northeast	3 (6%)	10 (5%)	22 (15%)	17 (6%)	52 (8%)
Northwest	2 (5%)	14 (8%)	18 (12%)	14 (5%)	48 (7%)
West Central	5 (12%)	3 (2%)	3 (2%)	11 (4%)	23 (4%)
Southwest	4 (8%)	11 (6%)	7 (5%)	12 (4%)	34 (5%)
South Inland	6 (14%)	99 (55%)	33 (22%)	129 (47%)	267 (41%)
North Inland	1 (1%)	16 (9%)	36 (24%)	30 (11%)	83 (13%)
South UP	1 (1%)	1 (1%)	9 (6%)	7 (3%)	17 (3%)
North UP	1 (2%)	6 (4%)	13 (8%)	11 (4%)	31 (5%)
Out of State	0 (0%)	0 (0%)	1 (1%)	1 (0%)	3 (0%)
Total Boats	45 (100%)	181 (100%)	151 (100%)	275 (100%)	652 (100%)
BOAT DAYS BY DESTINATION REGIONS (000's)					
Southeast	693 (38%)	492 (7%)	129 (3%)	506 (10%)	1,823 (10%)
East Central	132 (7%)	35 (0%)	113 (3%)	233 (5%)	510 (3%)
Northeast	206 (11%)	403 (6%)	550 (12%)	477 (9%)	1,636 (9%)
Northwest	80 (4%)	425 (6%)	509 (12%)	394 (8%)	1,408 (8%)
West Central	250 (14%)	92 (1%)	48 (1%)	300 (6%)	688 (4%)
Southwest	194 (11%)	379 (5%)	219 (5%)	195 (4%)	991 (5%)
South Inland	149 (8%)	4,518 (64%)	1,137 (26%)	1,519 (30%)	7,329 (40%)
North Inland	38 (2%)	440 (6%)	1,141 (26%)	895 (17%)	2,510 (14%)
South UP	37 (2%)	61 (1%)	209 (5%)	201 (4%)	506 (3%)
North UP	34 (2%)	178 (3%)	350 (8%)	414 (8%)	973 (5%)
Total Use	1,813 (100%)	7,023 (100%)	4,404 (100%)	5,136 (100%)	18,376 (100%)

The north inland region and the south inland region are frequently used by the boaters boating from their seasonal homes. However, comparing to the number of boats owned by seasonal home users living in the south inland region (40%), the number of boats stored in seasonal homes in the region is less (22%). On the other hand, the north inland region contains far more boats stored at waterfront seasonal homes (24%) than the number of boats owned by seasonal home users living in this region (2%). Comparing to the numbers of boats by residence regions, more boats are used in northeast, northwest, and north inland of Michigan.

Distribution of Boater Trip Spending

Trip expenditures are evaluated by "spending destination" (region where trip spending occurred) and by "spending origin" (region of boater residence). Spending is reported in eleven categories by "spending destination" and "spending origin". Trip spending is also divided between spending occurring in residence region (at home) and spending occurred in destination region (away from home).

Statewide trip spending was distributed to origin regions based on the distribution of boats by region where boaters reside (Table 39). Using equation (1) (in page 47) the total trip spending of $50.47 million generated in southeast region of Michigan by boaters living in the region and keeping their boats at marinas can be computed as: 16,348 (boats)*40.5 (days)*$76.2 (spending per day) = $50.47 million.

The majority of the boaters reside in south inland and southeast regions of Michigan, which are responsible for generating more than 60% of the total spending on boating trips, divided 46% ($292 million) for south inland and 18% ($112 million) for

Table 39. Distributions of Spending by Origin & Storage ($million): 1998

	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	TOTAL	
Southeast	50.47	13.65	22.25	26.12	112.48	(18%)
East Central	6.43	1.87	8.94	13.42	30.66	(5%)
Northeast	1.91	8.16	1.67	7.25	19	(3%)
Northwest	4.62	10.57	0.87	9.62	25.69	(4%)
West Central	7.86	2.59	3.16	9.32	22.93	(4%)
Southwest	8.91	8.77	2.01	8.36	28.04	(4%)
South Inland	47.56	78.52	51.48	114.04	291.61	(46%)
North Inland	1.3	11.83	2.83	18.5	34.47	(5%)
South UP	1.64	0.81	1.5	5.84	9.79	(2%)
North UP	1.12	5.47	5.73	9.43	21.75	(3%)
Out of State	6.34	0.26	27.75	4.31	38.66	(6%)
SUM	138.17	142.50	128.18	226.22	635.08	(100%)

southeast region of Michigan. The rest of the regions in Michigan generated 2% (south UP) to 5% (east central and north inland Michigan) of all boater trip spending, while out-of-state boaters generated 6% ($39 million) of the total spending on boating trips during the 1998 boating season.

Statewide trip spending was also allocated to the regions where spending occurred (Table 40). Spending that was reported "near home" was distributed to residence regions using the distribution of the number of boats by region where boaters reside (for seasonal home users, near home spending was allocated to the storage region). Spending "away from home" was allocated to destination regions based on the distribution of boat days by region where the boat was used. Near home and away from home spending were then summed to yield a total spent in each region.

Using the equations (2), (3), and (4) (in page 47-48) the total trip spending of $52.20 million that the southeast region received as a destination from boaters storing their boats at marinas can be illustrated as follows. First, the average trip spending of $20.5 per day spent near home by marina boaters (in Table 31) is multiplied by the total number of boat days (16,348 boats * 40.5 days per boat) by marina boaters residing in southeast of Michigan to yield $13.56 million. Second, the average spending of $55.7 per day spent away from home by marina boaters is multiplied by the total days of use (693,252 days in Table 38) by marina boaters in southeast of Michigan to yield $38.64 million. The total spending the region received from marina boaters is: $52.20 million = $13.56 million + $38.64 million.

The largest portion of the spending takes place in the south inland region, which accounts for 34% of the total. However, this region receives less money than it generates. On the other hand, three north regions, north inland, northwest, and northeast of Michigan, received more money than they generated. Based on trip spending by "spending destination" in Table 40, the distributions of boater spending by storage type in each region are depicted in Figure 9. Marina boaters attracted to southeast Michigan were the biggest contributors (56%) to boater dollars on trips that the region received, whereas seasonal home users made up only 4% of the total. Three north regions (northeast, northwest, and north inland of Michigan) benefited most from the boaters using waterfront seasonal home for their boating. Boaters who stored their boats at nonwaterfront home spent more money on trips than any other storage segments in east central, south inland, north inland, and south and north UP's of Michigan.

Table 40. Distributions of Spending by Destination & Storage ($million): 1998

	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	TOTAL	
Southeast	52.2	12.73	3.97	23.53	92.44	(15%)
East Central	9.07	1.58	3.84	11.27	25.76	(4%)
Northeast	11.98	8.17	18.38	16.58	55.1	(9%)
Northwest	5.7	10.08	15.23	14.86	45.88	(7%)
West Central	16.04	2.41	2.38	11.98	32.81	(5%)
Southwest	13.22	8.5	6.23	8.53	36.48	(6%)
South Inland	21.09	81.8	28.61	82.07	213.56	(34%)
North Inland	2.48	11.11	31.08	32.7	77.37	(12%)
South UP	2.48	0.92	7.1	7.89	18.39	(3%)
North UP	2.21	5.01	10.62	15.42	33.26	(5%)
Out of State	1.7	0.19	0.75	1.38	4.03	(1%)
Sum	138.17	142.50	128.18	226.22	635.08	(100%)

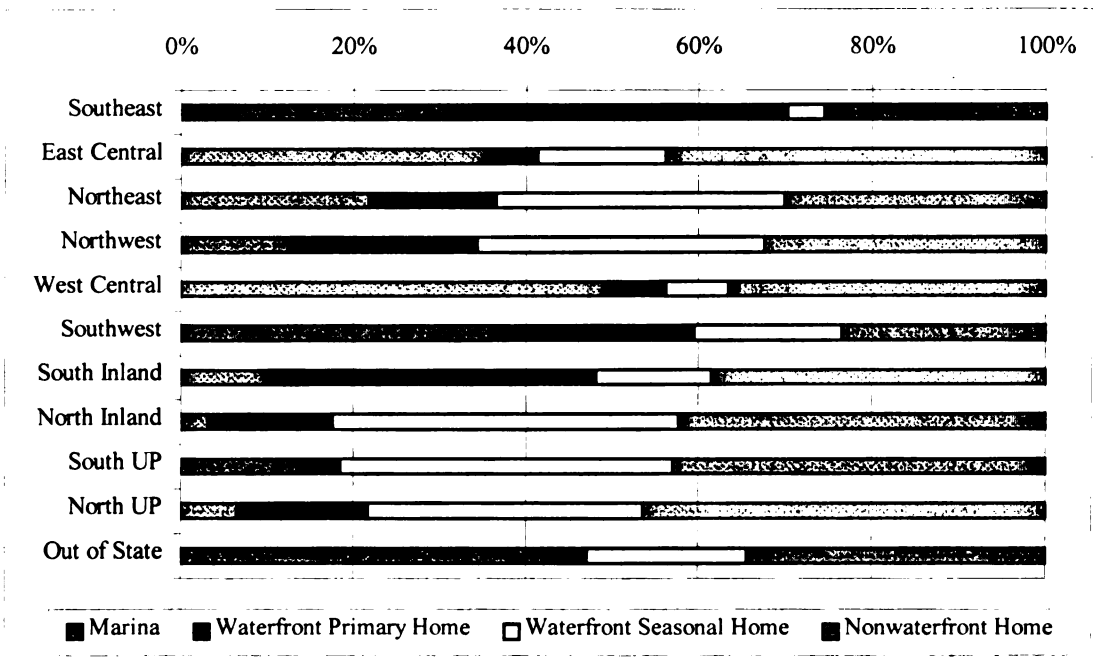

Figure 9. Percent Distribution of Trip Spending by Storage Segment: 1998

Regional Net Gains of Boater Trip Spending by Storage Segment

Assuming that the average spending within storage types does not vary across regions, we can measure the regional flows of boater spending by storage segment (Table 41). For example, the amount of $1.73 million that the southeast region benefits from marina boaters is the differences between trip spending occurring in the region ($52.20 million) and spending generated in the region ($50.47 million). All five northern regions including the UP are net gainers from boater spending on trips. These regions earned a net gain of $120 million from boater spending on trips in 1998. These gains resulted mainly from boaters storing their boats at seasonal homes. Northeast and north inland regions have the largest net gains from boater spending making up $80 million. West Central and southwest Michigan also benefited from boater trip spending but the amounts were small.

