PROJECTING USE OF A PROPOSED NEW LAKE MICHIGAN MARINA--A SPATIAL ANALYSIS APPROACH

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ABSTRACT

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The major objective of this study was to estimate the magnitude of the potential use for the proposed marina at Benton Harbor-St. Joseph, Michigan. The method used in this analysis and estimation was a spatial analysis approach. The basic concept of this approach is that the number of customers visiting a retail center is a function of the distances which separate the customers and the retail center.

Information needed for this study was obtained through the use of two mailed questionnaire surveys. One was a survey of marina operators and the other was a survey of boaters. The marina operator survey produced information needed for examining existing and potential availability of dockage facilities for recreational boats in the study region. The boater survey provided information about boaters' boating and travel characteristics which were used in the analysis of boaters' travel patterns and in estimating the proposed marina's potential market.

The marina operator survey identified an insufficiency

of the dockage facilities in the study area. Analysis of the boater survey first distinguished between boaters using Lake Michigan and those who do not use Lake Michigan. In the final analysis only information about Lake Michigan boaters were taken into account, because the proposed marina was to be built for Lake Michigan boaters only. Next, the boaters' travel patterns in the study region were analyzed to confirm that the boaters' travel pattern on choosing boating facilities was similar to that of the travel pattern of consumers visiting retail centers described in the conceptual model. Estimation of the potential use of the proposed marina was then undertaken.

In the process of the estimation, the possible users of the proposed marina were estimated under the conditions of "no closer facilities available" and "allowing for closer facilities". The results of the estimation indicate that the percentage of boaters willing to use the proposed marina from a given place was inversely related to the distance separating the boaters from the proposed marina.

It was also found that intervening facilities was a major factor in determining the potential use of the proposed marina. The estimated number of boaters decreased drastically when the factor of intervening facilities was introduced into the analysis.

The analysis also includes an estimation of potential boaters from information gathered in both the marina operator survey and the boater survey. From information in the

marina operator survey, boaters who could not rent a slip were estimated as the number of boaters turned away by marina operators. From the boater survey, boaters who could not rent a slip were estimated as the responding boaters' estimate of relatives or friends who could not rent a slip. In addition, boaters who were currently non-boaters but expected to become boaters because of the availability of marina facilities were also estimated.

Based on the analysis and estimations in this study, The major conclusion was that there will be a sufficient number of boaters willing to utilize the proposed marina if and when it is in operation. This conclusion supports the proposed marina development program at Benton Harbor-St. Joseph under consideration by the Michigan Waterways Commission.

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CHAPTER I

INTRODUCTION

The Need for Boating Facilities

Recreational boating in the United States has grown tremendously during the last two decades. In 1950, there were 3,510,000 recreational boats of all types in use in this country. In 1962, the number of boats in use on all waters was 7,468,000. By 1974, it had increased to 9,615,000 pleasure boats in use on U.S. waters. In terms of dollars, it was estimated that in 1951, 645 million dollars was spent in the retail sector on boating equipment, related services, and maintenance. In 1961, this figure had increased to 2.3 billion, and in 1974 to 4.6 billion dollars.[1]

Michigan, commonly called the "Water Wonderland", is the "heartland" of the Great Lakes region. Being bounded by Lake Superior, Michigan, Huron, St. Clair, and Erie, the State has over 3,200 miles of Great Lakes shorelines and 11,000 inland lakes 5 acres or larger in size.[2] Because of

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[1] Boating in 1974: A Statistical Report on America's Top Family Sport, Marketing Department of Marex, and the National Association of Engine and Boat Manufacturers, 1975.

[2] Michigan USA, Michigan State Chamber of Commerce, 1968, p. 26.

location and the accessibility to bodies of water, more and more people have been able to participate in recreational boating in Michigan. In Michigan, the total number of registered boats was 398,902 in 1965; by 1973, this figure had increased to 484,058.[1]

Recreational boating also has many participants in Illinois and Indiana. In Illinois, the total number of registered boats was 156,563 in 1965; in 1972, this figure had increased to 196,450.[2] In Indiana, the total number of registered boats was 136,106 in 1965; in 1973, the total number of registered boats had increased to 197,908.[3]

Of these three states, the growth of recreational boating in Michigan is particularly noticeable. Information complied by the editor of Boating Industry Magazine indicates that the State of Michigan had 9.4 percent of the nation's 6,339,678 numbered boats in 1974. It ranked at the top of the nation's 50 states and territories.[4]

Growth in outdoor recreation in the U.S. in general,

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[1]Michigan Department of the State, boat registration statistics from 1965 to 1973.

[2]Illinois Department of Local Government Affairs, boat registration statistics from 1965 to 1972.

[3]Indiana Department of Natural Resources, boat registration statistics from 1965 to 1973.

[4]The Boating Industry Magazine, The Boating Business 1974, The Boating Industry Magazine, 1975, p. 16.

and recreational boating in particular, may be attributable to a number of factors. These factors include an ever-growing population; a general trend towards higher discretionary income; more leisure time and increased mobility.[1] Other factors such as technological advancement in the recreational equipment industry, and advertising has also been important.

In view of these trends in recreational boating participation and in factors having a direct relationship to these trends, increasing pressures are felt for providing recreational boating facilities. One of the major concerns in terms of facilities related to boating is docking berths.[2]

A recently completed study indicates that in the area of northeastern Illinois and northwestern Indiana alone, about 1,415 additional berths on Lake Michigan are needed to eliminate the excess demand at present and about 2,285 additional berths will be needed to eliminate projected excess demand in 1980.[3] The excess demands for boating

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[1]Marion Clawson and Jack L. Knetsch, Economics of Outdoor Recreation, The Johns Hopkins Press, 1966, pp. 4-5. (Hereafter referred to as: Clawson and Knetsch, Economics of Recreation.)

[2]"Berth" is a form of wet storage, where access to the boat is made via a dock. (Source: Department of the Army, Corps of Engineers, Lake Michigan Regional Boating Survey and Analysis, Chicago District Economics Branch, 1974, p.2. Hereafter referred to as: Corps of Engineers, Regional Boating Survey.)

[3]Corps of Engineers, Regional Boating Survey, p. 62. The same study defines "excess demand" as the quantity or number of potential boaters that would likely appear if the price or costs of using these facilities were fixed at its present level.

facilities include both excess demand due to population and income changes and induced excess demand due to existence of additional facilities.[1] The same study also indicates that the induced effect, those that would buy boats if docks were available, averaged about 50 berths and moorings for each 100 additional berths and moorings provided.[2]

In Michigan, comparable figures of this kind do not exist. However, a similar investigation undertaken in 1971 indicates that there may be a 25 to 30 percent increase in Great Lakes boating participation in the southwestern counties of the State in the period from 1971 to 1980.[3]

In view of this ever-growing recreational activity and the shortage of facilities, public agencies as well as private enterprises are stimulated to construct recreational harbors and related facilities at an accelerated rate, in an attempt to meet what they perceive to be a rapidly increasing need.

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[1]For further discussion on "induced excess demand" for recreation see: Daniel E. Chappelle, The Need for Outdoor Recreation, An Economic Conundrum? Journal of Leisure Research, Vol. 5, No. 4, 1973, pp. 47-53.

[2]Corps of Engineers, Regional Boating Survey, p. 61.

[3]Recreation Resources Consultants, 1971 Michigan Recreational Boating Study, Michigan Department of Natural Resources, Waterways Commission, Report No. 2, 1971, p. 101. (Hereafter referred to as: Recreation Resources Consultants, 1971 Michigan Boating Study.)

The Proposed Marina Development Project

The Waterways Division of the Michigan Department of Natural Resources is the state agency responsible for the construction of recreational harbors in this State. In an effort to meet the needs of the growing number of boaters in the southwestern region of this State, the Waterways Division is considering constructing a marina at the City of Benton Harbor-St. Joseph.

According to the Waterways Division's preliminary plan for the development of this marina, harbor construction, provision of major access roads and utilities will be undertaken by the Division. The development of the rest of the marina's facilities will be undertaken by one or more private enterpreneurs under a leasing agreement with the Division. These facilities might include boat slips, office buildings, parking, fuel, repair, haul-out, rest rooms, shower, and other facilities which are not directly related to boating such as a restaurant and possibly a condominium housing unit.

It was also pointed out by the Division that this new site would be developed strictly for Great Lakes boaters (owners of boats at least 20' in length) who desire seasonal berths. The boat slips to be built will be in three different length categories--20 to 30 foot, 30 to 45 foot, and 45 foot and over. The total number of boat slips to be built as prescribed in the Waterways Division's preliminary

plan is about 300. The number of slips to be built in each length category will be determined by the number of boaters who express a need for the slips in each boat lenght category estimated through this study.

As this marina development program would involve Waterways Division's funding for its harbor construction, it may at first appear subject to the criticism scholars frequently make that the poor elements of society are subsidizing the richer elements.[1]

However, the main source of marina development funds is the marina fuel tax the amount of which is determined by multiplying an estimate of the percentage of total fuel consumed in recreational boats by the total taxes collected on fuel consumed in Michigan. Other sources of revenue to the Division include the watercraft license tax, which is levied solely on recreational craft (all large motor craft are registered); and from various Commission operations.[2] In the Division's words,

> ... that its program, which is intended to benefit recreational boat owners, is financed by taxes received from such boat owners and that no general taxation revenues have ever been used for this purpose.[3]

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[1]Daniel E. Chappelle, The Need for Outdoor Recreation: An Economic Conundrum? Journal of Leisure Research, Fall, 1973, pp.47-53.

[2]Michigan Department of Natural Resources, Michigan State Waterways Commission Biennial Report, 1968-1970, pp. 28-29.

[3]Ibid., p. 30.

Given the above statement, as the proposed marina would be developed strictly for Great Lakes boaters, it may still be subject to the criticism that "marinas constructed with federal and state funds tend to service the relatively small group of large boat owners".[1] In other words, funds collected from small boat owners may be being used to construct facilities to serve large boat owners. The reverse of this complaint is also true since facilities for small boat users are also being developed by the Division. Only a detailed accounting of from whom the Division collects its revenues and to whom these funds are allocated in terms of facilities and services will reveal whether or not small boat owners are actually being treated unfairly. Since such a detailed accounting would go beyond the requirements of this study, it was decided that the noting of the above equity considerations was appropriate but detailed analysis is a responsibility of the Division.

Problem Statement

It is almost axiomatic that market research should be conducted before the installation of any facility to produce some established or new commodities or services. The

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[1]James Oakwood, and Michael Chubb, Planning Public Recreational Boating Facilities in Michigan, Department of Resource Development, Michigan State University, Technical Report, No. 1, 1968, p. 37.

development of a marina complex needs a great amount of input of land and water resources and capital investment. Therefore, it is important that the responsible agency and the prospective consessionaires should have a prior knowledge about the magnitude of the potential market for the proposed marina before any decision concerning its development is made.

To determine the magnitude of the potential market for the proposed marina, the number of boaters needing seasonal slip space should be identified. In other words, potential use of the proposed facilities needs to be estimated. This study is, then, designed to serve the purpose of estimating the potential use of the proposed marina. Information developed in this study will be provided to Waterways Division and privator investors as a partial input to their decision-making process on the marina development program.

Hypothesis

The hypothesis of this study is that there will be a sufficient number of Lake Michigan boaters willing to rent a seasonal slip at the proposed marina (adequate to fill to capacity) if and when it is in operation assuming that the rental fees are competitive with other marinas in the study region.

Study Objectives

The ultimate objective of this study is to provide information, to the public and private investors involved, with respect to boaters' need for the proposed marina facility so that their decisions on the development of the marina can be made more rationally. Specifically, the objectives of this study can be stated as follows:

(1) Estimate the number of potential boaters willing to rent a seasonal slip at the proposed marina.

(2) To prove or disprove the hypothesis stated above.

CHAPTER II

REVIEW OF RELEVANT LITERATURE

This study represents an attempt to use a spatial interaction approach to predict potential consumption for the proposed marina. Clawson and Knetsch maintained that

> in choosing to use parks and other recreation facilities and to spend time, money, and travel in so doing, people behave in a way that is not fundementally different from the way they purchase other items.[1]

As such, the problem of "how many boaters would be willing to travel the distance which separates them and the proposed marina to rent a seasonal slip when it is in operation" is analogous to "a cluster of retail and service establishments located in a place that provides a convenient point of focus for consumers who visit to purchase the goods and services they need".[2]

Consumers, under these circumstances are willing to travel only short distances to obtain items they need frequently. Less frequent purchases can often be postponed so that several things can be accomplished in a single

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[1]Clawson and Knetsch, Economics of Recreation, p. 46.

[2]Brian J.L. Berry, Geography of Market Centers and Retail Distribution, Prentice-Hall, 1967, p. 3.

longer trip. In other words, consumers want a location that permits them to conduct their business with a minimum of effort. If a choice of location is available, they will probably choose the one which involves the least effort.[1] In this case, the market area of this focal point can be determined with the basic model developed by Lösch for the determination of the market area of a single good at a single store.[2]

For example, assume that consumers are evenly distributed over space, can move freely in any direction they choose, and possess identical preferences and purchasing power. Assuming also a retailer sells good "x". He offers

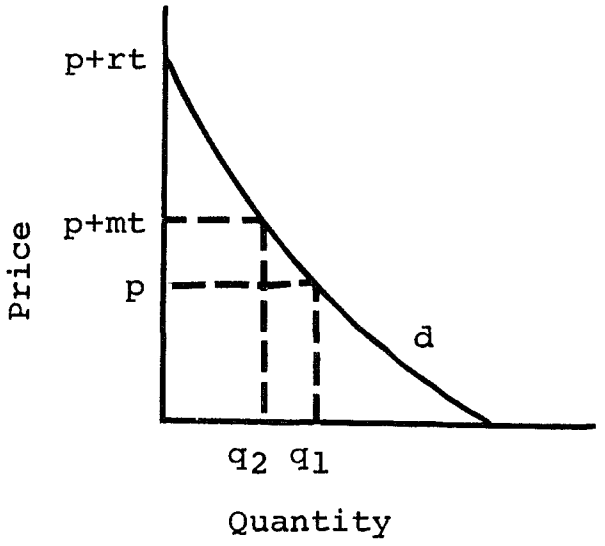

FIGURE 1 QUANTITY CONSUMED DECLINES AS PRICE INCREASES

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[1]For detailed discussion on "least effort" see: G.K. Zipf, Human Behavior and the Principle of Least Effort, Addision-Wesley Press, 1949, pp. 1-6.

[2]August Lösch, The Economics of Location, translated from the second revised edition by William H. Woglom, Science edition, John Wiley and Sons, 1967, pp. 105-7.

it to consumers at a given price "p". If the consumers live "m" miles away from the store, and "t" is the transport cost per mile, the actual price paid by any consumer is p+mt. Every consumer has a demand curve d for good x such that as price increases, he consumes less of it (Figure 1). This demand curve is assumed to be the same for each consumer. At price p, q_1 will be consumed, and at price p+mt (the price the consumer pays at distance m), the quantity consumed will be q_2. Amounts consumed by each consumer, then, are a function of distance if all retailers charge the same price for good x to each consumer.

If travel cost is equal in all directions, it is possible to draw a demand cone around the store, according to which quantity consumed drops off with distance because of price increases to the consumer due to increased transport cost (Figure 2). At distance r, price is p+rt and

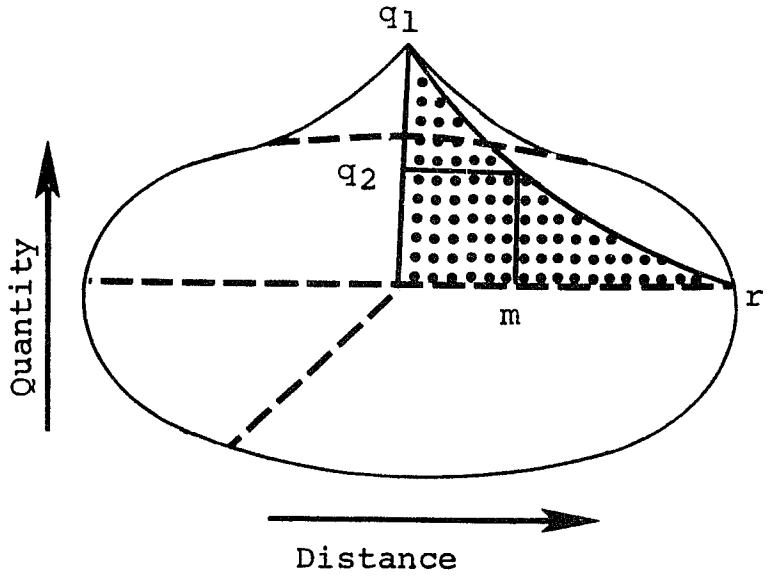

FIGURE 2 THE SPATIAL DEMAND CONE OF THE STORE

quantity consumed is zero (Figure 1). This is the maximum possible economic reach of the store. Ideally, the total quantity of good x consumed by consumers within this maximum reach r may be equal to the area beneath the demand cone.

Berry and Garrison contributed a generalization of a kind which brings the market principles nearer reality and concluded that Lösch's equilibuium conditions are not met in actual circumstances.[1] Among others, Isard points out that

> Unevenness of consumer spread, inequalities in effective purchasing power and differences of tastes among consumers, irregularities in geographic feature, economics of scale in transport, and a host of other factors distort the "natural" circular regularity.[2]

However, he also maintained that

> the essential condition that the market boundary be a locus of consumers who are just willing to pay a price which is equal to the price of the product plus transport cost to the point of comsumption still obtains.[3]

Related empirical studies that can be drawn upon are numerous. They have been completed by geographers, sociologists, economists, and others. These studies, in general, suggest that travel of consumers to urban retail centers, market trading areas, and medical service areas and others consist, in aggregate, of a very large number of short

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[1]B.J.L. Berry, and W.L. Garrison, A Note on Central Place Theory and the Range of Good, Economic Geography, Vol. 34, No. 4, 1958, pp. 304-11.

[2]Walter Isard, Location and Space Economy, M.I.T. Press, 1956, pp. 145-6.

[3]Ibid., p. 146.

trips with progressively fewer trips reported as distances increase.[1]

In the area of outdoor recreation, the use of travel cost as a means of estimating demand for recreation area was probably first suggested by Hotelling[2] and developed by Clawson.[3] The major contribution was probably made by Clawson and Knetsch in their Economics of Outdoor Recreation.[4]

To trace out the demand curve of a recreation area, they relied primarily upon geographic analysis by using differences in numbers of visits and in cost per visit from different areas or zones to estimate the basic relationship. They first put stress on the importance of the location of consumers by

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[1]John E. Brush, and Howard L. Gauthier, Jr., Service Centers and Consumer Trips, The University of Chicago, Department of Geography, Research Paper No. 113, 1968.

Bernard J. Kane, Jr., A Systematic Guide to Supermarket Location Analysis, Fairchild Publications, 1966.

Gardiner H. Barnum, Market Centers and Hinterlands in Baden-Württemberg, The University of Chicago, Department of Geography, Research Paper, No. 103, 1966.

Robert Earickson, The Spatial Behavior of Hospital Patients, The University of Chicago, Department of Geography, Research Paper No. 123, 1970.

D.L. Huff, A Probabilistic Analysis of Shopping Center Trade Areas, Land Economics, Vol. 39, 1963, pp. 81-9.

[2]Clawson, and Knetsch, Economics of Recreation, p. 64.

[3]Marion Clawson, Methods of Measuring the Demand for and Value of Outdoor Recreation, Resources for the Future, Reprint No. 10, 4th printing, 1972.

[4]Clawson, and Knetsch, Economics of Recreation. In this book, geographic approach of measuring demand for outdoor recreation was systemically examined and discussed.

stating that

> The location of customers is important in the demand for any good or service, but it is particularly so in considering the demand for outdoor recreation because travel from home to the recreation site and back takes time and money, sometimes relatively a lot of each. As a result, the demand for outdoor recreation is peculiarly affected by the location of the customers for each area and by the location of rival recreation areas.[1]

Then, they explained the situation as follows:

> If a park has many potential customers living near by, then it will have a relatively large number of visitors, other factors being equal, because costs of visiting it will be relatively low in terms of both money and time. Contrarily, a closely similiar park located at some distance from most of its potential customers will have relatively very few visitors because money and time costs of getting to it will be high. Two or more areas may be competitive for the time and money of a given group of recreationists, in this situation, an increase in visits to one area will be offset by a reduction in visits to the others.[2]

In a recently completed Corps of Engineers' study on recreational boating in Illinois and Indiana bordering Lake Michigan area, the influence of boaters' travel patterns on the use of boating facilities is also emphasized. It indicated that

> The site demand for the permanently stored boats, whether berthed, moored, or dry stored, is affected by the distance between the residence of the boater and the location of the facility. As the distance one must travel to reach the facility increases, the quantity demanded decreases. At a given point

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[1]Clawson, and Knetsch, Economics of Recreation, pp. 58.

[2]Ibid., pp. 58-9.

