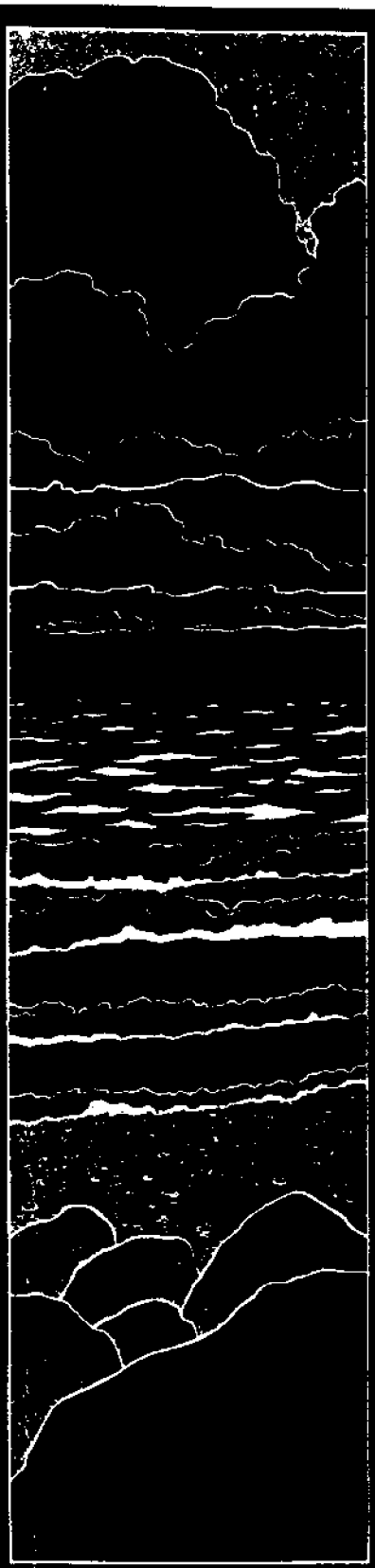


SEA GRANT COLLEGE PROGRAM REPRINT
UNIVERSITY OF WISCONSIN

WIS-SG-84-764

Social Carrying Capacity for Boating at Apostle Island National Lakeshore

Thomas A. Heberlein and Geraldine Alfano

Center for Resource Policy Studies Report, University of Wisconsin—Madison, 1983. Reprinted with permission.

Social Carrying Capacity for Boating at Apostle Island National Lakeshore

Thomas A. Heberlein
Professor

and

Geraldine Alfano
Graduate Research Assistant

Department of Rural Sociology
University of Wisconsin

December 1, 1983

Final Report to
The National Park Service

ABSTRACT

During the summer of 1981 Boater use patterns in the Apostle Islands National Lakeshore were examined to determine whether social carrying capacity had been exceeded by the increase in use level. Boats were counted both from flyovers and by rangers; these counts provided measures of system use level and site specific use level. The number of empty slips at marinas was also counted every day as an index of boats entering the system (input use level).

Boat use was highest on Fridays and Saturdays (high use days), but this "weekend effect" varied by site. Stockton and Rocky had the greatest increases on high use days versus low use days (Sunday through Thursday night): on Stockton, use increased by 137% and on Rocky, by 110%. The maximum number of boats observed on any night at Anderson Bay was 40 and 28 at Quarry Bay, the two most popular sites on Stockton. However, the average boat use at these two sites was considerably lower: 13 at Anderson and 6 at Quarry.

Surveys of Apostle Island boaters indicate that the contact preference curve for Quarry and Anderson Bays is 15, i.e. that boaters prefer to see fewer than 15 other boats. It is only when they saw 15 or more other boats that they reported the experience was unpleasant. Social carrying capacity was exceeded on a few days throughout the entire study period: 12 days at Anderson and 4 at Quarry. In comparison with other recreationists, Apostle Island boaters were found to be more tolerant of contacts than Brule River canoers and Sandhill deer hunters.

Regression analysis was used to determine the effect of increasing marina size on contacts at the two most popular sites (Quarry and Anderson Bay). Adding 100 or 200 new slips has no additional effect on weekdays, although adding 400 slips would increase the number of days that capacity was exceeded to 18%. However, the impact on weekends would be greater: if 400 slips are added, carrying capacity would be exceeded at Anderson Bay 83% of the weekend days.

ACKNOWLEDGMENTS

We would like to thank the National Park Service for their cooperation during all phases of the data collection. Pat Miller, the superintendent of Apostle Islands National Lakeshore, Bill Ferrano, the chief ranger, and Merryll Bailey were all most supportive and helpful. Dick Carrier patiently answered questions about boater contacts and potential mooring sites. The Apostle Islands ranger staff contributed substantially to the data set, taking time every day to draw maps and make summary counts of boat configurations.

Other personnel were instrumental in the success of the data collection. Mike Eldred served as field manager, organizing the boat counts and flyovers. The following graduate students helped with field observation: John Trent, Robert Baumgartner, Silvia Northey, and Mary Jo Kealy. Kim Bro of Sea Grant and Tom Klein, director of the Sigrud Olson Institute at Northland College, and his staff were also most helpful. The managers of the Bayfield area marinas provided us with a sampling list of Apostle Island Boaters.

Although this study would not have been possible without the help of all these people, any deficiencies or errors in the text are the sole responsibility of the authors.

TABLE OF CONTENTS

Page

ABSTRACT..... i

ACKNOWLEDGMENTS..... ii

TABLE OF CONTENTS..... iii

LIST OF TABLES..... v

LIST OF FIGURES..... vi

INTRODUCTION..... 1

Capacity Theory..... 1

The Descriptive Component..... 1

The Evaluative Component..... 4

A Generic Definition of Social Carrying Capacity..... 8

Carrying Capacity at the Apostle Islands..... 8

Use Level as a Management Parameter..... 8

Impact Parameters for Four Types of Carrying Capacity..... 11

Evaluative Standards..... 13

Contact Preference Curves..... 15

Summary..... 17

RESEARCH OBJECTIVES..... 18

METHODS AND PROCEDURES..... 19

Input Use Level..... 19

Contacts: Flyovers and Ranger Counts..... 20

Evaluative Standards: Visitor Surveys..... 22

Measurement of Contact Preference Standards..... 23

RESULTS..... 24

Input Use Level..... 24

System Use Level..... 26

Site Specific Use Level..... 29

Page

The Effect of Use Period..... 32

The Boater: 1975-1981 Comparisons..... 34

Prior Boating Experience..... 34

Crowding and Displacement..... 35

Predictions of Site Specific Use Level (Contacts)..... 37

Contact Preference Curves..... 43

The Impact of Increased Marina Development..... 54

CONCLUSIONS..... 59

FOOTNOTES..... 61

REFERENCES..... 62

APPENDIX 1 - Complete Data Set of Daily Boat Counts..... 63

APPENDIX 2 - Comparison of Flyover and Ranger Sailboat Counts..... 70

APPENDIX 3 - Daily Count of Sailboats by Use Period - Low, Medium and High Use Days..... 75

APPENDIX 4 - Apostle Island Boater Survey - Mailed Questionnaire..... 77

Table		Page
1	Apostle Island Carrying Capacity Framework	10
2	Number of Days with Flyover Counts - Apostle Islands, 1981	21
3	Median Boat Use for Each Marina by Day for Apostle Islands Area, Summer 1981	25
4	Total Number of Boats Seen Each Day from Flyovers, Summer 1981	28
5	Merged Count of Sailboats at Apostle Islands, Summer 1981	31
6	Daily Number of Sailboats by Use Period - Apostle Islands, Summer 1981	33
7	Ranking of Perceived Crowding for Different Settings and Activities	36
8	Comparison of Boater Contacts for 1975 and 1981 - Apostle Island Boaters	38
9	Regressions Boat Counts on Boats Out	40
10	Effect of Increasing Marina Space by 100 Boat Slips on Boater Contacts at Mooring Sites	42
11	Apostle Islands 1981 Boaters Average Contact - Preference Rating by Number of Other Boats	44
12	Structural Properties of Contact Preference Norms for Four Groups of Recreationists	53
13	Percentage of Days Contacts (Site Specific Use Level) Exceeds Social Carrying Capacity (i.e., more than 15 boats mooring off in each location) with Increasing Marina Slips	55
A1-1	Daily Boat Use Level Counts All Sites	64
A2-1	Sailboat Counts by Flyovers at Apostle Islands, Summer 1981	72
A2-2	Sailboat Counts by Rangers at Apostle Islands, Summer 1981	73
A2-3	Comparison of Flyover Boat Counts and Ranger Boat Counts, Apostle Islands, Summer 1981	74
A3-1	Daily Number of Sailboats by Use Period - Apostle Islands, Summer 1981	76

LIST OF FIGURES

Figure		Page
1	Hypothetical Contact Preference Curves	16
2	Median Number of Boats Out by Day of Week for Each Marina, Apostle Islands, Summer 1981	27
3	Apostle Islands Boaters Contact Preference Curve for Mooring Offshore in Anderson Bay	45
4	Apostle Islands Boaters Contact Proference Curve for Mooring at the Anderson Bay Dock	46
5	Apostle Islands Boaters Contact Preference Curve for Mooring Offshore in Quarry Bay	47
6	Apostle Islands Boaters Contact Preference Curve for Mooring at the Quarry Bay Dock	48
7	Canoer Return Potential Curves (Social Norms) for Meeting Three Types of Visitors	50
8	1980 Sandhill Data - Contact Norm Curve	51
9	Bong Data - Contact Norm Curve	52

INTRODUCTION

In 1970, 20 of the 22 islands in the Apostle Islands Archipelago off the Wisconsin shore of Lake Superior were designated a National Lakeshore. At that time, the Apostle Islands were not receiving many visits, but visitor numbers were expected to increase after Lakeshore designation. In 1975, Heberlein and Vaske conducted a baseline study of island boaters, campers, and day visitors. They planned to do a follow up study in 1985 to determine the effect of increasing visitor numbers on the quality and character of the recreational experience and to determine if visitors had been displaced. Visitor displacement occurs when visitors leave and seek other recreation settings because they have become dissatisfied with the changing experience.

In 1981, the National Park Service became concerned about current use levels, particularly in the face of proposed marina development, and requested a modest study of boating to explore possible carrying capacity issues.

Capacity Theory

There are two separate components necessary to establish social carrying capacity in a recreation setting. The descriptive component reports the observable aspects of the recreation system, while the evaluative component integrates value judgements into the determination. It is necessary to establish both, but care must be taken to distinguish the two.

The Descriptive Component

Carrying capacity is ultimately a number, usually a number of individuals or groups expressed in relation to time and area dimensions. Shelby and

Heberlein (1981) refer to this as the use level. Twenty boaters moored at Stockton Island on a Tuesday evening would be an example. Use level is a characteristic of a recreation system, as a human collectivity, not a characteristic of a single person. In this sense, it is analogous to a birth rate. A birth rate is expressed as the number of births per thousand people, and no single person has a birth rate, although each contributes to the birth rate. Similarly, no single person constitutes a use level, although each one contributes to it. There may be many types of use level in a complex system. One type of use level in the Apostle Islands would be the total number of boats moored in all locations for a system wide use level. Another type would be a site specific use level established at each mooring site. Carrying capacity is ultimately expressed in terms of a use level.

The descriptive component goes beyond simple use levels. Within recreation systems, people move around and distribute themselves in space and time. They engage in different activities, such as camping or sailing, and they engage in different use practices, such as motorized versus non-motorized boating, or camping at established versus undesignated sites. People also have different kinds of impacts on the recreation system; they affect trail width, ground cover, the amount of litter, the number of available camp spaces, water quality, and congestion at visitor attractions.

The descriptive component includes management parameters, impact parameters, and the relationship between the two. A management parameter is any factor which can be directly manipulated by managers. When managers can control the number of people in a particular area, use level is a management parameter. When access is open by law or costs make control out of the question, use level is not a management parameter. However, it may be possible to affect use and impacts through management parameters other than use level. For example, providing information about good mooring sites on

other islands may reduce the number of boats that moor off Stockton. Information is then a management parameter.

Impact parameters describe what happens to visitors or the environment as a result of use level and other management parameters; they are outcomes associated with different amounts and kinds of use. Examples include the number of parties encountered on a trail, the number of nights spent camping alone, the percent of vegetation damaged or lost, and time spent waiting to use facilities such as launch ramps or restrooms.

Stankey (1978) reviews the literature describing the impacts of visitor numbers and use patterns on vegetation, soil, water quality, and wildlife. He points out that use level is not always closely related to impacts. Even if use level cannot be controlled (i.e. it is not a management parameter), other management parameters can sometimes be manipulated to reduce impacts. Examples include dispersion of users to reduce trail encounters, scheduling to reduce campsite encounters, site hardening to reduce biological degradation, and education in back-country practices to make use less obtrusive. These represent management parameters which affect impact parameters independent of use level. They can often decrease impacts without reducing use, or even allow increased use while impact remains constant. Management parameters, then, can involve changing the kind of use as well as the amount of use in an attempt to affect impact parameters (see Lime and Stankey, 1971 and Stankey, 1978, for further discussion of such variables).

The first step in setting carrying capacity is to establish the relationship between management and impact parameters to see how use level and other management parameters affect the quality and character of recreation experiences. If a certain number of people enter an area under a certain set of conditions, what happens to the experience? Although recreational carrying capacity ultimately involves value judgements, documenting the impacts of different amounts and kinds of use is a basic scientific or technical task.

At the Apostle Islands, one of the most significant use level variables is the number of boats in the Apostle Island system. The simplest use level is the total number of boats out anywhere within the boundaries of the Apostle Island National Lakeshore, either out on the open water or moored at one of the islands. The time dimension could be the total number of boats per hour, per day, per week, or for the entire summer season. It would be extremely difficult to regard the boat use level as a management parameter, since there are many access points to the Apostle Island and these would be difficult, if not impossible, to control. Boat use level could also be defined according to more restricted areas, such as the number of boats moored at each island, or even more specifically, the number of boats moored at each mooring site. Impact parameters resulting from boat use levels include the number of other boats sighted, or the number of other boats moored within hearing distance. The relationship between the boat use level and the impact parameter - contacts with other boats - needs to be determined as the first step in assessing carrying capacity.

The Evaluative Component

The descriptive component specifies how a particular recreation system works, but it doesn't give any indication of what limits "should" be set. Given a specified set of impacts, how do we decide how much is too much? The evaluative component critically considers the different objective states produced by management parameters in an effort to determine their relative merits, and it is here that values enter the model.

Management objectives defining the experiences an area should provide are official statements of value judgements. Deciding that a given area shouldprovide hiking opportunities rather than coal mining opportunities, for example, involves a value judgement. Most researchers recognize the central

role of management objectives in capacity determinations. Lime and Stankey (1975), for example, argue that "capacity can be judged only in light of the particular management objective for a given area."

A difficulty with management objectives, however, is that they are often expressed in general terms. Objectives such as "provide a wilderness experience" are a good start, but they need to be accompanied by more specific numerical standards which can be applied to impact parameters. Does a wilderness experience mean seeing no other groups, or are two, five, or twenty encounters acceptable? Occasionally, legislation or agency policy specifies numerical limits such as "no motorized vehicles in wilderness areas," and certain levels of physical development are specified in both the Wilderness Act and the Wild and Scenic Rivers Act. But when considering levels of impact which affect the human experience, managers and researchers alike are usually left to determine acceptable levels on their own.

The evaluative component requires social judgements about levels of impact, resulting in evaluative standards. Evaluative standards determine the level of an impact parameter that is tolerable (the maximum) or most desirable (the optimum). Evaluative standards are "yard sticks" for determining how much is too much. Suppose we find that a river use level of three parties launching per day results in one river encounter, while seven per day produces five encounters; changes in a management parameter (use level) produce different amounts of impact (river encounters). To set a carrying capacity, we need to know which number of encounters is more desirable; we need some sort of evaluative standard.

There are two basic approaches to the evaluative components reflected in the social carrying capacity literature, and neither one clearly distinguishes impact from evaluation. Many researchers have tried to use visitor satisfaction as an evaluative criterion. Lucas (1964) says "The capacity of a

recreational area is its ability to provide satisfaction--this is the service being produced, and this service must be described in both quality and quantity terms" (p. 5). Lime and Stankey (1971) assume that the "...principle goal of recreation management is to maximize user satisfaction consistent with certain administrative, budgetary, and resource constraints" (p. 175). Lucas and Stankey (1974) are fairly unequivocal when they say that "In defining recreational carrying capacity, we assume the goal of recreation management is to maximize user satisfaction." As recently as 1977, Lime contended that "...the primary goal of recreation management is to provide enjoyment and benefits for the people..." (p. 122). Wagar (1964) seems somewhat less committed to satisfaction as a criterion when he defines carrying capacity as "...the level of recreational use an area can withstand while providing a sustained quality of recreation" (p. 3). However, he defines quality recreation solely in terms of satisfaction: "an experience is of high quality only to people for whom it provides a large measure of enjoyment or well being."

Visitor satisfaction combines impact and evaluation in the same concept. Presumably increased use level leads to dissatisfied visitors, and declining satisfaction signifies that capacity has been reached. The implicit value is that more satisfaction is better than less. As with resource damage, it is important to separate the impact from the evaluation. The impact component can be a measure of satisfaction taken by questionnaire from each visitor, and we can determine empirically its relationship to use level. Treated this way, satisfaction is analagous to other impact parameters such as encounters. Capacity determination then requires an evaluative standard that specifies how much satisfaction is appropriate.

Other researchers have tried to use <u>perceived crowding</u> as an evaluative criterion. An area must have too many people when visitors feel crowded.

However, like resource damage and satisfaction, this standard confuses impact and evaluation; the term "crowding" involves a negative evaluation of human or animal density.

The issues become clearer when impact and evaluation are separated. Perceived crowding can be measured, and we can see how it changes at different use levels. The evaluative component then requires a standard indicating what level of perceived crowding is too much. It is too crowded when 10 percent, 50 percent, or 100 percent feel crowded? Stankey (1978) points out that sometimes there are inflection points where an impact parameter increases rapidly with certain changes in use. Such an inflection would occur if, for example, perceived crowding jumped from 10 percent to 60 percent with a small increase in use. Such inflections might serve as evaluative standards.

We prefer a third approach to evaluative standards that is more specific than either satisfaction or perceived crowding and more clearly separated from impact. The approach is based on a social psychological technique for establishing group standards, and it involves measuring individual preferences under a specified set of conditions. If users agree to some extent, a usable standard emerges.

Let's consider tennis as an example. In this case, people have clear preferences which have been formalized into rules about appropriate numbers, and the rules serve as an evaluative standard for use level on a tennis court. We assume that there are similar but less formal standards for the right number of contacts for other activities in other settings. When backpacking in the wilderness, for example, do people prefer to camp alone all of the time, half the time, or not at all?

For boaters at the Apostle Islands, there are no formal standards for the right number of contacts with other boaters. There is not much information about how many other boaters sailors prefer to see, or to be within hearing

distance of, or to have contact with at a mooring site. Some sailors may prefer to moor alone, while others prefer to moor with several other boaters so that they can discuss sailing conditions. The evaluative standard that Apostle Island boaters use to assess use level is a matter of empirical determination.

A Generic Definition of Social Carrying Capacity

With the descriptive and evaluative dimensions identified, we can propose a generic definition. "Carrying capacity is the level of use beyond which impacts exceed acceptable levels specified by evaluative standards." Carrying capacity identifies a number for one parameter - use level. It assumes a fixed and known relationship between use level and impact parameters; it also assumes that the capacity will change if other management parameters alter that relationship. Capacity will also change if management objectives are altered or if user populations change radically. Carrying capacity determinations require objective measures of the impacts of management alternatives that are distinct from the evaluations of those impacts.

Carrying Capacity at the Apostle Islands

Use Level as a Management Parameter

The concern of Lake Shore managers, planners, and citizens is the impact of marina development. The addition of a marina and a given number of slips is a management parameter. It is not solely a decision of the park service, of course, but a matter of public policy and private development. Nevertheless, it is a factor that can be potentially modified. The major goal of this research is to provide information about the potential impact of additional marina slips in the Apostle Islands area on visitor experiences. While there are other management parameters (such as providing information,

locating mooring buoys, etc.), the key management parameter to be investigated in this research is the impact of additional marina slips.

Use level is a number which describes an entire system or an element of a system. Three types of use levels are identified in Table 1. Most closely associated with the management parameter is the number of boats leaving the marinas each day, called an Input Use Level. The number of slips places an upper bound on the number of boats leaving in any one day. If we assume all the slips are rented, we can measure the number of empty slips each day as an indicator of boats out in the recreation system. Obviously not all boats which have left the marinas will be sailing around the Apostle Islands; some may be at Isle Royale, Duluth or at other locations on the lake.