The biggest net loss of boater dollars is from the south inland region. Boaters living in this region spent $78 million more than the region received. The loss is primarily from boaters who kept their boats at a marina or seasonal home outside the region and also boaters coming from nonwaterfront homes. Southeast Michigan also showed a net loss, as the region sent $20 million more into other regions than it received. Boats registered from out-of-state spent $35 million in Michigan. Seasonal home users from out-of-state are important contributors to the spending that the state receives, as they spent $27 million in Michigan. Boaters originating from out-of-state are important because they represent new dollars to the state. Figure 10 depicts the flows of boater spending by storage type. Boats stored at marina and seasonal homes account for most of the regional flows of boater spending.

Table 41. Regional Net gains of Spending by Region & Storage ($million): 1998

	Marina	Waterfront Primary	Waterfront Seasonal	Non-waterfront	Sum
Southeast	1.73	-0.91	-18.27	-2.59	-20.05
East Central	2.64	-0.29	-5.1	-2.14	-4.9
Northeast	10.06	0.01	16.71	9.32	36.1
Northwest	1.07	-0.48	14.35	5.24	20.19
West Central	8.18	-0.18	-0.78	2.65	9.88
Southwest	4.31	-0.27	4.22	0.17	8.44
South Inland	-26.48	3.28	-22.88	-31.97	-78.05
North Inland	1.17	-0.72	28.26	14.2	42.9
South UP	0.84	0.1	5.6	2.05	8.6
North UP	1.09	-0.46	4.89	5.99	11.52
Out of State	-4.64	-0.06	-27.01	-2.92	-34.63

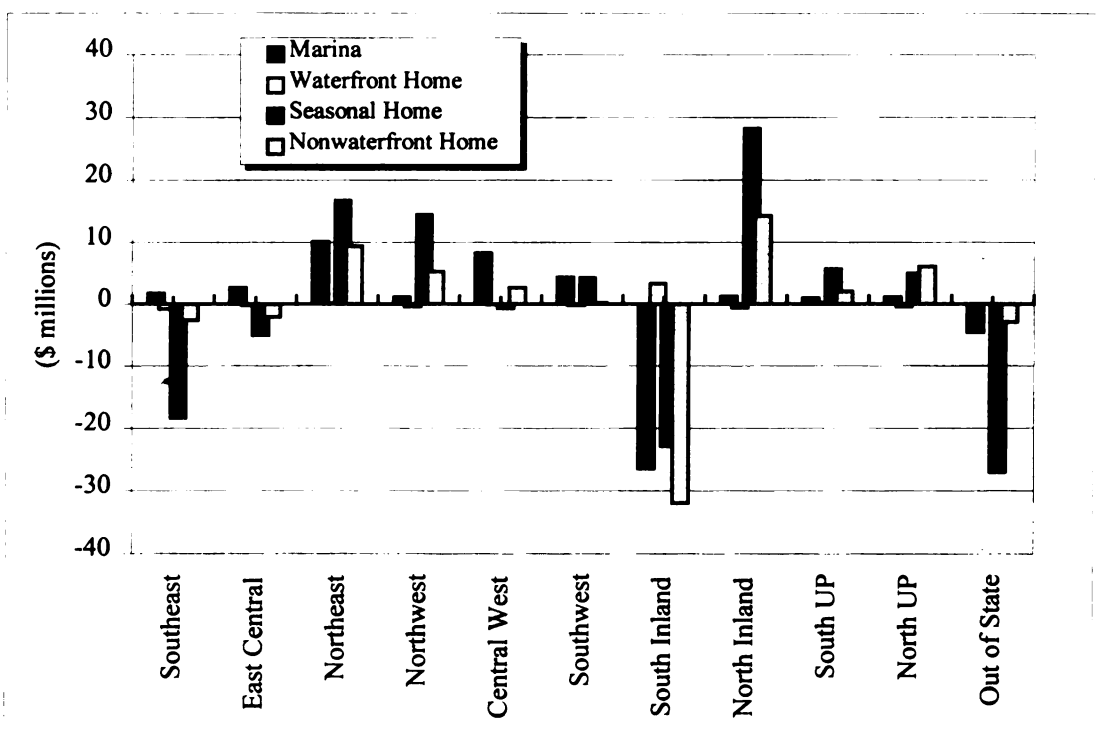

Figure 10. Regional Net Gains of Trip Spending by Storage: 1998

Regional Net Gains of Boater Trip Spending by Spending Category

The regional net gains of boater dollars spent on trip can also be computed by spending category to help identify which sectors of the region's economy benefit from boater spending (Appendix G). A negative sign in the regional flows of trip spending indicates that a net loss of boater spending within spending items, while a positive sign indicates a net gain of the spending. Four north regions, northeast, northwest, north inland, and UP of Michigan, are the net gainers of boater trip spending. Expenses for food (groceries and restaurant) and boat fuel categories spent by nonresident boaters are primary contributors to this gain. Lodging expenses were not measured in the survey. Previous studies (Warner, 1974; Stynes et al., 1983) report that boaters seldom stay overnight in commercial lodging establishments.

Out-of-State Boater Spending on Trips

Although Michigan registered boats owned by non-residents of the state that were used at least once in Michigan waters in 1998 constitute 5% of the state's registered fleet in 1998, they are an important segment because their spending represent new dollars to the state, creating income and employment within Michigan. Out-of-state registered boat owners spent approximately $35 million in Michigan in 1998 (Table 42). The two south regions (south inland and southwest) received more than 50% of the total out-of-state boaters spent in Michigan. Northwest and UP's, each received approximately 10% of the total out-of-state boater spending. Boats stored at seasonal homes account for most of the regional flows of boater spending from out-of-state boaters.

Table 42. Out-of-State Boater Spending on Trips to Michigan: 1998

Boating Region	Trip Spending ($ million)	%
Southeast	1.72	5%
East Central	0.01	0%
Northeast	2.53	7%
Northwest	3.41	10%
West Central	1.15	3%
Southwest	5.72	17%
South Inland	12.06	35%
North Inland	0.99	3%
South UP	3.79	11%
North UP	3.27	9%
TOTAL	34.63	100%

CHAPTER 5

CONCLUSIONS

This study estimated trip expenditures of active registered pleasure boats in Michigan in 1998, tested for differences in measures of boating activity and trip spending across different storage segments, and estimated regional flows of boater spending on trips by storage type and spending category. Several refinements were made in boater survey methods to address concerns about recall error, nonresponse bias, use estimates, definition of a trip, and handling zeros and missing data. The findings relating to the study objectives are summarized here, limitations of the study are specified, recommendations for future research, and implications for private and public sectors of the economy are made.

Summary of the Study

Estimation of Boater Trip Spending

A total of 652,000 active registered boats in Michigan logged an estimated 18.4 million days of boating in 1998. Boats averaged about 28 days of use. Owners of active registered boats spent an estimated $635 million on trips within Michigan in 1998. The total was divided $292 million (46%) on day trips and $343 million (54%) on overnight trips. Boats stored at nonwaterfront sites accounted for 36% of the total trip spending and the rest of the total was divided about equally among boats stored at marinas, waterfront primary homes, and waterfront seasonal homes. A typical boater spent $23 a day on day trips and $60 a day on overnight trips, averaging about $35 per day overall. Boaters who

kept their boats at marinas spent $76 a day on boating trips, while boaters at waterfront primary homes spent $20 a day.

Test for Measures of Variables by Storage Type

There were significant differences in both the level and pattern of spending by storage types. Owners of boats stored at marinas spent $156 per trip, while at the other extreme boaters at waterfront primary homes spent $22 on an average boating trip. About 30% of the trips by boats kept at marinas and nonwaterfront sites involved no money spent on the most recent trip, while more than 60% of the trips by boats at waterfront homes involved no cash outlays on the most recent trips. On average, boats kept at marinas and waterfront homes are used more frequently than boats stored at waterfront homes. Owners of boats kept at different types of storage were significantly different in terms of a number of socioeconomic variables. Owners who stored their boats at marinas had the highest average income. Boat type and size were also significantly different across storage segments. Boats stored at marinas are more likely to be large inboard boats.

Estimation of Regional Economic Benefits from Boater Trip Spending

Spending by boaters on trips to different regions of the state was estimated by storage segment and spending category in order to provide information that supports regional marketing and planning efforts. All northern regions (north inland, northwest, northeast, and UP's of Michigan) realized a net gain from boater spending on trips. Expenses for groceries, restaurant, and boat fuel by nonresident boaters at seasonal

waterfront homes were the primary contributors to this gain. The South inland region experienced the biggest net loss of boater dollars, as resident boaters in this region sought boating opportunities in other regions of Michigan. Out-of-state boaters, especially those owning seasonal waterfront homes in Michigan, were an important segment, spending $35 million in the state on boating.