> in time, however, the distribution of boaters from their county of residence to each harbor is affected both by distance and by the relative availability of facilities.[1]

In a study designed to predict reservoir attendance of St. Louis area residents to its nearby impoundments, Ullman and Volk found that the nearer the lake, the greater the St. Louis attendance except some variation occurs because of size and quality of the lakes.[2] Van Doren also made an analysis of the spatial variation of attendance at recreation areas which provides a spatial explanation of man's perceptions of recreational resources and activity opportunities.[3] A study concerned with the market of a Montreal area marina indicates that it is unlikely that there would be any significant number of Montreal residents owned craft moored outside the 45 mile radius survey area from downtown Montreal.[4]

Spatial analysis has its long history of development in the areas of economics, sociology, geography, and other fields. It has been used for the analysis of the location

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[1]Corps of Engineers, Regional Boating Survey, p. 33.

[2]Edward L. Ullman, and Donald J. Volk, An Operational Model for Predicting Reservoir Attendance and Benefits: Implications of a Location Approach to Water Recreation, Papers of the Michigan Academy of Science, Arts, and Letters, Vol. XLVII, 1962, pp. 473-84.

[3]Carlton S. Van Doren, An Interaction Travel Model for Projecting Attendance of Campers at Michigan State Park, unpublished Ph.D. Thesis, Michigan State University, 1967.

[4]Sasaki, Strong and Associates, Ile Ronde Marina--A Study of the Development and Operating Costs and Anticipated Revenues of A Marina for Power Craft Located on Ile Ronde, Montreal, Quebec, Sasaki, Strong and Associates, Limited, Toronto, Ontario, 1972.

of industries. It has also been used for the explanation of human settlement, migration, urban development, transportation, trade, and others. However, its application in the area of outdoor recreation is still relatively new. Hopefully, this study will serve further to illustrate the usefulness of spatial analysis in the recreation field.

CHAPTER III

RESEARCH METHODS

During the Summer of 1973 a series of interviews were conducted with marina operators and governmental officials who were responsible for the development and maintenance of boating facilities along the lower Lake Michigan shoreline. Based on information collected during these interviews and published and unpublished reports on boating in this area, the study plans were developed and boundaries of the study region designated.

In this chapter, the designation of the study region will be presented first. It will include a report on how the study region was chosen and a general description of the recreational boating situation in this area. It will then be followed by a brief description of the study methods and procedures. In this section, the general approaches of conducting the survey and analysis of the data will be presented.

The rest of this chapter will be devoted to a description of data collection and survey design. It will include a description of the survey population; sample size determination; sample selection; and the design, mailing, return of the survey questionnaires. Since the reliability

of reported results is highly related to quality of the information obtained from the questionnaire survey, the instruments and sampling procedure merit considerable attention.

The Study Region

The designation of the study region was based on the information obtained prior to this study. This information included the occupancy lists obtained from a number of sampled marinas along the lower Lake Michigan shoreline and other published and unpublished literature on recreational boating in this general area.[1]

The occupancy lists of the sampled marinas were analyzed and the number of boaters from each origin to each destination was maped as shown in Figure 3. In this figure, the general area where boaters of the sampled marinas came from can be clearly observed. It shows that considerably more boaters came to Michigan from Indiana or Illinois than from Michigan to Indiana or to Illinois. This tendency is more obvious at marinas closer to the Michigan-Indiana border

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[1]Great Lakes Basin Commission, Great Lakes Basin Framework Study, Appendix No. 2, Recreational Boating, 1972. (Hereafter referred to as: Great Lakes Basin Commission, Framework Study.)

Corps of Engineers, Regional Boating Survey.

Thomas D. Warner, An analysis of Recreational Boating Expenditures, unpublished M.S. Thesis, Michigan State University, 1974.

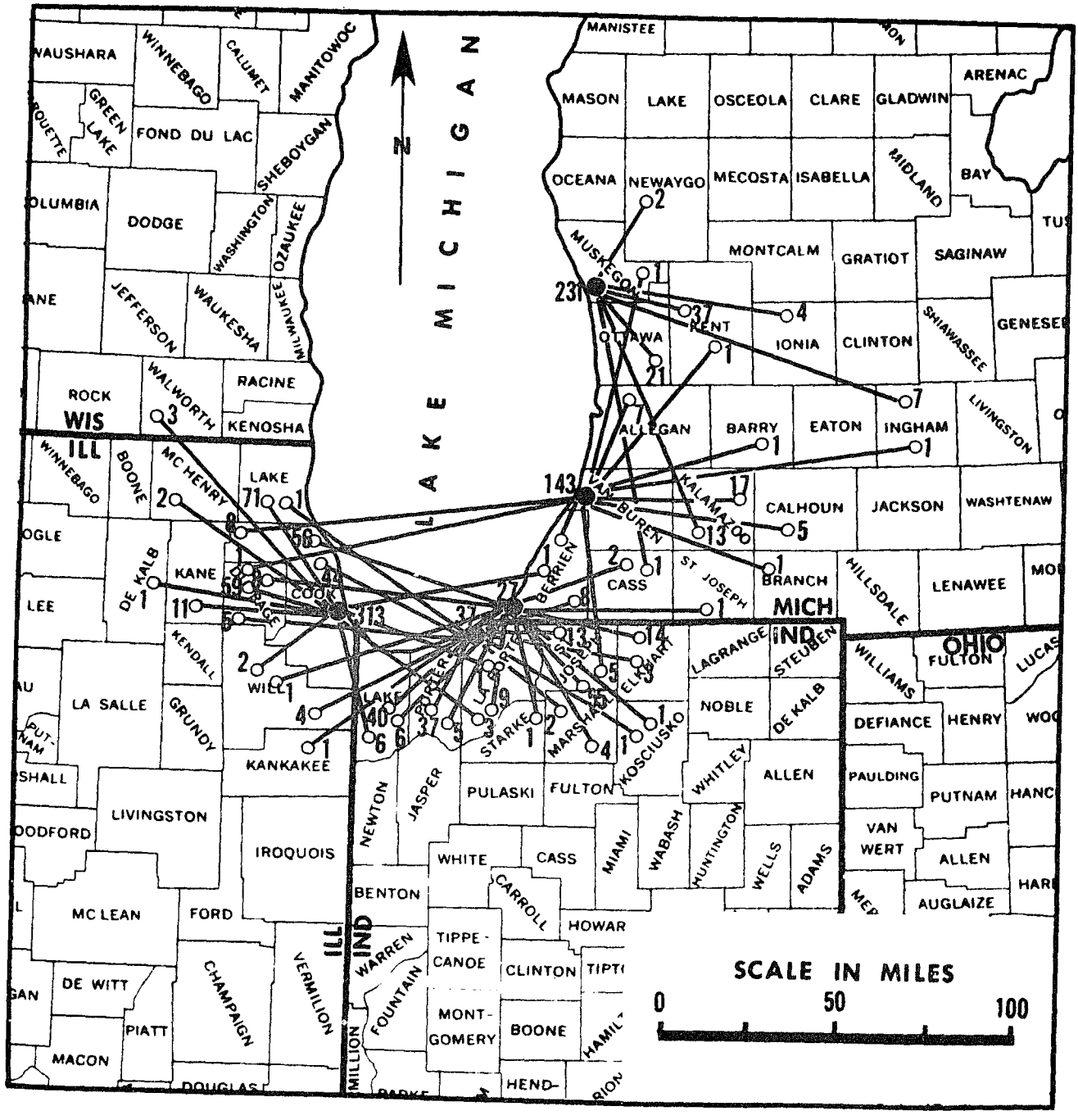

FIGURE 3 BOATER DISTRIBUTIONS OF SELECTED MARINAS

than those are more remote. As the proposed marina will be located at the City of Benton Harbor-St. Joseph, boaters from northwestern corner of Indiana and northeastern corner of Illinois should not be ignored.

Although there were a small number of boaters originating from large cities such as St. Louis, Missouri; Indianapolis, Indiana; and Detroit, Michigan; however, in considering the significance of these boaters to this study, it was decided not to include those areas in the study region.

This information plus knowledge of use of other water bodies in the region are all taken into consideration in determining what is expected to be the most likely market for the proposed marina. The study region includes northeastern Illinois, northwestern Indiana, and southwestern Michigan. Specifically, the counties in Illinois include Cook, Dupage, Kane, Lake, McHenry, and Will. The counties in Indiana include Elkhart, Kosciusko, Lake, Laporte, Marshall, Porter, St. Joseph, and Starke. The counties in Michigan include Allegan, Berrien, Branch, Calhoun, Cass, Clinton, Eaton, Hillsdale, Ingham, Ionia, Jackson, Kalamazoo, Kent, Muskegon, Ottawa, St. Joseph, and Van Buren. The study region is shown in Figure 4.

In terms of its geographical setting, the study region is included in the north-central megalopolis created by the Cities of Chicago, East Chicago, Hammond, and Gary to the west; South Bend, Kalamazoo, Grand Rapids, and Lansing, Jackson to the east. Many thousands of recreational boaters

FIGURE 4 STUDY REGION

visit the eastern shore of Lake Michigan from these Illinois, Indiana, and Michigan cities to participate in boating and boat related activities.

The shoreline of the Illinois portion of Lake Michigan is 45 miles in length. Public recreation areas occupy 24 miles of this distance. Its southern boundary is the Illinois-Indiana border and its northern boundary is Evanston, Illinois.

The recreational shoreline and its facilities are administered by the Chicago Park District and are provided solely for the enjoyment of Illinois residents. The general pattern of use is that the harbor authority provides only slips, moorings, and parking while other related facilities must be provided by private enterprises. In this area, demand greatly exceeds supply of the docking facilities. Existing harbors cannot be expanded without encroaching on heavily used parks and beaches which are also in short supply. Private marinas on the rivers have little or no room to expand. Also lands along these rivers are heavily industrialized, and the rivers themselves are frequently polluted and generally very unattractive for boating.[1]

The Lake Michigan shoreline of the Indiana portion is 33 miles in length. Only three miles, or 9 percent, of this is devoted as public recreation areas. The rest of it is

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[1]Correspondence with official of Bureau of Water Resources, Illinois Department of Transportation.

devoted to industrial and commercial use or private residential use. The access sites are constructed basically for fishermen, however, facilities may also be used by those seeking other types of water based recreation. An updated Lake Michigan small boat harbor development program for this state is essential to the expansion of recreational boating on these waters. The present program does not provide for adequate facilities to meet the existing demand. Thus, the deficit will increase proportionately to the projected growth in boating.[1]

The Michigan portion of the study region includes about 130 miles of Lake Michigan shoreline. The State of Michigan and the Federal Government have cooperated in the construction of six recreational boat harbors at Grand Haven, Port Cheldon, Holland, Douglas, South Haven, and Benton Harbor. These recreational boat harbors provide for the mooring of 2,560 boats(over 20 feet in length). Except for the above mentioned harbors, there are no sheltered Great Lakes waters in this area. Consequently, most boating activities are limited to a small area of 89,600 acres immediately offshore of the six harbors mentioned above.[2]

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[1]Great Lakes Basin Commission, Framework Study, p. 148.

[2]Ibid., pp. 162-9.

Study Methods

The projection of the potential use of the proposed marina is based primarily on the spatial analysis approach with data collected via two mailed survey instruments. The two mailed questionnaire surveys are: (1) the marina operator survey; and (2) the boater survey. The data collected via marina operator survey are used to estimate the existing and prospective availability of dockage facilities in the study region. The data collected via boater survey are used to estimate the potential users of the proposed marina. The data collection and survey design of this study will be presented in a later section. The methods of the estimation of the availability of dockage facilities and potential marina users will be described in the following paragraphs.

The estimation of the current and future availability of dockage facilities is based primarily on an inventory of the Lake Michigan marinas' current existing dockage facilities and their expansion plans in the future. This information was collected through the marina operator survey.

As for the estimation of the potential users of the proposed marina, the following approaches will be used. In general, the potential users of the proposed marina can probably be classified into the following categories: (1) Boaters who have expressed a desire to boat by placing their names on waiting lists for seasonal slips at other marinas,

or who had been turned away by marina operators because all of their slips were rented. These boaters will definitely seek facilities which are available because they have demonstrated an interest in this type of boating; (2) Individuals who are currently utilizing other facilities. Some of them may switch to the proposed marina because the distance from their residences to it is less than the marina they currently utilize or because they prefer the newer and better facilities and services which the proposed marina will offer; (3) Others who may desire to participate in this type of recreational activity but for one reason or another have not registered this desire by even entering their names on a waiting list at a marina.

The estimate of the number of boaters in the first category is based primarily on the marina operators' estimate of the number of boaters they turned away. As for the waiting list, it was learned from the preliminary field investigation and the interviews with a number of selected marina operators that only a few public marinas, and almost none of the private marinas, kept this kind of record. Marina operators contacted related that they did not feel the cost and effort required to maintain extensive waiting lists were justified since they experienced little difficulty in quickly renting boat slips as they became available. Therefore, instead of reqesting a waiting list from the surveyed marina operators, they were requested to make an estimate of the number of boaters they had turned away because all of their

boat slips were rented.

The estimate of the number of boaters in the second category is based on the information collected through the boater survey. Since legally most boaters in this category must register their craft,[1] they can, therefore, be identified. These boaters are the ones from whom reliable information about their boating and travel patterns can be obtained. From this information, the magnitude of the market of the proposed marina can be measured. The market of the proposed marina is measured by finding the number of boaters within successive distance bands or within successive increments of travel time.

Estimating boaters in the third category is rather difficult because these boaters are scattered throughout the general population. Information from members of this group would be both expensive and difficult to obtain. Therefore, it was decided to let the boaters estimate the number of their friends or relatives who would go boating if facilities are available. This approach is based on the assumption that people with similar incomes, lifestyles and buting habits may participate in similar recreational activities.

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[1] Illinois required all motorboats and those sailboats over twelve feet to be registered.

Michigan and Indiana required all motorboats and those sailboats with auxiliary engine to be registered.

Data Collection and Survey Design

The data needed for this study were collected from all marina operators and sampled boaters in the study region. In this section, several important steps of the data collection and survey design will be presented. To collect relevant information from the marinas, all marina operators in the study region were contacted by means of a mailed questionnaire. In addition, secondary information about marinas in the study region was also collected, and a limited number of personal interviews were conducted with individuals who were identified as having current knowledge of the recreational boating situation in this region.

Again, a mailed questionnaire survey was utilized to obtain the required data from recreational boaters. The important steps of the survey design which includes the definition of survey population; the determination of sample size; sample selection; and the design, mailing, and return of the survey questionnaire will be discussed in detail immediately following the brief marina data collection description below.

Marina Data Collection

The information needed about the marinas in the study region includes current dockage capacities, prospective expansion plans, number of customers turned away because

capacity fully occupied or number of vacant slips, and their current market areas. To collect this information, a field investigation and personal interviews with selected marina operators and government officials who were responsible for the boating facilities in the study region were contacted prior to the marina operator survey. From the field investigation and the interviews with marina operators, the general characteristics of the marinas in the study region were identified. From occupancy lists provided by marina operators, the market areas of the marinas were measured as shown in the section on "Study Region". Since this phase of the project was limited and as complete a picture as possible with respect to dockage capacity and its use was desired, the marina operator survey was planned for the collection of this and other information.

Since it was decided that the marina operator survey would include all Lake Michigan marinas in the study region, the procedure of the survey appeared very straightforward--mailed a questionnaire to every marina operator, and sent a follow-up questionnaire to those non-respondents to the first mailing. However, there were two basic problems. First, it was difficult to identify all the marinas in the study region. Second, marina operators were reluctant to release information about their businesses. Therefore, secondary information would be relied on heavily in this phase of the analysis.

For the marina operator survey a total of 92 questionnaires(Appendix B) with an introductory letter(Appendix A)

were mailed to the marina operators in the study region. Of these marinas, 12 were located in Illinois, 11 in Indiana, and 69 in Michigan. Among the returned questionnaires, 5 usable returns were received from Illinois marina operators, 1 from Indiana marina operators, and 35 from Michigan marina operators. The relatively low return rate of the marina operator survey was probably because that the marina operators were reluctant to release information about their businesses.

The marinas surveyed in Illinois were all private marinas. The needed information about the publicly owned recreational harbors was collected during a personal interview with an official from the Chicago Park District and was added to the analysis. In addition, because of the extremely low return rate of Indiana marina operators, four marina operators in that state were also contacted personally. All of the above information plus other secondary data collected was also used as a supplement to the rather limited information gathered from the marina operator survey in the subsequent analysis.

Boater Data Collection

As the collection of information of boaters relies primarily on the boater survey, several important steps of the survey design will be presented in this section. These steps include the definition of the survey population; the determination of sample size; sample selection; and the design, mailing, and return of the survey questionnaire.

Sample Population Determination of the population to be studied is a fundamental step in survey design. Briefly, the population to be studied includes all boaters owning boats at least 20 feet in length and registered in the study region. Since most boats in the study region are registered (see page 27 footnote No. 1), boat registration lists provide ready access to most boaters in the target population.

In Illinois, the total number of the registered boats over 16 feet in the study region was 29,449. According to the Illinois classification system, 27,184 or 92.3 percent are in the 16-to-25-foot length category; 2,128 or 7.2 percent are in the 26-to-40-foot length category; and only 137 or 0.5 percent of the boats are longer than 40 feet. This classification system presented a problem since there was no way to identify those boats greater than 20 feet in length. Given this situation, boats in the 16-to-25-foot category would have had to be heavily sampled to be assured that enough boats from 20 to 25 feet were included. This would have enlarged the required sample size considerably and thus increased the cost of the study. If the 16-to-25-foot category were omitted, about 9 percent[1] of the total boater population would have been ignored. Since the study's focus was on only large boats, the omission of boats in the

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[1]The Michigan figure shows 1,009 out of 10,763 boats over 20 feet are 20 to 25 feet in length.

length 20 to 25 feet would probably not alter the results of the survey significantly. Therefore, the decision was made to drop all the boats in the 16-to-25-foot category in Illinois from the sample population. The remaining boater population in Illinois thus totals 2,265. Of these, 2,128 are in the 25-to-40-foot category, and 137 are in the 40-foot-and-longer category.

In Indiana and Michigan, the determination of sample population was quite simple because the actual length of craft was shown in the boat registration lists. In Indiana, there were 2,886 boats greater than 20 feet in the study region. Of these, 2,737 were in the 20-to-30-foot category, 132 were in the 30-to-40-foot category, and 17 were in the 40-foot-and-over category.

In Michigan, the total number of registered boats over 20 feet in the study region was 10,763. Of these, 9,758 were in the 20-to-30-foot category, 819 were in the 30-to-40-foot category, and 186 were in the 40-foot-and-over category. The sample population in each boat length category in the study region is presented in Table 1.

The Sample Unit Because the concern of this study is with the number of boaters willing to rent a seasonal slip at the proposed marina, the sample unit then became each individual boaters who registered their boats in the study region. These boaters must own a boat at least 20 feet in length.

TABLE 1

BOATER POPULATION IN THE STUDY REGION

	20-30'	30-40'	26-40'	40'+	Total
Illinois[a]	n.a.	n.a.	2,128	137	2,265
Indiana[b]	2,737	132	n.a.	17	2,886
Michigan[b]	9,758	819	n.a.	186	10,763
Total	12,495	951	2,128	340	15,914

[a]1972 registration.

[b]1973 registration.

The Sample Frame The sample frame for each of the three states in the study region was the boat registration lists for each of the individual states. The boat registration lists for all three states were found to contain certain standard information. There is a registration number for each sample unit. Along with this code number appears the boat owner's name, address, city and county within which the boat owner's residence is located, boat length, boat type, maker, and material of boat.

The name of each individual boaters are listed by the order of registration in Illinois and Michigan, and by alphatical order of the boater's name in Indiana. Assume there is no relationship whatsoever between the listing of the boater's name and the chacteristics of their boats, the

listing of the boaters in the registration lists should be random in nature.

Determination of Sample Size In the process of determining the sample size, two factors have to be considered simultaneously. One is the appropriate sample size which will yield a relevant representation of the boater population to be studied in the study region. The other is that the cost of the survey, which must not exceed the research budget limit. At the outset, several approaches were considered and evaluated with these two concerns in mind. It was finally concluded that stratified sampling would yield the best results within the budget constraint.

Obvious, for their boating activities, the boaters in the study region would go either to the Great Lakes or various inland water bodies. Therefore, a binomial probability distribution of the boaters can be observed. Since the proposed marina is to be built on Lake Michigan and the primary objective of this study is to estimate the potential number of Lake Michigan boaters who would be likely to rent a seasonal slip at this marina, enough Lake Michigan boaters must be included to obtain a representative sample.

Cochran[1] suggests a formaula for the determination of sample size in sampling for proportions and percentages.

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[1]William G. Cochran, Sampling Techniques, 2nd. edition, John Wiley and Sons, Inc., 1963, pp. 71-5.

If the precision level is d, and if there is a small risk α which we are willing to incur that the probability of actual error between sample estimate and population estimate is larger than d; that is, we want

$$\Pr\ (|p-P| \geq d) = \alpha$$

If simple random sampling is assumed, and p is taken as normal distribution, the standard deviation σ_p can be calculated using the following formula:

$$\sigma_p = \sqrt{\frac{N-n}{N-1}} \sqrt{\frac{PQ}{n}}$$

where N = boater population.

n = sample size.

P = percentage of boaters using Great Lakes.