The second use level figure would be the number of boats located within Apostle Islands National Lake Shore boundaries at any one time. This is called System Use Level. Many of these come from the Bayfield area marinas, but some may come from other locations as well. The correlation between the input use level and the system use level should be substantial, but less than one. Boats that leave the marinas do not necessarily stay within the Apostle Islands boundaries. Since they are not equivalent, it is useful to differentiate between the two. Furthermore, input use level is more susceptible to management control than system use level.

If there is a capacity problem at the Apostle Islands it is likely to show up first at places of greatest boater concentration; therefore, this study focuses on the island mooring sites. The system use level which is most relevant is the total number of boats mooring off all of the islands at a given time, rather than those simply sailing during the day. System use level could be ten boats or two hundred. These boaters are not always aware of each other since some might be moored at Outer Island at the far northeast islands, and others at Sand which is much further west. In terrestrial parks system, system use level is analogous to total number of visitors camping overnight.

Table 1

Apostle Island Carrying Capacity Framework

Management Parameter	USE LEVELS			Impact Parameters	Evaluative Standards
	Input	System	Site Specific		
Number of marina slips → Number of empty slips → Number of boats moored off islands			Number of boats moored at Site 1	Physical Accidents Boats bumping into each other	Safety
			Number of boats moored at Site 2	Ecological Water quality Plants being trampled	EPA Water Quality
			Number of boats moored at Site 3	Facilities % times docks are full Boater behavior	Boater Preference
			. . .	Social Contacts at mooring sites	Boater Preference (Contacts)
			Number of boats moored at Site n		

To consider impacts, and ultimately carrying capacity, a Site Specific Use Level is necessary. This is the total number of boats moored at a single location, such as Anderson or Quarry Bays at Stockton. This number is directly influenced by the system use level. If there are only ten boats in the entire system, there cannot be 20 moored at Anderson Bay. Site specific use level could be managed directly by placing a given number of mooring bouys at each site and requiring boaters to only moor at a bouy, if managers and boaters so chose. Thus it could be a potential management parameter at some future time, but is not perceived as such in this report.

Impact Parameters for Four Types of Carrying Capacity

There are four types of recreational capacity: physical, ecological, facilities, and social. The type of capacity one is interested in determines what kind of impacts are measured at the specific mooring sites.

Every site has a physical capacity - the number of boats that could physically fit into the area. This could be determined nominally by using detailed charts which show depths and the location of shorelines and obstacles. By making assumptions about the amount of scope (length of the anchor rope), mooring depths that sailors choose, and swing room, a nominal capacity could be calculated for each site under specified wind conditions. Empirically a physical capacity could be estimated by observing boater behavior and counting avoidance behaviors (leaving or remooring), physical contact between boats (actually bumping into each other), or accidents. With the exception of Quarry Bay, which has the most restrictive mooring area, physical capacity is seldom an issue. Therefore, such impact measures were not taken as part of this research although the estimation of nominal capacities in each site would be a useful exercise.

When one is concerned about an ecological capacity impact measurements of ecosystem parameters are taken. Water quality is the most obvious ecological impact parameter. Some research by biologists on water quality around the Islands is underway. It is not yet sufficiently complete or comprehensive to be included in this report. Trampling of vegetation from boater visitation on sandspits would be another ecological impact parameter. A less apparent impact would be the disruption of wildlife, particularly those that require solitude, e.g., eagles, colonial nesting birds and nesting shore birds.

Facilities capacity in any recreation area may also be exceeded. Facilities are usually more modifiable than physical space. At Apostle Islands the major facilities of interest to boaters are docks and outhouses. Measuring the amount of time the docks are full and the behavior of boaters vis a vis docks would provide an index of the availability of dock space. Do they race or compete to obtain dock space? Once a space is empty do other boaters leave off shore mooring sites to relocate at a dock, etc.? Waiting time at outhouses might also be measured.

The fourth type of capacity, and the specific topic of this report, is social carrying capacity. The key impact parameter in a social capacity involves interactions with other recreationists. When are visitor numbers such that the nature of the experience changes? In most social capacity work the key variable has been contacts between parties or individuals while floating on a river, while hiking on a trail, or while hunting. The impact parameter is contacts with other visitors. Respondents are asked to report how many other visitors they encountered in a specific place.

These contacts are supposed to affect the recreation experience. For example, when a boater enters a harbor he or she may be all alone, and have the entire bay in which to moor. Solitude is achieved in such a situation. On some days there may be from 20-30 other boats moored in the same general

location. Now the boater must motor around avoiding anchor lines to find a suitable spot. Once moored, members of the boating party may modify their behavior such as talking in hushed tones to maintain privacy at the higher density levels. Thus, 30 contacts is different than zero contacts. Contacts is referred to as an experience parameter.

Usually contact is distinct from use levels. Observers have been placed on rafts on the Colorado River in the Grand Canyon to count encounters with other parties. Use level is the number of trips floating the river in a given period, and contacts is the experience of a particular group. At the Apostles, however, contacts is the same as site specific use level, since at any one site all boats are within visual contact. Thus, we don't have to place observers on boats or ask how many contacts they had at the mooring site, but rather simply count all of the boats present.

Evaluative Standards

To establish a carrying capacity in terms of marina slips (the primary management parameter), there first must be a relationship between the boats entering the system and the impacts. That is, as additional boats leave the Bayfield area marinas, there must be an observable increase in boats at the mooring sites[1]. Then it must be determined if these numbers are associated with any changes that exceed evaluative standards for a particular impact. The best example of an evaluative standard which might be applied here would be EPA water quality standards for coliform. Coliform standards exist specifying the highest coliform counts acceptable for drinking, swimming, and boating. If increasing boater numbers affected water quality such that it exceeded the standards for swimming, an ecological capacity has been exceeded. Society through its legislative and administrative processes has identified such evaluative standards for water quality.

In terms of physical capacity, a safety standard might be developed. A group of expert boaters and coast guard officials could be called upon to make judgements about the largest number of boats that could be safely moored in a given area under specified wind conditions. When use level increased to such a point that boater numbers exceed this safety standard, then one could say a physcial capacity had been exceeded.

It should be evident from these examples that recreational carrying capacity is not a hard and fast limit like the speed of light that can never be exceeded. It is merely a number that acts as a guide. If water quality is not a prime management objective, or boater safety is left to the discretion of the boater rather than the agency, then these limits may be exceeded without much concern; the excesses are simply interesting characteristics of the recreation system. If the prime management objectives are to keep water quality at drinkable levels, or to provide accident free boating, then these standards become central to resource management. Since the key thrust of this research is to examine social capacity, we did not accumulate information on physical or ecological capacity. Further water quality work must be carried out for the latter, and expert panels would need to be convened for the former.

Evaluative standards for social capacity are just being worked out in the carrying capacity literature. The standard we shall rely on is boater preferences for number of contacts at mooring sites. When the number of boats moored at a single site exceeds the number that the current boater population says is tolerable, then a social carrying capacity is exceeded. It is necessary, of course, that boaters generally agree on this number. That is, if half the boaters prefer to moor alone and half prefer 20 or more other boats, then there is no single capacity for the typical boater (i.e. ten boats would please no one). The existence or non-existence of some sort of standard is an empirical question to be explored in this research.

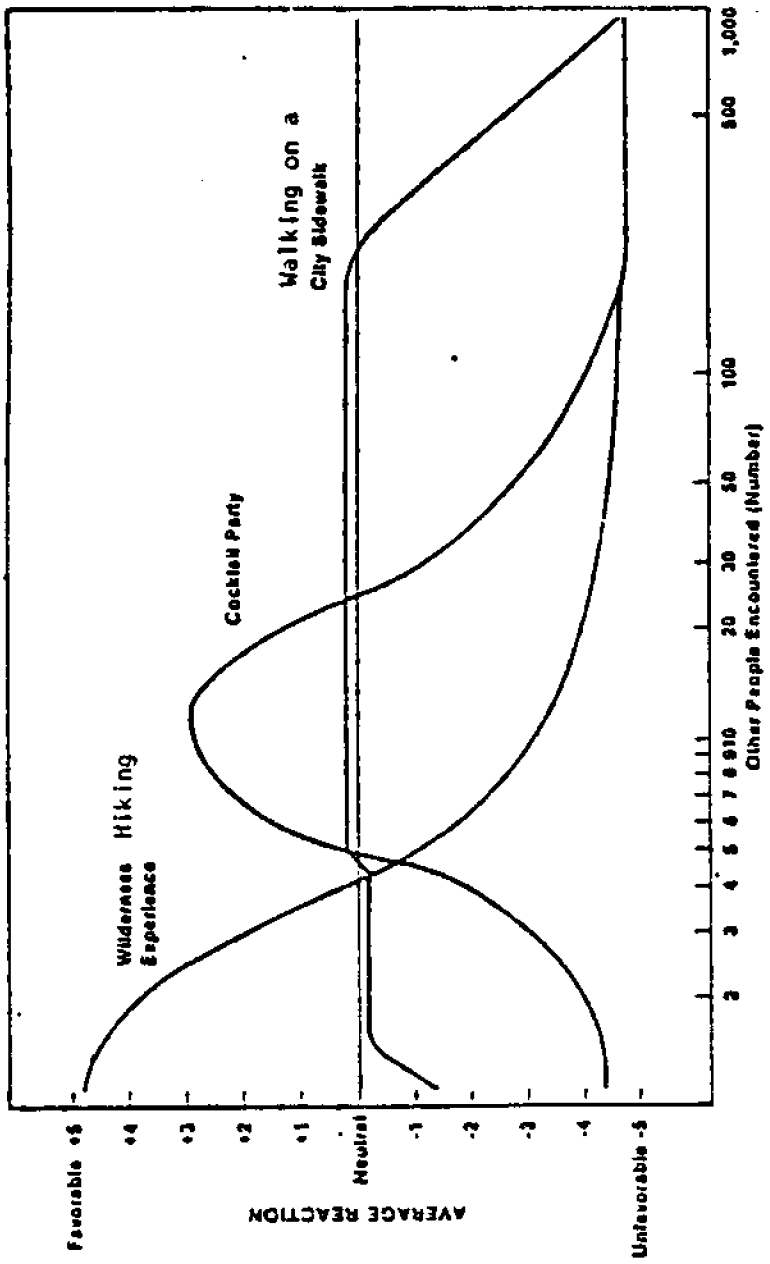
Contact Preference Curves

Visitor preferences can be described in terms of contact preference curves. A contact preference curve is based on answers to questions which ask people how they feel (favorable or unfavorable) about different number of contacts in a specific setting. The curve is generated by plotting the average responses on a graph, where the horizontal axis represents number of contacts and the vertical axis shows favorableness of the evaluation.[2] The horizontal axis is the experience dimension, and the vertical axis is the evaluative dimension.

Figure 1 shows hypothetical contact preference curves for wilderness hiking, a cocktail party in a small room, and walking on a city sidewalk. These can be used to illustrate four important characteristics of contact preferences curves. The optimum contact level is the highest point on the curve, and it represents the ideal situation. The optimum for the wilderness experience is zero contacts and for the small cocktail party it is about 12. Curves for both activities have relatively sharp peaks, so a single optimal level can be identified. Walking on a city sidewalk is different, because there is no clear optimum.

For activities such as making a call in a phone booth, there may be just one level of contact which is acceptable (ie. being alone in the booth), but for most experiences we would expect people to tolerate some variation. The range of tolerable contacts is represented by the portion of the curve about the neutral point. For the wilderness hike in our example the range is 0-5 contacts, for the cocktail party it is 5-25, and for the sidewalk it is 6-250. The range of tolerable contacts is useful for establishing capacity because it shows the point at which the average evaluation becomes negative. While a manager might try to provide the optimum level of contact, the point at which contacts exceed the tolerable seems to be an upper limit for

FIGURE 1. HYPOTHETICAL CONTACT PREFERENCE CURVES



evaluative standards. In our hypothetical examples, this means 5 encounters for wilderness hiking, 25 for the cocktail party and 250 for the city sidewalk.

Contact preference curves also show the degree to which reactions are favorable or unfavorable. The intensity is indicated by the distance of the curve about and below the neutral line. The hypothetical curves show three different intensities. The feelings for the wilderness hike are most intense because reactions to encounters range from extremely favorable to extremely unfavorable; we would expect wilderness visitors to be more adamant about the number of contacts because solitude is an important part of wilderness. People at a cocktail party are somewhat less sensitive to encounters, and in this setting intensity ranges from about +3.5 to -5. Norms for encounters on a city sidewalk show low intensity: reactions are generally neutral until there are so many people that it is impossible to travel. Intensity is interesting from a management point of view because it reflects the degree of concern about encounters; the need for control is greater where intensity is high.

Crystallization is used to refer to the amount of agreement about the evaluation of contacts. If all wilderness visitors say that having zero contact is very favorable, then we have maximum agreement at this point. If there were similar agreement at all points on the scale, then the standard is highly crystallized. Crystallization refers to the dispersion of individual evaluations above and below the curve which is plotted through the means. Crystallization indicates the degree of consensus about evaluation parameters.

Summary

There are three types of use level at the Apostle Islands: 1) Input use level, or the number of empty slips at the Bayfield area marinas; 2) System

use level or the number of boats mooring at all locations on the islands; and 3) Site specific use level or the number of boats mooring at each site. The evaluative standard is the boaters' preferences for the number of contact with other boaters. This standard is described in terms of a contact preference curve which shows the range of tolerable contacts, the level of intensity, and the amount of crystalization. The first step in estimating a social carrying capacity at the Apostle Islands is to determine the relationship between the input use level (boats out from the marinas) and the site specific use level (contacts at mooring sites). The second step is to determine at what point input use levels lead to site specific use levels that exceed boaters' evaluative standards.

RESEARCH OBJECTIVES

The research reported here has the following objectives:

1. To determine the feasibility of measuring use levels in terms of empty slips and impacts in terms of boater numbers at mooring sites.

2. To identify the relationship between input use level and site specific use level, and impacts.

3. To determine the effects of increases in the number of Bayfield area marina slips on site specific use level at Apostle Islands mooring sites.

4. To determine the existence of a boater evaluative standard for contacts at mooring sites.

5. To identify the times and locations when mooring levels exceed boater preferences, and hence identify where and when site specific social capacities, are exceeded.

6. To translate the social capacities at mooring sites into an input use level and ultimately, into the management parameter - number of slips.

METHODS AND PROCEDURES

The 1975 study showed that almost 60 percent of the boater visits to Apostle Islands National Lake Shore were during the months of July and August. Consequently, we focused our data collection on those potential peak use periods, beginning June 26, 1981 and ending September 7, 1981. This 74 day period included the fourth of July and Labor Day holiday periods.

A variety of data collection techniques were used. Input use level, or the number of empty slips, was obtained by an observer on the main land who counted slips daily. System use level, as well as site specific use level (or the impact parameter, contacts) at mooring sites, was measured by aerial flyovers and through observation by NPS rangers at the most popular mooring sites. The evaluative standards of boaters were measured using both an on-site and mailed questionnaire.

Input Use Level

The marina counts provide the most complete set of data: the number of empty slips was counted at each mainland marina on 72 days and at the Madeline Island marina on 67 days. The slip counts were made between 9 and 10 a.m. each day. The mainland marinas include Port Superior, Bayfield, Schooner Inn, Apostle Islands Yacht Club, Boat Ramp, and Buffalo Bay (Red Cliff). The marinas range in size from 172 slips at Port Superior to 15 at the Boat Ramp.[3]

The count of empty slips is an over-estimation of the number of sailboats out in the Apostle Island system. Not all the empty slips result in a boat in the Apostle Island system. The boat may be sailing elsewhere in the lake. Moreover, some slips were found to be empty for the entire season. To compensate for those slips, the number of continuously empty slips was subtracted from the marina slip count to calculate the actual

number of boats out from the marina. For example, for the entire study period there were never fewer than 23 empty slips at Port Superior. It was assumed that these slips, for whatever reason, contained no boats, and the constant 23 was subtracted from the daily empty slip counts at Port Superior to arrive at actual boats out from Port Superior. Similar modifications were made at other marinas. This is only an approximate correction, since it's conceivable that a few of these empty slips contained boats that were out every day.

Contacts: Flyovers and Ranger Counts

For purposes of sampling, Friday and Saturday evenings are considered high use periods and Sunday through Thursday, low use periods. The proposed design included 48 flights during the period June 26 through September 7, either at the evening mooring or during the early morning period to count boats at mooring sites. After six flights, it was determined that early morning was the optimum spotting time since most boats were in place, and weather conditions were optimal. On the designated days, a pilot and spotter flew over the entire area, counting and recording the location of all the boats in the Apostle Islands National Lakeshore system. Poor weather and other problems, such as scheduling difficulties, resulted in aerial counts being made for only 27 days, including 12 Fridays and Saturdays, and 15 low use days (Table 2). Flyovers made in the early morning counted boats that had moored the evening before, so they were regarded as boat counts for the previous day.

National Park Service Rangers made daily boat counts at a number of the sites at six of the islands: Stockton, (Anderson and Quarry Bays) Rocky, South Twin, Raspberry, Sand, and Oak. These counts were generally taken after evening moorings, although, in a few cases, they were made

Table 2

Number of Days with Flyover Counts
Apostle Islands, 1981

MONTH	Day of the Week[1]							TOTAL
	Mon	Tues	Wed	Thur	Fri	Sat	Sun	
June	1	0	0	0	1	1	0	3
July	0	0	2	4	3	3	2	14
August	1	0	2	2	2	2	0	9
September	0	0	1	0	0	0	0	1
Total	2	0	5	6	6	6	2	27

[1]Low use times are Sunday evening through Thursday evening.
High use times are Friday and Saturday evening.

early the following morning. Rangers mapped the location of boats moored at the docks and in the bays daily. The completeness of the data varies from 85 percent (counts were made for 63 days out of 74 days at Anderson Bay and Dock) to 8 percent (boat counts on only 6 days were recorded at Oak).

Evaluative Standards: Visitor Surveys

Apostle Islands boaters were surveyed in order to obtain measures of their contact preference standards, as well as information about the boaters (who they are, where they boat, how often they boat, etc.) and their perceptions of their boating experience on the Apostle Islands. The target population was Apostle Island boaters who had made an overnight trip during the study period, June 26 through September 7, 1981. The sampling frame consisted of names and addresses of the marina slip owners at all the marinas except Buffalo Bay, the Boat ramp, and the Apostle Islands Yacht Club, plus a list of charterers from the Apostle Island Charter Association.

On September 10, 1981, a 13 page questionnaire was mailed to 402 boaters proportionately sampled from the four marina lists and a list from Apostle Islands Charterers. Twenty percent of the sample were not current boaters on the Apostle Islands or were not qualified to fill out our questionnaire for other reasons (e.g., they had previously filled out a on-site questionnaire). Seventy-two percent of the eligible respondents returned a completed questionnaire. The sample size for the mailed questionnaire was 229.

Our mailed survey was supplemented by on-site distribution of approximately 225 questionnaires during the month of August. The questionnaires were identical, except for the phrasing of the item on the

length of the boating trip about which they were reporting. The on-site sampling technique was haphazard. Questionnaires were distributed to boaters at various locations, including marinas and the more popular mooring sites, such as Anderson Bay. The boaters were asked to fill out the questionnaires and return them, either in person or by mail. The sampling technique was not at all systematic, since the primary concern was to achieve an adequate sample size. This proved impossible to do, because boaters were unwilling to fill out the 13 page questionnaires on the spot and frequently failed to return them.

Two hundred and twenty-five is the maximum number of questionnaires that were distributed on site. More likely, however, the number is considerably smaller, since many of the questionnaires left at marinas did not actually reach a boater. The most conservative estimate of the response rate, based on 225 distributed questionnaires, is 42 percent, resulting in 94 completed questionnaires. The total sample size for the boater survey, including both the mailed and on-site returned questionnaires, is 323.

Measurement of Contact Preference Standards

Our research indicates that the best measurement method for contact preference standards is to ask each recreationist how he or she evaluates a given number of contacts with other recreationists (Shelby and Heberlein, 1981). The ideal measurement technique is to ask each respondent for his or her evaluation of a number of different contact levels within the range of possible contacts. The particular technique was utilized in the Brule River study (Heberlein and Vaske 1978) and in the Sandhill Hunter Study. This technique provides not only a contact preference standard for the group of recreationists, but also a contact preference standard for each individual recreationist (Vaske, 1978).

Unfortunately, this method involves utilizing many repetitive items. A more parsimonious method involves asking each respondent about a single point in the range of contacts. The values are selected and assigned randomly, so that each respondent is only asked about a single contact level. Enough data is obtained for each contact level so that an overall contact preference standard can be calculated for the group of recreationists. This is the method used for Apostle Island boaters and Bong pheasant hunters. It does not allow us, however, to calculate any single contact preference standard for an individual. It only provides a contact preference standard for the group.