Selected Methods to Improve Spending Estimates

Since the study developed methods to estimate both annual use and spending in a single survey, procedures were needed to measure spending for a recent trip to reduce recall errors, to sample in waves over the summer to capture seasonal variation in trips, and to extrapolate annual use from the in-season surveys. The study employed a wave approach in which surveys were sent out in nine waves asking boat owners to report trip expenditures on their most recent trips. Follow-up mailings were not made because it was important to obtain a sample representative not just of boats, but also of trips throughout the season. Follow-ups surveys would bias the sample more toward end-of-season trips. While this bias could be handled by an additional weighting procedure, the added cost of follow-ups were not justified in terms of potential improvement in the estimates.

Annual use per boat was estimated by applying a logistic model to nine points of the average days of use obtained from the waves in the in-season survey. The estimate of annual use days was compared to an annual use estimated from a season-end survey. The average use estimated from the wave survey was not statistically different than the average use estimated from the season-end survey.

The study tried to refine the treatment of zeros and missing values on spending by defining what a trip was, making it easier to explicitly report no spending via a checkbox, and by distinguishing between day outings and overnight trips. This procedure was quite useful in separating missing values and true zeros. The procedure also likely reduced the bias associated with trip spending reporting, as boaters, especially at waterfront homes, would be more likely to report overnight or extended trips that may not be their most recent trips. Comparisons of percentages of zero spending on trips between day vs. overnight trips and across storage segments suggested the importance of identifying the types of trips and obtaining a representative sample of boating trips when estimating spending.

Study Limitations

1. Nonsampling errors of many different types and sources affect the accuracy of survey-based estimates of spending. Possible sources of nonsampling errors are numerous. Recall errors may be the most significant problem of this type of error. Errors in recalling spending can be reduced by surveying respondents very close to when the spending takes place and having clear spending categories that help the respondent recall different expenditures. In this study the respondents were asked to report spending on the most recent trips to reduce recall bias through the wave approach. Even though the wave approach reduces the time between survey and the trip, boaters may still have reported incorrect amount of expenditures.
2. As use and spending varies considerably with boat size and storage, and possibly region, the existence of nonresponse bias in these variables would threaten the

external validity of survey results. Since weights were applied to adjust the final sample across region and boat size categories to the population of active craft, nonresponse bias would not be a problem for these variables. The weights also should correct for any bias in storage, as storage is closely related to boat size. Although the test results showed that there was no conclusive nonresponse bias due to nonuse, the number of samples used for the nonresponse bias test was small. Errors due to disproportionate response for low-frequency users, non-users, or other classes of respondents are also common in sample surveys. Local visitors and those not spending money tend to have lower response rates to spending surveys, which will bias spending estimate upward. It is likely that owners of inactive boats were less likely to return the survey. This would bias the estimates of the number of active craft upward, which would inflate overall use and spending estimates.

3. The extent of the bias in reporting of recent trips is unknown. The procedures adopted in this study likely reduced this bias, but did not eliminate it. It is expected that longer trips with larger spending were more likely to be reported. Trips might be better represented if they were directly sampled via on-site surveys, although problems in obtaining representation across the wide range of potential boating sites would likely create even greater potential for bias.
4. Another problem associated with analysis of spending data is confusion between trips with no spending and nonresponse to spending questions. Results can vary significantly depending on whether cases with blanks or missing values in the spending questions are discarded or treated as zeros. The study tried to improve on

this using selected methodological refinements, but the bias associated with trip spending reporting may not be eliminated.

5. Lodging expenses were not measured in the survey as previous studies of Michigan registered boat owners reported that boaters seldom stay overnight in commercial lodging establishments (Warner, 1974; Stynes et al., 1983). While owners of boats stored at marinas and waterfront homes rarely use lodging facilities, boat owners who trailer their boats from nonwaterfront homes are more likely to spend on lodging to stay overnight. Thus, trip spending by boater who store their boats at nonwaterfront homes would be deflated.
6. An important share of recreational boating activity is expected to take place in nonmotorized craft such as canoes and drift boats. However, smaller unpowered craft is not included in the study population because these boats are not subject to registration. This would bias the estimates of the number of active craft downward, which would deflate overall use and spending estimates. Boats visiting Michigan waters from out of state, but not registered in Michigan are not included in the study. This will bias overall use and spending estimates downward.

Recommendations for Future Research

1. The sample size (971 cases) was not large enough to estimate the regional net gains of boater spending by storage type, as the number of cells across storage and region categories is 40. For more accurate regional analysis of boater spending, it is thus necessary to increase sample size. If one succeeds to assign an adequate number of samples to each cell combined by region and storage, regionalization of boater

spending could be extended to the county level. In this case, once statistics on boating activity and spending are reported at the regional level, county estimates can be easily generated by allocating regional activity to counties within the region, based on number of registered craft or boating opportunity.

2. By disaggregating the boating fleet into different types of boat storage, the trip spending estimates became more meaningful and more applicable to situations involving planning and marketing efforts. While boat days can be divided into inland lakes boat days and Great Lakes boat days, the study reported trip spending for overall use days only. For general management and planing applications, destination type between inland lakes and Great Lakes appears to be the useful segmentation variable. It is expected that there exist important differences in patterns and types of boating activity between Great Lakes and inland locations.
3. It is recommended that the accuracy of boater spending estimates be tested in one or more coastal communities. This would provide a test of the generalizability of statewide spending figures to a local area. Careful comparisons of boater spending and business receipts could provide checks on the accuracy of reported figures. Since one of the primary activity in boating is fishing and boats are frequently used by anglers, creel survey estimates on fishing days and expenditures may be used to judge the accuracy of boating use and boater expenditures. For example, if one knows the percentage of fishing as a primary activity of boating and the percentage of anglers who use their boats for fishing purpose, a judgmental decision on the accuracy of boating use estimate can be obtained.

4. There is an important research question that could not be addressed in this study. Boater expenditure studies tend to ignore collecting information on the infrastructural, environmental, and social costs stemming from boating. Many boating studies have investigated the spending patterns of boaters, usually for the purpose of documenting the economic impact of boating. This tends to estimate the positive spending effects on community, region or on a state. Further analyses are needed to assess both the positive and negative effects of boating developments. This can include an assessment of taxes resulting from boaters as compared with public services provided.

Implications

1. Owners of active registered boats spent an estimated $635 million on trips within Michigan in 1998. Although days on overnight trips accounted for 30% of the total days of use, trip spending on overnight trips accounted for 54% ($343 million) of the total spending on trips. Thus, boating is an important part of Michigan's tourism industry. About half of the $635 million dollars that registered boat owners spend on trips would be considered tourism activity (overnight trips or more than 50 miles away from home). This estimate does not include spending associated with the use of smaller unregistered craft, boater spending on lodging, out-of-state boaters on craft not registered in Michigan, spending by guests of boat owners on boating trips, spending associated with boat rentals and cruises, or most of the spending of boaters on stays at seasonal homes. A rough estimate of boating's contribution to tourism

spending in Michigan is about $500 million, roughly 5% of all tourism spending in Michigan in 1998.

2. Boaters and boating should be an important part of Michigan's tourism promotional program. Boating fits very well with Michigan's current theme of "Great Lakes, Great Times". The featuring of lighthouse's at Welcome Centers and in promotional materials is also a natural connection to boating. Michigan's promotional programs should build on the water and Great Lakes images, by also targeting particular water-based activities and activity segments, such as boating. Local communities (CVBs, Chambers) should incorporate boating as part of their promotional materials including lists of boating facilities and services.
3. Three of the boating storage segments are particularly important tourism generators: marina, seasonal home, and nonwaterfront homes. These segments are tied to particular programs of public and private organizations that serve boaters in Michigan. The Michigan Department of Natural Resources along with its partners operates an extensive set of boating access sites around the state. Access to Michigan waters is particularly important for boaters trailering craft from nonwaterfront homes. These boats accounted for over a third ($235 million) of the total trip spending in 1998. Three quarters of the trip spending by boaters from nonwaterfront homes involved an overnight trip. Communities and businesses near popular boating access sites can benefit economically by tailoring offerings and services to these boaters and publicizing the access sites and community offerings. The state should continue to maintain the access site program and protect the quality of waters and waterfront facilities for boaters. The local economic benefits of these boaters can be used to

persuade local partners to assist in maintaining and managing access sites in their area.

4. The marina boating segment supports a sizeable industry of private marinas, boat repair shops and boat dealers in the state. The trip spending measured here largely accrues to other businesses in the community, showing that marinas indirectly support a variety of businesses in the community. Marina operators can use the estimates of spending for this particular segment to better document their impacts on the community. Such information can be important in obtaining favorable policies as well as in establishing partnerships with others to better serve boaters and the community interests.
5. Boating is closely linked with seasonal homes as a quarter of all registered craft are stored at seasonal homes. Spending per trip for the seasonal home segment is lower than for the marina and nonwaterfront home segments. However, we intentionally did not count spending associated with the trip to the seasonal home or the normal expenses associated with seasonal home stays. Boating is an important factor in seasonal home ownership and use.
6. There are a host of management and policy issues associated with boats at seasonal homes. Most (85%) of these boats are stored on inland waters. Many of Michigan's inland lakes, particularly in southeast Michigan have experienced carrying capacity problems and conflicts between riparians and boating access sites users. Most recently concerns have been raised about personal watercraft. The information on spending and use patterns provided here can contribute to the these discussions, at least at a broader state or regional level. The figures demonstrate that both access

sites users and boaters from seasonal homes have important local economic impacts. It is therefore important to develop management policies that accommodate both groups in a given area.