Q = percentage of boaters not using Great Lakes.

Hence the formula that connects n with the desired degree of precision is

$$d = t \sqrt{\frac{N-n}{N-1}} \sqrt{\frac{PQ}{n}}$$

Where t is the abscissa of the normal curve that cuts off an area at the tails. Solving for n, we find

$$n = \frac{\frac{t^2PQ}{d^2}}{1 + \frac{1}{N}\left(\frac{t^2PQ}{d^2} - 1\right)}$$

From this formaula, the sample sizes to be taken in each sub-population were calculated.

From previous studies, it was learned that 80 percent of Michigan boaters with boat 20 to 30 feet in length, 97.2 percent of the boaters with boat 30 to 40 feet in length, and 94.7 percent of the boaters with boat 40 feet and over used their boats on the Great Lakes.[1] Therefore, P was set equal to 0.8, 0.95, and 0.95 for boats in the 20-to-30, 30-to-40, and over-40 foot length categories respectively.

Setting desired precision d equal to 0.06, with t = 2 (that is $\mu \pm 2\sigma$ will contain approximately 95 percent of the estimate), and a risk $\alpha = 0.05$, the sample sizes to be taken in Michigan were calculated to be n = 175, 50, and 41 for boats in 20-to-30-foot, 30-to-40-foot, and over-40-foot categories respectively given N = 9,758; 819; and 186 for each boat length category. Assuming that 50 percent of all selected boaters would respond to the survey, at least 532 questionnaires would have to be mailed to obtain the desired number of responses. Similarly, if desired precision was set at 0.05, 746 questionnaires would be required, and with d = 0.07, 398 questionnaires would be required. Given the budget constraint, a d = 0.06 was finally selected as would yield acceptable sample sizes.

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[1]Michigan Department of Conservation, Transportation Predictive Procedures, Recreational Boating and Commercial Shipping, Waterways Division, Technical Report No. 9c, 1966, p. 34.

For Illinois and Indiana, the procedure of determining sample sizes is the same but the determinations of P and d are different. For Illinois, it was learned from an applicable Corps of Engineers' study that the percentage of boaters using Lake Michigan is 80.6 percent for counties bordering Lake Michigan and 43.9 percent for inland counties.[1] For the determination of the sample size, a weighted P equal to 0.74 was calculated for the entire region in Illinois. With $\alpha = 0.05$, $t = 2$, $d = 0.07$, and with $N = 2,265$; the value of n was calculated to be 147 for Illinois boaters. Assuming again that 50 percent of the selected boaters would respond to the survey, 294 questionnaires would have to be mailed.

For Indiana, no previous study was found. The only information available for estimating P is that above mentioned Corps of Engineers study. In this study, three Indiana counties--Lake, Porter, and LaPorte were included and P was found to be equal to 0.8. But because there are other counties included in the Indiana portion of the study region, this value was considered subject to error though reasonable in light of the Illinois and Michigan data. Therefore, it was decided to be conservative to use an estimate of 0.75 for the value of P for boats 20 to 30 feet in length, and 0.85 for boats over 30 feet in length. With $\alpha = 0.05$,

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[1] Corps of Engineers, Regional Boating Survey, 1974, p. 12.

t = 2, d = 0.07, and N = 2,644; and 138 for boats 20-to-30-foot, and over-30-foot categories respectively; n = 145, and 59 were obtained for each boat length categories. It was also assumed that 50 percent of the selected boaters would respond to the survey suggesting that a total of 408 questionnaires would have to be mailed in order to obtain the desired number of returns. The total number of questionnaires that were mailed, therefore, was 532 + 408 + 294 = 1,234 for the entire study region.

Desired precision level d was set at 0.06 for Michigan, and 0.07 for Illinois and Indiana. These were the maximum precision levels which could yield acceptable sample sizes within the given budget constraint. Because empirical evidence and logic suggested that the largest portion of boaters expected to use the proposed marina would be from Michigan rather than from the other two states, therefore, the desired precision level was set relatively higher for Michigan than for Illinois, and Indiana.

Sample Selection After the sample sizes in each state had been determined, samples were selected. For simplicity and since the boat registration lists used were more or less randomly ordered, systematic sampling was employed. The sample intervals were determined by dividing the number of boaters in each sub-population by its required sample size. Since the division did not always yield interger sample intervals, the calculated sample sizes were not followed

precisely. However, the number of boaters selected from each subpopulation exceeded the desired number previouly calculated to achieve the desired level of precision.

The actual number of questionnaire mailed by boat length category in each state are presented in Table 2. The actual number of questionnaires mailed in each state was 312, 420, 548 for Illinois, Indiana, and Michigan respectively. The total number of questionnaires mailed was 1,280 or almost 50 more than calculated using formula in preceding section. The actual selection of the samples was done manually from the boat registration lists for Illinois and Indiana, and via computer for Michigan because the Michigan list was made available on magnetic tape.

Questionnaire Design, Mailing, and Return Before the survey questionnaire was drawn up in its final form, a pretest of a preliminary questionnaire was made. The major purposes of the pretest were to solicit the type of information the study was seeking and to determine the ability of respondents to answer the questions.

A total of 30 pretest questionnaires were mailed to randomly selected registered boaters. The sample was confined to boaters residing in the Michigan portion of the study region. A cover letter was attached to each questionnaire mailed to explain the purpose of the questionnaire and requesting comments and opinions so that improvements could be made. Of the 30 mailed, 16 were returned with comments

TABLE 2

TOTAL NUMBER OF QUESTIONNAIRES
MAILED BY BOAT LENGTH

	Actual										Desired	
	20-30'		30-40'		26-40'		over 40'		State Total		M.R.S.S.[b]	
	No.	% of Pop.[c]	No.	% of Pop.[c]	No.	% of Pop.[c]	No.	% of Pop.[c]	No.	% of Pop.[c]	No.	% of Pop.[c]
Illinois[a]					231	10.9	81	58.1	312	13.8	294	13.0
Indiana	296	10.8	107	81.0			17	100.0	420	14.6	408	14.1
Michigan	353	3.6	109	13.3			86	46.2	548	5.1	532	4.9
Region	649	5.2	216	22.7	231	10.9	184	54.1	1.280	8.0	1,234	7.8

[a]Boat length categories used in Illinois differ from those used in Michigan and Indiana. Illinois classified boats into the following categories: 16-26', 26-40', 40'+. The 15-25' category would contain a preponderance of boats less than 20' in length and hence was not sampled in the interest of reducing study coasts.

[b]Minimum required sampled size--calculated by using formula on page 42.

[c]Boater populations in each category are presented in Table 3.1.

and opinions which proved to be useful in revising the original questionnaire.

The final survey questionnaire was divided into three major parts (Appendix D). The first part was designed to be completed by all boaters and focused on their boat and boating activities. This part of the questionnaire was also designed to provide information about boaters' travel patterns. Questions 3, 4, 5, 6, and 7 were designed to provide information about boaters' current travel patterns. Questions 10, 11a, and 11b were designed to provide information about boaters' prospective travel patterns with respect to the proposed marina. Other questions in this part were designed to provide information about boaters' preferences or needs for various marina facilities and services.

The second part of the questionnaire was designed to be completed by only Lake Michigan boaters. The questions were designed to provide information about boaters' slip rental preferences so that the need for additional slips could be ascertained. In addition, the responses to these questions provide some insight into the expected number of boaters currently using facilities of other existing marinas would be likely to switch to the proposed marina.

The third part of the questionnaire was designed to be completed by boaters who go boating on water bodies other than Lake Michigan. Also, the reason or reasons for not currently boating on Lake Michigan and the prospects of using it at sometime in the future were explored.

The initial questionnaire was mailed out to each selected boater accompanied with a introductory letter (Appendix C) and a self-addressed postage-paid return envelope. About a week after the initial questionnaire was mailed, a follow-up postcard was mailed to all the non-respondents. The postcard was simply a reminder to each boater to remind them to fill out the questionnaire and return it. Three weeks following the mailing of the initial questionnaire, a follow-up questionnaire was mailed to every non-respondent and a letter enclosed urging them to fill out and return the questionnaire.

Figure 5 shows the daily variations in the number of questionnaire returned during this phase of the study. It can be seen that there are three peak areas in the whole process. Each of them represents one mailing stage. Beginning from the left, the first one shows the extremely high return rate immediately following the initial mailing. The second highest peak occurs after the follow-up postcard was mailed. And the next highest peak was reached after the second mailing of the questionnaire. However, the over-all trend of returns was downward.

The returned questionnaires were accepted until data processing started. This was about two months after the first mailing of the questionnaires. There were about 7 questionnaires returned after data were punched on cards. These observations were excluded from processing.

The total number of questionnaires mailed, returned, not-returned, and usable and non-usable returns are presented

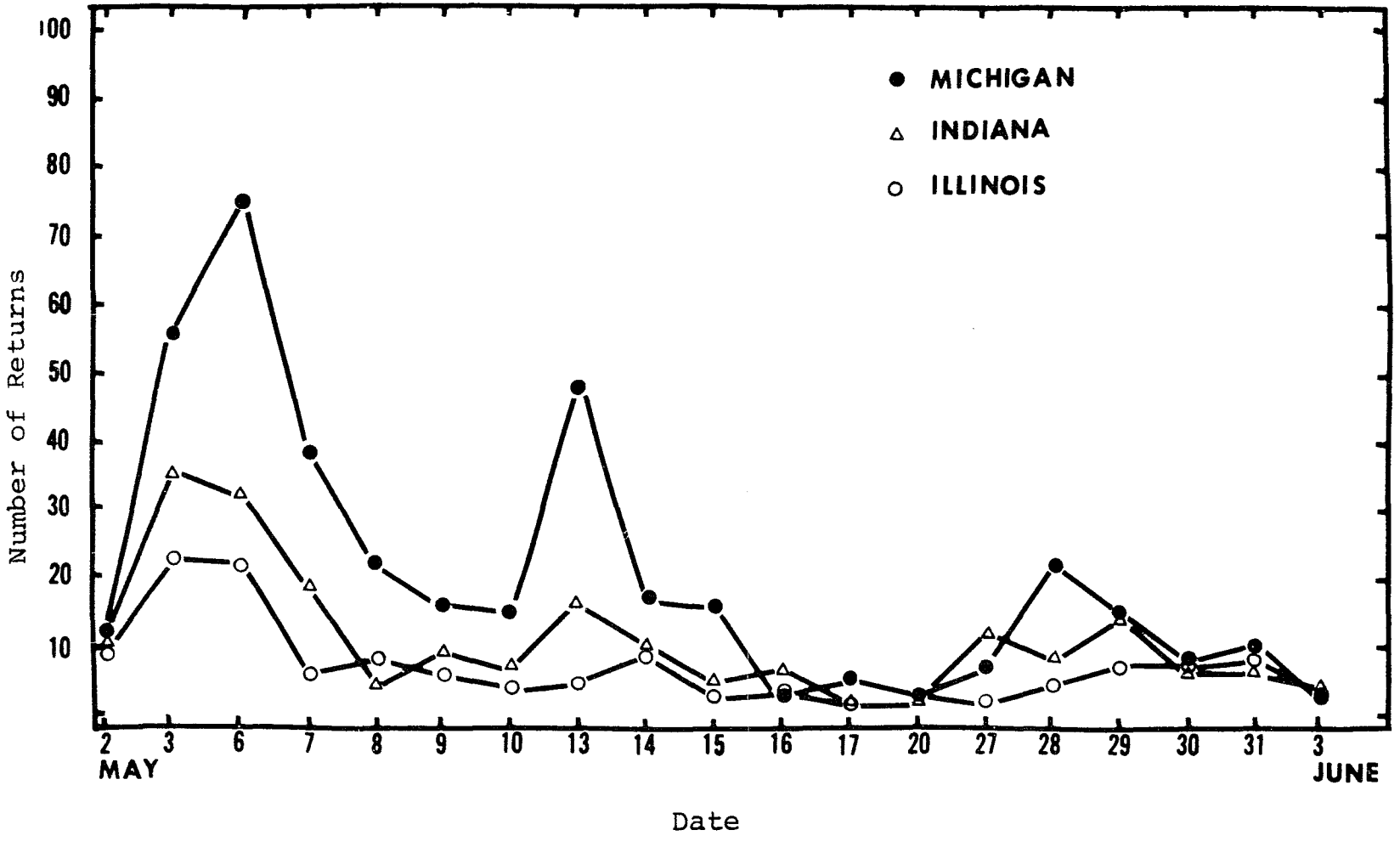

FIGURE 5 CHRONOLOGICAL RECORD OF QUESTIONNAIRE RETURNS

in Table 3. Column II of the table shows that the return rates for each state in the study region are 60.6 percent, 62.4 percent, and 76.1 percent for Illinois, Indiana, and Michigan respectively. They are all higher than what had been expected (50 percent) in the sampling design. Of the returned questionnaires, 83.6 percent, 69.5 percent, and 80.1 percent from Illinois, Indiana, and Michigan respectively were usable for analysis. The number of usable returns are shown in column V. There are 158, 182, and 334 usable returns for Illinois, Indiana, and Michigan respectively. In terms of the percentage of total questionnaires mailed, The usable returns in each state are 50.6 percent, 43.3 percent, and 60.9 percent of the total mailed questionnaires for Illinois, Indiana, and Michigan respectively. Except for Indiana, the usable returns also exceeded the expected return rates (50 percent).

Column IV presents the numbers of questionnaires which could not be delivered. There were 24 un-delivered questionnaires in Illinois, 7 in Indiana, and 5 in Michigan. The relatively higher rate of undeliverables in Illinois was probably because the boat registration list of Illinois was one year older than those of Indiana or Michigan (see Table 1). Another conceivable reason could be that the mobility with respect to changing places of residence is usually higher in large urban areas than the rest of the study region.

Column III consists of the numbers of questionnaires which were not returned from the selected boaters in each

TABLE 3

BOATER SURVEY SUMMARY: TOTAL QUESTIONNAIRES MAILED, TOTAL RETURNED, TOTAL NOT RETURNED, USABLE RETURNS, AND NON-USABLE RETURNS

	I Total Mailed		II Total Returned		III Total not Returned		IV Un-delivered		V Usable Returns			VI Non-usable Returns		
	No.	% of Pop.[a]	No.	% of Total Mailed	No.	% of Total Mailed	No.	% of Total Mailed	No.	% of Total Returned	% of Total Mailed	No.	% of Total Returned	% of Total Mailed
Illinois	312	13.8	189	60.0	99	31.7	24	7.7	158	83.6	50.6	31	16.9	9.9
Indiana	420	14.6	262	62.4	151	36.0	7	1.7	182	69.5	43.3	80	30.5	19.9
Michigan	548	5.1	417	76.1	126	23.0	5	0.9	334	80.1	60.9	83	19.9	15.1
Regional Total	1,280	8.0	868	67.8	376	29.4	36	2.8	674	77.6	52.7	194	22.4	15.2

[a]Total number of boaters in each state in the study region are shown in Table 3.1.

state. A sample of these non-respondents was interviewed via telephone in an attempt to determine if there was any significant difference between them and the respondents. The results of the telephone interview will be presented in Chapter V.

Column VI of Table 3 reports the number of the un-usable returns and the percentage they represent of questionnaires mailed and questionnaires returned. The percentages of un-usable returns are relatively higher for Indiana boaters than for the boaters in other two states.

The major reasons which made some questionnaires un-usable are presented in Table 4. Of these reasons for rejection, "no longer owning boat" was the number one reason cited by Illinois and Indiana boaters contacted in the telephone interview. In Michigan, the inclusion of more boats under 20 feet of length was the major reason for not using some data returned. Another notable phenomenon is that the incomplete rates in Indiana and Michigan are both relatively high. The major reasons for not completing questionnaires can be observed from the comments boaters made in the un-usable returned questionnaires. These reasons are: (1) boaters were not interested in the proposed marina because they had different boating habits and thought that the questionnaire did not apply to them; (2) Illinois and Indiana boaters thought that this was a Michigan business and thus did not concern them; (3) some boaters thought that the questionnaire was an invasion of their privacy and reluctant to respond.

TABLE 4

BREAKDOWN OF UNUSABLE QUESTIONNAIRES
BY REASON FOR REJECTION BY STATE OF RESIDENCE

	No Longer Own Boat		Boat under 20'		Incomplete		Out of Study Region		State Total
	No.	%	No.	%	No.	%	No.	%	
Illinois	24	77.4	2	6.5	1	3.2	4	12.9	31
Indiana	41	51.3	18	22.5	19	23.8	2	2.5	80
Michigan	22	26.5	37	44.6	19	22.9	5	6.0	83
Region Total	87	44.8	57	29.4	39	20.1	11	5.7	194

CHAPTER IV

ANALYSIS OF MARINA OPERATOR SURVEY

In this chapter, the analysis of the marina survey results will be reported. Major subjects to be reported include the current availability of boat slips, and the expansion plans of the marinas located in the study region. First, an inventory of the boat slips will be presented, and the number of boaters who could not rent a boat slip will be estimated. Next, the expansion plans of the marinas in the study region will be explored. From this information, the present and prospective availability of boat slips can be recognized, and the need or lack of need for new facilities can be identified.

Inventory of the Dockage Facilities at Marinas in the Study Region

The inventory of dockage facilities at the marinas in the study region provided a description of the existing availability of the dockage facilities in this region. The inventory was based on information obtained from the marina operator survey and other secondary sources.[1]

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[1]Corps of Engineers, Regional Boating Survey, 1974. Michigan Waterways Commission, 1972 Marina Survey, 1973.

The summary of the number of seasonal slips and transient slips in the counties bordering Lake Michigan in each state in the study region are presented in Table 5. It can be observed that more than 50 percent of the total seasonal slips in the study region are located in Michigan. The number of moorings greatly exceeds that of the slips in Cook County, Illinois, but this same relationship does not hold in Michigan or Indiana. It is probably because of the great competition for dockage facilities in Chicago area. In general, more boats can be accommodated by moorings than slips.[1]

The general pattern in Chicago area is that all dockage facilities are located in publicly owned lakefront harbors. The harbor authority provides only slips, moorings, and parking. Yacht clubs provide gas, food, and other services (for members only). Repairs and winter storage are provided at boat yards which are not on the lakefront. Sales of boating and marine supplies are provided by dealers scattered throughout the area.

Since slips frequently can not accommodate all craft lengths further breakdown of the total number of seasonal slips in each state by boat length category is necessary. This information is presented in Table 6. These figures

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[1]Mooring is a buoy to which a boat (usually a sailboat) is attached. The buoy is either anchored or tied to a structure in the harbor. Mooring usually occupies smaller area than slip does, therefore, more boats can be accommodated.

TABLE 5

INVENTORY OR ESTIMATED NUMBER OF LAKE MICHIGAN MARINA SLIPS, MOORINGS, AND TRANSIENT SLIPS BY COUNTY IN THE STUDY REGION

	Seasonal Slips	Seasonal Moorings	Transient Slips	Total Capacity
Illinois[a]				
Lake	147	129	6	282
Cook	1,222	2,038	20	3,280
Sub-total	1,369	2,167	26	3,562
Indiana[a]				
Lake	0	44	0	44
Porter	577	0	8	585
LaPorte	471	60	8	539
Sub-total	1,048	104	16	1,168
Michigan[b]				
Berrien	803	0	78	881
Van Buren	170	215	25	410
Allegan	347	608	71	1,026
Ottawa	984	60	95	1,139
Muskegon	410	108	6	524
Sub-total	2,714	991	275	3,980
Region	5,131	3,262	317	8,710

Sources: a. Corps of Engineers, Regional Boating Survey, 1974
b. Michigan Waterways Commission, 1972 Marina Survey, 1973

TABLE 6

ESTIMATED NUMBER OF BOAT SLIPS
IN EACH SIZE CATEGORY

	Illinois[a]		Indiana[a]		Michigan[b]		Total	
	No.	%	No.	%	No.	%	No.	%
20-30'	608	44.4	846	80.7	1,186	43.7	2,640	51.5
30-45'	711	51.9	184	17.9	1,238	45.6	2,137	41.6
45'+	50	3.7	14	1.4	290	10.7	354	6.9
Total	1,369	100.0	1.048	100.0	2,714	100.0	5,131	100.0

[a]Personal interviews and marina operator survey.

[b]Marina operator survey.

were derived from marina operator survey and personal interviews with marina operators.

It can be observed in Table 6 that, except for Indiana, there are more slips for boats in the 30-to-45-foot category than the other two categories. It is probably because that greater demand for accommodation for larger boats exists in these two states than in Indiana.

Boaters Turned Away from or on Waiting Lists at Marinas in the Study Region

As has been indicated previously, one way of estimating part of the existing need for docking facilities is to find

out how many boaters are on waiting lists or could not rent a slip. Since most marinas did not keep a waiting list, it was necessary to rely on the marina operators' estimates of the number of boaters being turned away because all of their slips were already rented. Table 7 presents the estimated number of boaters who had been turned away or put on waiting lists by the size of slip needed in each state.

It can be observed that in Michigan alone, the number of boaters being turned away exceeds the number of slips which will be built in the proposed marina. It may not be the case that all these boaters will seek a slip at the proposed marina. However, it would be very possible that a considerable number of them will be attracted to this marina.