RESULTS

Input Use Level

The maximum number of boats out from the marinas was 169 on August 8, 1981. The minimum was 31, which occurred on several days during the season. The sail boats out count is the total number of empty slips minus the number that are continuously empty. The maximum of 169 boats is 31 percent of the slips available. Thus, most boats moored in the Bayfield area on any given night are found in the marina slips and are not mooring off or around the islands in the National Lakeshore. Daily use level data are presented in Appendix 1, Table A1-1.

There was both a day-of-week and a marina effect on input use level. Input use level was much higher on weekends than on weekdays. Median input use levels for Monday through Thursday ranged from 11 to 14% of the marina slips or from 63 to 76 boats (Table 3). On Saturdays the median input use level was 150. This was fairly consistent, on four of the seven Saturdays for which data are available, input use level ranged from 149 to 169 boats.

Table 3

Median Boat Use for Each Marina by Day for Apostle Islands Area, Summer 1981

Day of Week	MEDIAN NUMBER OF BOATS OUT							Median Boat Use	Boat Use As % of Available Places*
	APOSTLE ISLANDS					MADELINE ISLAND			
	Port Superior	Bayfield	Schooner	Yacht Club	Ramp	Buffalo	Yacht Club		
Monday	18	12	5.5	5.5	7	5.5	14	74	13.5
Tuesday	13	10.5	7	6	5.5	3.5	19	62.5	11.4
Wednesday	16.5	14	6.5	6	3	4	15.5	65.5	12.0
Thursday	19	15	7	7	4.5	3.5	15	76	13.9
Friday	41.5	25	11	6.5	6	3.5	20.5	115	21.0
Saturday	47	31	15	8	7	5	26	151.5	27.6
Sunday	29	15	7	7	6	4	15	89	16.2
Correlation with day of week	.526	.500	.493	.244	.065	.006	.100		
Number of continuously empty slips	23	2	0	0	0	4	7		

*548 available places in 6 marinas plus the ramp.

It is also clear that the larger marinas, namely Port Superior, Bayfield, and Madeline Island put more boats into the system (Figure 2). They also add a disproportionate number on weekends. This suggests that, in terms of input use level, not all marinas have equal effects on the weekend peak.

System Use Level

The flyovers provide the most complete count of boater system use level, since the ranger counts cover only the most popular sites and miss the more obscure sites. The mean number of sailboats observed was 43 and the average number of motorboats observed mooring or beached was seven (Table 4). This means that, on the average night, about 50 boats were moored off or on the Apostle Islands in 1981. Sailboats compose the overwhelming majority of these and our subsequent analysis will focus only on sailboats. On 21 days of flyovers, there were fewer than 10 motor boats observed.

It is quite apparent that input use level, or boats out, is an overestimate of the boats actually mooring off the islands. The average number of boats out was 87 per day during the study period, while the average number of boats counted by rangers and on fly-overs was 43 per day during the same period. A maximum of 129 boats were observed mooring off the islands on August 8, the same day there were an estimated 169 boats out of the marinas, leaving 40 boats unaccounted for. On other days the discrepancy is much smaller, more in the range of 2-10 boats.

There are a number of reasons for this discrepency. First the empty slips should have been counted at 6:00 a.m., the same time as the flyover. By ten in the morning when some of the empty slip counts were made, boats could already have been underway from the marinas for the

FIGURE 2

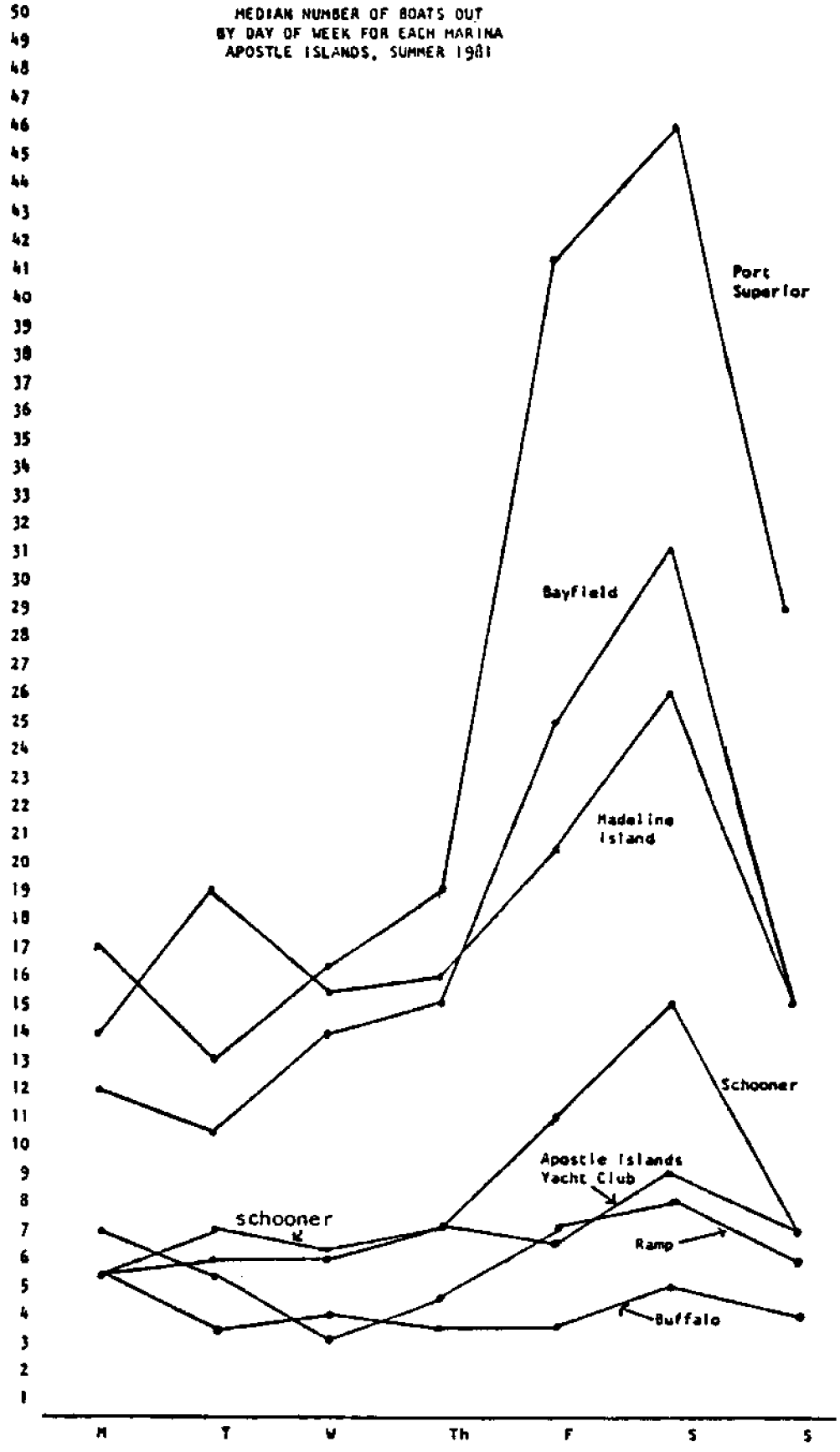

MEDIAN NUMBER OF BOATS OUT
BY DAY OF WEEK FOR EACH MARINA
APOSTLE ISLANDS, SUMMER 1981
50
49
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Port Superior
Bayfield
Madeline Island
Schooner
Apostle Islands Yacht Club
schooner
Ramp
Buffalo
M
T
W
Th
F
S
S

Table 4

Total Number of Boats Seen Each Day
From Flyovers, Summer 1981

Frequency	Number of Days		Total - Sailboats and Motorboats
	Sailboats	Motorboats	
0-10	1	21	1
11-20	3	3	2
21-30	4	1	4
31-40	3	0	3
41-50	7	0	4
51-60	2	0	5
61-70	1	0	1
71-80	2	0	1
81-90	1	0	1
91-100	0	0	1
101-110	1	0	1
111-120	0	0	1
$\bar{X}$	43.0	7.2	50.2
Md	42.0	6.6	47.0
Sd	25.5	5.0	29.1

next day's sailing, while the boats moored off the island had not yet returned to the marina. Thus, a 10:00 a.m. empty slip count probably includes a combination of two days of mooring boats counts, as well as day sailors. Even an early morning count (6:00 a.m.) could not account for the boats docked outside the Apostle Islands such as at Isle Royale, Barkers Island or Knife River. Finally the counts on the water, except for days of flyovers are underestimates, since rangers are located on only eight islands and could not be aware of all boats.

The correlation between boats out and the observation at mooring sites is .78 ($p < .001$). This shows a strong relationship between the number of boats mooring in the islands, or system use level, and the estimates of boats leaving the marinas, or input use level. So, while there may be a discrepancy between the two, system use level increases as input use level does in a relatively direct way.

Site Specific Use Level

The flyover and ranger counts at each site provide independent measures of site specific use level. Both measures have some missing data. They are, however, highly correlated. The correlations between the two at Stockton is .92, at South Twin .95, and .64 at Rocky (Appendix 2, Table A2-3). Reasonable correlations are observed at other locations with the exception of Sand, where both the flyover and ranger counts had considerable error. This is discussed further in Appendix 2.

In order to have a more complete count, we merged the flyover counts and the ranger counts to produce the "best" counts (Table 5). The criteria for selection were the following:

(1) If data were missing for one type of count on any particular day, the other was selected.

(2) If counts were available for both days, then the higher counts were selected. In most cases, the higher count was the ranger count because it was more likely to have picked up all the boats moored at the site.

The merged or best count gives us much more complete data. We have as high as 92% of the days counted (Quarry Bay), while the lowest percentage is only 42% (Oak). This produces a more reliable and accurate estimate of the number of sailboats at each site than are available with either the ranger or flyover counts alone. The amount of missing data is considerably less as well.

On the average day Stockton had 20 boats at all locations in contrast to Rocky with 8, and South Twin with 3 (for a total of 11 at the Rocky-South Twin complex), Raspberry with 4, Oak with 1, and Sand with 1 (Table 5). The average number of boats at all other locations (from flyovers only, see Appendix 2, Table A2-1) was 6, which totals an average of 43 boats in the system.

Thus on average about 46% are moored at Stockton, 25% at Rocky-South Twin, 14% at Raspberry-Oak, and 15% off the remaining islands. When we consider the specific locations at Stockton, we find that, on average, Anderson Bay (also called Presque Isle Bay) had 8 boats moored off and 5 at the dock, and that Quarry had 5 boats and one at the dock.

Of the 67 days observed at Stockton there were always boats either at the dock or moored off in Anderson Bay. Rocky was almost as popular with boats mooring or docked there 96% of the days observed. There was at least one boat at Raspberry almost 90% of the time. Quarry Bay had boats 88% of the time. Use at Oak was lower; it had a 55% "occupancy rate." Thus the 1981 data show that solitude is rare at the most popular mooring locations. The flyover data do show that solitude is possible at other

TABLE 5. MERGED COUNT OF SAILBOATS AT APOSTLE ISLANDS, SUMMER 1981

LOCATION	DAILY NUMBER OF BOATS MEAN	MEDIAN	MAXIMUM	DAYS OBSERVED	% OF DAYS WITH BOATS	POPULARITY INDEX[a]
STOCKTON	20.24	17.67	68	67	100.0	2024
ANDERSON	12.60	10.75	40	67	100.0	1260
BAY	7.92	5.75	33	67	92.5	733
DOCK	4.67	5.07	8	67	97.0	453
QUARRY	5.53	4.14	28	68	88.2	488
BAY	4.85	3.41	26	68	86.7	420
DOCK	.68	.37	5	68	42.6	29
JULIAN	2.12	.48	14	67	49.3	105
ROCKY	7.88	6.17	28	56	96.4	760
SOUTH TWIN	2.67	2.00	12	42	78.6	210
RASPBERRY	3.78	3.00	19	54	88.9	336
East of Sand Spit	2.57	1.64	14	54	64.8	167
West of Sand Spit	1.09	.62	10	54	53.7	59
Dock	.18	.06	4	55	10.9	2
SAND	1.32	.97	6	40	67.5	89
OAK	.94	.67	4	31	54.8	52
Sand Spit	.26	.15	2	31	22.6	6
Dock	.76	.44	4	34	47.1	36

[a] Popularity Index - $\bar{X}$ multiplied by %

sites such as Outer, Cat, Bear, and several other locations, even on the highest use days.

The highest observed use levels are much higher than the average numbers. On the peak day Anderson had 40 boats both moored off and at the dock (33 was the largest number of moored boats observed). Quarry had a maximum of 28 at both the dock and Bay. Twenty-six was the largest number moored in Quarry bay itself. Rocky had a maximum of 28 boats, South Twin, 12, Raspberry, 19, Sand, 6, and Oak, 4.

The Effect of Use Period

The tables presented so far have treated all the days of the week as if they were the same. Table 6 breaks down the data so that we can determine how much of a "weekend effect" there is. There appear to be two use periods: Sunday through Thursday evenings are low use, and Friday and Saturday evenings are high use[4]. Most weekend boaters will be mooring Friday and Saturday night. The high use period also includes two Sundays that are part of the holiday weekends: July 5 and September 6. As expected, there are considerable differences between high and low use periods. The magnitude of these differences vary by site. The more popular sites - Stockton and Rocky - have the greatest increase, both in percentages and in the actual number of boats. Overall, Stockton has a 137% increase, comparing the mean sailboat counts for low use versus high use days. In other words, there are, on the average, almost one and a half times more boats at Stockton during Friday and Saturday than the rest of the week. Most of the increase occurs in boats moored out in Anderson and Quarry Bay. The docks, of course, are limited by facilities capacity; however, even during high use periods, the docks are not filled to capacity 100% of the time.[5]

Table 6

DAILY NUMBER OF SAILBOATS BY USE PERIOD*

APOSTLE ISLANDS, SUMMER 1981

LOCATION	LOW USE DAYS				HIGH USE DAYS			
	MEAN	MEDIAN	MAXIMUM	DAYS OBSERVED	MEAN	MEDIAN	MAXIMUM	DAYS OBSERVED
STOCKTON	13.96	12.00	30	45	33.09	27.50	68	22
ANDERSON	9.40	8.08	24	45	19.14	17.50	40	22
BAY	5.27	4.43	18	45	13.36	12.50	33	22
DOCK	4.13	4.25	8	45	5.77	5.83	8	22
QUARRY	3.29	2.88	11	45	9.91	7.25	28	23
BAY	2.80	2.56	11	45	8.87	7.00	26	23
DOCK	.49	.20	5	45	1.04	.91	4	23
JULIAN	1.27	.36	8	45	3.86	2.00	14	22
ROCKY	5.57	3.92	25	35	11.71	9.33	28	21
SOUTH TWIN	2.04	1.80	6	28	3.93	3.00	12	14
RASPBERRY	3.19	2.75	11	32	4.64	3.17	19	22
EAST OF SAND SPIT	2.31	1.83	10	32	2.96	1.50	14	22
WEST OF SAND SPIT	.78	.44	5	32	1.55	.93	10	22
DOCK	.21	.05	4	33	.14	.08	1	22
SAND	.96	.78	4	23	1.82	1.25	6	17
OAK	1.06	.62	4	17	.79	.70	2	14
SANDSPIT	.24	.15	1	17	.29	.14	2	14
DOCK	.90	.36	4	19	.60	.57	2	15

* The week is divided into two use periods: Sunday, Monday, Tuesday, Wednesday and Thursday are low use days; Friday and Saturday, plus the Sundays following July 4 and Labor Day are high use days. Use level is based on evening mooring counts.

Rocky has a 110% increase from low use to high use days. In absolute numbers, however, this means an increase of 6 boats as compared to an increase of 19 on Stockton. Except for Oak Island, increases on the high use days range from .5 to 1.5 times the number of boats on low use days. It is only for Stockton that the charge involves a substantial number of boats.

In more concrete terms a weekday boater at Anderson Bay would see 8 or more boats half the time (median = 8.08), and would never see more than 24. In contrast, a weekend visitor saw 18 or more half the time and saw as many as 40 on the peak weekend. The weekday boater at Quarry saw 3 or more boats half the time up to a maximum of 11, while on weekends he or she saw 7 or more boats half the time, up to a maximum of 28.

The Boater: 1975-1981 Comparisons

Most (85%) of the respondents to our 1981 Apostle Islands Boater questionnaire come from local marinas. Only one-fourth of the 323 respondents are charterers. The high percentage of local marina users in the sample is not surprising considering that a majority of the respondents were sampled from lists of local marina slip owners. This technique produces a somewhat biased sample of boaters. In contrast, the 1975 sample of Apostle Island boaters was a random sample of persons who had boated around the islands in 1975. We will proceed to compare the two groups, with the caveat that the comparisons are suggestive rather than definitive.[6]

Prior Boating Experience. Thirty-two percent of the 1981 boaters started sailing in the Apostle Islands in 1970 or earlier, so that almost 1/3 of these boaters had 11 or more years of boating experience at the Apostle

Islands. Only 23.4% of the 1975 boaters had 11 or more years of experience at the Apostle Islands. These 1975 boaters would have had to start boating in 1964 or earlier in order to have the same number of years experience.

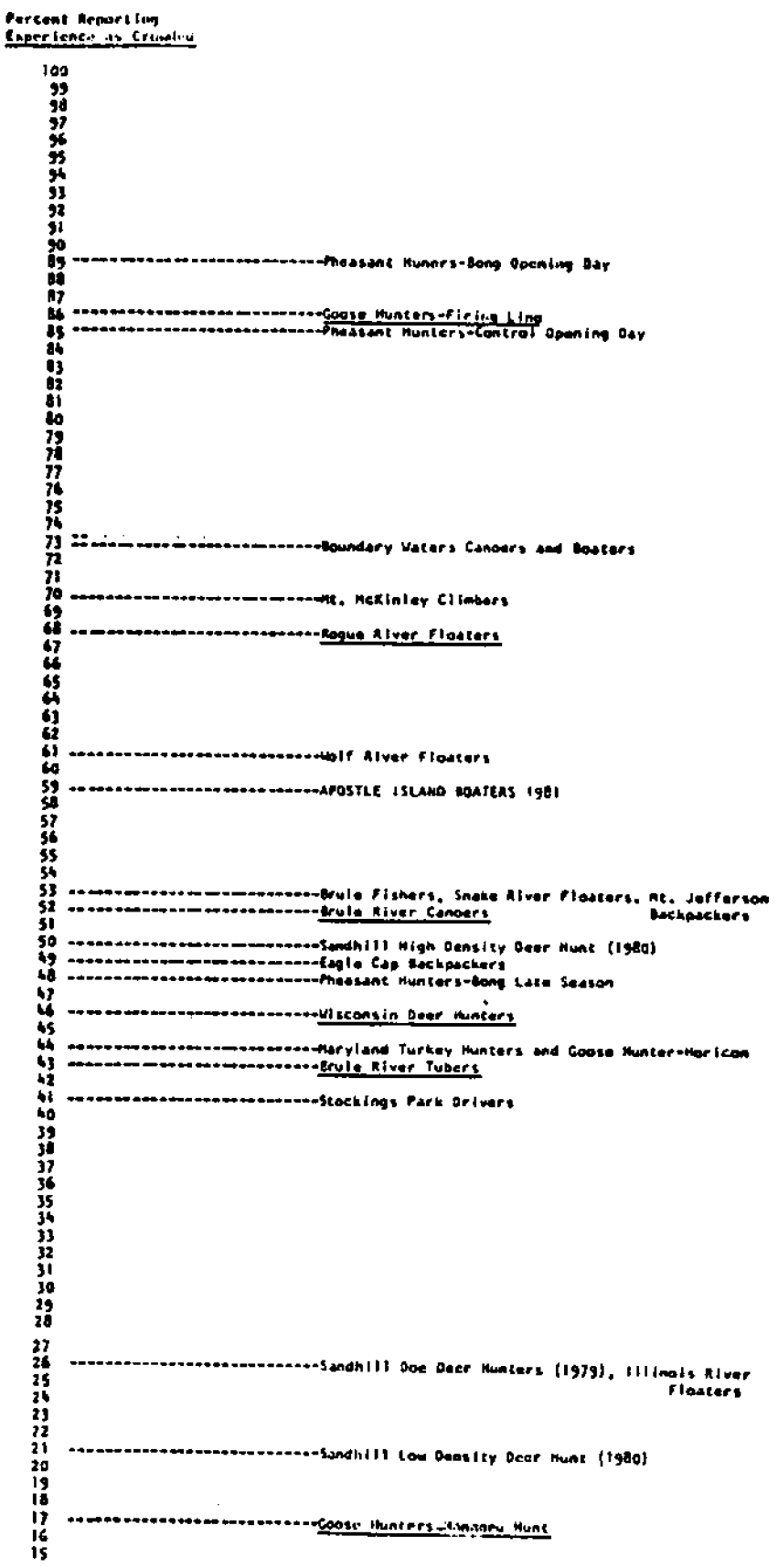
Current boaters have been boating at the Apostle Islands longer than those in the 1975 sample; they have also made more frequent visits. Forty-five percent of the 1975 boaters had only one or no prior visits to the Apostle Islands as compared to 11% of the 1981 boaters. At the other end of the distribution, only 19.5% of the 1975 boaters made 20 or more trips as compared to over half (52.9%) of the 1981 boaters. Furthermore, for the current season, they made more trips. The 1981 Apostle Island boater appears to be considerably more experienced with the resource, i.e., the Apostle Islands National Lakeshore, than the 1975 boater.