7. The study provided information on the number of boats kept at seasonal and permanent waterfront homes. This is important because there are a variety of issues relating to the amount and type of use of Michigan inland lakes. They include use levels and limits, enforcement and access to Michigan's inland lakes. Some regions of the state, particularly in southeast Michigan, have experienced carrying capacity problems and conflicts between riparians and boating access sites users. Information on spending and use patterns provided here can contribute to decision making related to boating management and facilities on inland lakes.

BIBLIOGRAPHY

Armstrong, S., and Overton, T. (1977). "Estimating Nonresponse Bias in Mail Surveys." *Journal of Marketing Research.* Vol. 14, August: 396-402.

Babbie, E. (1992). The Practice of Social Research. Wadsworth Pub. Co.

Baker, K., Hozier, G., and Rogers, R. (1994). "Marketing Research Theory and Methodology and the Tourism Industry: A Nontechnical Discussion" *Journal of Travel Research.* Winter: 3-7.

Becker, R. (1984). "Gatekeepers of Methodology: A Reply to Brown." *Leisure Sciences.* Vol. 6: 513-518.

Becker, R., and Iliff, T. (1983). "Nonrespondents in Homogeneous Groups: Implications for Mailed Surveys." *Leisure Sciences.* Vol. 5: 257-267.

Brog, W., and Meyburg, A. (1980). "Nonresponse Problems in Travel Surveys: An Empirical Investigation." *Transportation Research Record 775: Travel Demand Models: Application, Limitations and Quantitative Methods.* Washington, D.C.: Transportation Research Board, National Academy of Science.

Choi, S., Ditton, R., and Matlock, G. (1992). "Homogeneity across Mail Survey Waves: A Replicated Study." *Journal of Leisure Research.* Vol. 24, No. 1: 79-85.

Chris, P. (1995). "Increasing Survey Response Rate: Practical Instructions from the Total-Design Method." *Cornell Hotel and Restaurant Administration Quarterly.* Vol. 36, No. 4: 66-73.

Churchill, G. (1988). Basic Marketing Research. Dryden Press, Chicago.

Daniel, W. (1975). "Nonresponse in Sociological Surveys: A Review of Some Methods for Handling the Problem." *Sociological Methods and Research.* Vol. 3, February: 29 1-307.

Deleeuw, E., and Hox, J. (1988). "The Effects of Response-Stimulating Factors on Response Rates and Data Quality in Mail Survey: A Test of Dillman's Total Design Method." *Journal of Official Statistics.* 4: 24 1-250.

Dillman, D. (1991). "The Design and Administration of Mail Surveys." *Annual Review of Sociology.* Vol. 17: 225-249.

Dolsen, D., and Machlis, G. (1991). "Response Rates and Mail Recreation Survey Results: How Much Is Enough?" *Journal of Leisure Research.* Vol. 23, No. 3: 272-277.

Donald, M. (1960). "Implication of Nonresponse for the Interpretation of Mail Questionnaire Data." *Public Opinion Quarterly*. Vol. 24, Spring: 99-114.

Ellerbrock, M. (1981). "Improving Coupon Conversion Studies." *Journal of Travel Research*. Spring: 37-38.

Ellis, R., Endo, C., and Armer, J. (1970). "The Use of Potential Nonrespondents for Studying Nonresponse Bias." *Pacific Sociological Review*. Vol. 13, Spring: 103-109.

Falk, J., Graefe, A., and Swartz, D. (1987). *The 1985 Delaware Recreational Boating Survey: An Analysis of Delaware-registered Boaters*. DEL-SG-06-87. Newark, Delaware: University of Delaware.

Filion, F. (1975). "Estimating Bias due to Nonresponse in Mail Surveys" *Public Opinion Quarterly*. Vol. 40, Winter: 482-492.

Filion, F. (1976). "Exploring and Correcting for Nonresponse Bias Using Follow-ups of Nonrespondents." *Pacific Sociological Review*. Vol. 19, July: 401-408.

Frechtling, D. (1994a). "Assessing the Economic Impacts of Travel and Tourism-Introduction to Travel Economic Impact Estimation." In B. Ritchie and C. Goeldner (eds.) *Travel, Tourism and Hospitality Research* (pp. 325-332). New York: John Wiley and Sons Inc.

Frechtling, D. (1994b). "Assessing the Economic Impacts of Travel and Tourism-Measuring Economic Benefits." In B. Ritchie and C. Goeldner (eds.) *Travel, Tourism and Hospitality Research* (pp. 333-351). New York: John Wiley and Sons Inc.

Fuller, C. (1974). "Weighting to Adjust for Survey Nonresponse." *Public Opinion Quarterly*. Vol. 38, Summer: 239-246.

Fuller, C. (1974). "Weighting to Adjust for Survey Nonresponse." *Public Opinion Quarterly*. Vol. 38, Summer: 239-246.

Gitelson, R., and Drogin, E. (1992). "An Experiment on the Efficacy of a Certified Final Mailing." *Journal of Leisure Research*. Vol. 24, No. 1: 72-78.

Hammitt, W., and MaDonald, C. (1982). "Response Bias and the Need for the Extensive Mail Questionnaire Follow-ups among Selected Recreation Sample." *Journal of Travel Research*. Winter: 207-216.

Howard, D., Lankford, S., and Havitz, M. (1991). "A Method for Authenticating Pleasure Travel Expenditures." *Journal of Travel Research*. Spring: 19-23.

Humphrys, C. (1991). *Carrying Capacity for Boating on Michigan's Inland Lakes*. East Lansing, Michigan: Michigan State University.

Kinnunen, R., and Schwartz, J. (1994). *Upper Peninsula of Michigan Lake Superior 1992 Transient Boater Marketing and Economic Survey*. Ann Arbor, Michigan: Michigan Sea Grant Publications. MICHU-SG-94-204.

Kott, P. (1994). "A Note on Handling Nonresponse in Sample Surveys." *Journal of the American Statistical Association*. Vol. 89, No. 426: 693-696.

Lambert, D., and Harrington, T. (1990). "Measuring Nonresponse Bias in Customer Service Mail Surveys." *Journal of Business Logistics*. Vol. 11, No. 2: 5-25.

Lankford, S., Buxton, B., Hetzler, R., and Little, J. (1995). "Response Bias and Wave Analysis of Mailed Questionnaires in Tourism Impact Assessments." *Journal of Travel Research*. Spring: 8-13.

Lawton, L., and Parasuraman, A. (1980). "The Impact of the Marketing Concept on New Product Planning." *Journal of Marketing*. Vol. 44, Winter: 19-25.

Lipton. D. W., and Miller, 5. (1995). *Recreational Boating in Maryland: An Economic Impact Study*. UM-SG-MAP-95-02. College Park, Maryland: Maryland Sea Grant Extension Service, University of Maryland.

Mak, J., Moncur, J., and Yonamine, D. (1977). "How or How Not to Measure Visitor Expenditures." *Journal of Travel Research*. Summer: 1-4.

Mandell, L. (1974). "When to Weight: Determining Nonresponse Bias in Survey Data." *Public Opinion Quarterly*. Vol. 38, Winter: 247-252.

Meyburg, A., and Brog, W. (1981). " Validity Problems in Empirical Analyses of Non-Home-Activity Patterns." *Transportation Research Record 807: Travel Demand Forecasting and Data Considerations*. Washington, D.C.: Transportation Research Board, National Academy of Science.

National Marine Manufacturers Association. (1999). *Boating Statistics*. http://www.nmma-medialink.com.

National Sporting Goods Association. (1999). *Sport Participation*. http://www.nsga.org.

Neely, R., Johnson, R., and Young, B. (1998). *The Business of Boating Recreation in Oregon*. ORESU-G-98-003. Corvallis, Oregon: Oregon Sea Grant, Oregon State University.

Nelson, J. A. (1996). "The Frequency of Consumer Expenditures: An Empirical Analysis." *Journal of Consumer Affairs*. Vol. 30, No. 2: 322-347.

Oppennann, M. (1998). "Destination Threshold Potential and the Law of Repeat Visitation." *Journal of Travel Research*. Vol. 37, November: 13 1-137.

Pindyck, R., and Rubinfeld, D. (1981). *Econometric Models and Economic Forecasts*. McGraw-Hill.

Roger, J. (1991). "A Non-Technical Perspective on Data Collection Methodologies for Travel Survey: A Discussion Paper." *Journal of Travel Research*. Winter: 43-47.

Rowland, M., and Forthofer, R. (1993). "Adjusting for Nonresponse Bias in a Health Examination Survey." *Public Health Reports*. Vol. 108, No. 3: 380-386.

Rust, E., and Potepan, M. (1997). *The Economic Impact of Boating in California*. California Department of Boating and Waterways. California.

Rylander, R., Propst, D., and McMurtry, T. (1995). "Nonresponse and Recall Bias in a Survey of Travel Spending." *Journal of Travel Research*. Spring: 39-45.

Schott, R. (1995). *The Impact of Great Lakes Recreational Boating on the Economy of Michigan*. M.S. Thesis. East Lansing, Michigan: Michigan State University.

Spotts, D., and Mahoney, E. (1991) "Segmenting Visitors to a Destination Region Based on the Volume of Their Expenditures." *Journal of Travel Research*. Winter: 24-31.

Stewart, S. (1990). *A Pilot Study of Transient Boaters in Three Michigan Ports*. M.S. Thesis. East Lansing, Michigan: Michigan State University.

Stewart, W., Anderson, S., Fesenmaier, D., and Lue, C. (1993). "Highway Welcome Center Surveys: Problem with Nonresponse Bias." *Journal of Travel Research*. Winter: 53-57.

Stoll, J., Bergstrom, J., and Jones, L. (1988). "Recreational Boating and Its Economic Impact in Texas." *Leisure Science*. Vol. 10: 51-67.