There is no doubt that the great number of boaters seeking boat slips reflects the fact that great need for boating faclities exists in the study region. When the expansion plans of the marinas are examined, the situation of supply and demand for boat slips in the study region can be more clearly observed.

Prospective Expansion Plans of the Marinas

In order to determine the prospective increase of the number of boat slips at the marinas in the study region, the marina operators were asked if they planned to expand their existing marinas or build a new marina at another site. If

TABLE 7

ESTIMATED NUMBER OF BOATERS TURNED AWAY OR ON WAITING LISTS[a]

	Illinois		Indiana		Michigan		Region	
	No.	%	No.	%	No.	%	No.	%
20-30'	434	47.5	250	63.9	1,390	62.2	2,074	58.6
30-45'	421	46.1	109	27.8	711	31.8	1,241	35.1
over 45'	59	6.4	32	8.3	134	6.0	225	6.3
Total	914[b]	100.0	391	100.0	2,235	100.0	3,540	100.0

[a]The expansion factors for Illinois, Indiana, and Michigan are 0.42, 0.46, and 0.51 respectively.

[b]The Illinois total includes 300 applications for slips at Chicago Park District managed Lake Michigan harbors.

they did have such a plan, they were asked further when they planned this expansion and also the capacity of the planned expansion or the new marina to be built. Table 8 reports the information collected from the responding marina operators.

It can be observed from Table 8 that the planned expansions are not enough even to accommodate the existing boaters who were turned away from existing marinas. If the present growth rate of boating continues as mentioned in Chapter I, the demand for facilities may far exceed that of the future supply.

TABLE 8

PROSPECTIVE EXPANSION OF MARINA CAPACITY IN THE STUDY REGION

	Length of Boat			
	20-30'	30-45'	over 45'	Total
Illinois				
Cook -a	15	0	0	15
Indiana				
La Porte -c				750[e]
Michigan				
Berrien -a	0	10	0	10
-b	40	20	10	70
Van Buren -b	0	20	0	20
Ottawa -a	105	186	100	373
-b	192	0	10	202
-c	10	40	0	50
-d	12	12	0	24
Muskegon -a	46	0	8	54
-b	9	0	0	9
-c	10	10	0	20
-d	0	25	5	30
Sub-total -a	166	178	108	452
-b	241	40	20	301
-c	20	50	0	820
-d	12	37	5	54
Total	439	305	133	1,627

-a: will expand in 1974
-b: will expand in 1975
-c: will expand in 1976
-d: will expand in 1978

[e]The News-Dispatch, Michigan City, Indiana, February, 21, 1974, p. 1. (It reported that the number of slips to be built will be from 750 to 1,000. However, correspondence from Michigan City Harbor Authority indicated 500 is the number of slips to be built. Trying neither to underestimate nor to over-estimate it, it was felt that 750 could be a more appropriate number.)

Among the marina operators surveyed, there were only two of them reported that they would build a new marina. One of them plans to build a new marina in Manistee County, Michigan in 1978. The capccity of this planned new marina would be 50 slips in the 20-to30-foot length category. Another marina that may be built is the one which is being planned at Michigan City, Indiana. The harbor authorty reported that the total capacity of this marina would be 500 slips. However, the local news paper reported that the capacity would be 750 to 1,000 slips.

The factors that limiting their expansions are the availability of land, water, or capital resources. Fifteen of the responding marina operators indicated that limited land area was the major reason for not expanding, 11 of them indicated that limited water area was the major reason for not expanding, and 5 of them indicated that insufficient capital was the major problem.

Efforts of public agencies may ease the situation to a certain extent. However, except in Michigan, natural and man-made conditions in the other two states will be the most important limiting factors of the development of boating facilities. For example, in Chicago area, the accommodation capacity was 70 boats in 1972, and in 1973 it reduced to only 50 boats. Due to the limited area of shoreline in this area and the policy of the Chicago Park District, there will probably be little marina development in the future.[1] It is

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[1]Interview with Chicago Park District official, 1973.

expected that considerably more Lake Michigan boaters in Illinois and Indiana may be attracted by the proposed marina or other available facilities in Michigan and/or Wisconsin in the future. If the planned marina at Michigan City, Indiana is built, it is expected to be a great competitor for the proposed marina at Benton Harbor-St. Joseph, Michigan.

CHAPTER V

ANALYSIS OF BOATER SURVEY RESULTS

In this chapter, the analysis of the responses of the boater survey designed to determine the number of Lake Michigan boaters and their travel patterns will be reported. The characteristics of the sampled boaters in terms of length and type of boat owned will be analyzed first. Next, the sampled boaters who are using Lake Michigan and other water bodies for their boating activities will be examined, and the reason or reasons for not using Lake Michigan will be further explored. Lake Michigan boaters will be distinguished from those who are not using Lake Michigan. This information will be used in subsequent analysis. Because the proposed marina will be built on Lake Michigan for the use of Lake Michigan boaters, only Lake Michigan boaters will be taken into account in the subsequent analysis.

Before undertaking this analysis, a comparsion of respondents and a sampling of non-respondents (contacted via telephone follow-up) will be made to ascertain whether or not the two groups are similiar because a basic assumption of the survey technique is that the respondents to a survey are fully representative of both the respondents and the non-respondents.

In the latter part of this chapter, the current travel patterns of the Lake Michigan boaters will be examined. The results of this analysis will serve as a basis for the estimation of the number of boaters who will use the proposed marina. Essentially, if the travel patterns of the smapled Lake Michigan boaters show similar characteristics to the conceptual model of customers visiting a store discussed in chapter II, it, then, can be used to estimate the sought after number of marina users.

Specifically, the information needed is that of the sampled boaters' locations, where do they go for boating, and the driving time needed to travel from their residences to where they boat.

Analysis of Survey Responses

In column V of table 3, the total number of returned questionnaires from each state are reported. Further breakdown of these figures by boat length categories is needed for the analysis. Table 9 presents the number and percentage of the usable questionnaires returned in each state and for the entire region by boat length categories.[1] It can be

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[1]Among the returned questionnaires from Illinois, there were 12 boaters who owned boats 20 to 25 feet in length. Although only individuals owning registered boats at least 26 feet in length were selected in Illinois, inaccuracies in the registration list or changes in size of boat owned account for this result. Since these boats were of sufficient length to operate on Lake Michigan, their owners' responses were included in the subsequent analysis.

TABLE 9

USABLE QUESTIONNAIRES RETURNED BY STATE AND LENGTH OF BOAT OWNED: NUMBER AND PERCENTAGE OF SAMPLE

	20-30'		30-40'		26-40'		over 40'		Total	
	No.	% of Mailing	No.	% of Mailing	No.	% of Mailing	No.	% of Mailing	No.	% of Mailing
Illinois					134[a]	58.0	24	29.6	158	50.6
Indiana	128	43.2	52	48.6			2	11.8	182	43.3
Michigan	197	55.8	90	82.6			47	54.7	334	60.9
Region	325	50.1	142	65.7	134	58.0	73	39.7	674	52.7

[a]Includes 12 boats between 20 to 25 feet in length.

seen from Table 9, except for the over-40-foot category in Illinois and Indiana, that the return rates of the usable questionnaires are all over or close to the 50 percent expected return rate. Therefore, these responses should be relevant for the subsequent analysis.

Since the proposed marina slips to be built are for boats in 20 to 30 feet, 30 to 45 feet, and 45 feet and over length categories, the numbers in Table 9 were re-classified according to the Michigan Waterways Division's classification system. They are reported in Table 10.

Boaters Using Lake Michigan and Other Water bodies

Because the study region includes a large geographical areas, it contains several different types of recreational water bodies. These recreational water bodies include Lake Michigan, inland lakes, inland rivers, and other Great Lakes. The boaters' boating activities may take place on these different recreational water bodies depending upon their personal preferences and/or their locations relative to these water resources.

In this section, water bodies where the boaters' boating activities take place are identified and the relative importance of each is reported. Especially those boaters using Lake Michigan will be distinguished from those not using Lake Michigan. The number of Lake Michigan boaters in the sample will be used in subsequent analysis to estimate

TABLE 10

NUMBER OF USABLE QUESTIONNAIRES
RETURNED--BY BOAT LENGTH AND BOAT TYPE[a]

	Illinois		Indiana		Michigan		Region	
	No.	%	No.	%	No.	%	No.	%
Boat Size								
20-30'	69	43.7	128	70.3	197	59.0	394	58.5
30-45'	82	51.9	54	29.7	115	34.4	251	37.2
over 45'	7	4.4	0	0	22	6.6	29	4.3
Total	158	100.0	182	100.0	334	100.0	674	100.0
Boat Type								
Motor	117	74.1	161	88.5	232	69.5	510	75.7
Sail	41	25.9	21	11.5	102	30.5	164	24.3
Total	158	100.0	182	100.0	334	100.0	674	100.0

[a]The classification system used in this table is Michigan Waterways Division's classification system. The actual classification should be: 20'0"-30'0", 30'1"-45'0", and 45'1" and over. This classification system will be used for the subsequent analysis in this study.

the number of users of the proposed marina, because the proposed marina will be built on Lake Michigan for the use of Lake Michigan boaters. Therefore, only Lake Michigan boaters will be taken into account in the estimation.

The survey results are reported in Table 11. This table presents the numbers and percentages of the boaters who are using Lake Michigan and other water bodies by boat length and boat type categories. In terms of boat length, 52 percent of the sampled boaters who own small boats (20 to 30 feet) are Lake Michigan boaters; 45.7 percent of small boat owners use inland water bodies which include lakes and rivers; and the remaining 2.3 percent boat on other Great Lakes.

With the increase of boat length, the picture also varies. There are 87.2 percent of the boaters with medium (30 to 45 feet) size boats using Lake Michigan; 11.2 percent of them using inland lakes and rivers; and 1.6 percent of them boating on other Great Lakes. In the large (over 45 feet) size boat category, there are 86.2 percent of the boaters using Lake Michigan; 6.9 percent of them using inland water bodies; and another 7 percent of them using other Great Lakes.

In terms of boat type, 59.6 percent of motor boat owners questioned and 88.4 percent of sailboat owners use Lake Michigan; 38.6 percent of queried motor boat owners and about 8 percent of sailboat owners use inland water bodies; and the remaining 1.8 percent of sampled motor boat owners

TABLE 11

SAMPLED BOATERS USING LAKE MICHIGAN AND OTHER WATER BODIES--BY LENGTH AND TYPE OF BOAT OWNED

	Lake Michigan		Inland Waters[a]		Other Great Lakes		Total	
	No.	%	No.	%	No.	%	No.	%
Boat Length								
20-30'	205	52.0	180	45.7	9	2.3	394	100.0
30-45'	219	87.2	28	11.2	4	1.6	251	100.0
over 45'	25	86.2	2	6.8	2	7.0	29	100.0
Total	449	66.6	210	31.2	15	2.2	674	100.0
Boat Type								
Motor	304	59.6	197	38.6	9	1.8	510	100.0
Sail	145	88.4	13	7.9	6	3.7	164	100.0
Total	449	66.6	210	31.2	15	2.2	674	100.0

[a]Includes inland lakes and inland rivers.

and the remaining 3.7 percent sailboat owners use other Great Lakes.

For the entire sample, 66.6 percent use Lake Michigan, 31.2 percent use inland water bodies, and only 2.2 percent use other Great Lakes.[1]

It can also be observed that relatively more boaters owning larger boats use Lake Michigan and other Great Lakes than boaters owning small boats. In addition, relatively more boaters owning sailboats use Lake Michigan and other Great Lakes than boaters owning motor boats.

Further breakdown of boaters using Lake Michigan (column one of Table 11) by boat length, boat type, and by state where their major residences are located, is presented in Table 12. It can be observed, from this table, that 49.3 percent of the sampled boaters in Illinois, 48.4 percent in Indiana, and 55.3 percent in Michigan with small boat are Lake Michigan boaters. In the medium size boat category, 78 percent of the sampled boaters in Illinois, 88.9 percent in Indiana, and 93 percent in Michigan are Lake Michigan boaters. In the large boat category, 85.7 percent of the sampled boaters in Illinois, 86.4 percent in Michigan are Lake Michigan boaters. In Indiana, no Lake Michigan boater in this category was selected.

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[1]Recreation Resource Consultants, 1971 Michigan Boating Study indicates that 66.3 percent of boats over 20 feet were used on Great Lakes during the 1971 boating s-ason.

TABLE 12

SAMPLED BOATERS USING LAKE MICHIGAN FROM EACH STATE
--BY LENGTH AND TYPE OF BOAT OWNED--MAILED SURVEY

	Illinois			Indiana			Michigan			Region		
	Sample	L.M.[a]	%	Sample	L.M.[a]	%	Sample	L.M.[a]	%	Sample	L.M.[a]	%
Boat Length												
20-30'	69	34	49.3	128	62	48.4	197	109	55.3	394	205	52.0
30-45'	82	64	78.0	54	48	88.9	115	107	93.0	251	219	87.3
over 45'	7	6	85.7	0	0	0	22	19	86.4	29	25	86.2
Total	158	1o4	65.8	182	110	60.4	334	235	70.4	674	449	66.6
Boat Type												
Motor	117	64	54.7	161	93	57.0	232	147	63.4	510	304	60.0
Sail	41	40	97.6	21	17	81.0	102	88	86.3	164	145	88.4
Total	158	104	65.8	182	110	60.4	334	235	70.4	674	449	66.6

[a]Lake Michigan.

The comparison between these percentage figures presented in Table 12 with those P values (expected % of Lake Michigan boaters) used in the sampling design is shown below:

	Illinois		Indiana		Michigan	
	Sampling Design	Survey Result	Sampling Design	Survey Result	Sampling Design	Survey Result
20-30'	74.0	49.3	75.0	48.4	80.0	55.3
30-45'	74.0	78.0	85.0	88.9	95.0	93.0
45'+	74.0	85.7	85.0	-	95.0	86.4

From the above comparison, it can be found that, except for the small boat categories in each state, the percentages obtained from the survey results are all higher than or close to the P values used in the sampling design. It means that the sample sizes for the medium and large boat categories are adequate for the subsequent analysis.

In the small boat category, the percentages of boaters using Lake Michigan in each state used in the sampling design were much higher than what had been obtained from the survey. In other words, the sample sizes in the small boat categories are smaller than the initial target.

Further research is needed to determine the percentage of boaters using Lake Michigan in the small boat category. However, other information obtained in this survey suggests a possible reason for less than expected Lake Michigan use

by the small boat owners may be a feeling among these owners that their craft are not large enough for Lake Michigan. If this is the case, the P value used for small boat category in the sampling design could be too high.

With respect to boat type, the results in Table 12 indicate that considerably more sailboats than motor boats used on Lake Michigan irrespective of the state in which the owners reside.

Reported Reasons for Not Using Lake Michigan

It was found, from the analysis in the preceeding section, that about one third of the total sampled boaters are not Lake Michigan boaters. Therefore, it is important to examine the factors which affect boaters' choice of water bodies. This information will also be important in estimating demand for boating facilities on Lake Michigan in latter sections.

To determine these factors, those survey respondents indicating that they did not use Lake Michigan were asked why they did not use the lake. Table 13 presents their responses to this question along with the length of the respondents' boat and state of residence.

For the entire study region, "no interest" and "live by inland water bodies" appear to be the predominant factors affecting the boaters' use of Lake Michigan. "Boat not suitable for big lakes" and "too far from residence" are the

TABLE 13

MAJOR REASONS FOR NOT USING LAKE MICHIGAN--
BY STATE OF RESIDENCE AND LENGTH OF BOAT OWNED[a]

	I[b]		II[b]		III[b]		IV[b]		V[b]		VI[b]		Total[b]	
	No.	%[c]	No.	%[c]	No.	%[c]	No.	%[c]	No.	%[c]	No.	%[c]	No.	%[c]
Boat Length														
20-30'	28	14.1	41	20.6	54	27.1	57	28.6	13	6.5	6	3.0	199	100.0
30-40'	4	12.9	3	9.7	11	35.5	2	6.5	7	22.6	4	12.9	31	100.0
over 45'	1	20.0	1	20.0	0	0	0	0	1	20.0	2	40.0	5	100.0
Total	33	14.0	45	19.1	65	27.7	59	25.1	21	9.0	12	5.1	235	100.0
Residence														
Illinois	10	18.5	7	13.0	16	29.6	4	7.4	17	31.5	0	0	54	100.0
Indiana	9	12.0	17	22.7	22	29.3	27	36.0	0	0	0	0	75	100.0
Michigan	14	13.2	21	19.8	27	25.5	28	26.4	4	3.8	12	11.3	106	100.0
Total	33	14.0	45	19.1	65	27.7	59	25.1	21	8.9	12	5.1	235	100.0

[a]Multiple responses were permitted in this table, therefore, the number of total may not be the number of samples responded. [b]I--Too far from residence; II--Boat not suitable for big lake; III-- No interest; IV--Live by inland waters; V--No dockage facilities available; VI--Prefer other Great Lakes. [c]Percentages refer to row totals.

next important factors.

In terms of boat length, "live by inland water bodies" and "no interest" are the predominant factors affecting boaters' use of Lake Michigan in the small boat category. However, in the medium and large boat categories, in addition to "no interest"; "no dockage facilities", "too far from residence", and "prefer other Great Lakes" become the relatively more important factors affecting boaters' use of Lake Michigan.

Looking at the influence of residence upon reasons for not using Lake Michigan one sees that "live by inland water bodies" and "no interest" are still the predominant factors cited for not using Lake Michigan for boaters in Indiana and Michigan, However, "no dockage facilities" becomes the most important factor for boaters not using Lake Michigan in Illinois. Among the states in the study region, Illinois offers the smallest dockage capacity per number of registered boaters.[1] It is expected that more boaters indicating "no dockage facilities" as the major reason for not using Lake Michigan would be in this area of the study region.

One thing worth noting is the fact that "live by inland water bodies" is one of the major important factors affecting boaters' use of Lake Michigan. This implies that for many the distance from the boater's residence to Lake Michigan is farther than that from the boater's residence to other

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[1]Corps of Engineers, Regional Boating Survey, p. 30.

inland water bodies. If the individual boater does not have a strong preference for Lake Michigan boating, he will probably go boating on the inland water body which is closer to him. If one combines the factor "live by inland water bodies" with the factor "too far from residence", it can be seen that "distance" and "alternative boating water bodies" are the most important factors determining the boaters' use of Lake Michigan or other water bodies.

Another point worth noting is that 11.3 percent of the sampled boaters in Michigan prefer boating on other Great Lakes. It has also been observed that most of these boaters' residences are located midway between Lake Michigan to the west and Lake Huron, Lake St. Clair and Lake Erie to the east. There are still some boaters who prefer boating in the northern part of the state despite the longer distances involved likely because they prefer the northern environment.

Comparison of Respondents and Non-respondents

Up to this point, the boater survey responses have been analyzed, boaters using Lake Michigan have been distinguished from those who are not using Lake Michigan. These Lake Michigan boater responses will be used in the succeeding analysis. However, before the succeeding analysis can be undertaken, it must be ascertained that the survey responses are representative of the total Lake Michigan boater population. In order to assume that the survey responses

are fully representative of the total Lake Michigan boater population, the characteristics of non-respondents must be similar to that of the respondents. In order to compare the non-respondents with the respondents, a sample of non-respondents to the mail survey was telephoned and a short series of questions were asked the responses were tested for possible differences in the two groups.

The numbers of non-respondents of the boater survey in each category are shown in column III of Table 3. There were a total of 99 non-respondents in Illinois, 151 in Indiana, and 126 in Michigan. In Illinois, 20 (20 percent) of the 99 non-respondents were telephoned, and 15 usable responses were obtained. In Indiana, 27 (18 percent) of the 151 non-respondents were telephoned and 20 usable responses were obtained. In Michigan, 26 (20 percent) of the 126 non-respondents were telephoned and 21 usable responses were obtained. These responses and the numbers and percentages of Lake Michigan boaters are reported in Table 14 by length and type of boat owned.

In order to determine if there is any significant difference between the respondents and no-respondents, a statistical test is made on the difference between each cell in Table 14 and its counterpart in Table 12 which contains the mailed survey results.