Crowding and Displacement. Even though he or she is more experienced, the 1981 boater does not appear to be avoiding islands more than the 1975 boater. Twenty-seven percent in 1981 versus 35% in 1975 said they avoided some island because they expected it to be too crowded. In 1981, as in 1975, Stockton was the island to avoid: 9 out of 10 of those who avoided any island, avoided Stockton. Avoidance of other islands was almost non-existent in 1975; however in 1981, 3 out of 10 boaters who were displaced, i.e. left, and sought other recreational settings, avoided Rocky.

Although only 27% of the boaters avoid islands because they expected to be crowded, 59% report some feeling of crowding on their boating trip, from slightly to extremely crowded. This is fairly high, but when compared to studies of recreationists in different settings and activities, 1981 Apostle Island Boaters fall somewhere in the middle

TABLE 7

Ranking of Perceived Crowding for Different Settings and Activities



(Table 7). The percentage is higher than Brule River canoers, but lower than Boundary Water canoers and boaters and Rogue River floaters. We do not have the crowding measure for the 1975 boaters, so we cannot make the comparison of the 1975 and 1981 boaters on the experience of crowding. In the 1975 study, data on items that refer to crowded conditions suggest that this group might have scored lower on the crowding measure.For example, 52% of the 1975 boaters disagreed with the statement that the places that they stopped were too crowded and 66% reported that they did not meet too many people.

If we compare boater contacts, we would expect the 1975 boater to feel less crowded since boaters reported fewer contacts with other boaters. About one-fourth of 1975 boaters have 11 or more contacts with other boaters, while over half (58.1%) of the 1981 boaters have that many contacts. Even though 1981 boaters have more contacts, they don't appear to be bothered by them: only 26.1% report feeling unpleasant or very unpleasant toward seeing the number of boats that they saw.

Predictions of Site Specific Use Level (Contacts)

An input use level representing boats out on a particular day from all the marinas was created by summing over the boat counts for each marina. This mathematical operation ignores differences among the marinas; it treats them as if they were one huge marina with 548 slips. Input use level ranges from a low of 31 boats to a high of 169.

These data were analyzed using linear regression: boater contacts (site specific use level) was the dependent variable and it was regressed on boats out (impact use level). The regression equation is $\hat{Y}=BX$, where $\hat{Y}$ is the predicted number of boater contacts at a particular site each day, B is the estimated regression coefficient, i.e. the increase in $\hat{Y}$

Table 8

Comparison of Boater Contacts for 1975 and 1981
Apostle Island Boaters

Number of Reported contacts with other Boaters	Apostle Island Boaters	
	1975	1981
0	7.0	3.1
1	4.0	4.9
2	6.0	2.7
3	7.4	7.1
4	6.6	3.1
5	8.3	3.6
6-10	36.2	17.4
11-15	12.5	21.0
16-20	5.9	12.9
More than 20	6.0	24.2
	100.0 (647)	100.0 (224)

for an increase of one in X , and X is the daily impact use level (Draper and Smith, 1965).[7] Table 9 gives the values of B: a use level (boats out) can be substituted for X and $\hat{Y}$ is then calculated. The last two columns is the table list $\hat{Y}$ for the lowest and highest use days, using the median value for each.

All the regressions are significant at the $p < .05$ level except for Oak and Quarry Dock. This means that knowledge of the number of boats out does not help you predict the number of boats moored at Oak. Whether its 25 boats out or 125 boats out, the best estimate of boater contacts at Oak is the mean, .94 boats. For Quarry Dock, the mean (.68) is also the best estimate. For the rest of the sites, knowledge of the number of boats out does affect the value of Y. The amount of variance in boater contacts explained by boats out ranges from 57% (Stockton) to 16% at South Twin. This means that at Stockton the model does a good job of predicting boater contact with boats out, while at South Twin it does only about a third as well.

The validity of the regression models predictions are illustrated by the last two columns in Table 9. This illustrates how the regression equation can be used: with just boats out as a known quantity, boater contacts at each of the sites can be predicted. The values that we obtain appear to be reasonable; e.g., there are 3 times as many boats at Stockton on a high use day vs. a low use day. Furthermore, when we compare the predicted boater contacts to the means for merged boat counts in Table 9, we find a systematic correspondence. The predicted boater contacts at Anderson Bay on the lowest use day is 8.9; the actual mean for low use days is 9.4 (Table 9). The predicted boater contacts at Anderson Bay on the highest use day is 21.5; the actual mean for the high use days is 19.14.

Table 9

Regressions Boat Counts on Boats Out

MOORING SITE	B*	R^2**	PREDICTED BOAT COUNT ON LOWEST USE DAY[a]	PREDICTED BOAT COUNT ON HIGHEST USE DAY[b]
STOCKTON	.236	56.6	14.8	35.8
ANDERSON	.142	36.6	8.9	21.5
BAY	.043	35.6	5.8	14.1
DOCK	.050	24.6	3.1	7.6
QUARRY	.065	27.1	4.1	9.8
BAY	.058	39.3	3.6	8.8
DOCK	.007	.7	.4	1.1
JULIAN	.027	27.1	1.7	4.1
ROCKY	.090	30.4	5.6	13.6
SOUTH TWIN	.029	16.3	1.8	4.4
RASPBERRY	.042	19.7	2.6	6.4
SAND	.015	17.5	.9	2.3
OAK	.001	-3.8	.1	.2

* The regression line is forced through the zero point, which assumes that alpha is zero, i.e., when the number of boats out is zero there are no boats moored at the site.

**R^2 is the percent of variance in the dependent variable explained by the independent variable, adjusted for the degrees of freedom. It is calculated using the regression equation in which alpha is not assumed to be zero.

[a]The lowest use day is Tuesday and the median (62.5) was used as the number of boats out.

[b]The highest use day is Saturday and the median (151.5) was used as the number of boats out.

The values for boats out that are used in Table 9 are within the range of actual boats out during the period June 26 to September 7. We used the median for Tuesday (62.5) for the lowest use day and the median for Saturday (151.5) for the highest use days. These do not provide any new information, since we already know what happened in 1981. The real value of this method is to predict the effect of increasing boats out above the current use level at the Apostle Islands. Using the regression model, changes in contacts can be estimated as a function of increasing available marina slips.

An increase in the number of marina slips will not result in an identical increase in the number of boats out. Table 3 provides the information necessary for estimating the number of boats out, given the number of marina slips, on any day. For example, on Monday the use level (boats out) will equal 13.5% of the number of marina slips. Table 10 indicates the effect of adding 100 marina slips, either to an existing marina or as a separate marina in the Bayfield area. The increase in the total number of boats out ranges from slightly more than 11 on Tuesday to almost 28 on Saturday. The effect of an additional 100 marina slips not only varies by day of the week, but also by site. Increasing marina space by 100 boat slips will increase boats moored at Stockton from 3 on Tuesday to almost 7 on a Saturday. The increase, of course, has the greatest impact on Stockton Island, particularly Anderson Bay. On South Twin, Raspberry, and Sand the impact is barely one more boat moored on any day of the week. The impact on Julian Bay is also minimal. If there are, or will be, any carrying capacity problems at the Apostle Islands, they will begin at Stockton, particularly Anderson Bay and, to a lesser extent, Quarry Bay.

TABLE 10. EFFECT OF INCREASING MARINA SPACE BY 100 BOAT SLIPS ON BOATER CONTACTS AT MOORING SITES.

DAY OF THE WEEK	INCREASE IN NUMBER OF BOATS OUT FROM MARINAS	INCREASE IN NUMBER OF BOATS MOORED AT								
		STOCKTON	ANDERSON BAY	QUARRY BAY	JULIAN	ROCKY	SOUTH TWIN	RASP-BERRY	SAND	OAK
MONDAY	13.5	3.2	1.9	.9	.4	1.2	.4	.6	.2	0
TUESDAY	11.4	2.7	1.6	.7	.3	1.0	.3	.5	.2	0
WEDNESDAY	12.0	2.8	1.7	.8	.3	1.1	.3	.5	.2	0
THURSDAY	13.9	3.3	2.0	.9	.4	1.3	.4	.6	.2	0
FRIDAY	21.0	5.0	3.0	1.4	.6	1.9	.6	.9	.3	0
SATURDAY	27.6	6.5	3.9	1.8	.7	2.5	.8	1.2	.4	0
SUNDAY	16.2	3.8	2.3	1.1	.4	1.5	.5	.7	.2	0

Contact Preference Curves

Contact Preference Curves were completed for mooring off shore in Anderson and Quarry Bays and mooring at the docks. Only these locations were included on the questionnaire since we couldn't be certain that boaters had experience at other sites. The mean response for each number of contacts is displayed in Table 11, and the curves themselves are presented in Figures 3 - 6.

At Anderson and Quarry Bays boaters rate mooring with one other boat as a pleasant experience, suggesting that the demand for solitude is not crucial to the experience[8]. Preferences for contacts in both sites hover around neutral (neither pleasant or unpleasant) when contacts range between 7 and 11 . It is only when the number of other boats mooring at each site reaches 15 that the mean rating is significantly in the unpleasant range. Thus we estimate the range of tolerable contacts at between 1 and 15, with one other boat most preferred.

Dock preferences decline much faster, of course, representing the facilities limitations at each dock. At neither dock do boaters mind five or fewer boats. When seven or more boats try to moor off either dock, boaters are dissatisfied. This, of course, affects the facilities capacity of the docks themselves. There were never more than eight boats observed off Anderson dock, or 5 at Quarry.

Thus, from a current boater perspective using this framework, 15 boats is the social carrying capacity of Quarry and Anderson Bays and 7 and 9 boats the social carrying capacity at the respective docks. Before examining the relationship between this standard and input use level and the management parameter marina slips, it is useful to explore the other aspects of the contact preference curves. How do the Apostle Islands boaters curves compare to curves generated by other recreation groups in

Table 11

Apostle Islands 1981 Boaters Average Contact Preference Ratings By Number of Other Boats

Number of Other Boats	Average Preference Ratings			
	Anderson Bay	Quarry Bay	Anderson Dock*	Quarry Dock*
1	+1.23	+1.52	+1.13	+.93
3	+.83	+.98	+.56	+.42
5	+.35	+.74	+.05	-.13
7	+.33	+.25	-.18	-.31
9	+.06	-.33	-.38	
11	-.07	0.00	-.57	
15	-.59	-.31	-.59	
25	-.53	-.81		
35	-1.00	-1.23		

*The number of other boats at the docks was limited by the physical capacity of the dock. Boaters were only asked about the number of other boats that did not greatly exceed the dock's capacity.