Stynes, D. (1983a). "An Introduction to Recreation Forecasting." In S. Lieber and D. Fesenmaier (eds.) *Recreation Planning and Management* (pp. 87-95). State College, PA: Venture Publishing.

Stynes, D. (1983b). "Time Series and Structural Models for Forecasting Recreation Participation." In S. Lieber and D. Fesenmaier (eds.) *Recreation Planning and Management* (pp. 105-119). State College, PA: Venture Publishing.

Stynes, D. (1998). *Guidelines for Measuring Visitor Spending*. http://www.msu.edu/user/stynes.

Stynes, D., and Chung, W. (1986). "Resistant Measures of Recreation and Travel Spending." *Abstract 1986 Symposium on Leisure Research.* Alexandria, VA: National Recreation and Park Association.

Stynes, D., and Holecek, D. (1982). *Michigan Great Lakes Recreational Boating: A Synthesis of Current Information.* MICH-SG-82-203. Ann Arbor, Michigan: Michigan Sea Grant Program.

Stynes, D., and Mahoney, E. (1989). "Measurement and Analysis of Recreational and Travel Spending." *Abstract 1986 Symposium on Leisure Research.* Alexandria, VA: National Recreation and Park Association.

Stynes, D., and Safronoff, D. (1982). *1980 Michigan Recreational Boating Survey.* MICHU-SG-82-202. Ann Arbor, Michigan: Michigan Sea Grant Program.

Stynes, D., Brother, G., Holecek, D., and Verbyla, D. (1983). *Recreational Boating Spending Patterns and Economic Impacts of Michigan Registered Boat Owners.* MICHU-SG-83-210. Ann Arbor, Michigan: Michigan Sea Grant Program.

Stynes, D., Wu, T., and Mahoney, E. (1995). *1994 Michigan Boating Survey.* East Lansing, Michigan: Michigan State University.

Sudman, S., and Kalton, G. (1986). "New Developments in the Sampling of Special Populations." *Annual Review of Sociology.* Vol. 12: 40 1-429.

Talhelm, D., Jordan, S., and Holecek, D. (1988). *1986 Michigan Recreational Boating Survey.* East Lansing, Michigan: Michigan State University.

Talhelm, D., Mahoney, E., Bishop, G., Lee, H-C., and Wu, T. (1998). *Great Lakes Marina Census and Marina Needs.* Research Report 548. East Lansing, Michigan: Michigan Agricultural Experiment Station, Michigan State University.

Tanfer, K. (1993). "National Survey of Men: Design and Expectation." *Family Planning* Perspectives. Vol. 25, No. 2: 83-86.

Travel Industry Association of America (1998). *Research and Statistics.* http://www.tia.org/research.

USDA, USFWS, and USDC. (1998). *1996 National Survey of Fishing Hunting and Wildlife-Associated Recreation-Michigan.*

Viswesvaran, C., Barrick, M., and Ones, D. (1993). "How Definitive Are Conclusions Based on Survey Data: Estimating Robustness to Nonresponse." *Personal Psychology.* Vol. 46: *551-567.*

Warner, T. D. (1974). *An Analysis of Recreational Boating Expenditures. A Study of Michigan Boaters.* M.S. Thesis. East Lansing, Michigan: Michigan State University.

Witt, S., and Witt, C. (1992). *Modeling and Forecasting Demand in Tourism.* Academic Press.

Woodside, A., and Ronkainen, I. (1984). "How Serious Is Nonresponse Bias in Advertising Conversion Research?" *Journal of Travel Research.* Spring: 34-37.

Wu, T. C. (1995). *A System of Models for Estimating Recreational Boating Use in Michigan Counties.* Ph.D. Dissertation. East Lansing, Michigan: Michigan State University.

Yuan, M., and Yuan, S. (1996). "Sixteen versus Nine Expenditure Categories in Tourism Survey: Is There a Difference?" *Journal of Travel Research.* Spring: 59-62.

APPENDICES

Appendix A. Questionnaire (In-Season Survey)

1998 MICHIGAN RECREATIONAL BOATING SURVEY

1. How many boats do you own that are currently registered in Michigan? _____

PLEASE ANSWER THIS SURVEY FOR THE BOAT INDICATED ON THE MAILING LABEL

DESCRIPTIVE INFORMATION ABOUT YOUR BOAT

2. Type of boat (check one) :
- ☐ Inboard
- ☐ Inboard/outboard
- ☐ Outboard
- ☐ Sail, unpowered
- ☐ Sail, with power
- ☐ Pontoon
- ☐ Canoe or Row
- ☐ Personal watercraft (e.g. Jet ski)
- ☐ Other, please specify

_____

3. Boat length (feet) _____

4. How long have you owned this boat? _____ years

5. Where are you keeping this boat during the 1998 boating season?

a. County where the boat is kept _____

b. Type of facility (check one):
- ☐ Permanent residence
- ☐ Cottage or second home
- ☐ Public marina
- ☐ Rented space in a commercial marina
- ☐ Owned space in marina or dockaminium
- ☐ Yacht / boat club
- ☐ Other (please specify) _____

c. Is this boat currently stored ... (check one)
- ☐ On land
- ☐ In a dry stack facility
- ☐ In the water (wet slip, mooring or dockside)
- ☐ Attached to or on a larger boat
- ☐ Other (please specify) _____

d. Is this location (check one):
- ☐ A waterfront site with access to the Great Lakes & connecting waters
- ☐ An inland lake waterfront site (no Great Lakes access)
- ☐ A river or stream waterfront site (no Great Lakes access)
- ☐ A non-waterfront site

6. Where do you store this boat most of the time during the non-boating season? (check one)
- ☐ A permanent residence
- ☐ A cottage or second home
- ☐ Marina
- ☐ Yacht / boat club
- ☐ Other rented space
- ☐ Other storage (please specify) _____

7. Has this boat been under power or sail in Michigan waters in 1998?

☐ NO ⇨ If No, do you plan to use the boat in Michigan this year? ☐ YES ☐ NO

If NO, why not? _____

If your boat has not been put in water in 1998, skip to question 19.

☐ YES

USE OF YOUR BOAT THIS YEAR

8. How many days has this boat been operated in Michigan waters so far in 1998?

_____ days of boating in 1998

8a. How many of these days was the boat operated on the Great Lakes or connecting waters? (That is, *Lakes Huron, Superior, Erie, Michigan, and St. Clair; the St. Mary's, St. Clair and Detroit River, and lakes and rivers that provide direct access to the Great Lakes).*

_____ days of boating on the Great Lakes

9. How many additional days (NOT COVERED ABOVE) has the boat been used this year when it was in the water, but not underway (e.g. used at the dock or mooring for lodging, repairs, entertaining, fishing etc.).

_____ days of additional use at the dock or mooring.

MOST RECENT BOATING OCCASION

This section asks about the most recent outing on which your boat was used (include trips to a boat stored at a marina even if the boat was not taken out under power or sail).

10. Which of the following best describes your most recent boating occasion: (check one)

- ☐ Transported my boat to a launch site
- ☐ Boated from my waterfront permanent home
- ☐ Boated from my waterfront seasonal home
- ☐ Traveled to where the boat is stored (e.g. a marina or yacht club) and boated from there
- ☐ Traveled to where the boat is stored (e.g. a marina or yacht club) and used the boat at the dock without getting underway
- ☐ Other, please specify _____

11. When did this most recent use occur? _____ day/month

12. Where did this most recent use occur? County _____, Body of Water _____

13. Was the boat used on the Great lakes or connecting waters on this occasion?

☐ YES ☐ NO

14. Were you away from your permanent home or seasonal residence overnight on this boating occasion?

☐ YES ☐ NO

14a. If Yes, how many nights were you away from home? _____ (nights)

15. How many people used the boat on this occasion? _____ adults

_____ children (17 or younger)

SPENDING ON YOUR MOST RECENT BOATING OCCASION

16. Did you spend any money on this boating occasion? ☐ YES ☐ NO (skip to question 18)

↓

16a. If Yes, please report how much money you spent within each of the following categories. Report spending near your permanent or seasonal home in the first column and spending away from home (more than 20 miles from home) in the second column. If you are boating from a waterfront home, report spending on any items bought specially for this outing (e.g. boat gas, groceries etc.). If boating away from home, report all expenses on this trip.

SPENDING ON YOUR MOST RECENT BOATING OCCASION
(*enter zero if you did not spend anything in a particular category*)

	NEAR HOME	AWAY FROM HOME
BOAT EXPENSES		
Boat Fuel and oil	$_____	$_____
Temporary dockage	$_____	$_____
Pump-out & launch fees	$_____	$_____
Repair and maintenance	$_____	$_____
Marine supplies	$_____	$_____
PERSONAL EXPENSES		
Restaurant meals and drinks	$_____	$_____
Groceries & take out food & drink	$_____	$_____
Auto gas and oil	$_____	$_____
Shopping & souvenirs	$_____	$_____
Recreation & entertainment	$_____	$_____
Other expenses	$_____	$_____

17. Was your spending on this trip outing (check one):

☐ More than you usually spend ☐ Typical ☐ Less than usual

BOATS ACQUIRED IN THE PAST THREE YEARS

18. Have you purchased or otherwise acquired a new or used boat **within the past three years (1996, 1997 or 1998)**?

☐ YES ☐ NO (If No, skip to question 19)

↓

If YES, please complete the following table for each boat purchased since January 1996.

Year Bought	Make	Type (see question 2)	Length (feet)	Price	Bought new or used	Bought from (check one)
					☐ new ☐ used	☐ boat dealer ☐ retail store ☐ other boater
					☐ new ☐ used	☐ boat dealer ☐ retail store ☐ other boater
					☐ new ☐ used	☐ boat dealer ☐ retail store ☐ other boater

INFORMATION ABOUT YOU AND YOUR FAMILY

This information is requested to provide a profile of registered boat owners and to identify boating patterns for different subgroups of boaters. 19. Please give the county, state, and zip code of your permanent residence.