To compare the respondents and the non-respondents, it is assumed that the number of boaters who use Lake Michigan will follow approximately a binomial probability distribution

TABLE 14

SAMPLED BOATERS USING LAKE MICHIGAN--BY LENGTH AND TYPE OF BOAT OWNED AND BY STATE OF RESIDENCE--TELEPHONE SURVEY

	Illinois			Indiana			Michigan			Region		
	sample	L.M.[a]	%	sample	L.M.[a]	%	sample	L.M.[a]	%	sample	L.M.[a]	%
Boat Length												
20-30'	9	6	66.7	14	7	50.0	15	11	73.3	38	24	63.2
30-45'	5	4	80.0	6	5	83.3	6	5	83.3	17	14	82.4
over 45'	1	1	100.0	0	0	0	0	0	0	1	1	100.0
Total	15	11	73.3	20	12	60.0	21	16	76.2	56	39	69.6
Boat Type												
Motor	14	10	71.4	18	10	55.6	18	13	72.2	50	34	68.0
Sail	1	1	100.0	2	2	100.0	3	3	100.0	6	5	83.3
Total	15	11	73.3	20	12	60.6	21	16	76.2	56	39	69.6

[a]Lake Michigan.

for both respondents and non-respondents with parameters p1 and p2, respectively. For the test of any difference between p1 and p2, we set the null hypothesis that

$$H_o : p1 = p2$$

against the alternative hypothesis that

$$H_a : p1 \neq p2$$

Note that a two-tailed statistical test will be employed because if a difference exists, we wish to detect either a $p1 > p2$ or a $p1 < p2$. Choosing $\alpha = 0.05$, we will reject H when $z > 1.96$ or $z < -1.96$. The best estimates of p1 and p2 are $\hat{p}1$ and $\hat{p}2$, respectively. The test statistic is

$$z = \frac{\hat{p}1 - \hat{p}2}{\sqrt{\hat{p}\,\hat{q}\,(\frac{1}{n_1} + \frac{1}{n_2})}}$$

The values of the test statistic are calculated and reported in Table 15. Since the z values do not fall in the rejection region, we will not reject the hypothesis that p1 = p2 and conclude that the data present sufficient evidence to indicate that there is no significant difference between the non-respondents and the respondents with respect to size and type of craft owned, and the use of Lake Michigan.

TABLE 15

TEST STATISTICS FOR ESTABLISHING THE COMPARABILITY OF RESPONDENTS AND NON-RESPONDENTS WITH RESPECT TO USE OF LAKE MICHIGAN BY STATE OF RESIDENCE AND LENGTH AND TYPE OF CRAFT OWNED[a]

	Illinois	Indiana	Michigan
Length			
20-30'	-1.62	-0.08	-1.86
30'+[b]	0.82	0.14	1.28
Type			
Motor	1.96	0.79	-1.60
Sail	1.62	-0.10	1.22

[a]Null hypothesis: $H_o : p1 = p2$

(p1, p2 are population parameters of mailed survey and telephone survey respectively.)

Alternative hypothesis: $H_a : p1 \neq p2$

Test tatistic

$$z = \frac{\hat{p}1 - \hat{p}2}{\sqrt{\hat{p}\,\hat{q}\,(\frac{1}{n_1} + \frac{1}{n_2})}}$$

($\hat{p}1$, $\hat{p}2$ are sample estimates of p1, p2; n_1, n_2 are sample sizes.)

Choosing $\alpha = 0.05$, reject H_o when $z > 1.96$ or $z < -1.96$.

(Reference: William Mendenhall, Introduction to Probability and Statistics, 2nd. ed., Wadsworth Publishing Co., 1968, pp. 179-80.)

[b]Due to the lack of data in 45'+ category in Indiana in the telephone survey, numbers in other 45'+ categories are added to 30-45' category and two boat length categories are used.

CHAPTER VI

ANALYSIS OF BOATERS' TRAVEL PATTERNS

Introduction

The analysis of the travel patterns of the sampled Lake Michigan boaters in the study region is one of the most important parts of this study because the approaches to be used in the estimation of the number of marina users of the proposed marina will be based on the existing travel patterns of the boaters in the study region. The applicability of the existing boater travel patterns depends upon whether or not they are consistent with the conceptual model described in chapter II. In other words, if the travel patterns of boaters visiting marinas bear similar characteristics to those of customers visiting retail stores, the model for estimating use of the proposed marina can be constructed based on the boaters' travel patterns. Therefore, the purposes of the analysis of boaters' travel patterns is to examine the major characteristics of the boaters' travel patterns as they seek out boating facilities in the study region and to examine them for consistency with the conceptual model.

Specifically, the major characteristics of the travel patterns of the sampled boaters to be examined include (1) the origin and destination of boating related trips; (2)

the travel time involved between these origins and destinations; and (3) the number of trips which boaters make between these origins and destinations in a period of time (one year in this study).

Before proceeding, three things have to be defined. First of all, "travel" is defined as boaters moving from one place to another via motor vehicles along the existing highway system. For the purpose of simplifying the measurement and analysis, other types of transportation will not be included in this study since there is little doubt that the family auto is almost the exclusive means of transportation for these recreationists.

Second, the measurement of the distance traveled used is determined in terms of "time" rather than miles. This distance traveled per unit time will be estimated by the new speed limit law, i.e., 55 miles per hour on major highways. About "travel time" which will be used in this study, Blome gives the following statements:

> The concept of time-distance is defined as the time required to travel a specified distance. When a certain location is said to be "...ten minutes from downtown", this emphasis is on time rather than on distance. To many people, especially in larger urban areas, a point to point orientation in terms of time is more meaningful than distance orientation, and the question "How much time will it take to reach my destination" is of greater concern than "How many miles is it to my destination". In fact, the spatial arrangement of shopping patterns and visits to alternative locations are usually decisions which are all based on an attempt to minimize ones total travel time. However, a minimization of the total travel time between two points

> does not necessarily minimize the total distance traveled. In order to determine a minimum travel time, one must consider variations in traffic congestion, quality of the highway or street surface, legal speed limits, and other impediments to traffic movement.[1]

Third, the analysis will be restricted to Lake Michigan boaters only since only these boaters' travel patterns are of major interest in this study.

Origin-Destination Analysis

To determine the number of boaters from each county of origin to each county of destination in the study region, the sampled boaters were requested to indicate the county and state where their major residences are located and where they usually rented a slip, a mooring, or launched their boat during the study period.

Table 16 presents the summary figures of the number of Lake Michigan boaters by state of origin and state of destination. It can be observed that, while some Lake Michigan boaters residing in Illinois boat in Wisconsin, Indiana, and Michigan, the largest portion of them remain in Illinois. Among the total of 104 sampled Lake Michigan boaters in Illinois, 90 or 86.5 percent of them remain in Illinois; 5

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[1]Donald A. Blome, A Map Transportation of the Time-Distance Relationships in the Lansing Tri-County Area, Institute for Community Development and Services, Michigan State University, 1963, p. 1.

TABLE 16

SAMPLED LAKE MICHIGAN BOATERS BY STATE OF ORIGIN AND STATE OF DESTINATION

	Destination								Origin Total	
	Illinois		Indiana		Michigan		Wisconsin			
	No.	%	No.	%	No.	%	No.	%	No.	%
Origin										
Illinois	90	86.5	6	5.8	3	2.9	5	4.8	104	100.0
Indiana	1	0.9	92	83.6	17	15.5	0	0	110	100.0
Michigan	0	0	0	0	235	100.0	0	0	235	100.0
Destination Total	91		98		255		5		449	

or 5.8 percent of them go to Indiana, 3 or 2.9 percent of them go to Michigan; and 5 or 4.8 percent of them go to Wisconsin. In this case, minimizing travel time which boaters have to spend is probably the major factor affecting the travel patterns of the Illinois Lake Michigan boaters.

Although the greatest portion of Indiana Lake Michigan boaters remain in their home state, 15.5 percent of them boat in Michigan compared with only 0.9 percent of them who boat in Illinois. Perhaps the great competition for facilities in Illinois is the major factor detering the Indiana boaters from going there to find a place to boat. Thus, both distance and availability of facilities seem to influence Indiana boater travel patterns.

All Lake Michigan boaters included in the dample who reside in Michigan boat in their home state. Because access to Lake Michigan is greater in Michigan than in either Illinois or Indiana, Michigan residents evidently need not to travel beyond the borders of their state to find appropriate boating facilities.

Figure 6 presents the number of Lake Michigan boaters from each county of origin to each county of destination in the study region. From the illustration in this figure, the travel patterns of the sampled Lake Michigan boaters can be observed.

In Illinois, Cook and Lake are the only two counties bordering Lake Michigan. Cook County has both a large number of Lake Michigan boaters and a large marina capacity.

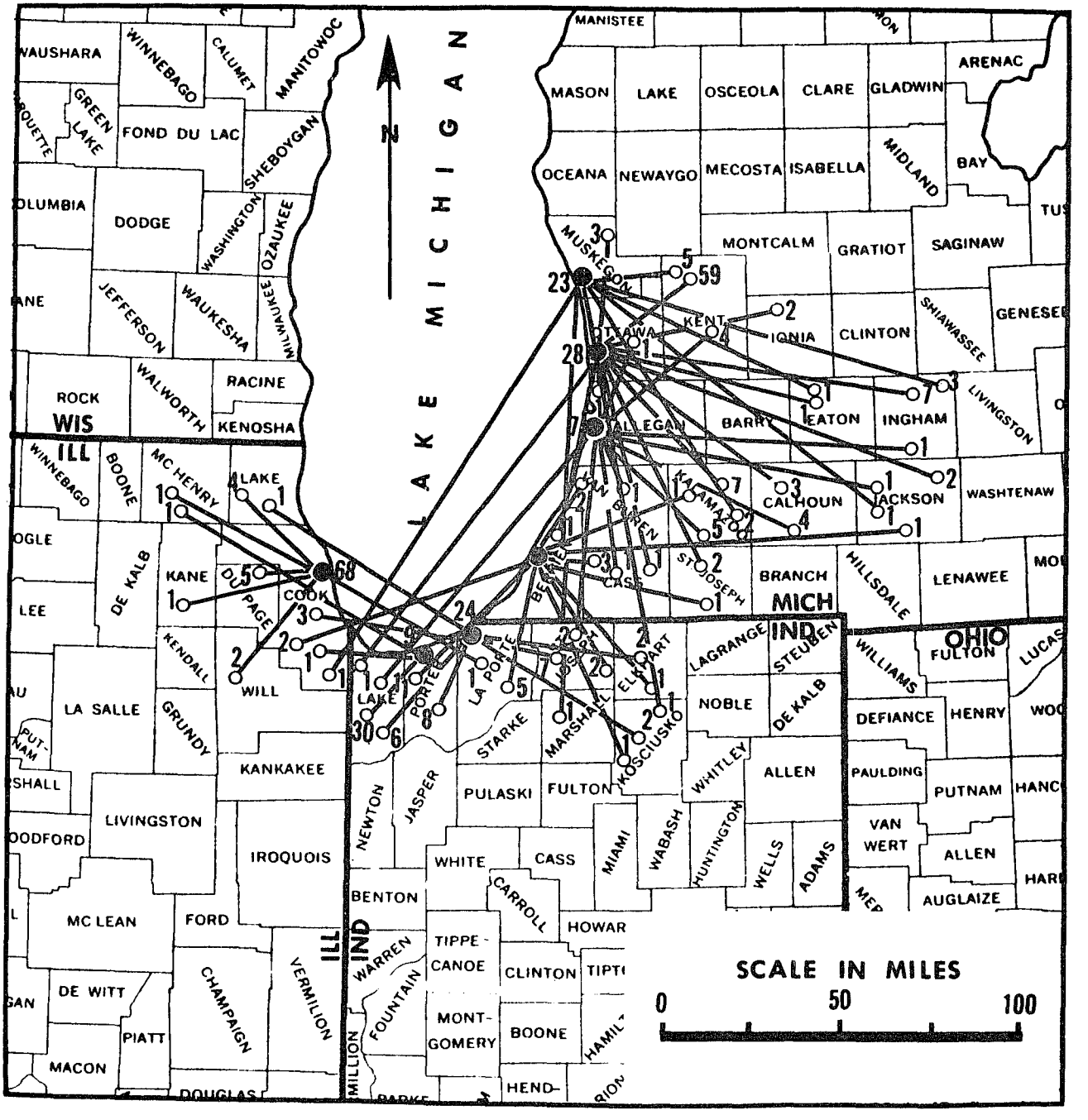

FIGURE 6 ORIGIN-DESTINATION TRAVEL PATTERNS OF SAMPLED LAKE MICHIGAN BOATERS
(○ Origin, ● Destination)

Logically, most Illinois boaters both originate and boat in Cook County.

In Indiana, most Lake Michigan boating facilities are developed in LaPorte and Porter Counties. Combined LaPorte and Porter Counties attract about 80 percent of all sampled Lake Michigan boaters in the Indiana portion of the study region. On the other hand, Lake County attracts only 3.6 percent of the sampled Indiana Lake Michigan boaters but about 38.2 percent of the sampled Indiana Lake Michigan boaters originate from it. Its neighboring county, Porter, absorbs about 71.4 percent of the boaters who reside in Lake County, Indiana.

In Michigan, Kent County has about 31 percent of the total sampled Michigan Lake Michigan boaters and about 81 percent of these sampled boaters go to Ottawa County. Other counties with relatively high Lake Michigan boating population are Ottawa, Muskegon, and Ingham Counties. However, there is a remarkable difference between Ottawa, Muskegon, and Ingham County. Ingham County is a inland county while the other two counties border Lake Michigan. Also, large portion of Ingham County boaters boat in the northern part of the lower peninsula.

On the destination side, Ottawa County attracts about 50 percent of all the sampled Lake Michigan boaters in the Michigan portion of the study region. Muskegon County attracts about 15 percent, Allegan County attracts about 11 percent, and Berrien County (where the proposed marina will

be built) now attracts more than 10 percent of all the sampled Michigan Lake Michigan boaters.

One thing worth noting is that of the Illinois and Indiana Lake Michigan boaters using Michigan facilities Berrien County attracts two-thirds of those from Illinois and about 59 percent of those from Indiana. Therefore, one might expect that even more Indiana and Illinois boaters will be attracted to this county when the proposed marina is in operation.

Travel Time Between Origin and Destination

In order to ascertain the travel time expended between boaters' residences and their marinas, the boaters were asked to indicate the average time needed to drive from their major residences to the location where they rented a seasonal slip, mooring, or where they launched their boat most frequently. The responses to this question were tabulated into travel-time intervals. Table 17 presents the results of this tabulation.

When the number of boaters in each travel-time zone are compared, it can be seen that the percent of boaters decreases as travel-time increases. For the study region as a whole, about 49.2 percent of the total sampled Lake Michigan boaters fall in the 0-to-30 minute zone. As the travel time increases to 30-to-60 minute zone, the percent of boaters decreases to 29.8 percent. There are about 8.5

TABLE 17

SAMPLED BOATER TRAVEL BETWEEN THEIR RESIDENCES AND CURRENTLY USED MARINAS BY TRAVEL TIME ZONE

	Illinois		Indiana		Michigan		Region	
	No.	%	No.	%	No.	%	No.	%
Travel Time								
Less Than 30 (min.)	55	52.9	72	65.5	94	40.0	221	49.2
30-60	34	32.7	26	23.6	74	31.5	134	29.8
60-90	6	5.8	8	7.3	24	10.2	38	8.5
90-120	5	4.8	2	1.8	15	6.4	22	4.9
120-150	0	0	2	1.8	13	5.5	15	3.3
150-180	0	0	0	0	2	0.9	2	0.5
over 180	4	3.8	0	0	13	5.5	17	3.8
Total	104	100.0	110	100.0	235	100.0	449	100.0

percent in the 60-to-90 minute zone, 4.9 percent in the 90-to-120 minute zone, 3.3 percent in the 120-to-150 minute zone, 0.5 percent in the 150-to-180 minute zone, and 3.8 percent in the over-180 minute zone. The break in this pattern in the over-180 minute zone can at least partially be explained by its relatively large size.

A plot of the information in Table 17 provides a picture of the boaters' travel patterns. In Figure 7, the horizontal axis represents travel time, and the vertical axis represents the percent of boaters in each travel time zone.

Examining the boaters' travel patterns in each state in the study region suggests that another phenomenon needs to be discussed. Specifically, this phenomenon is the very rapid decrease in the number of boaters up to the 60-to-90 minute travel time zone. After this zone, the rates of decreases become very moderate and similar to each other until the 150-to-180 minute zone is reached. It would probably suggests that 60 to 90 minutes represents a psychological time barrier beyond which these boaters are unwilling to travel to recreate.

However, a significant number of boaters do travel more than 60 minutes to recreate. The reasons why these are willing to travel greater distances to boat were not specifically addressed in this study, however, it seems reasonable to assume that the factors commonly cited in many recreation demand studies--income, tastes, leisure time--are

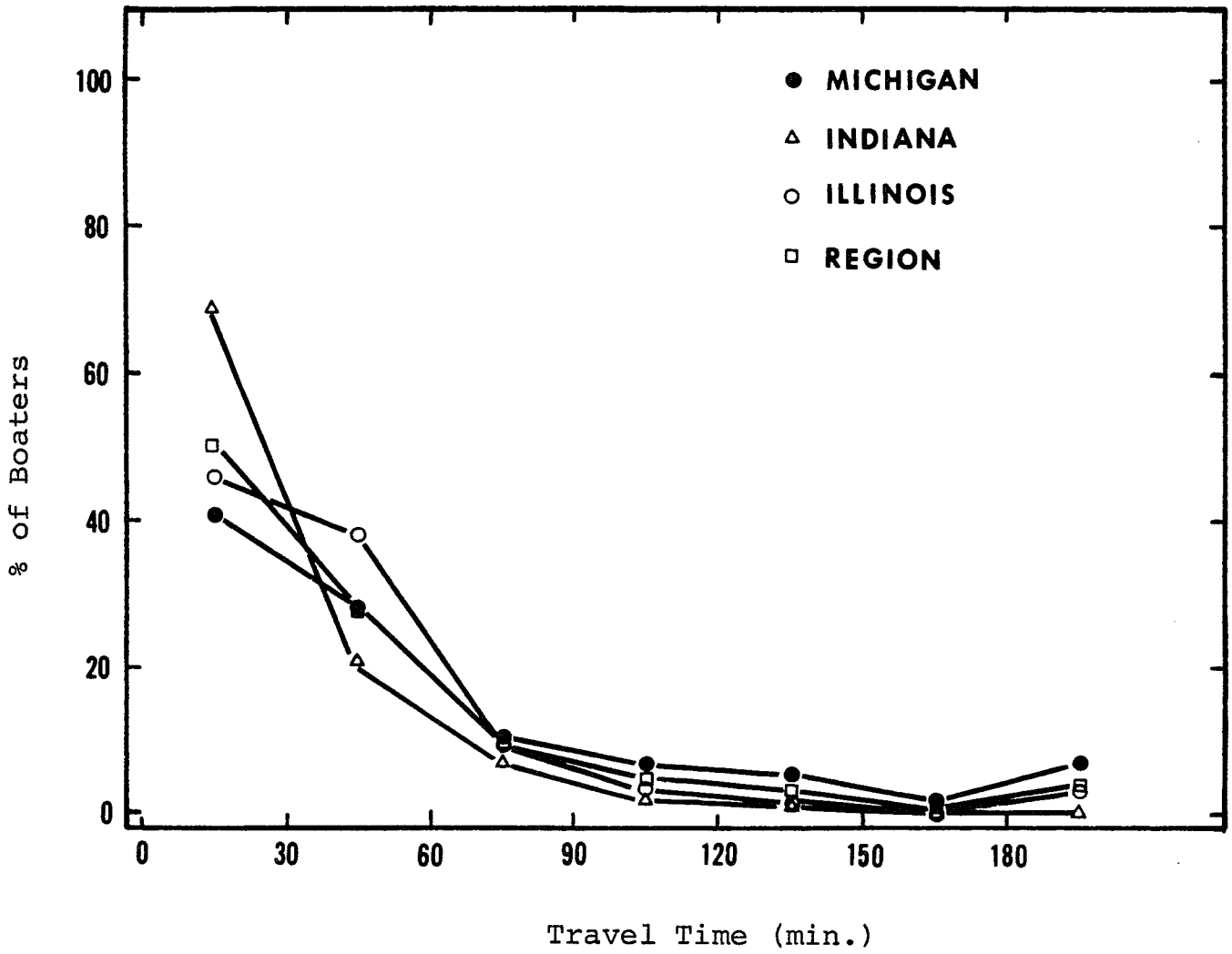

FIGURE 7 PERCENTAGE OF SAMPLED LAKE MICHIGAN BOATERS IN EACH TRAVEL TIME ZONE BETWEEN RESIDENCES AND CURRENTLY USED MARINAS

also factors in this case. In addition, a prior knowledge of this area suggests that availability of facilities may be an important factor and perceived differences in resource quality (including the congestion factor) probably prompt increased travel.

The results of the telephone interview show that, for the study region as a whole, about 66.7 percent of the Lake Michigan boaters fall in the 0-to-30 minute zone, 25.6 percent in the 30-to-60 minute zone, 5.1 percent in the 60-to-90 minute zone, and 2.6 percent in the 120-to-150 minute zone. In general, the travel patterns of the non-respondents to the mailed survey are similar to that of the respondents as far as the travel time expended is concerned.

Number of Trips Boaters Made

Another aspect of the boaters' travel pattern to be investigated is the number of trips that boaters make between origins and destinations in a period of time (one year in this study). Table 18 presents the total number of trips made by boaters in each travel time zone, total number of boaters in each travel time zone, and the average number of trips made per boater in each travel time zone.