FIGURE 3
APOSTLE ISLANDS BOATERS CONTACT PREFERENCE CURVE
FOR MOORING OFF-SHORE IN ANDERSON BAY

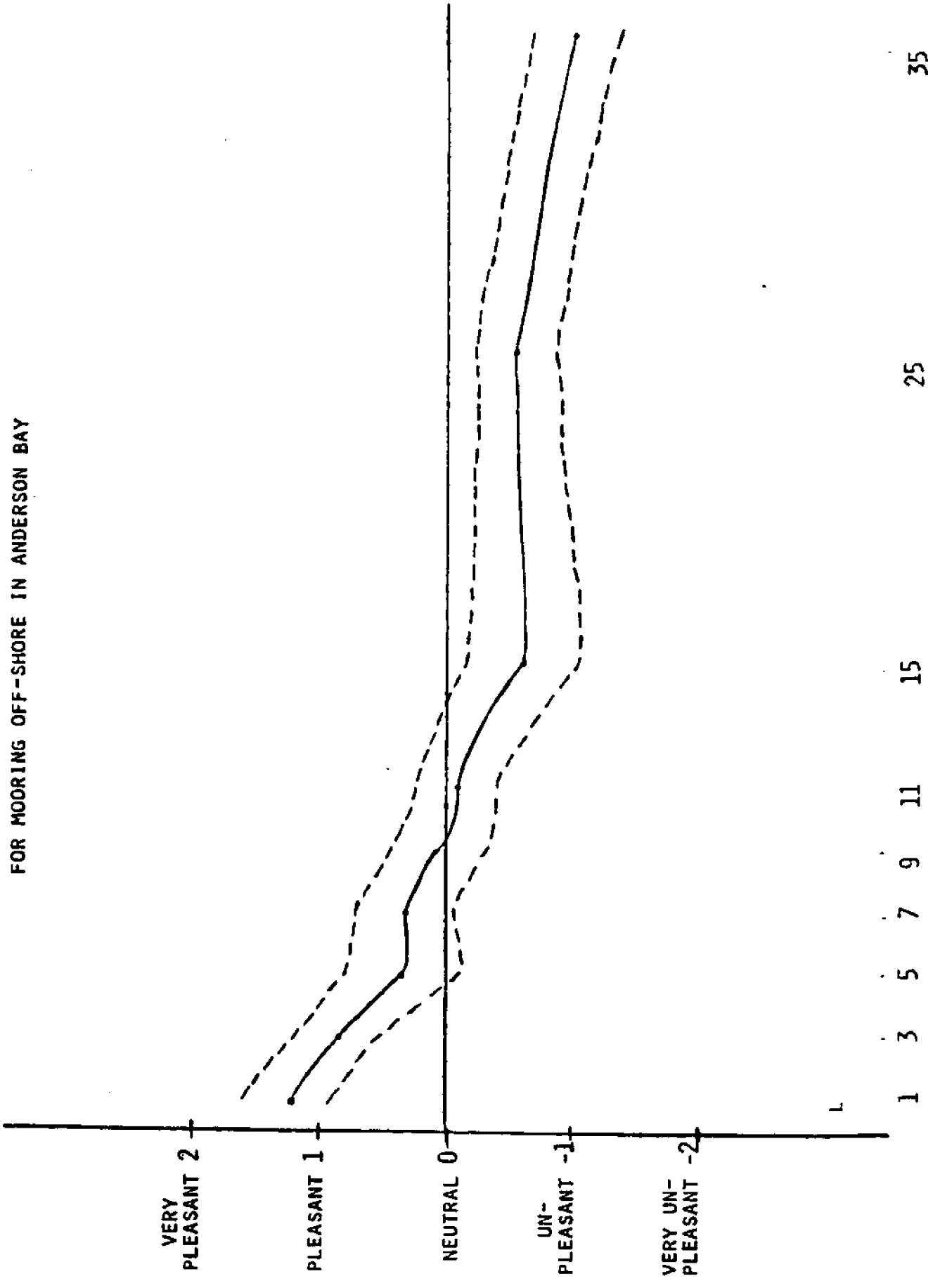


FIGURE 4. APOSTLE ISLANDS BOATERS CONTACT PREFERENCE CURVE FOR MOORING AT THE ANDERSON BAY DOCK

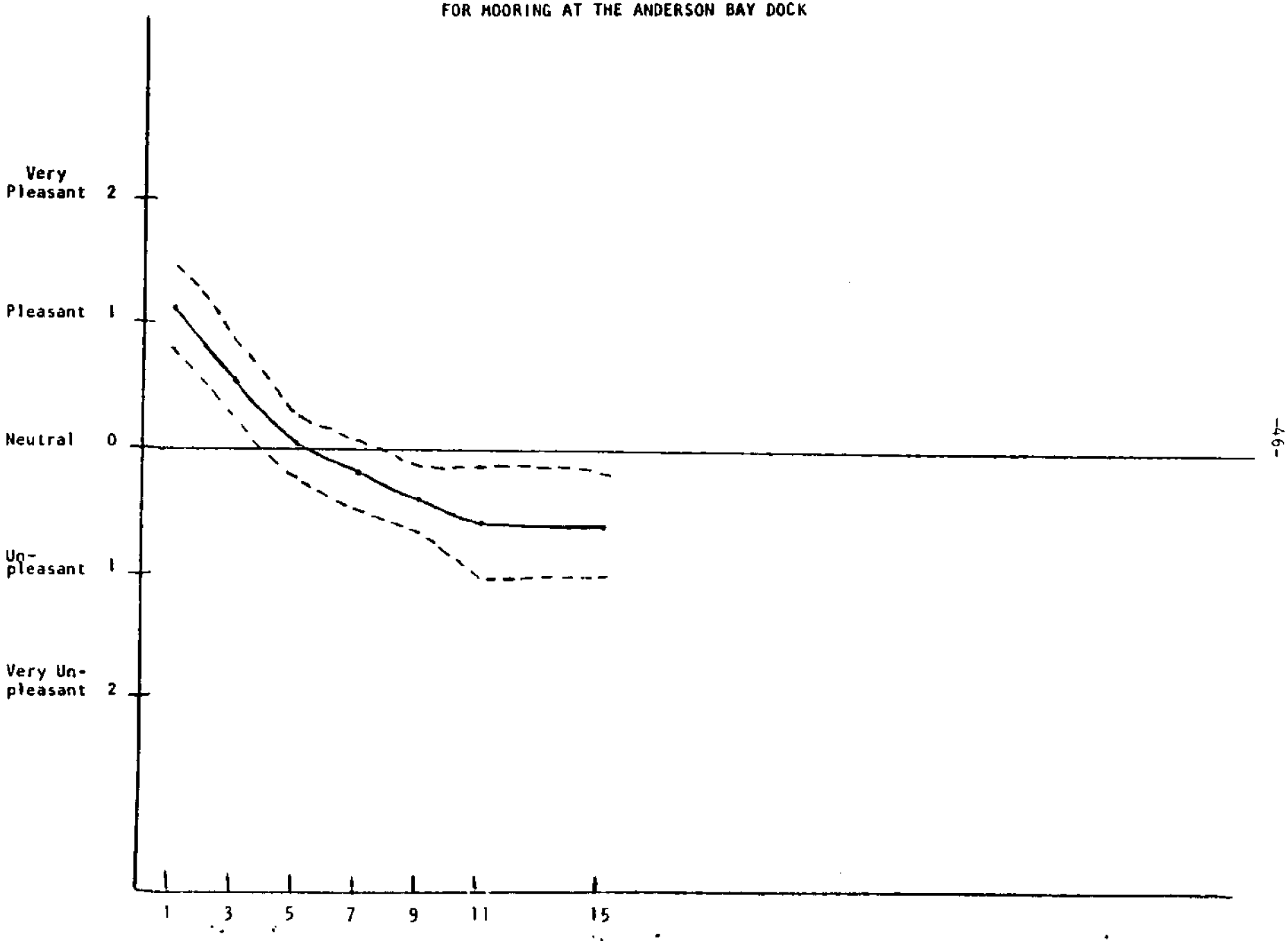


FIGURE 5

APOSTLE ISLANDS BOATERS CONTACT PREFERENCE CURVE
FOR MOORING OFF-SHORE IN QUARRY BAY

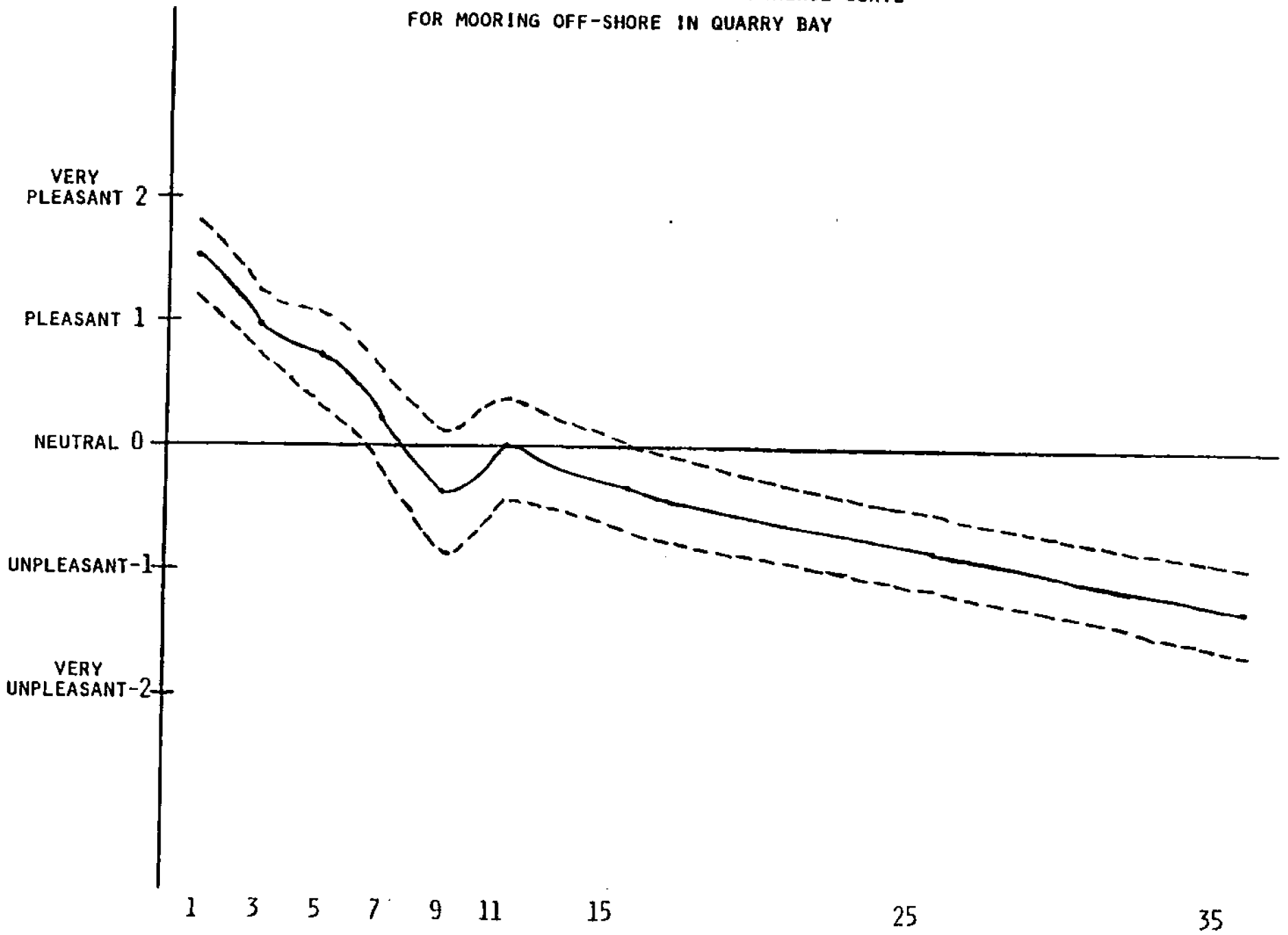
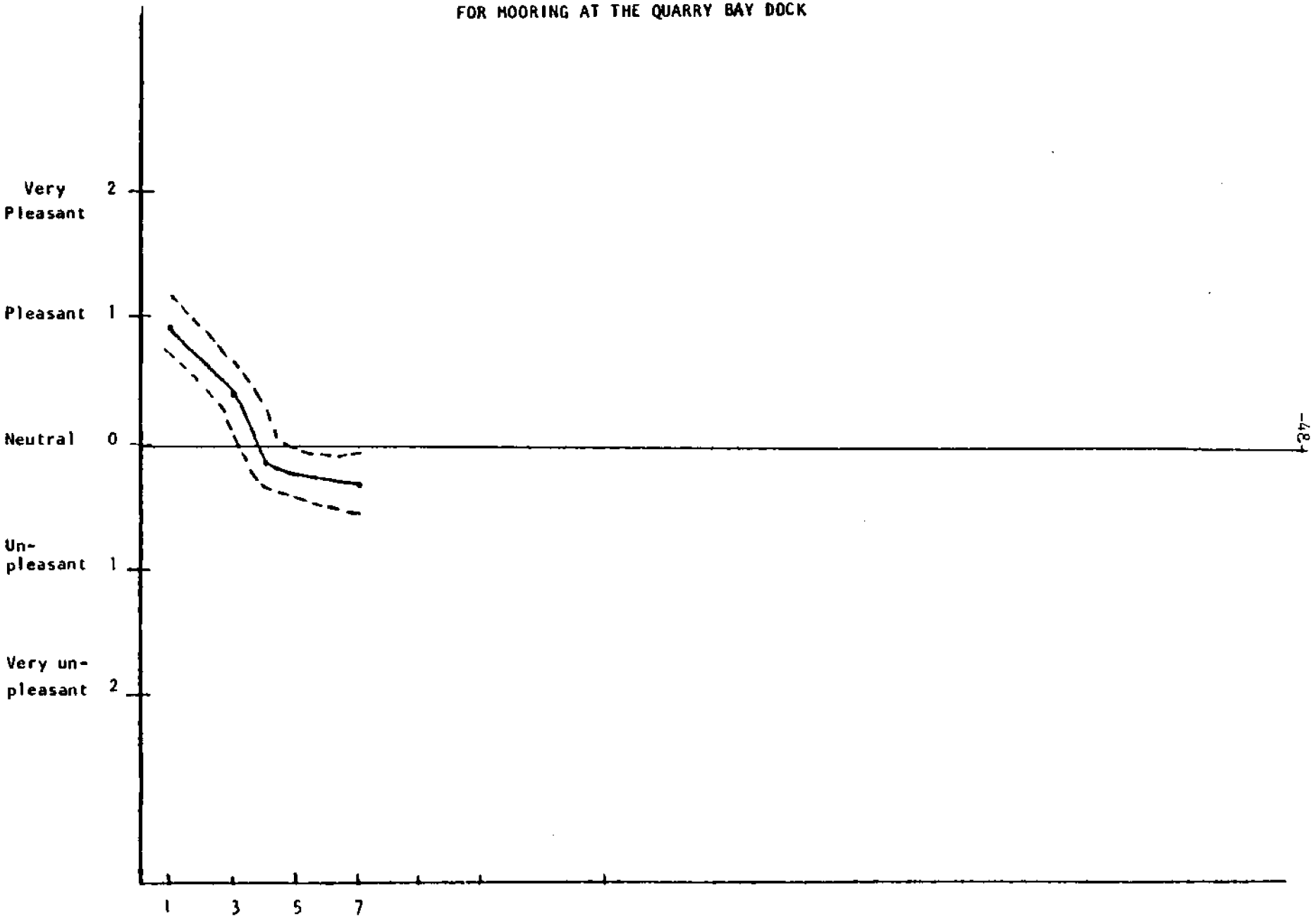


FIGURE 6. APOSTLE ISLANDS BOATERS CONTACT PREFERENCE CURVE FOR MOORING AT THE QUARRY BAY DOCK



different settings? We have studied canoer preferences for contacts with canoers, inner tube floaters, and fishers on the Brule River, deer hunters at the Sandhill wildlife area, and pheasant hunters at the Bong recreation area in Southeastern Wisconsin. Three comparative curves are displayed in Figures 7 - 9. The Apostle Island boaters feel much more favorable toward one contact than do recreationists in these three other groups. For the three comparison curves, evaluation of one contact ranges between neutral and pleasant, while at Anderson and Quarry Bays one contact is rated between pleasant and very pleasant. This suggests that Apostle Island boaters may actually prefer to see a few other boats mooring with them.

Canoers and deer hunters are also more negative about large numbers of contacts. These recreationists rate 25 contacts somewhere between unpleasant and very unpleasant. This is particularly true of contacts with tubers on the Brule and deer hunters at Sandhill. In contrast the Apostle Island boaters rate 25 contacts at Quarry and Anderson Bays as somewhere between neutral and unpleasant. Thus, overall it appears that Apostle Island boaters are not as concerned about large numbers of contacts that exceed the maximum tolerable contacts as Sandhill deer hunters and Brule canoers are. In contrast, the Bong pheasant hunters are less concerned about large numbers of contacts than the Apostle Island boaters (Figure 8). This may in part be due to the large number of contacts (between 40 and 50 actual contacts reported while hunting). The lower level of concern, i.e. all points being closer to neutral, for pheasant hunters is shown by the fact that they have the lowest intensity index of any group (Table 12).

Apostle Islands boaters tend to agree more about the appropriate number of contacts than do the other groups. If every person agreed at

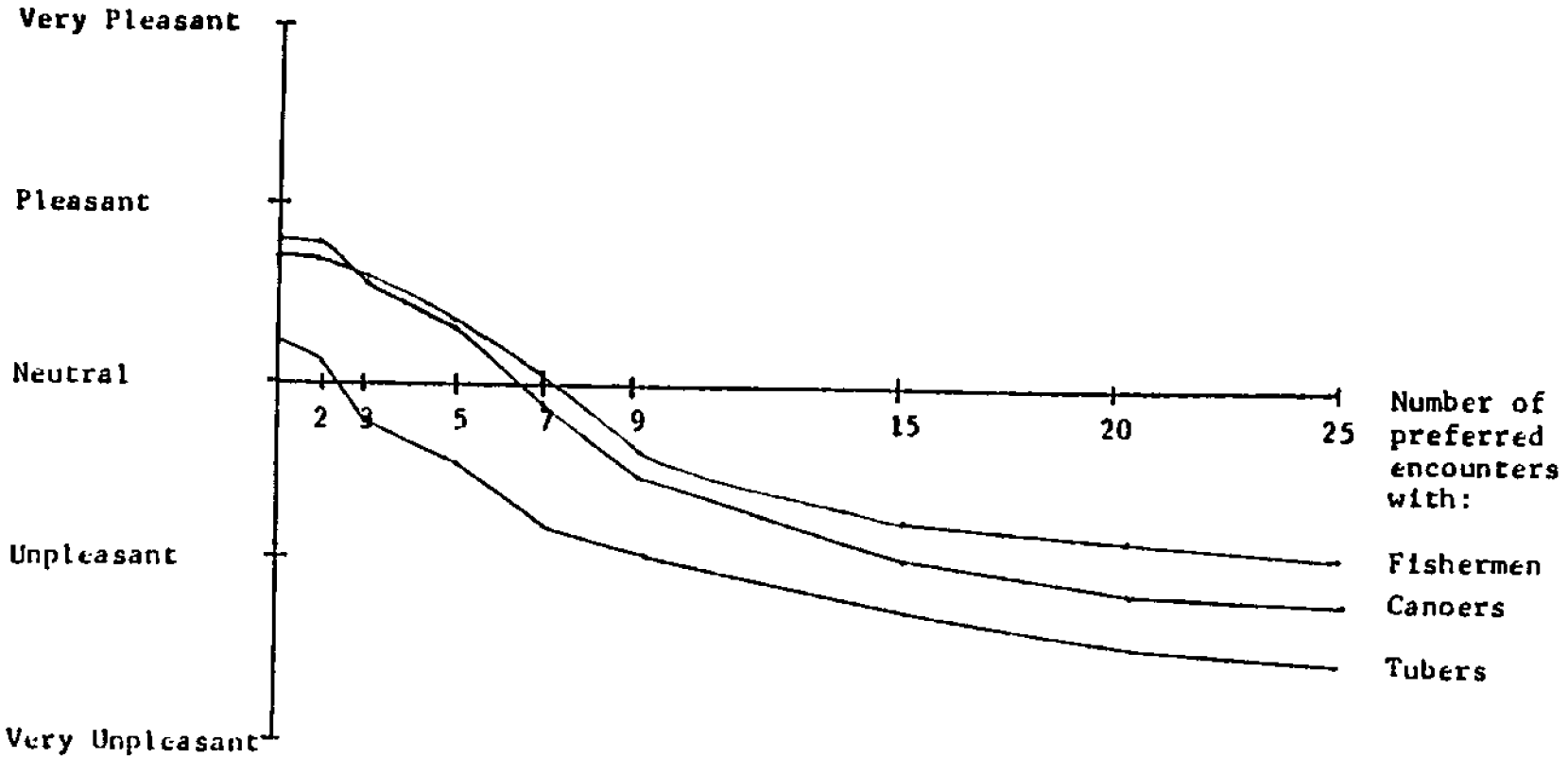


Figure 7. Canoer Return Potential Curves (Social Norms) for Meeting Three Types of Visitors

FIGURE 8

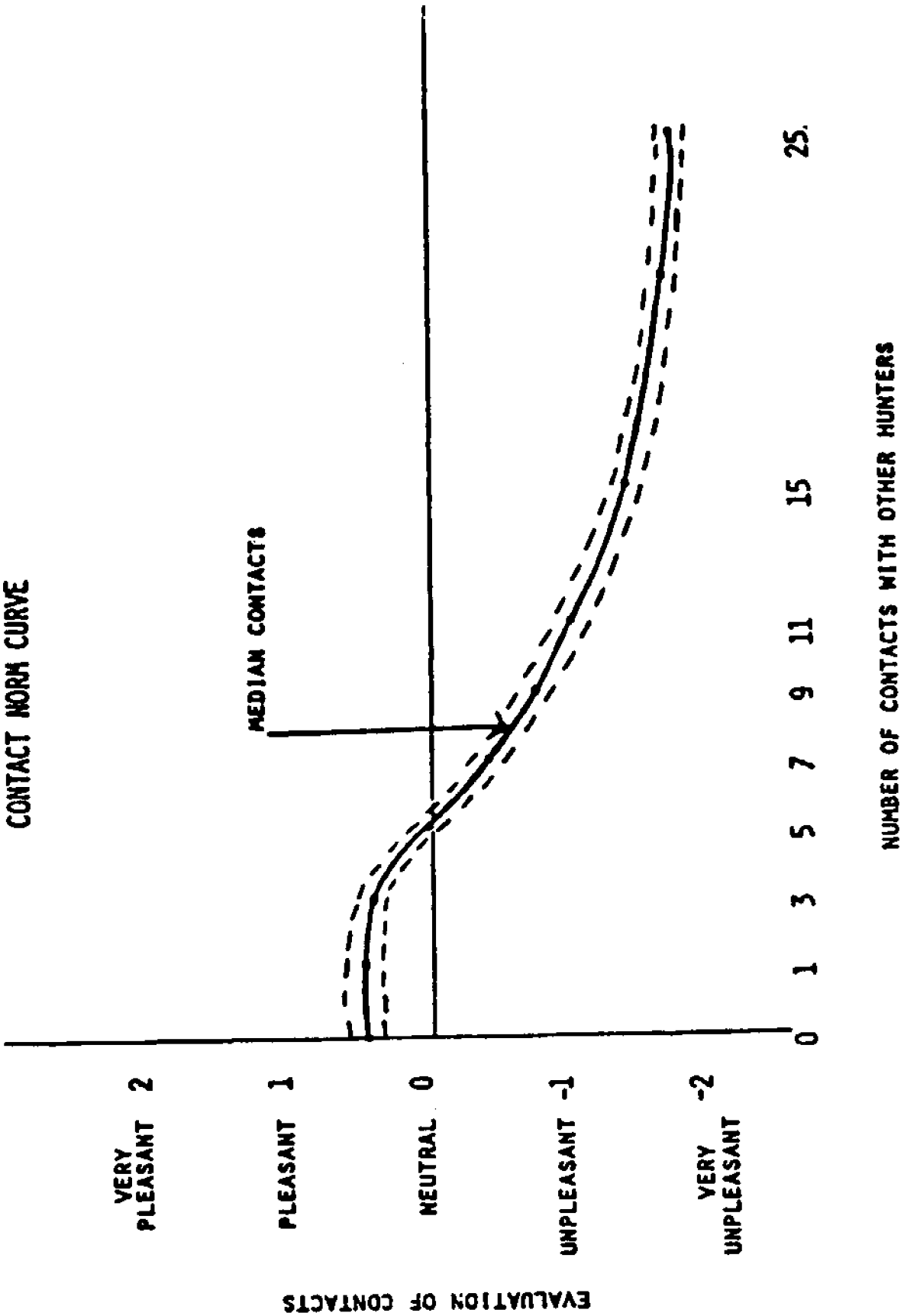

1980 SANDHILL DATA
CONTACT NORM CURVE
MEDIAN CONTACTS
EVALUATION OF CONTACTS
VERY PLEASANT 2
PLEASANT 1
NEUTRAL 0
UNPLEASANT -1
VERY UNPLEASANT -2
0 1 3 5 7 9 11 15 25
NUMBER OF CONTACTS WITH OTHER HUNTERS

FIGURE 9

BONG DATA

CONTACT NORM CURVE

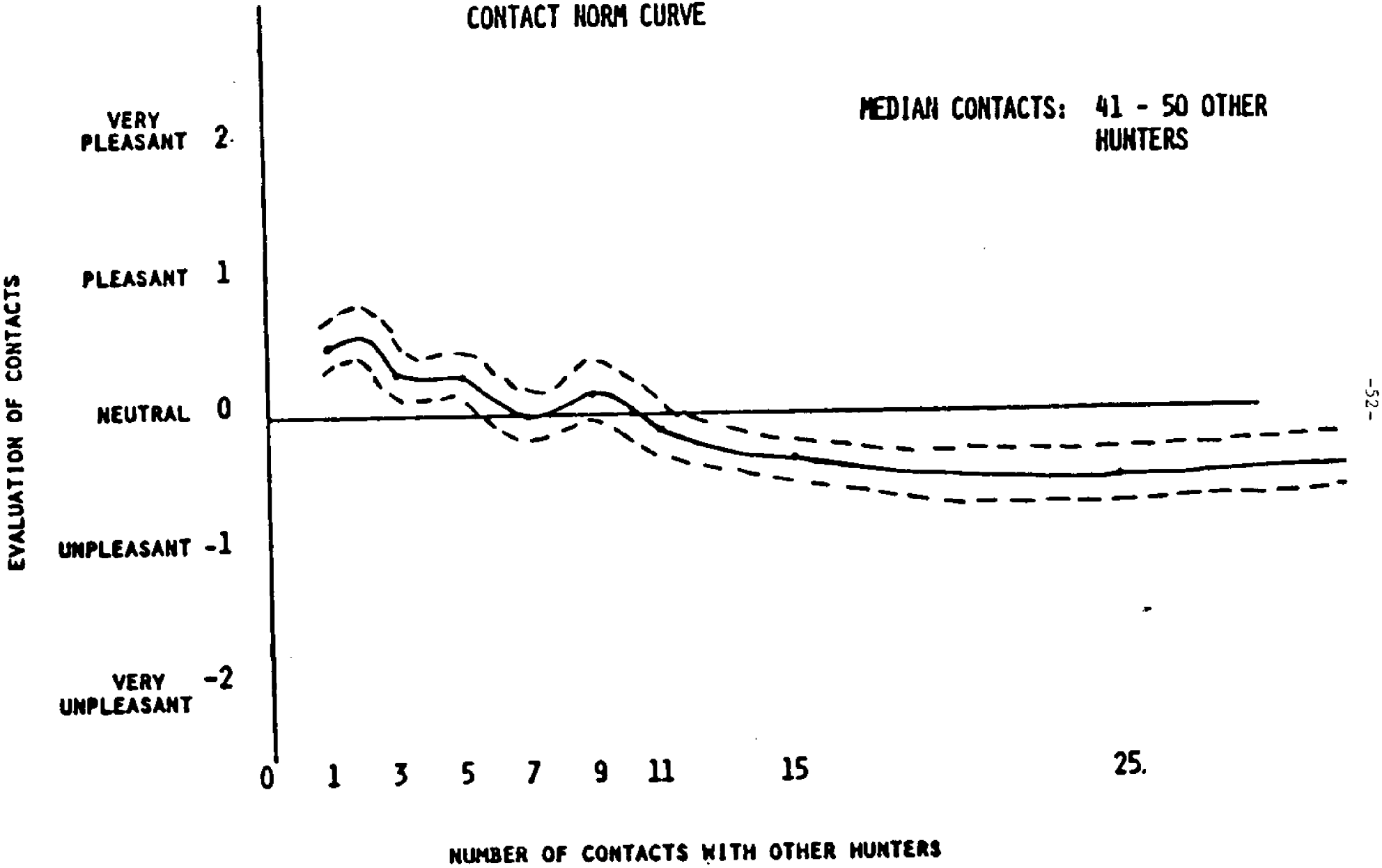


Table 12

Structural Properties of Contact Preference Norms for Four Groups of Recreationists

CONTACT PREFERENCE STANDARD	RANGE OF TOLERABLE CONTACTS	INTENSITY	CRYSTALLIZATION
APOSTLE ISLAND BOATERS			
Anderson Bay	1-15	.55	.95
Anderson Dock	1-9	.49	.94
Quarry Bay	1-15	.69	.79
Quarry Dock	1-7	.44	.81
BRULE RIVER CANOERS			
Canoers	0-7	.64	1.04
Tubers	0-3	.70	1.14
Fishers	0-9	.56	1.01
BONG PHEASANT HUNTERS	1-11	.35	1.21
SANDHILL DEER HUNTERS	0-5	.72	1.24

each number, the crystallization score would be zero. This would suggest similar preferences for each recreationist, such as we might expect to find about contacts on the tennis court. The higher the crystallization score, the less agreement. Brule River canoers, Sandhill deer hunters, and Bong pheasant hunter show less agreement about the appropriate number of contacts than Apostle Island boaters. (Table 12).