_____ County _____ State _____ Zip Code

20. Age of the boat owner _____ years

21. How many people, including yourself, reside in your household?

_____ Adults _____ Children under 18 years of age

22. What was your annual household income in 1997 ? (check one category below)

- ☐ Under $20,000
- ☐ $20,000- $39,999
- ☐ $40,000-$59,999
- ☐ $60,000-$99,999
- ☐ $100,000 -$149,999
- ☐ Over $150,000

23. Do you currently own a seasonal home, condominium or cottage in Michigan?

☐ YES ⇨ In what Michigan county is it located? _____ County

☐ NO

THANK YOU VERY MUCH FOR YOUR HELP WITH THIS SURVEY.

TO RETURN YOUR COMPLETED QUESTIONNAIRE, FOLD IT SO THE RETURN ADDRESS SHOWS AND THEN TAPE OR STAPLE IT TOGETHER. MAIL IT FROM ANY U.S. POSTAL BOX.

91-1103

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 941 EAST LANSING, MI

POSTAGE WILL BE PAID BY ADDRESSEE

DEPARTMENT OF PARK, RECREATION
AND TOURISM RESOURCES
MICHIGAN STATE UNIVERSITY
131 NATURAL RESOURCES BUILDING
EAST LANSING MI 48824-9902

Appendix B. Questionnaire (Season-End Survey)

1998 MICHIGAN RECREATIONAL BOATING SURVEY

1. How many boats do you own that are currently registered in Michigan? _____ .

PLEASE ANSWER THIS SURVEY FOR THE BOAT INDICATED ON THE MAILING LABEL.

DESCRIPTIVE INFORMATION ABOUT YOUR BOAT

2. Type of boat (check one):
   - ☐ Inboard
   - ☐ Inboard/outboard
   - ☐ Outboard
   - ☐ Sail, unpowered
   - ☐ Sail, with power
   - ☐ Pontoon
   - ☐ Canoe or Row
   - ☐ Personal watercraft (e.g. Jet ski)
   - ☐ Other (please specify)

_____

3. Boat length (feet) _____

4. How long have you owned this boat? _____ years

5. Where did you keep this boat during the 1998 boating season?

   a. County where this boat is kept (*see map for county names*) _____

   b. Type of facility (check one):
   - ☐ Permanent residence
   - ☐ Cottage or second home
   - ☐ Public marina
   - ☐ Commercial marina
   - ☐ Owned space in marina or dockaminium
   - ☐ Yacht / boat club
   - ☐ Other (please specify) _____

   c. Was this boat currently stored (check one):
   - ☐ On land
   - ☐ In a dry stack facility
   - ☐ In the water (wet slip, mooring or dockside)
   - ☐ Attached to or on a larger boat
   - ☐ Other (please specify) _____

   d. Is this location (check one):
   - ☐ A waterfront site with access to the Great Lakes & connecting waters
   - ☐ An inland lake waterfront site (no Great Lakes access)
   - ☐ A river or stream waterfront site (no Great Lakes access)
   - ☐ A non-waterfront site

6. Where do you store this boat most of the time during the non-boating season? (check one)
   - ☐ Permanent residence
   - ☐ Cottage or second home
   - ☐ Marina
   - ☐ Yacht / boat club
   - ☐ Other rented space
   - ☐ Other storage (please specify) _____

7. Has this boat been under power or sail in Michigan waters in 1998?
   - ☐ NO ⇨ If No, do you plan to use the boat in Michigan this year? ☐ YES ☐ NO
     If NO, why not? _____
   - ☐ YES

If your boat has not been put in water in 1998, skip to question 10.

USE OF YOUR BOAT THIS YEAR

8. How many days has this boat been operated in Michigan waters so far in 1998?

_____ days of boating in 1998

8a. How many of these days was the boat operated on the Great Lakes or connecting waters?
(That is, Lakes Huron, Superior, Erie, Michigan, and St. Clair; the St. Mary's, and Detroit Rivers; and lakes and rivers that provide direct access to the Great Lakes)

_____ days of boating on the Great Lakes

9. How many additional days (NOT COVERED ABOVE) has the boat been used this year when it was in the water, but not underway? (e.g. used at the dock or mooring for lodging, repairs, entertaining, fishing, etc.)

_____ days of additional use at the dock or mooring

BOATS ACQUIRED IN THE PAST THREE YEARS

10. Have you purchased or otherwise acquired a new or used boat **within the past three years (96, 97, 98)**?

☐ YES ☐ NO (If No, skip to question 11.)

⇩

If YES, please complete the following table for each boat purchased since January 1996.

Year Bought	Make	Type (see question 2)	Length (feet)	Price	Bought new/or used	Bought from (check one)
					☐ new ☐ used	☐ boat dealer ☐ retail store ☐ other boater
					☐ new ☐ used	☐ boat dealer ☐ retail store ☐ other boater
					☐ new ☐ used	☐ boat dealer ☐ retail store ☐ other boater

ANNUAL EXPENSES FOR THIS BOAT

11. Estimate the amount of money spent in 1998 to operate and maintain **this boat (shown on the label).** Report expenses only for the boat that you have described above. **DO NOT** include spending for consumable items used on boating trips or transportation to and from boating areas (for example, auto fuel, food, bait and lures).

Boat Equipment (e.g., motors, trailer, anchors, sails, fishing, water-ski, safety & electronic equipment, etc.)	$_____	**Seasonal slip rental or Dry stack storage**	$_____
Repair & Maintenance (e.g., to hull, motor, trailer, mast, sails, galley, deck, shaft, prop, docks, etc.)	$_____	**Put in and Haul out fees**	$_____
Boat Insurance	$_____	**Off-season storage**	$_____

12. How much money was spent on fuel for **this boat** in 1998? $_____

INFORMATION ABOUT YOU AND YOUR FAMILY

This information is requested to provide a profile of registered boat owners and to identify boating patterns for different subgroups of boaters (*see map to identify county names for questions 13 and 17*).

13. Please give the county, state, and zip code of your permanent residence.

_____ County _____ State _____ Zip Code

14. Age of the boat owner _____ years

15. How many people, including yourself, reside in your household?

_____ Adults _____ Children under 18 years of age

16. What was your annual household income in 1997 ? (check one category below)

- ☐ Under $20,000
- ☐ $20,000- $39,999
- ☐ $40,000-$59,999
- ☐ $60,000-$99,999
- ☐ $100,000 -$149,999
- ☐ Over $150,000

17. Do you currently own a seasonal home, condominium or cottage in Michigan?

☐ YES ⇨ In what Michigan county is it located? _____ County

☐ NO

THANK YOU VERY MUCH FOR YOUR HELP WITH THIS SURVEY.
TO RETURN THE QUESTIONNAIRE, FOLD IT SO THE RETURN ADDRESS SHOWS, TAPE OR STAPLE IT TOGETHER, AND MAIL IT AT ANY U.S. POST OFFICE MAILBOX.

91-1103

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 941 EAST LANSING, MI

POSTAGE WILL BE PAID BY ADDRESSEE

DEPARTMENT OF PARK, RECREATION
AND TOURISM RESOURCES
MICHIGAN STATE UNIVERSITY
131 NATURAL RESOURCES BUILDING
EAST LANSING MI 48824-9902

Appendix C. Measures in Boats & Trip Spending by Wave

Table 43. Measures in Boats & Trip Spending by Wave

		Wave										
	Total	1	2	3	4	5	6	7	8	9	F or χ^2	P
Boat Length in Feet	N=971	N=269	N=81	N=82	N=93	N=98	N=87	N=85	N=82	N=94	χ^2=22.29	0.899
PWC	12%	13%	4%	19%	18%	12%	8%	11%	9%	15%		
< 16'	40%	43%	45%	35%	35%	40%	46%	33%	34%	39%		
16 - 20'	34%	30%	36%	37%	34%	35%	26%	42%	43%	29%		
21 - 28'	12%	12%	13%	7%	9%	10%	16%	11%	11%	14%		
29' +	3%	2%	3%	2%	4%	3%	3%	3%	2%	3%		
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
TYPE OF BOAT	N=968	N=268	N=80	N=82	N=92	N=98	N=87	N=85	N=82	N=94	χ^2=25.56	0.963
Inboard (in/outboard)	23%	20%	25%	22%	29%	21%	18%	26%	32%	17%		
Outboard	42%	42%	53%	32%	39%	52%	42%	41%	41%	41%		
Sail	4%	5%	3%	5%	4%	2%	7%	3%	7%	1%		
Pontoon	10%	11%	10%	8%	5%	7%	14%	8%	10%	12%		
Canoe/row	9%	9%	5%	14%	5%	5%	13%	11%	1%	13%		
PWC	12%	13%	4%	19%	18%	12%	8%	11%	9%	15%		
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		
BOAT STORAGE	N=922	N=253	N=77	N=77	N=88	N=95	N=85	N=85	N=75	N=87	χ^2=17.79	0.813
Marina	7%	6%	8%	4%	12%	5%	6%	7%	6%	7%		
Waterfront Primary Home	27%	23%	20%	47%	20%	24%	32%	22%	26%	43%		
Waterfront Seasonal Home	23%	22%	21%	32%	31%	26%	20%	20%	26%	16%		
Nonwaterfront Home	42%	48%	51%	17%	36%	44%	42%	51%	42%	34%		
% of Day Trips	N=950	N=265	N=78	N=82	N=90	N=95	N=86	N=83	N=79	N=92		
	85%	81%	87%	83%	86%	85%	91%	80%	87%	92%	χ^2=0.75	0.651
% of Zero Spending	N=964	N=268	N=81	N=82	N=90	N=98	N=87	N=85	N=81	N=92		
	46%	43%	48%	46%	49%	43%	49%	53%	49%	57%	F=1.26	0.258