The first columns in Table 18 under the headings for each state and the study region report the number of trips which boaters made in each travel time zone. These figures show that for all three states and the region more trips

TABLE 18

TOTAL NUMBER OF TRIPS, BOATERS, AND AVERAGE NUMBER OF TRIPS MADE PER BOATER BY TRAVEL TIME ZONE--STATE AND REGION

	Illinois			Indiana			Michigan			Region		
	No. of Trips	No. of Boat-ers	Trips per Boat-er	No. of Trips	No. of Boat-ers	Trips per Boat-er	No. of Trips	No. of Boat-ers	Trips per Boat-er	No. of Trips	No. of Boat-ers	Trips per Boat-er
Travel Time												
Less Than 30 (min.)	3,236	55	59	4,898	72	68	5,832	94	62	13,966	221	63
30-60	1.788	34	53	1,142	26	44	2,737	74	37	5,667	134	42
60-90	217	6	36	308	8	39	565	24	24	1,090	38	29
90-120	89	5	18	64	2	32	344	15	23	497	22	23
120-150	0	0	0	16	2	8	269	13	21	285	15	19
150-180	0	0	0	0	0	0	32	2	16	32	2	16
over 180	46	4	12	0	0	0	195	13	15	241	17	14
Total	5,376	104	52[a]	6,428	110	58[a]	9,974	235	42[a]	21,778	449	49[a]

[a]State or regional average.

were made by the boaters in the first travel time zone than in the second travel time zone. This pattern persists in each column with number of trips decreasing with increasing travel.

The third columns under each heading report the average number of trips made per boater. This figure provides a more meaningful indication of trip frequency by boaters in different travel time zones. These figures are derived by dividing the total number of trips by total number of boaters in each travel time zone. In terms of the entire study region, the average number of trips made per boater ranges from 63 trips per boater in the less than 30 minutes zone to 14 trips per boater in the over 180 minutes zone.

If these figures (last column in Table 18) are also plotted on a graph as was done for the percentages of boaters in each travel time zone in the preceding section, Figure 8 can be drawn. This information would seem to further support the inverse relationship demonstrated in Table 18 between trip frequency and travel distance. As distance increases, both the number of individual boaters in appearance and the frequency of their visits can be expected to decline based upon this analysis of boater travel pattern.

Summary

From the analysis in this chapter, several important characteristics of the travel patterns of the Lake Michigan

boaters in the study region can be ascertained. First, more Illinois and Indiana boaters boat in Michigan than Michigan boaters who boat in Illinois or Indiana. Of these boaters from Illinois and Indiana who boat in Michigan, more are from Indiana than from Illinois. Therefore, it is expected that the proposed marina will attract more boaters from Indiana than from Illinois. Second, more boaters are attracted by a nearby marina than one located at a greater distance, i.e., an inverse relationship can be observed between the number of boaters visiting a marina and the distances (travel time) which separate the boaters from that marina. Third, boaters residing closer to a marina make more trips to that marina during a certain period of time than boaters residing at a greater distance, i.e., again an inverse relationship can be observed between the number of trips made per boater and the distances (travel time) which separate the boaters from that marina.

These characteristics of the boaters' travel patterns in the study region are very similar to the conceptual model discussed in Chapter II. It is, therefore, believed that a similar model can be built based upon the boaters' travel patterns for the estimation of the number of users of the proposed marina. The development and use of this model is presented in the following chapter.

CHAPTER VII

ESTIMATION OF USE OF THE PROPOSED MARINA FACILITY

Introduction

In this chapter, an estimate will be developed of the number of boaters who will rent seasonal slips at the proposed marina. This process will involve several steps and will rest upon several assumptions. The final estimate will take into account boater preferences with respect to both travel and quality of marina facilities and services. It will also take into account location of competing facilities.

In the first part of this chapter, the process used to estimate the number of users at the proposed marina in the absence of any competing facilities will be presented. The second part of this chapter will be devoted to the estimation of users of the proposed marina under the more realistic condition that there are competing facilities available in the area. In the last part of this chapter, the estimation of not currently registered boater use will be presented.

Estimation of Current Registered Boater Use--No Closer Facilities Available

In this part of the estimation process the purpose is that of ascertaining the maximum possible attendance at the proposed new marina in the absence of any competing facilities. This estimation is based on several basic assumptions. First, it is assumed that there are no other facilities at Lake Michigan marinas which are closer to the boaters' residences available for rental. Second, it is assumed that the proposed marina will provide the best quality facilities and services available anywhere in the study region. Third, it is assumed that boaters will seek the nearest marina which also provides the best facilities and services. Fourth, it is assumed that the rental fees at marina facilities in the region are competitive[1] so that the force of distance in affecting boaters' choice of facilities can be fully recognized.

Other things being equal, boaters will probably seek the nearest marina which provides them with the best facilities and services. However, such marinas may not

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[1]In the question from which this analysis is derived, boaters were specifically asked to assume competitive pricing. Their perceptions of what competitive pricing means, since the term was not defined, could impact the validity of this assumption. However, the information collected from the marina operator survey did show that the rental fees were competitive within groups of marinas offering similar facilities and services.

always be available due to the great competition among boaters for a limited supply of such facilities. Therefore, boaters must frequently make trade-offs between accessibility and quality. If no closer facilities of any type are available, boaters will probably travel up to some maximum distance to reach a full-service marina.[1] In this case, if any boaters whose location to the proposed marina is less than or equal to the maximum distance he is willing to travel to a full-service marina (non-site-specific), there is a strong possibility that he will utilize the proposed marina. Therefore, if the number of boaters in each travel time zone with respect to the proposed marina and the maximum distance they are willing to travel are known, the maximum possible users of the proposed marina can be estimated.

This estimation is based on the assumption that the proposed marina is exactly the same as the "full-service marina" which the boaters can imagine. Once the actual location of the specific site is specified (site-specific), boaters may or may not be willing to use this particular

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[1] A "full-service marina" is one which provides not only the basic facilities and services such as slips and/or mooring, water, ice, fuel and oil, and other minor selected items for the convenience of its clientele but provides also haul-out facilities, storage, maintenance or repairs, food services and supply stores. Marinas providing only basic facilities and services is termed a "limited-service marina". (Source: Economic Analysis of Marinas in Maryland, University of Maryland, Agricultural Experiment Station, 1969, p. 3.)

marina because of their preferences with respect to this specific location, i.e., the attractivity of the resource base surrounding the specific marina location. Therefore, in order to obtain a more reliable estimate, boaters were also asked in the questionnaire whether or not they would be willing to use the proposed marina if it will be built at Benton Harbor-St. Joseph, Michigan. In the final estimate, only those boaters who both are willing to travel the required distance and who are also willing to rent a seasonal slip at the particular site will be taken into account. The steps will be followed in the estimation are: (1) develop a maximum travel model based upon the boaters' travel patterns; (2) apply this maximum travel model to estimate the maximum possible users--non-site-specific; (3) apply the maximum travel model to estimate the maximum possible users--site specific.

Development of a Maximum Travel Model

In order to determine the number of boaters by maximum travel time zone, the sampled boaters were asked the maximum time they would be willing to travel to a full-service marina assuming that no other closer facilities at Lake Michigan marinas were available for rental. The responses from the sampled boaters are reported in Table 19.

It can be observed in Table 19 that the highest percentage of boaters selected 30 to 60 minutes as the

TABLE 19

NUMBER AND PERCENTAGE OF SAMPLED LAKE MICHIGAN BOATERS BY THE MAXIMUM TIME THEY ARE WILLING TO TRAVEL TO A FULL-SERVICE MARINA

	Illinois	Indiana	Michigan	Region		
	No.	No.	No.	No.	%	Cum. %[a]
Travel Time						
Less Than 30 (min.)	7	17	54	78	17.4	100.0
30-60	43	47	74	164	36.5	82.6
60-90	20	27	38	85	18.9	46.1
90-120	16	15	22	53	11.8	27.2
120-150	12	4	18	34	7.6	15.4
150-180	2	0	10	12	2.7	7.8
over 180	4	0	19	23	5.1	5.1
Total	104	110	235	449	100.0	

[a]Cumulative percentage.

maximum travel time that they would be willing to travel to a full-service marina. The number of boaters decreases with increases in required travel fairly consistently beyond the 30-to-60 minute interval. The slight break in this trend which occurs for the 180 and over category probably results because it includes all travel zones beyond the 180 minute minimum. In comparing Table 19 (maximum willingness to travel to boat) with Table 17 (current distance travel to boat) in the preceding chapter, some significant differences between them can be observed. In Table 17, there are more boaters concentrated in the 0-to-30 minute zone while in Table 19, there are more boaters concentrated in the 30-to-60 minute zone. Equally important is the fact that, except for the 0-to-30 minute zone, more boaters appear in every travel time zone in Table 19 than its counterpart in Table 17. Possible reasons for these differences are discussed in the following paragraph.

In Table 17, the sampled boaters reported the distances between their residences and the marinas they currently use. It seems safe to assume that when they were choosing facilities they tried to minimize the travel time. Information in Table 19 shows the maximum travel time boaters are willing to spend to reach a full-service marina. Because some boaters have the good fortune to live nearer a marina than the maximum distance they would be willing to travel, one would expect shifting to occur between the percentage of boaters in each travel time zone.

If the information in these two tables are plotted on a graph, a clearer comparison of the differences between them can be observed. One can see, in Figure 8, that the curve which represents the information in Table 17 starts from the left hand side of the graph with a highest point in the 0-to-30 minute travel time zone and, then, sloping downward to the right. However, the curve which represents the information in Table 19 starts from the left hand side of the graph with a low point in the 0-to-30 minute zone and has a highest point in the 30-to-60 minute zone. After the highest point, the curve shifts to the right to the curve which represents the information in Table 17.

The reason why there are more boaters in the 30-to-60 minute zone in Table 19 is probably because many boaters currently in the 0-to-30 minute zone are willing to travel farther than 30 minutes to boat if there are no other closer facilities available. The reasons underlying this situation would be the fact that both the supply of marina facilities and the consumers (boaters) are not evenly distributed throughout the study region. Especially in the Table 19 situation, the supply of the marina facilities is extremely short (assuming no closer facilities available).

It is quite evident from what is reported in Table 19 that boaters in aggregate are willing to travel longer distances to a full-service marina than they are now traveling because they have located closer facilities. It may also be true that if the proposed marina provides better

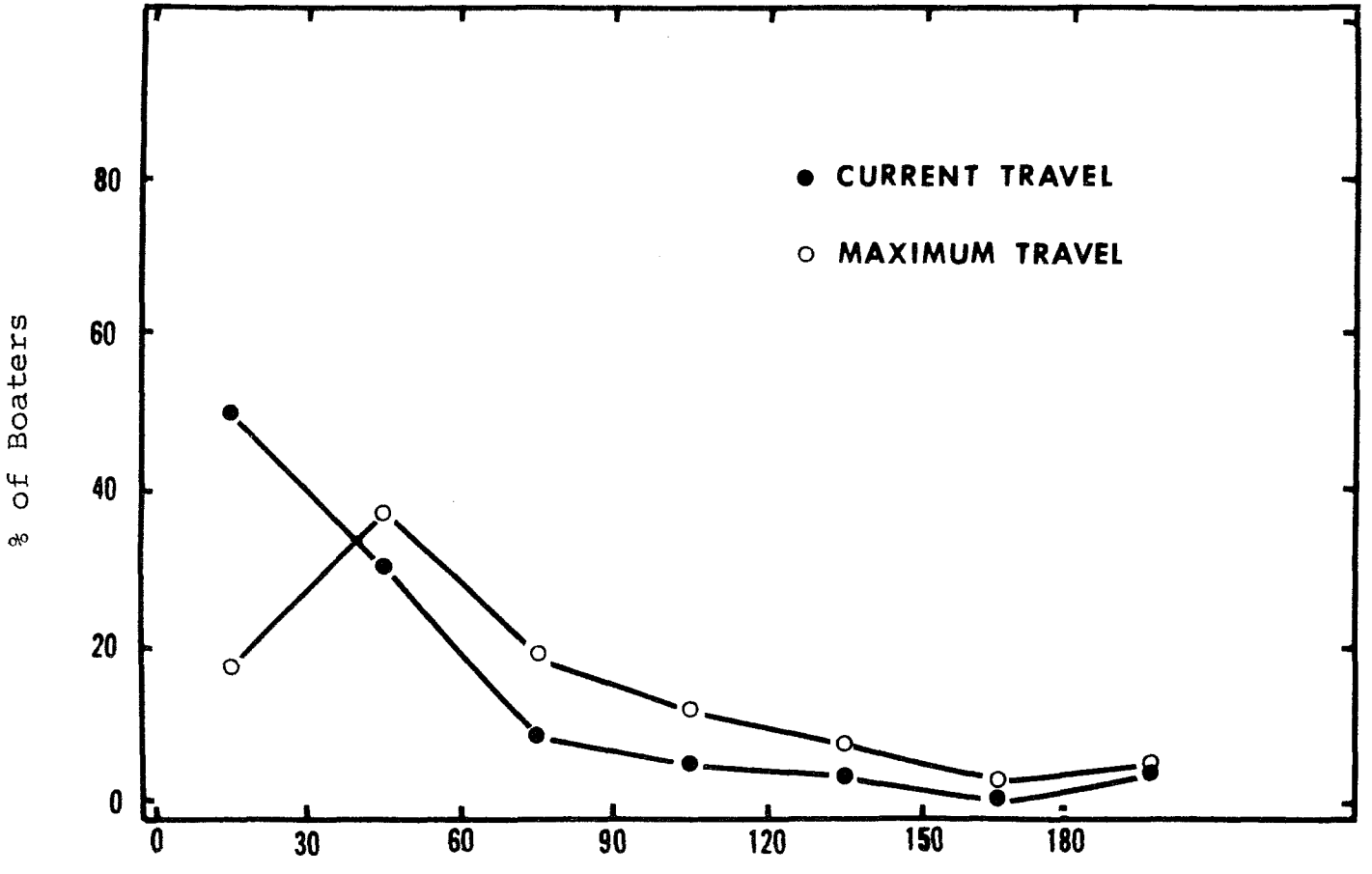

FIGURE 8 CURRENT TRAVEL PATTERN AND MAXIMUM TRAVEL PATTERN OF SAMPLED LAKE MICHIGAN BOATERS

facilities and services some boaters will select it over a closer but less attractive facility. In other words, its market could be greater than marinas offering only basic facilities and services.

To ascertain that the maximum travel model is representative of all Lake Michigan boaters, the non-respondents to the mailed questionnaire survey were also asked about the maximum time they are willing to spend on travel to a full-service marina. The results of the telephone interview indicate that, for all the 39 selected Lake Michigan boaters, about 23.1 percent fall in the 0-to-30 minute zone, 46.2 percent in the 30-to-60 minute zone, 17.9 percent in the 60-to-90 minute zone, 5.1 percent in the 90-to-120 as well as the 120-to-150 minute zone, and the remaining 2.6 percent in the over-180 minute zone. In general, it can be observed from the above information, that there is no significant difference in the maximum travel time boaters are willing to spend to visit a full-service marina between the respondents and the non-respondents of the boater survey.

The cumulative percentages in the last column of Table 19 indicate the maximum percent of boaters in each travel time zone who are likely to use the proposed marina. The logic of using cumulative percentages is that if any boater willing to spend 180 minutes to visit a full-service marina, he would also be willing to spend any time less than 180 minutes to visit the same marina. Therefore, there should be a hundred percent of the boaters in the 0-to-30 minute

zone in the study region willing to visit this full-service marina. The percentage in the second travel time zone is derived by subtracting those who are not willing to spend more than 30 minutes on travel. By the same process, the percentages in the other zones can also be obtained. This information will be used for the estimation of the maximum possible users of the proposed marina.

Data Preparation for Application of the Model

As a part of the estimation process, the number of boaters in each travel time zone with respect to the proposed marina will be developed in this section. In order to determine the number of boaters in each travel time zone about the proposed marina, the sampled Lake Michigan boaters are classified into travel time zones based upon the travel time needed to travel from their residences to the proposed marina. Then, the population distribution of Lake Michigan boaters in each travel time zone can be estimated since the total Lake Michigan population in the study region is known. The results are reported in Table 20.

It can be observed, from Table 20, that in the study region only 5.1 percent of the sampled Lake Michigan boaters reside within 30 minutes driving time of the proposed marina; about 17 percent of the boaters would have to travel 30 to 60 minutes to reach it. Furthermore, there are more boaters in 60 to 90 and 90 to 120 minutes zone than in the

TABLE 20

DISTRIBUTION OF ESTIMATED LAKE MICHIGAN BOATERS ABOUT THE PROPOSED MARINA BY TRAVEL TIME ZONE

	Sampled Boaters	% of Sampled Boaters	Estimated L.M. Boater Population[a]
Less Than 30 (min.)	23	5.1	543
30-60	76	16.9	1,794
60-90	114	25.4	2,691
90-120	116	25.8	2,738
120-150	84	18.7	1,983
150-180	23	5.1	543
over 180	13	3.0	307
Total	449	100.0	10,599

[a]Estimated Lake Michigan Boater Population: 10,599 x % of sampled boaters in each travel time zone.

other zones. These two zones alone include more than 51 percent of all the sampled Lake Michigan boaters in the study region. After the 120 minutes limit, the number of boaters decreases from zone to zone.

This distribution pattern of Lake Michigan boaters closely mimics the geographical distribution patterns of the general population in the study region. The reason for fewer boaters in the closest zone is probably because of its relatively small area and small population. The reason for small number of boaters in farther zones is probably because they contain a relatively small per capita boating population.

For the entire study region, the mean time boaters would have to spend traveling from their residences to the proposed marina is 105.6 minutes. However, the current existing regional mean travel time from boaters' residences to where they usually boat is 51.1 minutes. When these two figures are compared, it can be seen that the former is about two times greater than the latter. This comparison would probably suggest that, on the average, the sampled Lake Michigan boaters would have to travel twice as far to reach the proposed marina than they are now traveling to the existing marinas they currently use. Thus, one would expect that there would be a great number of Lake Michigan boaters who would not be likely to use the proposed marina if travel time is a major concern to them and if the attraction of the proposed marina is not sufficient to

overcome locational advantages of existing facilities. However, as is frequently the case in comparing means of this nature, later analysis will demonstrate detailed analysis frequently yields different results than aggregate analysis.

Application I--
Non-Site-Specific

As has been stated before, if the travel time needed for any boater to drive from his residence to the proposed marina is less than or equal to the maximum travel time he is willing to spend to reach a full-service marina, there is a possibility that this boater may visit the proposed marina. Therefore, given the information on the number of sampled Lake Michigan boaters in each maximum travel time zone to a full-service marina, the maximum possible number of users of the proposed marina can be estimated.

The number in each travel time zone obtained would be the maximum possible number of users of the proposed marina in the sample. Then, these sample figures can be extroplated to take into account the entire Lake Michigan boater population residing in the study region. This estimate is, of course, not site specific since the question on the survey upon which this analysis is based was not site specific. The results are reported in Table 21.

In Table 21, the first column contains the number of the maximum possible users of the proposed marina in the

TABLE 21

MAXIMUM ESTIMATED POSSIBLE USERS IN EACH TRAVEL TIME ZONE IN THE REGION--NON-SITE-SPECIFIC--ASSUMING NO CLOSER FACILITIES ARE AVAILABLE

Travel Time	Maximum Users in Sample	Maximum % of Possible Users in Each Zone[a]	Estimated Boater Population[b]	Estimated Maximum Possible Users (Col. 3 x Col. 2)
Less Than 30 (min.)	78	100.0	543	543
30-60	164	82.6	1,794	1,482
60-90	85	46.1	2,691	1,241
90-120	53	27.2	2,738	745
120-150	34	15.4	1,983	305
150-180	12	7.8	543	42
over 180	23	5.1	307	16
Total	449		10,599	4,374

[a]Table 19.

[b]Table 20.

sample. The second column contains the maximum percentages of the possible users in each travel time zone with respect to the proposed marina. The information in both the first and second columns are derived from the data in Table 19. The third column contains the estimated Lake Michigan boater population in each travel time zone with respect to the proposed marina. This information is derived from the data in Table 20. The fourth column contains the estimated number of maximum possible users of the proposed marina. These figures are derived by multiplying the information in column three by the percentages in column two.

It can be observed, from these percentage figures in column two, that the percentage of the estimated maximum possible users of the proposed marina decreases as travel time increases. If boaters possess similar characteristics and preferences, are uniformaly distributed over space and can move freely from or to all directions, the maximum possible market of the proposed marina in the absence of competing facilities would be a perfect circle with a radius equal to the greatest travel time boaters are willing to expend to reach the centrally located marina. However, as the study region includes such a vast area, the distribution of boaters varies greatly from place to place, the transport routes are different, and boaters possess different characteristics and preferences, the market of the proposed marina is almost certainly not as mentioned above. In

subsequent analysis, a more realistic description of the possible market for the proposed marina will be evolved.

Application II--Site-Specific

The estimated number of users in the preceding section is the maximum possible number of users of the proposed marina under the condition that its specific location is unknown or, in other words, assuming that characteristics (both real and perceived) of the site itself have no influence on boaters preferences for it. The estimation was based on the maximum distance boaters would be willing to travel to an "ideal" full-service marina. This kind of marina may exist only in boaters' imaginations at a location they might prefer. Once the boaters realize where the proposed marina will actually be located, some of them may not be willing to come and rent a seasonal slip there due to their personal preferences with respect to the site's characteristics or for some other reason or reasons such as undesirable highway linkages.