Considering the four locations at Stockton, boaters show the greatest intensity and most crystallization for mooring in Quarry Bay. There is also more agreement about the Quarry dock than either of the Anderson Bay sites. At Anderson Bay and dock, boaters show lower levels of intensity. This suggests that the contact preference standards are better defined and more likely to play a role in the boater evaluation of recreation at Quarry Bay than at Anderson Bay.

The Impact of Increased Marina Development

Now that the influence of additional marina slips on the number of boats at specific sites has been estimated (Table 9) and the contact preference curves established, it is possible to estimate the impact of additional marina development. Currently, how often do boater numbers at Anderson and Quarry Bay, the two most popular mooring sites, exceed social carrying capacity? How might this change with additional marina development? Since we have established curves only for these two sites, our discussion here is restricted to these areas only.

The first column of Table 13 shows current conditions. On only one of the 50 weekdays observed did mooring reach or exceed 15 boats moored off in Anderson Bay, and this level was never reached or exceeded at Quarry Bay. The 1981 weekday site specific use level of both Quarry and Anderson Bays is almost always below social carrying capacity.

Table 13

Percentage of Days Contacts (Site Specific Use Level) Exceeds Social Carrying Capacity (i.e. more than 15 boats mooring off in each location) with Increasing Marina Slips

Site	Current Marina Slips	+100	+200	+300	+400
		WEEKDAYS			
Anderson Bay	2	2	2	16	18
Quarry Bay	0	0	0	0	0
		WEEKENDS			
Anderson Bay	46	58	63	75	83
Quarry Bay	17	21	25	42	42
		TOTAL DAYS			
Anderson Bay	16	20	21	35	39
Quarry Bay	5	7	8	14	14

This is not true on weekends. On 46 percent of the 24 weekend days, boats mooring at Anderson Bay exceeded the site specific carrying capacity. This was also the case for 17 percent of the weekend days at Quarry Bay. The higher impact use level on weekends, combined with the popularity of these two sites, pushes the number of boats moored at each location over the social capacity limit.

Under current conditions, if all days are considered without regard for weekends and weekdays, mooring levels at Anderson Bay exceed social carrying capacity on 16 percent, or 12 out of 74 days, and at Quarry Bay, 4 out of 74 days. Thus, on most days of even the two most popular sailing months of the year, the two most popular sites in the Apostle Islands do not exceed a social carrying capacity.

The remaining columns on Table 13 show what we would have expected to have observed in 1981 if an additional marina opened in the Bayfield area with 100, 200, 300 or 400 slips. A two hundred slip marina would be larger than the current Port Superior. The projections were made assuming that each 100 slips would increase input use level by 27.6 boats on weekends, and by 13.4 boats on weekdays, since these were the observed levels in 1981. The regression coefficients from Table 9 were used to translate the input use level into site specific use level or contacts. These coefficients were .093 for Anderson and .058 for Quarry Bay. An additional 100 slips would lead to 27.6 boats out on weekends. This multiplied by .093 or .058 yields a projected increase of 2.6 boats at Anderson and 1.6 boats at Quarry. These figures were added to the 1981 observed levels for each 100 projected additional slips. When the projected levels reached 15 boats per day the area was judged to exceed social capacity. The percentage of days in excess of the 15 boat evaluative standard is presented in Table 13. An increase of up to 200

additional slips has no additional effect on weekdays at either Anderson or Quarry. Adding 300 and 400 new slips is projected, however, to have an impact at Anderson, increasing the number of weekdays that capacity is exceeded to 16 and 18 percent respectively.

Adding slips has a greater impact on weekends since a higher proportion of boats leave the marinas on those days. If an additional 400 slips were created in the Bayfield area, the number of boats mooring at Anderson Bay would be projected to exceed social carrying capacity on 4 out of 5 weekend nights, or twice as often as is now the case. The percentage of nights social capacity would be exceeded at Quarry Bay on weekends would increase from 17 percent of the night to 42 percent.

Of course, weekend days only count for about one-third of the total available days. Increasing the number of slips available by 200 would lead to social carrying capacity excesses on 20 percent of the July and August days at Anderson Bay, and 8 percent of the days at Quarry Bay. Almost all of these excesses would be on weekends. With an additional 400 new slips mooring at Anderson would almost always exceed capacity on weekends, and about 40 percent of the total available days would show an excess at Anderson.

In conclusion, building a 200 slip marina in the Bayfield area would significantly effect the boater mooring experience on weekends, particularly at Anderson Bay. We project no significant effect on weekdays, however, and only a modest effect at Quarry on weekends. Our measure of effect here is the percentage of days that site specific use levels exceed capacity.

Assumptions. Like any projections, these are based on a set of assumptions, and hold only so long as these assumptions are viable. First, the marina development must be in the Bayfield area, along

shoreline ranging from Redcliff Bay to Pikes Bay (the location of Port Superior). Marinas at Washburn, Ashland, and Cornucopia would be likely to have less impact on the system because of the greater sailing distances from these locations to the Apostle Islands. While having a smaller system impact, this does not preclude the possibility of a greater or equal site specific impact. It is possible a boat sailing from an Ashland marina would exert a greater impact on Anderson Bay than boats leaving from the Bayfield area because this location could be the greatest distance a sailboat could reach on a given day, while the Bayfield area boats could reach other sites such as Rocky more easily.

A second assumption is that user preferences would remain unchanged with additional development. If those sailing from the new sites were more (or less) tolerant of crowding, the contact preference curves could change and lead to different social carrying capacities at each site.

A third assumption is that boater behavior patterns remain relatively constant. If suddenly 50 percent of the boats leave their slips on weekends rather than only 27 percent, even the current number of marina slips could create significant capacity excesses. These would be accentuated by development.

A fourth assumption is that the linear estimates between input and site specific use levels remain constant. Our current estimates are based on a small number of cases, so this stability issue is an important question.

Capacity at Other Sites. Contact preference curves were estimated at only the two most popular sites. It is not safe, in our opinion, to assume that these same standards of 15 boats mooring hold in the other sites. It may be that boaters taking the time and effort to sail to Rocky prefer smaller numbers of contacts. It may also be true that in

some of the smaller sites, such as the sand spit at Raspberry or Outer, the social capacities are as low as, or lower than, four or five contacts. The projections on Table 13 hold for Anderson and Quarry Bay sites only.

CONCLUSIONS

The 1981 Apostle Islands boater appears to have more experience sailing in the Apostle Islands than the 1975 boater. They report more contacts at mooring sites, suggesting higher use levels in 1981. In spite of the higher use levels, boaters do not report higher levels of displacement in 1981, i.e. they are not avoiding Stockton Island any more than the 1975 boater. So it appears that 1981 boaters may be more tolerant than 1975 boaters. Comparative data on crowding suggests that the Apostle Islands is one of the more crowded sites we have studied, and while the crowding levels are not extreme, the issue does warrant some concern. The Apostle Islands, in spite of the overall low level of boating density, is perceived as at least slightly crowded by the majority of the boaters surveyed.

There are currently over 450 slips in the Bayfield area. On weekends about 30 percent of these boats leave the marinas, and on peak weekends over 100 boats are observed to be mooring off the Apostle Islands. There are really three popular mooring sites: Anderson and Quarry Bays at Stockton and the Rocky South-Twin Complex. While there are many places to moor off of other islands and sandspits, these locations are all somewhat more exposed to certain weather conditions. By way of contrast, the San Juan Islands, a very popular sailing area in Northern Puget Sound, have much greater protection for mooring than the Apostles. In those islands there are a number of natural harbors which provide protection from all directions. The relatively smooth configuration of

the Apostle Islands greatly limits the available mooring sites and enhances the concentration of mooring boats at Stockton and Rocky. Stockton and Rocky also have the best docks.

Recreation use patterns show that sailing in the Apostles is a weekend phenomena. Input use levels and site specific use levels more than double on weekends. Thus, any capacity problems are most likely to be observed on weekends if at all. Current data show that on most days during the two most popular months of the season, use level does not exceed social carrying capacity at the two most popular sites. However, on almost half of the weekend days social capacity is exceeded at Anderson Bay, under current conditions. The week day sailor almost never encounters excesses of social carrying capacity while mooring at Anderson and Quarry bays.

The conclusion we can make from this study is that an additional 200 slip marina in the Bayfield area would not have a great effect on the current Apostle Islands boating experience. Other capacities, such as ecological and physical, might be more limiting.

FOOTNOTES

[1]The Bayfield area refers to the area from Pikes Bay on the south to Buffalo Bay on the North, including Madeline Island. Whenever a reference is made to the Bayfield area in this report, this is the area that is intended.

[2]In 1965, a social psychologist named Jay Jackson (Jackson, 1965) developed a method to describe and quantify the evaluative dimension of social norms. The technique resulted in graphic descriptors of norms with Jackson call "return potential curves." We have applied his curves.

[3]The number of empty slip counts at the Boat ramp is actually a count of the empty sailboat trailers. The total "slips" were determined by the maximum number of empty sailboat trailers. Consequently, the boat ramp did send all its boats out on some of the days.

[4]The week could be divided into three use periods, based on the total number of boats in Apostle Islands system. Sunday through Tuesday is low use, Wednesday and Thursday is medium use, and Friday and Saturday is high use. For our analysis, a breakdown into low and high use periods is sufficient. (See Appendix 3, Table A3-1 for use level by low, medium, and high use periods).

[5]Quarry Bay Dock has few boats moored there on any day because it does not provide good mooring. It is never filled to capacity, even on the highest use days.

[6]The 1975 Apostle Islands study does not provide information on the percentage of respondents who were local marina slip owners. We assume that there are a higher percentage of local marina slip owners in the 1981 study because of the sampling technique. Therefore, the 1981 boater sample may be somewhat less representative of the Apostle Islands boaters than the 1975 sample.

[7]Regression is a statistical technique that assumes a causal relationship between the variables. In this analysis, the assumption is that an change in the input use level (boats out) causes an change in the site specific use level (boater contacts). In calculating the regression coefficients, we have placed contraints on the analysis so that when X (boats out) is zero, Y (boater contacts is also zero. There is never an actual case when there are no boats out from the marinas. However, without the constraints, Y would be allowed to take on a negative value, which is an impossibility.

[8]Boaters were not asked about their evaluation of zero contacts. Most of the studies cited do not include an evaluation of zero contacts (an exception is Sandhill). The theoretical assumption is that zero contacts would always be the most pleasant and therefore of little value in determining contact preference standards.

REFERENCES

Draper, N. R. and H. Smith. 1977. Applied Regression Analysis. New York: John Wiley and Sons, Inc.

Heberlein, T. T. and J. J. Vaske. 1977. Crowding and Visitor Conflict on the Bois Brule River. Technical Report WIS WRC 77-04, Water Resources Center, University of Wisconsin, Madison

Jackson, J. 1966. A Conceptual and Measurement Model for Norms and Roles. Pacific Sociological Review, 35-47.

Lime, D. W. 1977. Principles of Recreation Carrying Capacity. In Proceedings of Southern States Recreation Research Applications Workshop. Asheville, North Carolina.

Lime D. W. and G. H. Stankey. 1971. Carrying Capacity: Maintaining Outdoor Recreation Quality. In Proceedings of Recreation Symposium, U.S.D.A. Forest Service, Northeastern Forest Experiment Station, Upper Darby, Pennsylvania.

Lucas, R. C. 1964. The Recreational Capacity of the Quetico-Superior Area. USDA Forest Service Resource Paper LS-15. Lake States Forest Experiment Station.

Lucas, R. C. and G. H. Stankey. 1974, Social Carrying Capacity for Backcountry Recreation. In Outdoor Recreation Research: Applying the Results. USDA Forest Service General Technical Report NC-9. North Central Forest Experiment Station.

Shelby, B. and T. A. Heberlein. 1981. Social Carrying Capacity in Recreation Settings. (Unpublished Book Draft).

Stankey, G. H. 1978. Wilderness Carrying Capacity. In J. C. Hendee, G. Stankey and R. C. Lucas, Wilderness Management. USDA Forest Service Miscellaneous Publications No. 1365.

Vaske, J. J. 1978. Contact-Preference Norms Versus Actual Contacts: Crowding Among Brule River Canoers. Paper presented at the Rural Sociological Society Meeting, San Francisco, California.

Wagar, J. A. 1964. The Carrying Capacity of Wildlands for Recreation. Society of American Forester: Forest Service Monograph 2.

APPENDIX I: COMPLETE DATA SET OF DAILY BOAT COUNTS

TABLE A1-1 DAILY BOAT USE LEVEL COUNTS
ALL SITES

MONTH	DATE	DAY OF WEEK	INPUT USE LEVEL	SYSTEM USE LEVEL [1]	STOCKTON ISLAND						
					ANDERSON BAY DOCK		QUARRY BAY DOCK		JULIAN BAY	NORTH* WEST	TOTAL[2]
JUNE	26	FRI	-	17	3	3	3	3	0	0	12
	27	SAT	105	59	11	6	4	2	1	6	24
	28	SUN	62	21	4	3	0	0	0	-	7
	29	MON	48	9	1	3	0	0	1	0	5
	30	TUES	55	19	2	3	2	0	0	-	7
JULY	1	WED	51	13	0	2	0	0	0	-	2
	2	THURS	80	35	11	6	2	0	0	0	19
	3	FRI	157	68	16	5	14	0	0	-	35
	4	SAT	125	95	17	6	11	0	9	1	43
	5	SUN	93	40	8	5	5	2	1	0	21
	6	MON	83	28	5	3	0	0	2	-	10
	7	TUES	123	26	2	3	3	0	0	-	8
	8	WED	60	27	2	5	2	0	3	0	12
	9	THURS	85	25	1	4	3	2	3	0	13
	10	FRI	135	57	4	6	4	1	3	-	18
	11	SAT	154	69	24	6	3	1	7	-	41
	12	SUN	70	21	1	5	2	0	2	0	10
	13	MON	65	27	5	3	3	0	1	-	12
	14	TUES	46	17	1	1	1	1	0	-	4
	15	WED	66	23	5	1	1	0	0	-	7
	16	THURS	72	23	6	3	2	0	0	-	11
	17	FRI	113	56	15	5	7	0	0	-	27
	18	SAT	149	60	-	-	5	1	-	-	-
	19	SUN	59	34	8	6	3	1	0	-	18
	20	MON	58	38	11	5	3	0	0	-	19
	21	TUES	70	42	12	6	3	3	0	-	24
	22	WED	65	33	8	6	1	1	0	-	16
	23	THURS	66	15	2	4	0	0	1	0	7
	24	FRI	102	55	6	7	6	0	7	0	26
	25	SAT	164	85	12	5	18	1	5	1	41
	26	SUN	88	44	7	5	3	1	4	-	20
	27	MON	94	44	11	6	6	1	4	-	28
	28	TUES	128	32	-	-	-	-	-	-	-
	29	WED	92	41	0	4	0	0	8	0	12
	30	THURS	94	50	0	2	2	0	7	0	11
	31	FRI	-	48	0	7	6	0	2	0	15

MONTH	DATE	DAY OF WEEK	INPUT USE LEVEL	SYSTEM USE LEVEL	STOCKTON ISLAND						
					ANDERSON BAY DOCK		QUARRY BAY DOCK		JULIAN BAY	NORTH* WEST	TOTAL2
AUGUST	1	SAT	-	63	-	-	-	-	-	-	-
	2	SUN	114	28	-	-	-	-	-	-	-
	3	MON	84	40	-	-	-	-	-	-	-
	4	TUES	108	50	12	6	8	0	2	-	28
	5	WED	104	54	11	6	11	0	0	0	28
	6	THURS	81	33	4	4	4	0	1	-	13
	7	FRI	92	71	20	5	16	4	5	0	50
	8	SAT	169	126	20	6	19	1	12	0	58
	9	SUN	92	41	4	6	4	1	5	-	20
	10	MON	85	51	18	6	3	0	3	0	30
	11	TUES	74	33	-	-	-	-	-	-	-
	12	WED	71	39	10	8	4	0	0	-	22
	13	THURS	71	30	4	5	7	0	0	-	16
	14	FRI	148	62	7	6	4	0	5	-	22
	15	SAT	167	100	33	7	26	2	0	-	68
	16	SUN	89	48	13	7	4	1	0	-	25
	17	MON	95	28	1	6	1	0	2	-	10
	18	TUES	37	33	7	5	4	0	0	-	16
	19	WED	83	49	4	4	6	5	0	0	19
	20	THURS	84	45	8	6	5	2	0	0	21
	21	FRI	117	72	4	7	0	1	12	4	24
	22	SAT	-	90	19	7	8	1	14	0	49
	23	SUN	139	36	4	4	4	0	6	-	18
	24	MON	46	30	5	3	3	1	0	-	12
	25	TUES	37	26	5	7	0	0	0	-	12
	26	WED	45	28	3	6	1	0	0	-	10
	27	THURS	50	24	8	3	0	0	0	0	11
	28	FRI	-	46	8	5	11	0	0	-	24
	29	SAT	-	75	23	8	12	1	2	-	46
	30	SUN	48	25	4	2	2	0	0	-	8
	31	MON	31	21	1	2	2	0	1	-	6
SEPTEMBER	1	TUES	31	29	1	0	4	0	1	-	6
	2	WED	35	27	5	0	5	0	0	0	10
	3	THURS	31	21	0	1	2	2	0	-	5
	4	FRI	-	42	7	3	1	1	0	-	12
	5	SAT	-	64	15	5	11	1	0	-	32
	6	SUN	131	72	22	7	10	1	0	-	40
	7	MON	-	32	-	-	-	-	-	-	-

1) System Use Level was computed by summing the boat counts at all sites. Missing data was replaced by the Mean boat count for the site

2) Total for Stockton, Raspberry and Oak do not include those sites for which only flyover counts were available.

* Only flyover boat counts were done at this site.