Appendix D. Sampling Errors

Table 44. Sampling Errors for Trip Expenditures (90% Confidence Level)

	N	Mean	Standard Error	%Error
DAY TRIPS				
Marina	85	52.6	9.0	28%
Waterfront Primary Home	238	15.0	2.5	28%
Waterfront Seasonal Home	191	27.7	4.2	25%
Nonwaterfront Home	213	30.8	3.1	17%
Day Trips All	727	23.1	1.9	13%
OVERNIGHT TRIPS				
Marina	58	90.7	9.2	17%
Waterfront Primary Home	15	79.0	17.0	35%
Waterfront Seasonal Home	13	36.9	13.1	58%
Nonwaterfront Home	62	51.4	6.7	21%
Overnight Trips All	148	60.2	4.9	13%
ALL TRIPS BY STORAGE				
Marina	143	76.2	7.0	15%
Waterfront Primary Home	253	20.3	2.6	21%
Waterfront Seasonal Home	204	29.1	4.0	23%
Nonwaterfront Home	275	44.1	2.9	11%
ALL TRIPS BY TRIP				
Day Trips	727	23.1	1.9	13.4%
Overnight Trips	148	60.2	4.9	13.3%
TOTAL	875	34.6	1.8	9%

Appendix E. Average Trip Spending

Table 45. Average Trip Spending by Storage Segment & Type of Trip: 1998

	Marina	Waterfront Primary	Waterfront Seasonal	Non-waterfront	Total
(1) PER BOAT PER DAY TRIP SPENDING FOR DAY TRIPS					
Boat Fuel	18.0	7.3	7.1	8.5	8.0
Temporary Dockage	0.0	0.0	0.1	0.1	0.0
Pump-out & Launch Fees	0.1	0.2	0.0	0.4	0.2
Repair & Maintenance	0.2	1.2	2.8	3.3	1.9
Marine Supplies	3.7	0.7	1.7	1.1	1.2
Restaurant	13.5	2.5	3.4	3.9	3.6
Groceries	8.7	2.1	9.3	5.9	5.1
Auto Gas	2.5	0.5	2.3	4.9	1.8
Shopping	4.3	0.2	0.0	0.1	0.3
Recreation	1.1	0.3	0.5	0.4	0.4
Other Expenses	0.5	0.1	0.7	1.9	0.5
Overall Mean	52.6	15.0	27.7	30.8	23.1
Lower Bound [a]	37.8	10.9	20.8	25.7	20.0
Upper Bound [a]	67.4	19.1	34.6	35.9	26.2
% Sampling Error [a]	28%	28%	25%	17%	13%
(2) PER BOAT PER DAY TRIP SPENDING FOR OVERNIGHT TRIPS					
Boat Fuel	22.7	28.4	3.8	7.8	12.4
Temporary Dockage	12.2	8.4	0.4	0.9	3.9
Pump-out & Launch Fees	0.9	1.8	0.3	0.6	0.7
Repair & Maintenance	1.2	1.1	8.2	3.1	3.1
Marine Supplies	3.9	1.3	1.5	1.2	1.8
Restaurant	17.7	12.8	8.1	6.7	9.6
Groceries	15.1	9.4	11.0	12.2	12.3
Auto Gas	3.4	8.1	1.5	7.0	5.7
Shopping	8.8	2.3	1.3	3.3	4.0
Recreation	1.7	5.1	0.0	4.4	3.4
Other Expenses	3.1	0.2	0.8	4.3	3.2
Overall Mean	90.7	79.0	36.9	51.4	60.2
Lower Bound	75.6	51.1	15.4	40.4	52.2
Upper Bound	105.8	106.9	58.4	62.4	68.2
% Sampling Error	17%	35%	58%	21%	13%
(1+2) PER BOAT PER DAY SPENDING (WEIGHTED AVERAGE OF TOW TRIPS)					
Boat Fuel	20.9	9.0	6.5	8.1	9.3
Temporary Dockage	7.6	0.7	0.1	0.7	1.2
Pump-out & Launch Fees	0.6	0.3	0.1	0.5	0.3
Repair & Maintenance	0.9	1.2	3.6	3.2	2.3
Marine Supplies	3.8	0.8	1.6	1.2	1.4
Restaurant	16.1	3.3	4.1	5.7	5.4
Groceries	12.7	2.7	9.5	9.9	7.3
Auto Gas	3.0	1.2	2.2	6.2	3.0
Shopping	7.1	0.3	0.2	2.2	1.5
Recreation	1.5	0.7	0.4	3.0	1.3
Other Expenses	2.1	0.1	0.7	3.4	1.4
Overall Mean	76.2	20.3	29.1	44.1	34.6
Lower Bound	64.8	16.0	22.5	39.3	31.6
Upper Bound	87.6	24.6	35.7	48.9	37.6
% Sampling Error	15%	21%	23%	11%	9%

a. Sampling errors for estimates of trip expenditures are reported with a 90% confidence level.

Table 46. Average Trip Spending by Storage & Spending Location: 1998

	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	Total
(1) PER BOAT PER DAY TRIP SPENDING NEAR HOME					
Boat Fuel	6.4	7.7	5.9	3.4	6.0
Temporary Dockage	0.1	0.5	0.0	0.0	0.2
Pump-out & Launch Fees	0.2	0.3	0.0	0.1	0.2
Repair & Maintenance	0.1	1.1	2.8	1.3	1.5
Marine Supplies	2.7	0.7	1.6	0.7	1.1
Restaurant	4.2	2.0	2.4	1.3	2.1
Groceries	4.1	2.2	8.4	3.7	4.3
Auto Gas	1.4	0.5	1.7	2.3	1.4
Shopping	1.2	0.1	0.1	0.1	0.2
Recreation	0.0	0.2	0.1	0.3	0.2
Other Expenses	0.1	0.1	0.7	1.0	0.5
TOTAL	20.5	15.2	23.7	14.2	17.5
(2) PER BOAT PER DAY TRIP SPENDING AWAY FROM HOME					
Boat Fuel	14.5	1.3	0.6	4.6	3.4
Temporary Dockage	7.5	0.2	0.1	0.6	1.0
Pump-out & Launch Fees	0.4	0.0	0.0	0.4	0.2
Repair & Maintenance	0.8	0.1	0.8	1.9	0.8
Marine Supplies	1.1	0.1	0.0	0.5	0.3
Restaurant	11.9	1.3	1.7	4.4	3.3
Groceries	8.6	0.5	1.1	6.2	3.1
Auto Gas	1.6	0.7	0.5	4.0	1.6
Shopping	5.9	0.3	0.1	2.1	1.3
Recreation	1.4	0.5	0.3	2.7	1.2
Other Expenses	2.0	0.0	0.0	2.4	0.9
TOTAL	55.7	5.1	5.4	29.9	17.1
(1+2) PER BOAT PER DAY SPENDING ON TRIP					
Boat Fuel	20.9	9.0	6.5	8.1	9.3
Temporary Dockage	7.6	0.7	0.1	0.7	1.2
Pump-out & Launch Fees	0.6	0.3	0.1	0.5	0.3
Repair & Maintenance	0.9	1.2	3.6	3.2	2.3
Marine Supplies	3.8	0.8	1.6	1.2	1.4
Restaurant	16.1	3.3	4.1	5.7	5.4
Groceries	12.7	2.7	9.5	9.9	7.3
Auto Gas	3.0	1.2	2.2	6.2	3.0
Shopping	7.1	0.3	0.2	2.2	1.5
Recreation	1.5	0.7	0.4	3.0	1.3
Other Expenses	2.1	0.1	0.7	3.4	1.4
TOTAL	76.2	20.3	29.1	44.1	34.6