Therefore, to further refine the estimated number of boaters who would be willing to use the proposed marina, the sampled boaters were asked to express their willingness to use the proposed marina at Benton Harbor-St. Joseph, Michigan. The number of sampled boaters with positive responses to this site-specific inquiry again assuming no closer facilities are available and the estimated possible users

are reported in Table 22.

The first column contains the number of sampled Lake Michigan boaters in each travel time zone in the study region. The second column contains the number of boaters who expressed their willingness to use the proposed marina. The third column contains the percentages of users of the sampled boaters in each travel time zone. This information is derived from dividing the figures in column two by figures in column one. The fourth column contains the estimated boater population in each travel time zone, and the fifth column contains the estimated number of possible users in each travel time zone with respect to the proposed marina with site specified.

Comparing Table 22 with Table 21, one may note that the estimated total number of boaters is 78 (1.8 percent) fewer in Table 22 than in Table 21. Since these respondents are the same boaters who provided the data for Table 21, it seems reasonable to assume that the introduction of the specific location of the proposed marina accounts for this reduction even it is very small. Apparantly, only a small percentage of current boaters do not view the Benton Harbor-St. Joseph location as attractive as other possible locations in the study region. These results would probably suggest that specific location of the proposed marina might not be a crucial factor influencing boaters' use of this particular marina in the study region.

TABLE 22

ESTIMATED MAXIMUM POSSIBLE USERS IN EACH TRAVEL TIME ZONE IN THE REGION--SITE-SPECIFIC--ASSUMING NO CLOSER FACILITIES ARE AVAILABLE

	Sampled L.M.[a] Boaters	Users in Sample	% of Users in Sample[b]	Boater Population	Estimated Possible Users[c]
Less Than 30 (min.)	23	19	82.6	543	449
30-60	76	51	67.1	1,794	1,204
60-90	114	53	46.5	2,691	1,251
90-120	116	31	26.7	2,738	731
120-150	84	24	28.6	1,983	567
150-180	23	4	17.4	543	94
over 180	13	0	0	307	0
Total	449	182		10,599	4,296

[a]L.M. = Lake Michigan.

[b]Column two/column one

[c]Column four/column three

Estimation of Current Registered Boater Use--Allowing for Closer Facilities

The estimates in the preceding section were based primarily upon the unrealistic assumption that no other closer facilities are available for the boaters to choose from. This assumed condition may be somewhat applicable when other closer facilities are all occupied. However, eventually, there could be closer facilities available due to expansion of the existing facilities, construction of new facilities, and/or current slip renters leaving their currently occupied facilities. Therefore, if a more practical and reliable estimate is desired, closer competing facilities must be considered or in the words of an economist supply as well as demand must be taken into account in the analysis.

In this section, the analysis will take both competing facilities and boaters' preferences with respect to travel time and quality of marina facilities and services into account. As a basis for deriving this estimate, the sampled boaters were asked to respond in the survey questionnaire to the following question: "If there are seasonal slips or moorings available at a closer marina which provides only basic facilities and services, would you still prefer renting a seasonal slip at the proposed full-service marina at Benton Harbor-St. Joseph, Michigan, if the rental fees were

competitive?"

In this question, the assumption that "no closer facilities were available" was relaxed. As for the attractiveness of the proposed marina, it was still assumed that the proposed marina would provide better facilities and services than the closer ones. Finally, the wording, "...if the slip rental fees were competitive" was inserted in an attempt to remove this factor from boater responses.

The responses of this question are presented in the second column of Table 23. The last column contains the estimated number of users of the proposed marina. It should be noted that when the factor "with closer facilities available" was introduced into the analysis, it brought about a drastic decrease in the estimated number of the users of the proposed marina. For the entire study region, the estimated number of marina users decreases from a total of 4,296 in Table 22 to 2,266 in Table 23. In other words, about 47.3 percent of the marina users estimated with the assumption that no closer facilities are available would turn away to seek closer facilities if and when they are available.

Based on the above information, there is evidence to indicate that the availability of closer competing facilities is an important factor affecting the boaters' willingness to use the proposed marina. Stouffer introduced the concept of "intervening opportunities and competing migrants". The idea is that the number of people going a

TABLE 23

ESTIMATED USERS IN EACH TRAVEL TIME ZONE IN THE REGION--WITH CLOSER FACILITIES AVAILABLE

	Sampled L.M.[a] Boaters	Users in Sample	% of Users in Sample[b]	Boater Population	Estimated Possible Users[c]
Less Than 30 (min.)	23	16	69.6	543	378
30-60	76	30	39.5	1,794	708
60-90	114	25	21.9	2,691	590
90-120	116	14	12.1	2,738	330
120-150	84	10	11.9	1,983	236
150-180	23	1	4.3	543	24
over 180	13	0	0	307	0
Total	449	96		10,599	2,266

[a] L.M. = Lake Michigan.

[b] Column two/column one

[c] Column four/column three

given distance from a point is not a fraction of distance directly but rather a function of the spatial distribution of opportunities.[1] He also suggests that everything else being equal, the attractiveness of City Y for migrants from City X will depend, at least to some extent, on how many potential migrants are closer to Y than are the potential migrants in X.[2]

As Golledge also maintained:

> "As distance from a designated node increase, the opportunity for contact with the node decreases and the possibility of obtaining information about condition at the center diminishes. As these two variables change there is a correspounding increase of uncertainty about possible rewards for making a trip. It can be deduced from this that as distance increases and uncertainty outcomes of trips increases the possibility of finding evidence of the one-center least effort syndrome will dimish."[3]

These authors' theories would seem to suggest that the boaters who would not be willing to use the proposed marina could be attracted by the "closeness" of any available alternative marina facility even though better facilities and services are offered by the proposed marina. In this case, then, boaters were asked to choose between travel costs and the quality of the marina facilities and services being

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[1]Samuel A. Stouffer, Intervening Opportunities and Competing Migrants, Journal of Regional Science, Vol. 2, No. 1, 1960, pp. 1-26.

[2]Ibid., pp. 1-26.

[3]R. G. Golledge, Conceptualizing the Market Decision Process, Journal of Regional Science, Vol. 7, No. 2, p.246.

offered.

As has been mentioned before, if the marina at Michigan City, Indiana is built, it will be a great competitive force for the market share of the proposed marina at Benton Harbor-St. Joseph, Michigan. As for the spatial competition for market in the case of two producers, Isard stated that

> Introduction of a competitor producing the identical commodity alters the condition in the area in which competition is in force. Where both producers set the same factory price, effective for all consumers, and where the freight rate is invariant with direction, being a function of weight and distance only, the boundary separating the consumers served by each producer is the perpendicular bisector of the straight line joining the two producers.[1]

However, in a more practical sense as in this study, such boundaries are usually blurred. Instead of a sharp line, one finds a zone of transition of indifference. Deletoglou demonstrates that the closer two firms locate to each other the greater the zone of indifference, and the lower the probability that each firm will receive a half-share of the market, the greater the dispersion, the greater the chance of each firm receiving its half.[2]

In summary, the market of the proposed marina will be affected by many factors. It has been found, from this section, that distances and alternative facilities are the major important ones.

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[1]Isard, Location and Space-Economy, p. 146

[2]Nicos E. Deletoglou, A Dissenting View of Duopoly and Spatial Competion, Economica, Vol. 32, 1965, pp. 140-60.

Eatimated Users by Boat Length and Type

One final step in the estimation process is to estimate the number of users by boat length and type categories. The purpose of this estimate is to provide some information to the marina developers as how many slips should be built in each length category as mentioned in Chapter I.

To estimate the users in each length category, the total estimated possible users of the proposed marina obtained in Table 23 (2,266) are further classified by length and type of boats these boaters owned. The results are reported in Table 24.

From the information in Table 24, one can see that Lake Michigan boaters in this region own more boats in the 30-to-45 foot category than in the other two length categories. At the same time, there are more motor boats than sail boats in the study region.

Estimation of Not Currently Registered Boater Use--Allowing for Closer Facilities

The estimation of potential marina users in the previous sections was concentrated primarily in individuals who are presently engaged in boating activities. It is felt that there could be a number of individuals who are presently not engaged in any boating activities primarily because of perceived or real shortages of desirable boating facilities.

TABLE 24

ESTIMATED USERS BY LENGTH
AND TYPE OF BOAT OWNED

	Users in Sample	% of Users	Estimated Users
Boat Length			
20-30'	38	39.6	897
30-45'	51	53.1	1,204
Over 45'	7	7.3	165
Total	96	100.0	2,266
Boat Type			
Motor	75	78.1	1,770
Sail	21	21.9	496
Total	96	100.0	2,266

However, information from this group would be both expensive and difficult to obtain because the individuals in this group are difficult to be identified.

A priori, it was believed that obtaining waiting lists from marina operators would serve to identify the most interested component of the potential boating population. However, from the preliminary field investigation, it was learned that only a few public marinas and almost none of the private marinas, keep this kind of record. Marina

operators contacted related that they did not feel the cost and effort required to maintain extensive waiting lists was justified since they experienced little difficulty in quickly renting boat slips as they became available. It was hoped to rely heavily on names on waiting lists as a vehicle for determining the "demand" for dockage facilities. However, the unavailability of these lists necessitated a search for a low cost alternative for obtaining information about these potential boaters.

The method used in this study was to ask the sampled Lake Michigan boaters two related questions in the survey questionnaire. The boater were first asked: "Do you have relatives or friends who would like to boat if they could be assured of a seasonal alip on Lake Michigan?" The boaters who responded affirmatively to this question were further asked to provide approximate number of their relatives or friends who might be in the market for renting a seasonal boat slip. The second question was: "How many of your boating friends or relatives have been unable to find a seasonal slip to rent on Lake Michigan and are still looking?".

The first question was designed to find out how many of the current non-boaters would become a boater because of the availability of dockage facilities (potential induced demand). The assumption made here was that the future of this form of boating and the characteristics of these boaters are such that peer influence is highly significant in bringing new

boaters into the market.[1]

The second question was designed to find out how many existing boaters could not rent a boat slip (existing excess demand). In Chapter IV, the number of boaters in this category was estimated from the marina operator survey from the question which asked for the number of boaters turned away by the marina operators. It was decided that this multiple approach to estimating the number of boaters seeking to rent a seasonal slip would provide a more reliable estimate than would either approach by itself. The comparability of the two will be discussed at the conclusion of this chapter.

Table 25 and 26 report the tabulation of the responses to these two questions. Both tables are divided into two parts at places between the 10 and 11 relatives and friends categories. The tables were so divided because it was felt that the few respondents providing estimates greater than 10 had highly inflated their responses and, therefore, these should not be incorporated in the estimates. Thus, a more reliable sample estimate of "induced demand" would be a total of 724 (see Table 25), and a more reliable estimate of "existing excess demand" would be a total of 606 (see Table 26). If these two figures are expanded to the total boater population by using the percentage of sampled Lake Michigan

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[1]Such was found to be the case in a nationwide survey of campers. See, "A Perspective on the Camping--Involvement Cycle", Analysis No. 3 by the Northeastern Forest Experiment Station, Forest Service Research paper, NE-322, 1975.

TABLE 25

TABULATION OF SAMPLED BOATER RESPONSES TO THE QUESTION:"HOW MANY OF YOUR RELATIVES OR FRIENDS WHO WOULD LIKE TO BOAT IF THEY COULD BE ASSURED OF A SEASONAL SLIP ON LAKE MICHIGAN?"

No. of Friends or Relatives	Responses	Total
1	13	13
2	58	116
3	24	72
4	30	120
5	19	95
6	12	72
8	12	96
10	14	140
Sub-total	182	724
11	1	11
12	2	24
13	1	13
15	1	15
20	3	60
30	2	60
100	1	100
Sub-total	11	283
Total	193	1,007

TABLE 26

TABULATION OF SAMPLED BOATER RESPONSES TO THE QUESTION: "HOW MANY OF YOUR BOATING FRIENDS OR RELATIVES HAVE BEEN UNABLE TO FIND A SEASONAL SLIP TO RENT ON LAKE MICHIGAN AND ARE STILL LOOKING?"

No. of Friends or Relatives	Responses	Total
1	23	23
2	59	118
3	15	45
4	19	76
5	22	110
6	11	66
7	2	14
8	3	24
10	13	130
Sub-total	167	606
12	1	12
14	1	14
15	3	45
16	1	16
20	5	100
25	5	125
30	2	60
40	1	40
50	1	50
Sub-total	20	462
Total	187	1,068

boaters of the total Lake Michigan boater population (449/10,599x100), the total estimated non-current boater population would be 17,076 and the total estimated boater population who could not rent a slip would be 14,292.

Assuming the distribution of these potential boaters is the same as that of the current boaters. And also assuming that the potential boaters have the same characteristics as the current boaters, the potential users of the proposed marina can be estimated by applying the estimation model derived in the preceding section titled "Estimation of Current Boater Use--Allowing for Closer Facilities". The estimates are reported in Table 27 and 28 for induced users (induced demand) and existing excess users (existing excess demand) for the proposed marina. The induced users would be 3,646 and the existing excess users would be 3,042.

Some limitations on the reliability of the estimates reported above deserve highlighting. First, there is a possibility that the same person could be double counted, especially when the sample estimates are expanded to the total boater population. Second, length of boat owned or will be owned could not be identified to fit the specification of the proposed marina, therefore, a great number of boaters with boat under 20 feet could be included in the estimated potential users.

TABLE 27

ESTIMATED USE OF THE PROPOSED MARINA ATTRIBUTABLE TO NEW BOATERS (INDUCED DEMAND)

	% of Sampled Boaters[a]	Estimated New Boater Population[b]	% of Users[c]	Estimated Users
Less Than 30 (min.)	5.1	871	69.6	606
30-60	16.9	2,886	39.5	1,140
60-90	25.4	4,337	21.9	950
90-120	25.8	4,406	12.1	533
120-150	18.7	3,193	11.9	380
150-180	5.1	871	4.3	37
over 180	3.0	512	0	0
Total	100.0	17,076		3,646

[a]Distribution of sampled Lake Michigan boaters in each travel time zone (see Table 20).

[b]Estimated new boaters in each travel time zone = 17,076 x each percentage figure in column one.

[c]Estimated percentages derived from preceding section and reported in Table 23.

TABLE 28

ESTIMATED USE OF THE PROPOSED MARINA ATTRIBUTABLE TO CURRENT BOATERS WHO HAVE BEEN UNABLE TO RENT A SLIP (EXCESS DEMAND)

	% of Sampled boaters[a]	Estimated New Boater Population[b]	% of Users[c]	Estimated Users
Less Than 30 (min.)	5.1	729	69.6	507
30-60	16.9	2,415	39.5	954
60-90	25.4	3,630	21.9	795
90-120	25.8	3,687	12.1	446
120-150	18.7	2,673	11.9	318
150-180	5.1	729	4.3	32
over 180	3.0	429	0	0
Total	100.0	14,292		3,042

[a]Distribution of sampled Lake Michigan boaters in each travel time zone (see Table 20).

[b]Estimated new boaters in each travel time zone = 14,292 x each percentage figure in column one.

[c]Estimated percentages derived from preceding section and reported in Table 23.

Summary

In this chapter, the estimation of the use of the proposed marina was presented. The whole process of the estimation was divided into three major parts. First, the estimation was made under the assumed condition that no closer facilities were available. The second part of the estimation was to estimate the use of the proposed marina under the more realistic condition that closer facilities were allowed. The third part of the estimation was to estimate the existing excess demand and induced demand of the proposed marina.

From the first part of the estimation, 4,296 possible users of the proposed marina were obtained. From the second part of the estimation, 2,266 possible users of the proposed marina were obtained. Comparing these two estimates, one may note that a significant decrease (2,030 or 47.3%) was occured when closer facilities were allowed than no closer facilities condition was assumed. It was found that "alternative closer facilities" is a major significant factor affecting boaters' use of the proposed marina.

In the telephone interview, the non-respondents to the questionnaire survey was asked to respond to the same questions that were asked in the questionnaire (Appendix D, question 11). Twelve out of the 39 Lake Michigan boaters responded that they would be willing to use the proposed marina if there were no other closer facilities available.

If allowing for closer facilities, only 8 of them responded that they would be willing to use the proposed marina. There was a 33.3 percent decrease between the assumed condition of no closer facilities and allowing for closer facilities among the selected Lake Michigan boaters.

The relatively lower decreasing rate in the non-respondents than in the respondents between the conditions of no closer facilities and allowing for closer facilities seems to suggest that there would be more boaters in the boating population willing to use the proposed marina. However, if the percentages of the positive responses between the respondents (182/449x100=40.5%) and the non-respondents (12/39x100=30.8%) are compared, one may found that the non-respondents who would be willing to use the proposed marina was about 10 percent lower than the respondents with the same assumed condition that no closer facilities were available. Under the condition of allowing for closer facilities, the percentages of positive responses between the respondents (96/449x100=21.4%) and the non-respondents (8/39x100=20.5%) are about the same. These results may suggest that the final estimate based on the survey responses (allowing for closer facilities) is fairly reliable.

In the third part of the estimation, the induced users and the existing excess users were estimated. The number of induced users are 3,646 and existing excess users are 3,042. For the existing excess users, estimate had also been made

in Chapter IV through the marina operator survey which asked the marina operators to estimate the number of boaters been turned away because all slips were rented. The estimated number of boaters had been turned away by marina operators was 3,540. Compare this figure with the number of estimated existing excess users derived from the boaters' estimate, one may found that there are about 500 boaters less in the boaters' estimate than the marina operators' estimate.

To sum up, the estimated potential use of the proposed marina = Induced users + Existing excess users + Users in the current registered boaters. Thus,

Estimated Potential = 3,646 + 3,540 (or 3,042) + 2,266 Users

then, the total

Estimated Potential = 9,452 or 8,954. Users

CHAPTER VIII

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary and Conclusion

The major objective of this study was to estimate the potential use of the proposed marina at Benton Harbor-St. Joseph, Michigan. This information would be provided to the public and private developers in their decision making process.

To estimate the potential use of this proposed marina, a spatial analysis approach was used. The basic concept of this approach is that the boaters visiting a marina is a function of the distance (travel time) which separates the boaters and the marina.

Data needed for this study was collected via two mailed questionnaire surveys. One was a survey of marina operators and the other was a survey of current registered boaters. This information was analyzed and estimation was made. In addition, the non-respondents to the questionnaire survey of boaters were interviewed through telephone. The impact of the non-respondents on the estimates was presented.

The analysis of this study indicates that the potential use of the proposed marina depends upon several factors.

First, the distances(travel time) which separates the boaters' residences and the location of the marina facility, and alternative or intervening facilities are major factors affecting boaters' use of the proposed marina. The result of the boater survey indicates that there was a 47.3 percent decrease in the number of boaters who would use the proposed marina under the conditions that other closer facilities are available than if other closer facilities are not available. At the same time, the result of the telephone interview of the non-respondents indicates that there was a 33.3 percent decrease in the number of boaters who would use the proposed marina under the condition that other closer facilities are available than if other closer facilities are not available. However, both the responses of respondents and non-respondents show that about 21 percent of the Lake Michigan boater population would be willing to use the proposed marina if other closer facilities are available.

Second, personal preferences and other factors such as the location and surrounding of the facility, friends and relatives with similar boating habits are also factors affecting boaters' choice of facilities. Although in depth analysis has not been conducted on these issues, the boater survey reveals that when the site of the proposed marina was specified, the number of possible users decreased.

In the estimation of potential use of the proposed marina, it has been found from the marina operator survey that the existing demand for dockage facilities exceeds that

of the existing supply. The analysis of the marina operator survey show that there were an estimated total of 3,540 boaters who had been turned away by marina operators because of the unavailability of the dockage facilities. The result of the boater survey shows that there were also 3,042 boaters who could not rent a slip and were still looking (existing excess users). On the other hand, the planned expansion of the capacities of marinas in this region to 1978 will provide only about 1,627 slips (the proposed marina is not included).

From the analysis of the boater survey, it has also been estimated that there were 4,296 current boaters who expressed a willingness of renting a seasonal slip at the proposed marina if no other closer facilities are available in the study region. This is the maximum possible users of of the proposed marina of current boaters if all other closer facilities were occupied. And it has also been estimated that there were 2,266 current boaters willing to rent a seasonal slip at the proposed marina even if there are other closer facilities available. This estimate could be a more realistic estimate since it takes the availability of other closer facilities into account.

Finally, the current non-boaters who may become a boater and could be a user of the proposed marina (induced users) were also estimated. The estimate shows that there would be a total of 3,646 induced users for the proposed marina in the study region.

Based upon these analysis, the estimated potential use of the proposed marina would be the total of these estimates derived in this study and summarized above. Thus, the

$$\begin{aligned}\text{Estimated Potential Users} &= \text{Induced Users} + \text{Existing Excess Users} + \text{Users in the Current Registered Boaters.}\\ &= 3{,}646 + 3{,}540 \text{ (or } 3{,}042) + 2{,}266\end{aligned}$$

Then, the total

$$\text{Estimated Potential Users} = 9{,}452 \text{ or } 8{,}954.$$

Based upon these estimates, the conclusion of this study can be made that there will be a sufficient number of boaters willing to rent a seasonal slip at the proposed marina at Benton Harbor-St. Joseph, Michigan if and when it is in operation. The hypothesis of this study is accepted.