MONTH	DATE	DAY OF WEEK	ROCKY	SOUTH TWIN	RASPBERRY						SAND
					EAST SAND	WEST SPIT	NORTH* DOCK	EAST	NORTH* WEST	TOTAL[2]	
JUNE	26	FRI	0	1	0	3	0	0	0	3	0
	27	SAT	15	3	0	0	0	0	0	0	0
	28	SUN	2	-	-	-	-	-	-	-	-
	29	MON	2	0	0	0	0	0	0	0	1
	30	TUES	0	-	-	-	-	-	-	-	-
JULY	1	WED	1	2	0	1	0	-	-	1	-
	2	THURS	7	2	0	0	0	0	0	0	2
	3	FRI	11	-	-	-	-	-	-	-	2
	4	SAT	15	6	14	5	0	0	0	19	3
	5	SUN	7	2	3	0	0	0	0	3	2
	6	MON	4	-	5	0	0	-	-	5	-
	7	TUES	-	-	-	-	-	-	-	-	-
	8	WED	8	2	1	1	0	0	0	2	0
	9	THURS	4	0	2	0	0	0	0	2	4
	10	FRI	15	7	3	0	0	0	0	3	1
	11	SAT	8	8	1	0	0	-	-	1	0
	12	SUN	2	2	5	0	0	0	0	5	0
	13	MON	3	2	-	-	-	-	-	-	-
	14	TUES	1	-	-	-	-	-	-	-	-
	15	WED	6	1	0	1	1	-	-	2	-
	16	THURS	1	0	4	0	0	-	-	4	-
	17	FRI	9	-	2	2	0	-	-	4	1
	18	SAT	8	-	0	1	0	-	-	1	-
	19	SUN	5	1	-	-	-	-	-	-	-
	20	MON	-	-	-	-	-	-	-	-	-
	21	TUES	2	6	-	-	-	-	-	-	-
	22	WED	4	3	-	-	-	-	-	-	-
	23	THURS	2	1	0	1	0	0	0	1	0
	24	FRI	18	0	2	0	0	0	0	2	1
	25	SAT	18	4	2	2	0	0	0	4	5
	26	SUN	4	2	10	1	0	-	-	11	-
	27	MON	4	-	3	0	0	-	-	3	1
	28	TUES	-	-	3	0	0	-	-	3	-
	29	WED	9	0	5	0	2	0	0	7	0
	30	THURS	25	0	3	1	0	0	-	4	1
	31	FRI	25	0	3	1	0	0	0	4	1

MONTH	DATE	DAY OF WEEK	ROCKY	SOUTH TWIN	RASPBERRY						SAND
					EAST SAND	WEST SPIT	DOCK	NORTH* EAST	NORTH* WEST	TOTAL[2]	
AUGUST	1	SAT	6	-	-	0	0	-	-	8	1
	2	SUN	3	-	-	-	-	-	-	-	0
	3	MON	11	-	4	2	0	-	-	6	1
	4	TUES	-	-	6	0	0	-	-	6	2
	5	WED	8	2	3	3	0	0	2	6	0
	6	THURS	-	-	0	5	0	-	-	6	1
	7	FRI	8	1	1	1	1	0	1	5	0
	8	SAT	28	3	13	1	0	0	0	3	5
	9	SUN	-	-	6	0	0	-	-	14	1
	10	MON	15	0	4	0	0	0	2	6	0
	11	TUES	-	-	4	0	0	-	-	4	-
	12	WED	5	2	-	-	4	-	-	4	1
	13	THURS	2	2	2	1	0	-	-	-	1
	14	FRI	13	-	9	1	0	-	-	3	-
	15	SAT	5	6	0	10	0	-	-	10	1
	16	SUN	8	6	0	2	0	-	-	10	-
	17	MON	-	-	2	0	0	-	-	2	2
	18	TUES	-	-	0	2	0	-	-	2	-
	19	WED	17	0	0	0	0	0	0	2	1
	20	THURS	6	5	1	2	0	0	2	0	3
	21	FRI	19	2	2	0	0	1	0	3	6
	22	SAT	9	12	0	0	0	0	0	2	2
	23	SUN	-	-	-	-	-	-	-	0	-
	24	MON	-	-	-	-	-	-	-	-	-
	25	TUES	2	-	-	-	-	-	-	-	-
	26	WED	-	2	-	-	-	-	-	-	-
	27	THURS	1	6	0	0	0	0	0	-	0
	28	FRI	1	-	-	-	-	-	-	0	-
	29	SAT	9	-	1	2	0	-	-	-	-
	30	SUN	-	3	0	1	0	-	-	3	-
	31	MON	3	-	-	-	-	-	-	1	-
SEPTEMBER	1	TUES	14	1	0	1	0	-	-	-	-
	2	WED	-	4	1	0	0	-	-	1	0
	3	THURS	4	-	-	-	-	-	-	1	-
	4	FRI	-	-	0	1	0	-	-	-	-
	5	SAT	-	-	0	3	1	-	-	1	-
	6	SUN	-	-	1	1	1	-	-	4	-
	7	MON	-	-	-	-	-	-	-	3	-

			OAK					OUTER*							
MONTH	DATE	DAY OF WEEK	SAND SPIT	DOCK	NORTH* WEST	NORTH* EAST	TOTAL[2]	CAT	EAST	WEST	TOTAL	BEAR*	BASS WOOD	YORK	ELSE-WHERE
JUNE	26	FRI	0	0	0	1	0	0	0	0	0	0	0	0	0
	27	SAT	0	0	0	9	0	0	0	0	0	0	0	0	2
	28	SUN	-	-	-	-	-	-	-	-	-	-	-	-	-
	29	MON	0	0	0	0	0	0	0	0	0	0	1	0	0
	30	TUES	-	-	-	-	-	-	-	-	-	-	-	-	-
JULY	1	WED	-	-	-	-	0	0	-	-	-	-	-	-	-
	2	THURS	0	1	0	0	1	1	0	0	0	0	3	0	0
	3	FRI	-	2	-	-	-	-	-	-	-	-	-	-	-
	4	SAT	1	1	2	1	2	2	0	0	0	0	0	1	0
	5	SUN	0	0	0	2	0	0	0	1	1	0	0	2	0
	6	MON	1	0	-	-	1	-	-	-	-	-	-	-	-
	7	TUES	-	-	-	-	-	-	-	-	-	-	-	-	-
	8	WED	0	0	0	0	0	0	0	0	0	0	0	0	3
	9	THURS	0	0	0	1	0	0	0	0	0	1	0	0	0
	10	FRI	0	1	0	0	1	0	0	1	1	0	0	2	7
	11	SAT	-	-	-	-	-	-	-	-	-	-	-	-	-
	12	SUN	0	0	0	0	0	0	0	0	0	0	0	0	2
	13	MON	-	0	-	-	-	-	-	-	-	-	-	-	-
	14	TUES	-	-	-	-	-	-	-	-	-	-	-	-	-
	15	WED	0	1	-	-	1	-	-	-	-	-	-	-	-
	16	THURS	-	-	-	-	-	-	-	-	-	-	-	-	-
	17	FRI	0	1	-	-	1	-	-	-	-	-	-	-	-
	18	SAT	1	1	-	-	2	-	-	-	-	-	-	-	-
	19	SUN	1	0	-	-	1	-	-	-	-	-	-	-	-
	20	MON	1	1	-	-	2	-	-	-	-	-	-	-	-
	21	TUES	-	-	-	-	-	-	-	-	-	-	-	-	-
	22	WED	-	-	-	-	-	-	-	-	-	-	-	-	-
	23	THURS	0	3	0	0	3	0	0	0	0	0	0	0	1
	24	FRI	0	0	0	0	0	0	0	0	0	0	0	0	8
	25	SAT	0	1	1	0	1	0	7	0	0	0	0	0	3
	26	SUN	-	3	-	-	-	-	-	-	-	-	-	-	-
	27	MON	-	-	-	-	-	-	-	-	-	-	-	-	-
	28	TUES	-	-	-	-	-	-	-	-	-	-	-	-	-
	29	WED	0	3	3	0	3	0	0	0	0	3	0	1	3
	30	THURS	0	0	0	1	0	0	0	0	0	0	0	1	7
	31	FRI	0	0	0	0	0	0	0	0	0	2	0	0	1

MONTH	DATE	DAY OF WEEK	OAK					OUTER*							
			SAND SPIT	DOCK	NORTH-WEST	NORTH-EAST	TOTAL[2]	CAT-	EAST	WEST	TOTAL	BEAR*	BASS WOOD	YORK	ELSE-WHERE
AUGUST	1	SAT	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	SUN	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	MON	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	TUES	-	-	-	-	-	-	-	-	-	-	-	-	-
	5	WED	0	0	1	0	0	2	0	0	0	1	1	0	3
	6	THURS	-	-	-	-	-	-	-	-	-	-	-	-	-
	7	FRI	0	0	0	0	0	0	0	0	0	1	1	0	6
	8	SAT	2	0	1	0	2	0	0	1	1	1	3	1	9
	9	SUN	-	-	-	-	-	-	-	-	-	-	-	-	-
	10	MON	0	0	0	0	0	0	0	0	0	0	0	0	0
	11	TUES	-	-	-	-	-	-	-	-	-	-	-	-	-
	12	WED	-	-	-	-	-	-	-	-	-	-	-	-	-
	13	THURS	-	-	-	-	-	-	-	-	-	-	-	-	-
	14	FRI	-	-	-	-	-	-	-	-	-	-	-	-	-
	15	SAT	-	-	-	-	-	0	0	0	0	1	-	-	-
	16	SUN	-	-	-	-	-	-	-	-	-	-	-	-	-
	17	MON	-	-	-	-	-	-	-	-	-	-	-	-	-
	18	TUES	-	-	-	-	-	-	-	-	-	-	-	-	-
	19	WED	1	1	0	0	2	4	0	2	2	1	0	0	3
	20	THURS	0	0	0	1	0	1	0	0	0	0	1	0	1
	21	FRI	0	1	1	0	1	0	0	0	0	6	1	2	2
	22	SAT	0	1	0	0	1	2	0	0	0	5	1	0	1
	23	SUN	-	-	-	-	-	-	-	-	-	-	-	-	-
	24	MON	-	-	-	-	-	-	-	-	-	-	-	-	-
	25	TUES	-	-	-	-	-	-	-	-	-	-	-	-	-
	26	WED	-	-	-	-	-	-	-	-	-	-	-	-	-
	27	THURS	0	4	0	1	4	0	0	0	0	0	0	0	1
	28	FRI	-	-	-	-	-	-	-	-	-	-	-	-	-
	29	SAT	-	-	-	-	-	-	-	-	-	-	-	-	-
	30	SUN	-	-	-	-	-	-	-	-	-	-	-	-	-
	31	MON	-	-	-	-	-	-	-	-	-	-	-	-	-
SEPTEMBER	1	TUES	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	WED	-	-	-	-	-	-	0	0	0	-	1	0	3
	3	THURS	-	-	-	-	-	0	-	-	-	-	-	-	-
	4	FRI	-	-	-	-	-	-	-	-	-	-	-	-	-
	5	SAT	-	-	-	-	-	-	-	-	-	-	-	-	-
	6	SUN	-	-	-	-	-	-	-	-	-	-	-	-	-
	7	MON	-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX 2: COMPARISON OF FLYOVER AND RANGER SAILBOAT COUNTS

Neither the flyovers nor the ranger boat counts provide data for all 74 days of the study period. Flyover data is available for only 1/3 of the days. Dependent on the site, the days observed for flyovers varies from 23 to 27 (Table A2-1). The ranger counts are, in general, more complete than the flyover counts (Table A2-2). For example, while there are only 27 days observed on the flyovers at Anderson Bay, ranger counts are available on 63 days. At Rocky, there are twice as many days observed by the rangers as by the flyovers.

While the ranger counts are more complete in terms of time, they are less complete in terms of area. It was not logistically feasible for the rangers to cover all the possible mooring sites within the boundaries of the Apostle Islands National Lakeshore. Therefore, the ranger counts are available for fewer sites than the flyover counts. Ranger counts were taken at all the more popular sites, including those on Stockton, Rocky, South Twin, and Raspberry (Table A2-2).

In general, the Ranger counts are somewhat higher than, or equal to, the sailboat flyover counts as indicated in Table A2-3, which compares ranger and flyover counts. At Stockton, the mean for ranger counts is only .4 boats higher than the the mean flyover count. Similarly, at Quarry Bay and Julian Bay, the differences in the mean number of boats observed by flyovers and by ranger counts are so slight they can be considered estimation errors. It's only at Rocky and Oak that the mean ranger count is lower than the mean flyover count. At Oak, we were only able to obtain boat counts by rangers on six days, i.e., less than 10% of the days during the study period.

Flyovers and Ranger counts, with one exception, are highly related. For Sand, the correlation between the ranger and flyover counts is only .12. This is probably due to the fact that it is difficult to obtain accurate

counts at Sand Island using either method. Consequently, there is quite a bit of error in both measures. The intercorrelations (Table A2-3) could be regarded as reliability coefficients, since they appear to be the strength of the relationship between two different measures of the same variable. If we look more closely, we can see that they are measuring somewhat different things. Flyover counts were done in the morning when boats had already started to move from their overnight mooring sites. Ranger counts were done in the evening when boaters had settled down for the night. The numbers in parentheses following the correlations in Table 8 refer to the number of days on which there were both ranger and flyover counts. The highest number of coinciding counts is 23 (Anderson Bay, Quarry Dock, and Julian Bay). There are numerous days when there is a Ranger count but not a flyover count.

If we examine the correlations, we find that for the eleven sites for which these are both ranger and flyover counts, five are above .85. (We have not included Stockton and Raspberry because they are simply aggregation of the specific sites on each island) Only two are below .50: Quarry Bay and the Dock at Quarry. We can assume that, given the high intercorrelations, the basis for merging the two measures is valid.

TABLE A2-1

SAILBOAT COUNTS BY FLYOVERS AT

APOSTLE ISLANDS, SUMMER 1981

LOCATION	DAILY NUMBER OF BOATS MEAN	MEDIAN	MAXIMUM	DAYS OBSERVED	% OF DAYS WITH BOATS	POPULARITY INDEX[a]
STOCKTON	19.60	14.75	49	25	100.00	1960
Anderson Bay	6.44	4.00	23	27	85.2	549
Dock at Anderson	3.59	4.79	7	27	81.5	293
Quarry Bay	4.67	2.43	19	27	74.1	346
Dock at Quarry	.85	.29	5	27	37.0	31
Julian Bay	3.04	1.38	14	27	63.0	191
Elsewhere	.48	.10	6	25	16.0	8
ROCKY	9.72	8.00	28	25	96.0	9[illegible]
SOUTH TWIN	2.23	1.50	12	26	61.5	137
RASPBERRY	2.92	2.38	15	25	68.0	199
East of Sand Spit	1.92	1.00	11	25	56.0	108
West of Sand Spit	.60	.19	5	25	28.0	17
Dock	.08	.02	2	25	4.0	.3
Elsewhere	.32	.12	2	25	20.0	6
SAND	.62	.18	4	26	26.0	17
OAK	1.74	1.25	6	23	69.6	121
CAT	.48	.18	4	27	35.0	17
OUTER	.44	.11	7	27	18.5	8
BEAR	.85	.31	6	26	38.5	33
BASSWOOD	.50	.26	3	26	34.6	17
YORK	.38	.18	2	26	26.9	10
ELSEWHERE	2.54	1.83	9	26	73.1	186
TOTAL	43.00	42.00	109	25		

[a] Popularity Index - $\bar{x}$ multiplied by %

TABLE A2-2

SAILBOAT COUNTS BY RANGERS AT

APOSTLE ISLANDS, SUMMER 1981

LOCATION	DAILY NUMBER OF BOATS MEAN	MEDIAN	MAXIMUM	DAYS OBSERVED	% of DAYS WITH BOATS	POPULARITY INDEX[a]
STOCKTON	18.97	16.12	68	63	100.00	1897
Anderson Bay	7.84	5.75	33	63	96.8	759
Dock at Anerson	4.62	5.04	8	63	96.8	447
Quarry Bay	4.92	3.65	26	59	94.9	467
Dock at Quarry	.59	.45	3	59	47.5	28
Julian Bay	1.60	.351	14	63	41.3	66
ROCKY	7.04	4.90	25	50	98.0	690
SOUTH TWIN	3.26	2.25	12	31	90.3	294
RASBERRY	4.21	3.17	17	44	100.00	421
East of Sand Spit	2.91	1.92	14	44	72.7	212
West of Sand Spit	1.60	.77	10	44	59.1	95
Dock	.22	.08	4	45	13.3	3
SAND	1.62	1.17	6	26	88.5	143
OAK	1.33	1.25	2	6	100.0	133

[a]Popularity Index - $\bar{x}$ multiplied by %

TABLE A2-3

COMPARISON OF FLYOVER BOAT COUNTS
AND RANGER BOAT COUNTS
APOSTLE ISLAND, SUMMER 1981

LOCATION	FLYOVERS		RANGER COUNTS		CORRELATIONS OF FLYOVER AND RANGER COUNTS	
	DAYS OBSERVED	MEAN NO. OF BOATS	DAYS OBSERVED	MEAN NO. OF BOATS		
STOCKTON	25	19.6	63	20.0	.92	(21)
ANDERSON BAY	27	6.4	63	7.8	.66	(23)
DOCK AT ANDERSON	27	3.6	63	4.6	.79	(21)
QUARRY BAY	27	4.7	59	4.9	.45	(21)
DOCK AT QUARRY	27	.8	59	.6	.39	(23)
JULIAN BAY	27	3.0	63	1.6	.77	(23)
ELSEWHERE	25	.5	-	-	-	**
ROCKY	25	9.7	50	7.0	.64	(19)
SOUTH TWIN	26	2.2	31	3.3	.95	(15)
RASBERRY	25	2.9	44	4.2	.86	(15)
EAST OF SAND SPIT	25	1.9	44	2.9	.87	(15)
WEST OF SAND SPIT	25	.6	44	1.6	.56	(15)
DOCK	25	.1	45	.2	.88	(15)
ELSEWHERE	25	.3	-	-	-	**
SAND	26	.6	26	1.6	.12	(12)
OAK	23	1.7	6	1.3		
CAT	27	.5	-	-	- *	
OUTER	27	.4	-	-	- **	
BEAR	26	.8	-	-	- **	
BASSWOOD	26	.5	-	-	- **	
YORK	26	.3	-	-	- **	
ELSEWHERE	26	2.5	-	-	- **	

* Too few cases

** No ranger counts at this site

APPENDIX 3: DAILY COUNT OF SAILBOATS BY USE PERIOD - LOW, MEDIUM AND HIGH USE DAYS

TABLE A3-4

DAILY NUMBER OF SAILBOATS BY USE PERIOD*

APOSTLE ISLANDS, SUMMER 1981

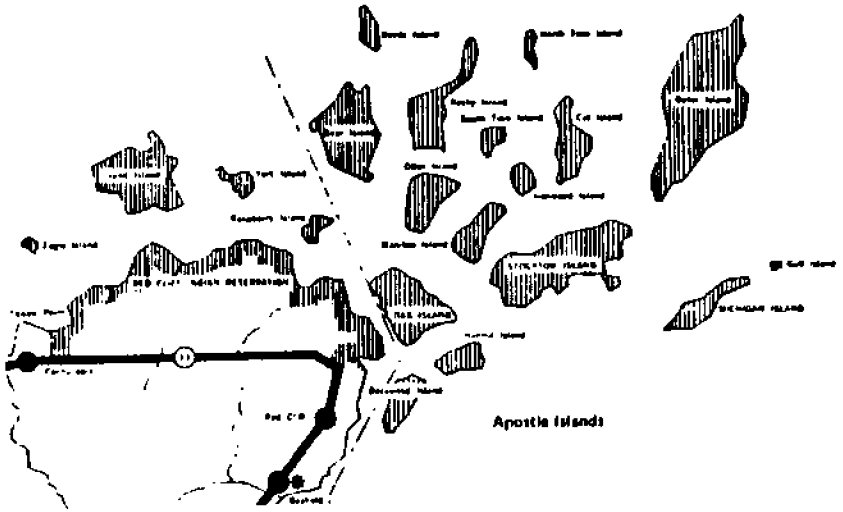
LOCATION	LOW USE DAYS				MEDIUM USE DAYS				HIGH USE DAYS			
	MEAN	MEDIAN	MAXIMUM	DAYS OBSERVED	MEAN	MEDIAN	MAXIMUM	DAYS OBSERVED	MEAN	MEDIAN	MAXIMUM	DAYS OBSERVED
STOCKTON	15.70	12.33	40	27	13.25	12.00	28	20	33.35	27.50	68	20
ANDERSON BAY	10.55	8.33	29	27	8.60	8.00	18	20	18.95	17.50	40	20
DOCK	6.48	4.88	22	27	4.60	4.17	11	20	11.20	12.50	33	20
	4.37	4.60	7	27	4.00	4.10	8	20	5.75	5.83	8	20
QUARRY BAY	3.56	3.38	11	27	3.50	2.50	11	20	10.00	7.00	28	21
DOCK	3.07	2.94	10	27	2.90	2.10	11	20	9.00	7.00	26	21
	.48	.29	3	27	.60	.17	5	20	1.00	.35	4	21
JULIAN	1.30	.60	6	27	1.15	.21	8	20	4.20	2.50	14	20
ROCKY	4.84	3.33	15	19	6.47	5.00	25	17	11.95	9.50	28	20
SOUTH TWIN	2.27	1.86	6	11	1.89	1.79	6	18	4.08	3.25	12	17
RASPBERRY EAST OF SAND SPIT	3.72	3.25	11	18	2.56	2.17	7	16	4.80	3.25	19	20
WEST OF SAND SPIT	3.11	3.17	10	18	1.38	.83	5	16	3.05	1.50	14	20
DOCK	.56	.32	2	18	1.00	.67	5	16	1.65	1.00	10	20
	.06	.03	1	18	.41	.11	4	17	.10	.06	1	20
SAND	1.00	1.00	2	10	1.00	.70	4	14	1.81	1.17	6	16
OAK SANDSPIT	.57	.38	2	7	1.27	.75	4	11	.85	.80	2	13
DOCK	.43	.38	1	7	.09	.05	1	11	.31	.15	2	13
	.44	.14	3	9	1.18	.67	4	11	.64	.64	2	14

* The week is divided into three use periods: Sunday, Monday and Tuesday are low use days; Wednesday and Thursday are medium use days; Friday and Saturday are high use days. Use level is based on evening mooring counts.

APPENDIX 4: APOSTLE ISLAND BOATER SURVEY - MAILED QUESTIONNAIRE

APOSTLE ISLANDS BOATER SURVEY

1981



THIS QUESTIONNAIRE SHOULD BE FILLED OUT BY THE CAPTAIN

THE QUESTIONNAIRE HAS BEEN DIVIDED INTO SECTIONS TO MAKE IT EASIER FOR YOU TO COMPLETE. PLEASE TRY TO ANSWER EVERY QUESTION. WE CAN ONLY TALK TO A SMALL SAMPLE OF ALL OF THE APOSTLE ISLANDS BOATERS, SO EVERY ONE OF YOUR ANSWERS IS VERY IMPORTANT TO OUR STUDY.