Appendix F. Total Trip Spending

Table 47. Total Trip Spending by Storage Segment & Type of Trip: 1998

	Marina	Waterfront Primary	Waterfront Seasonal	Non-waterfront	Total
(1) TOTAL TRIP SPENDING FOR DAY TRIPS ($ MILLIONS)					
Boat Fuel	12.4	46.9	26.2	15.6	101.2
Temporary Dockage	0.0	0.1	0.2	0.2	0.6
Pump-out & Launch Fees	0.1	1.1	0.1	0.8	2.1
Repair & Maintenance	0.2	7.9	10.3	6.1	24.5
Marine Supplies	2.6	4.6	6.2	2.1	15.4
Restaurant	9.3	16.0	12.6	7.2	45.1
Groceries	6.0	13.3	34.5	10.8	64.5
Auto Gas	1.7	3.4	8.5	9.0	22.6
Shopping	3.0	1.1	0.0	0.3	4.3
Recreation	0.7	2.0	1.8	0.7	5.2
Other Expenses	0.3	0.5	2.5	3.5	6.9
TOTAL	36.3	96.9	102.9	56.3	292.4
Percent of Spending by Segment	12%	33%	35%	19%	100%
(2) TOTAL TRIP SPENDING FOR OVERNIGHT TRIPS ($ MILLIONS)					
Boat Fuel	25.5	16.4	2.6	25.9	70.4
Temporary Dockage	13.7	4.9	0.3	3.1	22.0
Pump-out & Launch Fees	1.0	1.0	0.2	1.9	4.0
Repair & Maintenance	1.4	0.7	5.6	10.1	17.8
Marine Supplies	4.4	0.8	1.0	4.0	10.2
Restaurant	19.8	7.4	5.5	22.0	54.8
Groceries	17.0	5.4	7.5	40.2	70.2
Auto Gas	3.8	4.7	1.0	23.0	32.5
Shopping	9.9	1.3	0.9	10.9	23.0
Recreation	1.9	2.9	0.0	14.6	19.4
Other Expenses	3.5	0.1	0.6	14.1	18.2
TOTAL	101.9	45.6	25.3	169.9	342.7
Percent of Spending by Segment	30%	13%	7%	50%	100%
(1+2) TOTAL STATEWIDE SPENDING ON TRIPS ($ MILLIONS)					
Boat Fuel	37.9	63.4	28.8	41.5	171.6
Temporary Dockage	13.8	4.9	0.5	3.4	22.6
Pump-out & Launch Fees	1.1	2.1	0.2	2.7	6.1
Repair & Maintenance	1.6	8.5	16.0	16.2	42.3
Marine Supplies	6.9	5.4	7.2	6.1	25.7
Restaurant	29.1	23.4	18.1	29.2	99.8
Groceries	23.0	18.7	42.0	51.0	134.7
Auto Gas	5.5	8.1	9.5	32.0	55.1
Shopping	12.9	2.4	0.9	11.2	27.3
Recreation	2.7	4.9	1.8	15.3	24.6
Other Expenses	3.8	0.6	3.1	17.6	25.1
TOTAL	138.2	142.5	128.2	226.2	635.1
Percent of Spending by Segment	22%	22%	20%	36%	100%
SUMMARY ($ MILLIONS)					
Trip Spending on Day Trips	36.3	96.9	102.9	56.3	292.4
Trip Spending on Overnight Trips	101.9	45.6	25.3	169.9	342.7
	138.2	142.5	128.2	226.2	635.1
Trip Spending on Day Trips	26%	68%	80%	25%	46%
Trip Spending on Overnight Trips	74%	32%	20%	75%	54%
	100%	100%	100%	100%	100%

Table 48. Total Trip Spending by Storage Segment & Spending Location: 1998

	Marina	Waterfront Primary Home	Waterfront Seasonal Home	Non-waterfront Home	Total
(1) TOTAL TRIP SPENDING NEAR HOME ($ MILLIONS)					
Boat Fuel	11.6	53.9	26.2	17.7	109.4
Temporary Dockage	0.1	3.6	0.0	0.2	3.8
Pump-out & Launch Fees	0.4	1.9	0.1	0.5	3.0
Repair & Maintenance	0.2	8.0	12.4	6.4	27.0
Marine Supplies	4.9	4.9	7.0	3.6	20.3
Restaurant	7.6	13.9	10.7	6.4	38.6
Groceries	7.5	15.1	37.0	19.0	78.6
Auto Gas	2.5	3.3	7.4	11.6	24.8
Shopping	2.2	0.6	0.3	0.6	3.7
Recreation	0.0	1.4	0.4	1.4	3.2
Other Expenses	0.1	0.5	2.9	5.3	8.8
TOTAL	37.1	107.0	104.5	72.7	321.3
Percent of Spending by Segment	12%	33%	33%	23%	100%
(2) TOTAL TRIP SPENDING AWAY FROM HOME ($ MILLIONS)					
Boat Fuel	26.3	9.5	2.6	23.8	62.2
Temporary Dockage	13.6	1.4	0.5	3.2	18.8
Pump-out & Launch Fees	0.7	0.2	0.1	2.2	3.1
Repair & Maintenance	1.4	0.5	3.6	9.8	15.3
Marine Supplies	2.1	0.6	0.2	2.6	5.4
Restaurant	21.5	9.5	7.4	22.8	61.2
Groceries	15.5	3.6	5.0	32.0	56.1
Auto Gas	3.0	4.8	2.1	20.4	30.3
Shopping	10.7	1.9	0.5	10.6	23.7
Recreation	2.6	3.5	1.4	13.9	21.4
Other Expenses	3.7	0.1	0.2	12.3	6.3
TOTAL	101.0	35.5	23.7	153.5	313.8
Percent of Spending by Segment	32%	11%	8%	49%	100%
(1+2) TOTAL STATEWIDE SPENDING ON TRIPS ($ MILLIONS)					
Boat Fuel	37.9	63.4	28.8	41.5	171.6
Temporary Dockage	13.8	4.9	0.5	3.4	22.6
Pump-out & Launch Fees	1.1	2.1	0.2	2.7	6.1
Repair & Maintenance	1.6	8.5	16.0	16.2	42.3
Marine Supplies	6.9	5.4	7.2	6.1	25.7
Restaurant	29.1	23.4	18.1	29.2	99.8
Groceries	23.0	18.7	42.0	51.0	134.7
Auto Gas	5.5	8.1	9.5	32.0	55.1
Shopping	12.9	2.4	0.9	11.2	27.3
Recreation	2.7	4.9	1.8	15.3	24.6
Other Expenses	3.8	0.6	3.1	17.6	25.1
TOTAL	138.2	142.5	128.2	226.2	635.1
Percent of Spending by Segment	22%	22%	20%	36%	100%
SUMMARY ($ MILLIONS)					
Trip Spending Near Home	37.1	107.0	104.5	72.7	321.3
Trip Spending Away From Home	101.0	35.5	23.7	153.5	313.8
	138.2	142.5	128.2	226.2	635.1
Trip Spending Near Home	27%	75%	81%	32%	51%
Trip Spending Away From Home	73%	25%	19%	68%	49%
	100%	100%	100%	100%	100%

Appendix G. Regional Distribution of Trip Spending by Spending Category

Table 49. Regional Net Gains of Trip Spending by Spending Item ($million): 1998

	South-East	East Central	North-east	North-west	West Central	South-west	South Inland	North Inland	South UP	North UP	Out of State
TRIP SPENDING BY ORIGIN											
Boat Fuel	29.71	7.07	5.86	7.93	5.73	8.33	80.46	9.65	2.22	5.76	8.88
Dockage & Launch	6.93	1.20	0.82	1.28	1.24	1.63	12.37	1.24	0.38	0.68	0.98
Repair & Maintenance	6.03	2.26	1.24	1.48	1.31	1.47	19.84	2.40	0.67	1.73	3.86
Marine Supplies	5.01	1.26	0.70	0.94	0.92	1.12	11.34	1.17	0.36	0.84	2.00
Restaurant	19.40	4.66	2.91	4.07	3.73	4.68	44.90	5.00	1.44	3.16	5.86
Groceries	23.37	7.27	3.57	4.61	4.79	5.18	60.80	6.87	2.19	4.91	11.15
Auto Gas	8.13	2.93	1.69	2.21	2.01	2.18	26.33	3.56	1.05	2.12	2.94
Shopping & Recreation	9.89	2.57	1.52	2.21	2.17	2.47	23.80	2.98	0.94	1.63	1.81
Other Expenses	4.02	1.45	0.69	0.94	1.03	0.98	11.78	1.60	0.54	0.93	1.18
TOTAL	112.48	30.66	19.00	25.69	22.93	28.04	291.61	34.47	9.79	21.75	38.66
TRIP SPENDING BY WHERE SPENDING OCCURS											
Boat Fuel	25.42	6.21	13.74	12.13	8.07	10.35	64.23	18.26	4.07	7.96	1.16
Dockage & Launch	6.93	1.45	2.66	1.68	2.47	2.26	7.54	2.05	0.61	1.05	0.05
Repair & Maintenance	3.60	1.52	4.04	3.61	1.48	2.07	14.66	6.85	1.51	2.73	0.23
Marine Supplies	3.96	0.99	2.02	1.85	1.10	1.44	8.99	2.99	0.73	1.23	0.35
Restaurant	16.54	4.08	8.71	6.96	5.67	6.15	32.32	11.25	2.71	4.83	0.57
Groceries	17.03	5.54	12.60	10.53	6.35	7.23	42.79	19.13	4.62	7.89	1.00
Auto Gas	6.35	2.30	4.46	3.94	2.52	2.61	20.06	7.48	1.77	3.24	0.40
Shopping & Recreation	9.18	2.42	4.65	3.41	3.62	3.12	15.30	5.91	1.50	2.76	0.15
Other Expenses	3.43	1.25	2.22	1.75	1.53	1.25	7.68	3.46	0.88	1.57	0.13
TOTAL	92.44	25.76	55.10	45.88	32.81	36.48	213.56	77.37	18.39	33.26	4.03
NET GAIN OR LOSS TO REGION											
Boat Fuel	-4.29	-0.86	7.88	4.20	2.34	2.02	-16.23	8.61	1.85	2.20	-7.72
Dockage & Launch	0.00	0.25	1.84	0.40	1.23	0.63	-4.83	0.81	0.23	0.37	-0.93
Repair & Maintenance	-2.44	-0.74	2.80	2.13	0.18	0.59	-5.18	4.45	0.84	1.00	-3.62
Marine Supplies	-1.05	-0.27	1.32	0.91	0.18	0.32	-2.35	1.81	0.38	0.39	-1.65
Restaurant	-2.85	-0.58	5.80	2.89	1.94	1.48	-12.57	6.24	1.26	1.67	-5.29
Groceries	-6.34	-1.73	9.03	5.92	1.56	2.05	-18.01	12.26	2.43	2.98	-10.15
Auto Gas	-1.77	-0.63	2.77	1.73	0.51	0.43	-6.27	3.93	0.72	1.13	-2.54
Shopping & Recreation	-0.71	-0.15	3.13	1.20	1.44	0.64	-8.50	2.93	0.56	1.13	-1.66
Other Expenses	-0.59	-0.20	1.53	0.81	0.50	0.27	-4.10	1.86	0.34	0.64	-1.06
SUM	-20.05	-4.90	36.10	20.19	9.88	8.44	-78.05	42.90	8.60	11.52	-34.63