Recommendations

From this study, there is evidence to indicate that spatial analysis techniques are useful tools that can be applied to outdoor recreation analysis as have been used in other fields such as transportation, population migration, industrial locations, and others. However, further improvements are needed. Some of these are discussed in the following paragraphs.

In the sampling design of the boater survey, samples were selected from the areas of each state in the study region. Therefore, the distribution of the number of boaters

by travel time zone was estimated. If the reverse condition was true and the boater population in each travel time zone was known first and samples could be selected by travel time zones but not by political boundaries, a more precise relationship between distance (travel time) and number of users could be determined and a more reliable estimate of the potential use of the proposed marina could be obtained.

In this study, the intervals of each travel time zone was 30 minutes. Therefore, it was not possible to observe the more detailed variations of the boaters' distribution over space in the study region. If a shorter interval had been used, a more precise estimate probably could be obtained.

In this study, the attractiveness of the proposed marina and other marinas in the study region was not identified. Therefore, how the attractiveness of marinas would affect boaters' choice of facilities could not be precisely measured. The roles of the neighboring marinas in the shaping of the market of the proposed marina could not be determined.

In the boater survey, those boaters, who would not be likely to use the proposed marina if other facilities were available, should be asked why they would not use the proposed marina so that factors other than distance and/or intervening facilities could be found.

Finally, the energy problem was not taken into consideration in the analysis although one question was asked in the

questionnaire. From a separate analysis of the responses of that question, it was found that the influence of the energy shortage and higher gasoline prices on boating would not be very significant. One possible reason was, since the study was conducted at the beginning of the energy crisis, boaters might not have taken it very seriously thinking that is was a temporary situation. Another possible reason may be because that boat owners are higher income people in the society that they do not care about the higher fuel prices. No matter what the situation will be in the future, further studies are needed to explore impacts of the energy problem on recreational boating.

APPENDICES

APPENDIX A

INTRODUCTORY LETTER THAT ACCOMPANIED THE MARINA OPERATOR SURVEY

MICHIGAN STATE UNIVERSITY East Lansing, Michigan 48824

Department of Park and Recreation Resources Natural Resources Building

April 5, 1974

Dear Marina Operator:

The Department of Park and Recreation Resources, Michigan State University is conducting a research study on the needs for boating facilities in the lower Lake Michigan area. One important aspect of the study is to determine the present and future supply of seasonal slips and other facilities available in this area. The findings of this study will be provided to you to indicate where and what kind of facilities are urgently needed. This information should be helpful to you in planning for the future. In addition, all cooperating firms will be placed on our mailing list to receive publications such as the one enclosed that will be of considerable interest to you. Water based recreation continues to be a major research emphasis in this department and you will be assured of copies of all relevant research publications that result from our future efforts if you return the enclosed questionnaire.

Please take a little of your time to fill out the enclosed questionnaire and return it to us in the enclosed postage-paid envelope. All responses made by you on this questionnaire will remain strictly confidential, following rigid University policies. Only summary figures will be shown in the study report.

Your time and effort spent in filling out this questionnaire will be greatly appreciated and will benefit both you and your customers.

Sincerely,

Donald F. Holecek
Assistant Professor

DFH:jg

APPENDIX B

MARINA OPERATOR QUESTIONNAIRE

MARINA OPERATOR QUESTIONNAIRE

I. SEASONAL SLIP INFORMATION:

1. Please give the total number of slips (a ship's berth between two piers or along a pier) that were available at your marina during the 1973 boating season in the following boat length categories.
_____ 20'0"-30'0",_____30'1"-45'0",_____45'1" and over

2. How many of these slips in each size category were available for rental on a seasonal basis, i.e. from the time boats are normally taken out of winter storage and placed in the water to the time they are taken out of the water and placed in winter storage?
_____20'0"-30'0",_____30'1"-45'0",_____45'1" and over

3. How many slips in each size category did you actually rent last year on a seasonal basis?
_____20'0"-30'0",_____30'1"-45'0",_____45'1" and over

4. How many boaters requesting seasonal slips did you turn away or put them on a waiting list last year because all your seasonal slips were rented? (Please estimate by boat length category)
_____20'0"-30'0",_____30'1"-45'0",_____45'1" and over

5. Do you plan to expand this marina in the future?
_____Yes
_____No

If "yes", please give when?_____Year; and the number of slips in each boat length category you plan to add.
_____20'0"-30'0",_____30'1"-45'0",_____45'1" and over

6. Do you plan to build a new marina at another location on Lake Michigan?
_____Yes
_____No

If "yes", please give when?_____Year; where?_____City_____County _____State; and the number of slips in each boat length category you plan to build?
_____20'0"-30'0",_____30'1"-45'0",_____45'1" and over

7. If you don't plan to expand this marina or build a new marina at another location, please give the reason or reasons (please check all items that apply).

_____land space is limited or not available
_____water space is limited or not available
_____insufficient capital
_____the present size is sufficient for boaters' demand in the foreseeable future
_____other reason(s); please specify:_____
_____

II. OFF-SEASON STORAGE INFORMATION:

8. **Please give the number of storage spaces your marina can provide for boats in the following size categories.**

Indoor: _____20'0"-30'0",_____30'1"-45'0",_____45'1" and over
Outdoor:_____20'0"-30'0",_____30'1"-45'0",_____45'1" and over

9. Was all of your off-season storage space rented last year?

_____Yes
_____No

If "yes", please enter below by boat and storage type the number of boaters requesting storage space that you had to turn away or put on a waiting list.

	20'0"-30'0"	30'1"-45'0"	45'1" and over
Indoor	_____	_____	_____
	20'0"-30'0"	30'1"-45'0"	45'1" and over
Outdoor	_____	_____	_____

If "No", please enter below by boat and storage type the number of storage spaces that were not rented.

	20'0"-30'0"	30'1"-45'0"	45'1" and over
Indoor	_____	_____	_____
	20'0"-30'0"	30'1"-45'0"	45'1" and over
Outdoor	_____	_____	_____

III. OTHER FACILITIES INFORMATION:

10. **Please check the following that are available in your marina.**

_____fuel and oil
_____haulout facility
_____marine supplies
_____fishing & hunting supplies
_____boat sales
_____repair services
_____restroom & showers
_____restaurant
_____lounge
_____grocery store
_____motel or hotel
_____recreation facilities

11. **Enter below additional facilities and/or services which you think are important and could be possibly added to your marina.**

_____

_____

12. Do you foresee any effect of the "fuel shortage" and the higher prices of fuel on recreational boating?

_____Yes
_____No

If "Yes", please enter below the effects which you think are important.

_____ _____

_____ _____

13. **Please give the rental fees rate of the following facilities of your marina.**

a) Slip $_____foot/season or $_____foot/month
b) Indoor storage $_____foot/season or $_____foot/month
c) Outdoor storage $_____foot/season or $_____foot/month

(As an alternative, you may enclose the rental fees schedule of your marina facilities with the completed questionnaire.)

WHEN YOU HAVE COMPLETED THIS QUESTIONNAIRE, PLEASE MAIL IT BACK TO US TODAY IN THE ENCLOSED POSTAGE-PAID ENVELOPE.

IF YOU ACCIDENTALLY MISPLACE THE RETURN ENVELOPE PROVIDED, PLEASE MAIL TO:

Recreation Research & Planning Unit
Dept. of Park & Recreation Resources
Room 131 Natural Resources Building
Michigan State University
E. Lansing, Michigan 48824

THANK YOU, WE ARE GRATEFUL FOR YOUR ASSISTANCE.

APPENDIX C

INTRODUCTORY LETTER THAT ACCOMPANIED THE BOATER SURVEY

MICHIGAN STATE UNIVERSITY EAST LANSING • MICHIGAN 48823

DEPARTMENT OF PARK AND RECREATION RESOURCES • NATURAL RESOURCES BUILDING

Dear Boat Owner:

The Department of Park and Recreation Resources, Michigan State University, is conducting a boating demand study in the lower Lake Michigan area.

The most important aspect of this study is to find out the needs and preferences for marina facilities and services of boat owners in this area. This study is necessary so that we can provide this information to public and private agencies in order that they can develop the facilities boaters are demanding. We are, therefore, sending this questionnaire to you with the request that you take a few moments to fill it out and send it back to us.

It would be almost impossible to contact all boaters for their opinions. We have, therefore, selected your name at random from a list of all registered boat owners. In essence then, you are a representative for many other boaters who are not included in our sample. Your responses will be heavily weighed and your cooperation is crucial to the success of this endeavor. All individual responses will be kept strictly confidential, following rigid University policies, and your individual responses will not be released to anyone. Only summaries of data will be made available to appropriate public and private agencies.

When replying, simply place your completed questionnaire in the enclosed stamped, pre-addressed envelope and mail it back to us at your earliest convenience. Your cooperation and the time and effort spent in filling out this questionnaire will be greatly appreciated and will hopefully lead to improved boating in this area.

Sincerely,

Donald F. Holecek

Donald F. Holecek
Assistant Professor

APPENDIX D

BOATER SURVEY QUESTIONNAIRE

REGIONAL BOATING DEMAND STUDY-
BOAT OWNER QUESTIONNAIRE

A. *If you own more than one registered boat, please answer this questionnaire for the larger boat or the one you use or might use on the Great lakes.*

B. *If you don't own a boat currently and do not plan to buy one in the future, please check this BOX and return this questionnaire to us immediately in the enclosed postage paid envelope.*

☐

If you don't own a boat currently but planned to buy one in the future, please check this BOX and complete PART I *and* PART II *or* PART III *of this questionnaire.*

☐

PART I. ALL BOATERS, AS LONG AS YOU OWN A BOAT OR WILL BUY A BOAT, NO MATTER WHERE YOU BOAT OR WILL BOAT, PLEASE COMPLETE THIS PART OF THE QUESTIONNAIRE.

1. Type of craft(please check one):_____Motor craft_____Sailboat

2. Length of the craft(to the nearest foot):_____Feet

3. Please give the location of your major residence.
_____City or village_____County_____State

4. On which of the following bodies of water did you boat most of the time last year? (please check one)
_____Lake Michigan,_____Inland lake,_____Inland river,
_____Other Great Lakes(please specify)_____

5. Please give the location where you rent a seasonal slip, mooring space, or where you launch your boat mostly last year.

Definitions: SLIP- *A ship's berth between two piers or along a pier.*
MOORING- *A buoy to which a boat is attached so that it may move freely in all directions.*
SEASON- *The boating season i.e. from the time boats are normally taken out of winter storage and placed in the water to the time they are taken out of the water and placed in storage.*

_____City or village,_____County,_____State

6. On the average, how long does it take to drive from your major residence to the above site?
_____Hour(s);_____Minutes(please estimate under the new speed limit laws)

7. How many trips did you make last year from your major residence to the above site? (including trips for boating and boat maintenance)
_____Number of trips

8. Please estimate the number of days spent on various kinds of boating activity. Count each part day spent on an activity as a full day for that activity. This means you will count a day more than once if you did more than one activity on that day.

_____Cruising	_____Water skiing
_____Salmon/trout fishing	_____Hunting
_____Other fishing	_____Other activities(please specify)
	_____

9. What percent of your time on your boat, while it is docked, is devoted to the following activities?
_____% entertaining family and guests
_____% boat maintenance
_____% resting or relaxation
_____% others(please specify)_____

10. If you boat or intend to boat on Lake Michigan, assuming that no other seasonal slips or moorings at Lake Michigan marinas are available for rental closer to your major residence, what is the maximum time you are willing to spend traveling to a new, full-service marina on Lake Michigan?(please check one and estimate under new speed limit laws)

Definition: FULL SERVICE MARINA- *Besides the basic facilities and services such as water, electricity, ice, fuel, etc., there will be off-season storage, restaurant, lounge and other services.*

_____ 0-15 minutes	_____45-60 minutes	_____120-150 minutes
_____15-30 minutes	_____60-90 minutes	_____150-180 minutes
_____30-45 minutes	_____90-120minutes	_____over 180 minutes

11. A new, full-service marina is being planned for the Cities of Benton Harbor-St. Joseph, Michigan(note the location on the map on the back of the questionnaire). Please estimate the driving time from your major residence to Benton Harbor-St. Joseph.

_____Hour(s)_____Minutes

a) If all seasonal slips and moorings were not available at marina closer to your major residence, would you be willing to travel to this marina to rent a seasonal slip if the rental fees were competitive?
_____Yes
_____No

b) If there are seasonal slips or moorings available at a closer marina which provides only basic facilities and services, would you still prefer renting a seasonal slip at the proposed full-service marina at Benton Harbor-St. Joseph, Michigan, if the slip rental fees were competitive?
_____Yes
_____No

12. Would you prefer to store your boat for the off-season months at the marina where you rent a seasonal slip, if the storage rental fees are competitive?
_____Yes
_____No

If "yes", what type of off-season storage do you prefer for your boat?
_____Indoor storage
_____Outdoor storage

13. If a restaurant offering a wide selection of food and beverage items at competitive prices were to be available at the marina where you keep your boat, while visiting the marina

a) what percent of your breakfasts would you be likely to eat in the restaurant?
_____%
b) What percent of your noon meals would you be likely to eat in the restaurant?
_____%
c) What percent of your evening meals would you be likely to eat in the restaurant?
_____%

14. If a motel were available at the marina where you keep your boat, how many nights would you be likely to lodge at the motel and how many nights would you be likely to lodge on your boat during a given year?
_____Number of nights at motel _____Number of nights on boat (including lodging for when your boat is both in the water and in off-season storage)

15. If a grocery and package liquor store were available at the marina where you keep your boat, what percent of food and beverage items consumed on board your craft would you be likely to purchase at such a store?(This store would probably charge prices somewhat higher than would your local supermarket, but could offer specialty food items and services.)
_____% groceries and food items purchased at marina store
_____% groceries and food items purchased elsewhere

16. Would you consider purchasing a condominium(apartment, town-house, etc.) if one were available in the vicinity of the marina where you keep your boat at competitive price?
_____Yes
_____No

17. Do you have relatives or friends who would like to boat if they could be assured of a seasonal slip on Lake Michigan?
_____Yes; If "yes", please give the approximate number:_____
_____No

18. How many of your boating friends or relatives have been unable to find a seasonal slip to rent on Lake Michigan and are still looking?
_____Please give the approximate number

19. What effect do you foresee that the "fuel shortage" and higher fuel prices will have upon your boating activities?
_____No effect at all; will boat as usual
_____Will make fewer and shorter cruising trips
_____Will stay longer and make fewer visits to the site where you keep your boat
_____Will try to rent a seasonal slip at a closer marina
_____Will shift to non-motored craft
_____Will delay purchase of new boat until energy situation stabilizes
_____Will sell boat and get out of boating altogether
_____Other(please specify)_____
_____

20. Please give your annual family gross income(before taxes)(please check one):

_____Less than $10,000	_____$30,001 to $35,000
_____$10,001 to $15,000	_____$35,001 to $40,000
_____$15,001 to $20,000	_____$40,001 to $45,000
_____$20,001 to $25,000	_____$45,001 to $50,000
_____$25,001 to $30,000	_____$50,001 and over

21. What is your current employment situation?(please check one)
_____Full-time employed;_____Part-time employed;_____Retired;_____Un-employed

PART II. IF YOU BOAT OR INTEND TO BOAT ON LAKE MICHIGAN, PLEASE COMPLETE THIS PART OF THE QUESTIONNAIRE

22. What type of the following facilities did you rent for your boat last year?
_____Seasonal slip;_____Seasonal mooring;_____Other(specify)_____

23. What type of the following facilities do you prefer to rent if available?
_____Seasonal slip;_____Seasonal mooring;_____Other(specify)_____

24. When you first decided to rent a seasonal slip, was one immediately available?
_____Yes
_____No; if "no", how long did you have to wait to rent it?
_____Year(s);_____Month(s)

25. When you selected this marina, could you have rented a seasonal slip in a marina closer to your major residence?
_____Yes; how much closer?_____Miles; travel time:_____Hour(s);_____Minutes
_____No

26. If your answer to #25 is "yes", why did you select this marina over others closer to your home?
_____
_____

27. If your answer to #25 is "no", is this marina totally satisfactory?
_____Yes
_____No; why not?_____
_____

PART III. IF YOU BOAT OR INTEND TO BOAT ON WATER AREAS OTHER THAN LAKE MICHIGAN, PLEASE COMPLETE THIS PART OF THE QUESTIONNAIRE

28. Why did't you boat on Lake Michigan?
_____
_____

29. Do you intend to boat on Lake Michigan this year or in the future if a seasonal slip is available?

_____Yes; if "yes", please specify the following:
_____This year; _____What year in the future?
_____No; If "no", please give your reason or reasons:

_____
_____
_____

IN THE SPACE BELOW, PLEASE WRITE ANY COMMENTS OR SUGGESTIONS YOU MAY HAVE:

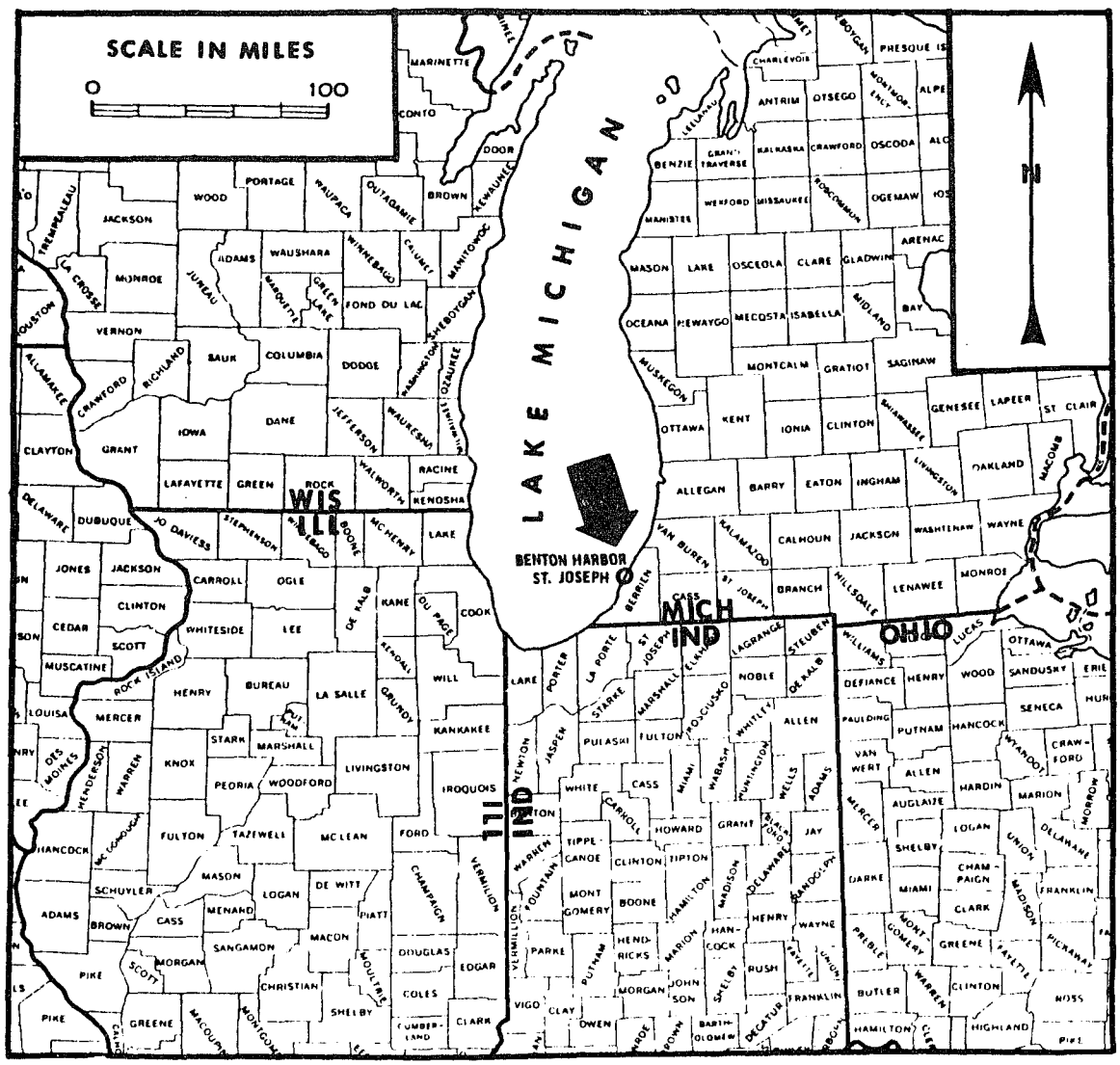
WHEN YOU HAVE COMPLETED THIS QUESTIONNAIRE, PLEASE MAIL IT BACK TO US TODAY IN THE ENCLOSED POSTAGE PAID ENVELOPE.

IF YOU ACCIDENTALLY MISPLACE THE RETURN ENVELOPE PROVIDED, PLEASE MAIL TO:

Recreation Research and Planning Unit
Department of Park & Recreation Resources
Room 131, Natural Resources Building
Michigan State University
East Lansing, Michigan 48823

THANK YOU, WE ARE GRATEFUL FOR YOUR ASSISTANCE.

MAP OF LAKE MICHIGAN REGION



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