DEPARTMENT OF RURAL SOCIOLOGY
UNIVERSITY OF WISCONSIN-MADISON

BE SURE TO FILL OUT THE DATES OF YOUR TRIP

WE WOULD LIKE TO KNOW EXACTLY WHEN YOU MADE THE BOATING TRIP YOU ARE REPORTING IN THIS QUESTIONNAIRE.

FROM: ________ (MONTH) ________ (DATE)

TO: ________ (MONTH) ________ (DATE)

YOU SHOULD ANSWER ITEMS THAT REFER TO "THIS TRIP" OR "YOUR CURRENT TRIP" ACCORDING TO THE ABOVE TRIP.

FIRST, WE WOULD LIKE TO KNOW ABOUT YOUR BOAT.

1. What is the name of your boat?

____

2. Do you own or charter the boat? (CHOOSE ONE)

____ own the boat
____ chartered the boat
____ I'm sailing with friends who own the boat

3. Is the boat usually stored at a marina near the Apostle Islands?

____ yes--WHICH ONE?
  ____ Port Superior
  ____ Bayfield
  ____ Madeline Island
  ____ Schooner Inn
  ____ Red Cliff
  ____ Buffalo Bay
  ____ other ____________

____ no--WHERE IS IT USUALLY STORED?

____

4. How did you get your boat to the Apostle Islands? (CHOOSE ONE)

____ sailed from the marina where it is stored
____ trailered the boat to a marina near the Apostle Islands
____ trailered the boat to a public boat landing

5. Is your boat: (CHOOSE ONE)

____ a sailboat
____ a motorboat

6. Including yourself, how many people are on the boat?

____ people

7. When was your first boating trip in the Apostle Islands? (CHOOSE ONE)

____ this is my first trip
____ last year (1980)
____ 2 years ago (1979)
____ 3 years ago (1978)
____ 4 years ago (1977)
____ 5 years ago (1976)
____ 6 years ago (1975)
____ 7-8 years ago (1973-74)
____ 9-10 years ago (1971-72)
____ more than 10 years ago (1970 or earlier)

8. How many boating trips have you made to the Apostle Islands so far this season? (CHOOSE ONE)

___ this is my 1st trip this season
___ this is my 2nd trip this season
___ this is my 3rd trip this season
___ this is my 4th trip this season
___ this is my 5th trip this season
___ this is my 6th trip this season
___ this is my 7th trip this season
___ this is my 8th trip this season
___ this is my 9th trip this season
___ this is at least my 10th trip this season

9. Since you first began boating in the Apostle Islands, how many trips have you made here? (CHOOSE ONE)

___ this is my first trip ever
___ I've made 2 trips
___ I've made 3 trips
___ I've made 4 trips
___ I've made 5-6 trips
___ I've made 7-8 trips
___ I've made 9-10 trips
___ I've made 11-15 trips
___ I've made 16-20 trips
___ I've made more than 20 trips

THIS NEXT SECTION IS ABOUT YOUR CURRENT TRIP

1. [redacted] (CHOOSE ONE)

___ [redacted]
___ [redacted]
___ [redacted]
___ [redacted]
___ [redacted]
___ [redacted]
___ [redacted]
___ [redacted]

2. Did you leave from a marina on this trip?

___ yes--WHICH ONE? ___ Port Superior ___ Bayfield ___ Madeline Is. ___ Other _____ ___ Schooner Inn ___ Red Cliff ___ Buffalo Bay

___ no--WHERE DID YOU PUT YOUR BOAT IN?

_____

_____

3. How much time did you spend at the marina (or the area where you began your trip) before you went out into the Apostle Islands? (CHOOSE ONE)

___ I didn't leave from a marina in the Apostle Islands area
___ a few hours (1/2 day)
___ one day
___ 1 1/2 days
___ 2 days
___ 2 1/2 days
___ 3 or more days

4. When you were planning a route for this trip, were there any islands you decided to avoid mooring at because you expected too many other boats would be there?

___ yes--WHICH ISLAND(S)? _____ Island _____ Island _____ Island

___ no

5. On this trip, so far, have there been any times when there were too many other boats on the water for you to enjoy the kind of boating experience you prefer?

___ yes--WHICH ISLANDS WERE YOU NEAR?

_____ Island
_____ Island
_____ Island

___ no

6. On this trip, so far, have there been any times when there were too many other boats moored in the same area as you for you to enjoy the type of mooring you prefer?

___ yes--WHICH ISLANDS WERE YOU MOORED OFF?

_____ Island
_____ Island
_____ Island

___ no

7. Including your own, how many boats are moored or docked in this area now?

___ boats

8. How do you feel about seeing this number of boats moored or docked here now? (CHOOSE ONE)

1 Very Unpleasant — 2 Unpleasant — 3 Neutral — 4 Pleasant — 5 Very Pleasant

9. So far, how satisfied are you with your Apostle Islands boating trip? (CHOOSE ONE)

___ poor
___ fair, things haven't worked out very well
___ good, but a number of things could have been better
___ very good, but some things could have been better
___ excellent, only minor problems
___ perfect

10. So far, how crowded have you felt on your Apostle Islands boating trip? (CIRCLE ONE NUMBER)

1	2	3	4	5	6	7	8	9
Not at all Crowded			Slightly Crowded			Moderately Crowded		Extremely Crowded

WE WOULD ALSO LIKE TO KNOW SOME OF YOUR FEELINGS ABOUT BOATING IN THE APOSTLE ISLANDS AND HOW THE ISLANDS SHOULD BE MANAGED.

1. When you are boating in the Apostle Islands, do you prefer to moor at a dock or off-shore?

____ I prefer to moor at a dock--WHY? (CHOOSE THE MOST IMPORTANT REASON)

- ____ easier access to the dock
- ____ chance to meet other people
- ____ place for kids to play
- ____ it is nice to get off the boat for awhile
- ____ it is a safer place to moor
- ____ other _____

____ I prefer to moor off-shore--WHY? (CHOOSE THE MOST IMPORTANT REASON)

- ____ away from other boats
- ____ too many people on the docks
- ____ enjoy using the dinghy
- ____ it is a safer place to moor
- ____ other _____

2. Do you feel that there are docks on certain islands which might be too full if you wait until the end of the day (6:00 or 7:00 p.m.) to moor?

____ yes--WHICH ISLANDS? _____ Island
_____ Island
_____ Island

WHAT DO YOU DO? (CHOOSE ONE)

- ____ I avoid these islands altogether
- ____ I plan on mooring off-shore
- ____ I get to these islands earlier in the day
- ____ I have a second choice for a mooring spot if the dock is full when I get there

____ no, I don't worry about docks or mooring sites being full on any of the islands

DAILY TRIP LOG

THE DAILY TRIP LOG DESCRIBES YOUR ROUTE ON THIS TRIP. PLEASE FILL OUT A SHEET OF QUESTIONS FOR EACH DAY YOU HAVE BEEN ON THE WATER. (If you have been on the water more than 3 days on this trip, please use the additional trip log sheets.)

FIRST DAY ON THE WATER

1. After the first day on the water, where did you moor for the evening?

_____ Island

Please describe the location at which you moored (such as Quarry Bay or the Southeastern corner, etc.)

_____

_____

2. About how many other boats were moored there that night? (CHOOSE ONE)

- ____ no other boats
- ____ 1-2 other boats
- ____ 3-5 other boats
- ____ 6-10 other boats
- ____ 11-15 other boats
- ____ 16-20 other boats
- ____ 21-30 other boats
- ____ more than 30 other boats

3. How crowded did you feel when you were moored there that night? (CIRCLE ONE NO.)

1	2	3	4	5	6	7	8	9
Not at all Crowded			Slightly Crowded			Moderately Crowded		Extremely Crowded

4. Were you able to moor where you wanted to on the first day? (CHOOSE ONE)

- ____ Yes, we moored at the island we wanted
- ____ No, we were unable to moor off the island we wanted to because of the weather--WHAT ISLAND WAS THIS? _____ Island
- ____ No, we were unable to moor off the island we wanted to because there were too many other boats there--WHICH ONE? _____ Island

5. Were you able to moor at the location you wanted off this island on the first day? (CHOOSE ONE)

- ____ Yes, we wanted to moor off a dock and were able to.
- ____ Yes, we wanted to moor off-shore and were able to.
- ____ No, we wanted to moor off a dock but there were too many boats so we moored off-shore.
- ____ No, we wanted to moor off-shore but there were too many boats so we moored off a dock.

SECOND DAY ON THE WATER

☐ Check here if you were only on the water for 1 day

1. After the second day on the water, where did you moor for the evening?

_____ Island

Please describe the location at which you moored (such as Quarry Bay or the Southeastern corner, etc.)

_____

_____

2. About how many other boats were moored there that night? (CHOOSE ONE)

____ no other boats	____ 11-15 other boats
____ 1-2 other boats	____ 16-20 other boats
____ 3-5 other boats	____ 21-30 other boats
____ 6-10 other boats	____ more than 30 other boats

3. How crowded did you feel when you were moored there that night? (CIRCLE ONE NO.)

1	2	3	4	5	6	7	8	9
Not at all Crowded		Slightly Crowded		Moderately Crowded				Extremely Crowded

4. Were you able to moor where you wanted to on the second day? (CHOOSE ONE)

____ Yes, we moored at the island we wanted

____ No, we were unable to moor off the island we wanted to because of the weather--WHAT ISLAND WAS THIS?

_____ Island

____ No we were unable to moor off the island we wanted to because there were too many other boats there--WHICH ISLAND?

_____ Island

5. Were you able to moor at the location you wanted off this island on the second day? (CHOOSE ONE)

____ Yes, we wanted to moor off a dock and were able to.

____ Yes, we wanted to moor off-shore and were able to.

____ No, we wanted to moor off a dock but there were too many boats so we moored off-shore.

____ No, we wanted to moor off-shore but there were too many boats so we moored off a dock.

THIRD DAY ON THE WATER

☐ Check here if you were only on the water for 2 days or less

1. After the third day on the water, where did you moor for the evening?

_____ Island

Please describe the location at which you moored (such as Quarry Bay or the Southeastern corner, etc.)

_____

_____

2. About how many other boats were moored there that night? (CHOOSE ONE)

____ no other boats	____ 11-15 other boats
____ 1-2 other boats	____ 16-20 other boats
____ 3-5 other boats	____ 21-30 other boats
____ 6-10 other boats	____ more than 30 other boats

3. How crowded did you feel when you were moored there that night? (CIRCLE ONE NO.)

1	2	3	4	5	6	7	8	9
Not at all Crowded		Slightly Crowded		Moderately Crowded				Extremely Crowded

4. Were you able to moor where you wanted to on the third day? (CHOOSE ONE)

____ Yes, we moored at the island we wanted.

____ No, we were unable to moor off the island we wanted to because of the weather--WHAT ISLAND WAS THIS?

_____ Island

____ No, we were unable to moor off the island we wanted to because there were too many other boats there--WHICH ISLAND?

_____ Island

5. Were you able to moor at the location you wanted off this island on the third day? (CHOOSE ONE)

____ Yes, we wanted to moor off a dock and were able to.

____ Yes, we wanted to moor off-shore and were able to.

____ No, we wanted to moor off a dock but there were too many boats so we moored off-shore.

____ No, we wanted to moor off-shore but there were too many boats so we moored off a dock.

IF YOU WERE ON THE WATER FOR MORE THAN 3 DAYS, PLEASE USE THE ADDITIONAL SHEETS FOR YOUR TRIP LOG.

Now, we would like you to think back to the times you've moored off Stockton Island. The two mooring areas we are interested in are Anderson Bay, the dock by the ranger station on the western side of Presque Isle and Quarry Bay, on the southwestern side of Stockton Island

FIRST, CONSIDER ANDERSON BAY, BY THE STOCKTON ISLAND RANGER STATION

1. If you were going to moor there, how would you feel about seeing 7 other boats moored at the dock? (CIRCLE ONE NUMBER)

1	2	3	4	5
Very Unpleasant	Unpleasant	Neutral	Pleasant	Very Pleasant

____ I don't know, I've never been moored in Anderson Bay.

2. How would you feel about seeing 11 other boats moored off-shore in Anderson Bay? (CIRCLE ONE NUMBER)

1	2	3	4	5
Very Unpleasant	Unpleasant	Neutral	Pleasant	Very Pleasant

____ I don't know, I've never been moored in Anderson Bay

3. Considering both the dock and the off-shore mooring areas in Anderson Bay, what is the largest number of boats that could be moored there before it would be too crowded for a pleasant mooring experience in good weather?

____ boats would be too many

____ I don't know, I've never moored in Anderson Bay

SECOND, CONSIDER QUARRY BAY ON THE SOUTHWESTERN SIDE OF STOCKTON ISLAND.

1. If you were going to moor there, how would you feel about seeing 3 other boats moored at the dock in Quarry Bay? (CIRCLE ONE NUMBER)

1	2	3	4	5
Very Unpleasant	Unpleasant	Neutral	Pleasant	Very Pleasant

____ I don't know, I've never moored in Quarry Bay.

2. How would you feel about seeing 11 other boats moored off-shore in Quarry Bay? (CIRCLE ONE NUMBER)

1	2	3	4	5
Very Unpleasant	Unpleasant	Neutral	Pleasant	Very Pleasant

____ I don't know, I've never moored in Quarry Bay.

3. Considering both the dock and the off-shore mooring areas in Quarry Bay, what is the largest number of boats that could be moored there before it would be too crowded for a pleasant mooring experience in good weather?

____ boats would be too many

Next, we would like you to think of the various marinas such as Port Superior, Bayfield, Madeline Island, Schooner Inn, Red Cliff and Buffalo Bay that are close to the Apostle Islands. These marinas have mooring space for about 700 boats.

How would you feel if marina space for an additional 400 boats were constructed in the Apostle Islands area?

1. Do you think that additional marina space for 400 boats would make sailing in the Apostle Islands too crowded?

____ Definitely Yes
____ probably yes
____ probably not
____ Definitely Not

2. Do you think that the additional marina space would make overnight mooring too crowded?

____ Definitely Yes
____ probably yes
____ probably not
____ Definitely Not

3. If additional marina space for 400 boats was constructed in the Apostle Islands, would you like to see more docks constructed off islands?

____ Definitely Yes
____ probably yes
____ probably not
____ Definitely not

THIS NEXT SECTION CONTAINS A SERIES OF QUESTIONS THAT ARE OF INTEREST TO ECONOMISTS WHO STUDY RECREATIONAL VISITORS TO AN AREA. THEY USE INFORMATION LIKE THE DISTANCE TRAVELLED, THE AMOUNT OF TIME SPENT AT AN AREA AND A PERSON'S INCOME TO ESTIMATE HOW VALUABLE A RECREATIONAL EXPERIENCE IS. WHILE WE RECOGNIZE THAT THERE ARE MANY OTHER ASPECTS WHICH MAKE A RECREATION EXPERIENCE VALUABLE, MANY PROJECTIONS RELY SOLELY ON ECONOMIC INDICATORS. THESE QUESTIONS SHOULD PROVIDE INFORMATION WHICH WILL IMPROVE THE INDICATORS WHICH ARE NOW USED IN THIS WAY.

YOUR ANSWERS TO THESE QUESTIONS ARE STRICTLY CONFIDENTIAL. INDIVIDUALS ARE NEVER IDENTIFIED AND OUR RESULTS ARE REPORTED ONLY FOR GROUPS OF PEOPLE SUCH AS "50% OF THE APOSTLE ISLANDS BOATERS MAKE MORE THAN ONE TRIP PER SEASON."

1. After this one, do you expect to make any more boating trips to the Apostle Islands this season?

   ____ yes--HOW MANY MORE TRIPS DO YOU EXPECT TO MAKE?
   ____ trips
   ____ no, I don't expect to make any more boating trips this season

2. Do you own land or a residence in the Bayfield area? (WITHIN 25 MILES OF BAYFIELD)

   ____ yes--DO YOU: (CHOOSE ONE)
   ____ live there year round
   ____ live there during the summer or boating season
   ____ visit occasionally during the summer or boating season
   ____ no, I don't own land within 25 miles of Bayfield

3. How far did you have to travel to get from your home (where you live in the summer) to the marina where you store or charter your boat or the place where you put your boat in for this trip? (CHOOSE ONE)

   ____ less than 25 miles
   ____ 25-74 miles
   ____ 75-149 miles
   ____ 150-224 miles
   ____ 225-299 miles
   ____ 300-399 miles
   ____ 400-500 miles
   ____ more than 500 miles

4. What form of transportation did you use to get from your home (where you live in the summer) to the marina where you store or charter your boat?

   ____ full-sized automobile
   ____ intermediate sized autorobile
   ____ compact or small automobile
   ____ private airplane
   ____ recreational vehicle
   ____ commercial airplane
   ____ other, please specify:
   _____
   _____

5. How long did it take you to travel from your home (during the summer) to the marina where you store or charter your boat or the place where you put your boat in for this trip?

   ____ less than 1 hour
   ____ 1-2 hours
   ____ 3-4 hours
   ____ 5-6 hours
   ____ 7-8 hours
   ____ 9 or more hours

6. Usually, how enjoyable is the time you spend traveling from your home to the marina or put-in place? (CIRCLE ONE NUMBER)

1	2	3	4	5	6	7	8	9
Very Unenjoyable		Moderately Unenjoyable		Neither enjoyable nor unenjoyable		Moderately enjoyable		Very enjoyable

7. This time, travelling to the place where you began your boating trip, how many persons other than members of your immediate family shared travel expenses with you?

   ____ persons other than myself and members of my family

8. Not counting your travel time to and from the place where you begin your boating trip, how long do you usually stay in the Apostle Islands area? (CHOOSE ONE)

   ____ less than 1 day
   ____ 1-2 days
   ____ 3-4 days
   ____ 5-6 days
   ____ 7-8 days
   ____ 9 or more days
   ____ I live in the area where I start my boating from for all or most of the summer

9. What is your primary occupation?

   _____ (job title)
   _____ (description of duties)
   _____

10. Please check the category that best describes your personal income before taxes from your primary occupation. (CHOOSE ONE)

___ $0 - $3,999	___ $32,000-$35,999
___ $4,000-$7,999	___ $36,000-$39,999
___ $8,000-$11,999	___ $40,000-$43,999
___ $12,000-$15,999	___ $44,000-$47,999
___ $16,000-$19,999	___ $48,000-$51,999
___ $20,000-$23,999	___ $52,000-$55,999
___ $24,000-$27,999	___ $56,000-$59,999
___ $28,000-$31,999	___ $60,000 or more

11. If you had to give up one hour of your working time, without pay, from your primary occupation, can you estimate how much this would cost you personally?

It would cost me about $_____

THESE FINAL QUESTIONS ASK YOU ABOUT WHAT YOU WOULD BE DOING IF YOU DIDN'T COME TO THE APOSTLE ISLANDS OR HOW MUCH SOMETHING WOULD BE WORTH TO YOU. THESE MAY BE A BIT DIFFICULT TO ANSWER, BUT TRY TO GIVE US YOUR BEST ESTIMATE.

1. If you hadn't come to the Apostle Islands on this trip, what would you most likely be doing instead? (CHOOSE ONE)

___ working regular time at my primary occupation

___ working overtime at my primary occupation--AT WHAT RATE OF PAY?

$___ per hour for overtime

___ working at a second job, consulting or earning additional income

AT WHAT RATE OF PAY? $ ___ per hour

___ boating somewhere else

___ engaging in some other recreational activity--WHAT ACTIVITY?

_____

___ other, please specify _____

_____

2. Do you have a purpose, such as visiting relatives, or business reasons, in addition to boating, for coming to the area where you began your boating trips?

___ No, the only purpose of my trips is for boating.

___ Yes, my purpose for coming to the area where I begin my boating trips may also include reasons other than boating.

What percent of the purpose for the trip is to go boating?

___ % of the purpose is to go boating

3. As closely as you can determine, excluding transportation costs, how much will you have spent on boating at the Apostle Islands during the entire season this year? (COUNT EXPENSES SUCH AS MOTELS, BOAT CHARTERS, SLIP RENTAL, FUEL, REPAIRING EQUIPMENT, LICENSES OR FEES, ETC.)

$_____

4. If it were possible for you to decrease the time you spend travelling to the Apostle Islands merely by spending money:

How much would you be willing to spend to decrease your travel time by one hour? $_____

___ doesn't apply, it takes less than 1 hr. of travel for me

How much would you be willing to spend to decrease your travel time by two hours? $_____

___ doesn't apply, it takes less than 2 hrs. of travel for me

Suppose there was some magical way to transport you instantly to the Apostle Islands with the same amount of equipment and supplies you now bring. How much would you be willing to pay to get to the Apostle Islands instantly? $_____

THANK YOU FOR YOUR HELP AND COOPERATION

WE HOPE YOU HAVE FOUND THIS QUESTIONNAIRE INTERESTING AND ENJOYABLE TO COMPLETE