BOATING IN NORTH CENTRAL MINNESOTA: STATUS IN 1998 AND TRENDS SINCE 1985

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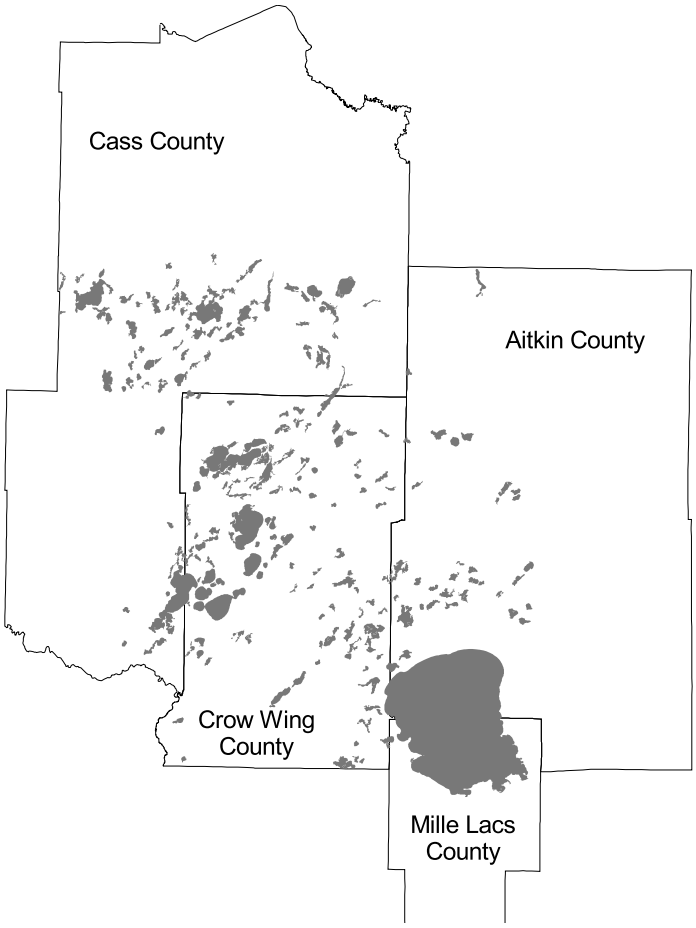

The 1998 North Central Boating Study was a cooperative research project of the Minnesota Department of Natural Resources Boating Safety Program, Division of Fish and Wildlife, and Trails and Waterways Division

Report prepared by:
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Minnesota Department of Natural Resources

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SUMMARY

INTRODUCTION

The north central lake region is one of Minnesota's premier water-recreation areas. The region supports a thriving water-oriented resort industry and one of Minnesota's largest concentration of seasonal lakehomes, both of which attest to the attractiveness of the lakes in the area. It also contains Mille Lacs, a 132,000 acre body of water that is one of the top walleye fisheries in the state. The lake region is the closest northern-forest lake concentration to the Twin Cities metropolitan area, from which it draws its major source of tourists and seasonal lakehome owners.

This boating study has three broad goals: describe the many facets of the boating experience; measure the total number of boats on lakes and trace those boats to their means of access; and provide information to guide public access programs. The goals are accomplished through a combination of aerial observations and boater surveys with public access users, commercial access users and riparian residents. Specific study objectives are:

- Measure the total number of boats on lakes and tracing those boats to their means of access;
- Describe the boaters' experience on the water, including trip satisfaction, on-water problems, and crowding;
- Describe the boaters' perception of public accesses, including quality, use problems, improvements needed, and desire for additional access;
- Describe the boaters' view of boating safety and enforcement concerns, including boating restrictions, enforcement presence, safety courses, beverages consumed on boats, and safety equipment;
- Obtain boaters' perspectives about the effectiveness of techniques to prevent the spread of exotics species such as Eurasian watermilfoil and zebra mussels; and
- Describe the characteristics of the boating trip, including boating activities, boating equipment, and boater characteristics.

This study is an update of a study done in 1985, and changes since 1985 are presented throughout the report. Three MN DNR programs provided resources for this study: water recreation, boating safety and fisheries.

BOAT NUMBERS AND SOURCES

The north central region has nearly 300,000 acres of boating water on 205 major recreational boating and fishing lakes, which include the Gull and Whitefish lake chains and Mille Lacs.

The majority of lakes (79%) had at least minimal public access in 1998, up from 66 percent with access in 1985. Minimal public access is not synonymous with adequate public access. Minimal access only involves the presence of a public access launch facility, while adequate access incorporates the number, size and location of facilities, as well as facility characteristics such as good launching depth and amenities such as a dock to ease launching and landing.

The large lakes (excluding Mille Lacs) are slightly more popular for boating than the other lakes, as evidenced by how intensely they are used. Differences in boating intensities among lake classes are not dramatic. Boating intensities in the study area are typical of Minnesota's rural

lake regions and comprise part of their attraction for vacationers and lakehome owners looking for relatively uncongested waters. In contrast, boating intensities are far higher (4 to 5 times higher) in the Twin Cities metro area.

Between 1985 and 1998 the number of boats on lakes did not change significantly overall, or on any of the lake classes in the study area. This lack of change is contrary to boaters' perception of congestion and crowding on the water, which went up between 1985 and 1998 (15% of boaters thought lakes were crowded in 1998, up from 5% in 1985—see section below on the boating experience). The same lack of change in overall boat numbers was found for Twin Cities metro waters between 1984 and 1996. Apparently, the typical boat is being used less today than 10-15 years ago, since boat registrations in Minnesota have risen some 20 percent since the mid 1980s.

Public access contributes 28 percent of boats on the water, commercial access contributes another 23 percent (e.g., resorts and private campgrounds), and all other sources (mainly riparian residents) contribute nearly half (49%). Between 1985 and 1998, the contribution of public accesses grew—consistent with the growth in the number of public access—and commercial access fell, while the remainder (mainly riparian resident) showed little change. Putting a public access facility on a lake brings new users to the lake. A similar pattern of change was experienced in the Twin Cities metro area between 1984 and 1996: public access contribution went up, commercial access went down, and the riparian resident contribution stayed about the same.

THE BOATING EXPERIENCE

Boating trip satisfaction is high in the north central lake region: just over half of all boaters report being 'very satisfied' with their outing, while another 40 percent report being 'satisfied', and only 10 percent are 'dissatisfied' to any extent. Anglers as a group report lower levels of satisfaction with their trips. Angler dissatisfaction is mainly due perceptions of fishing quality and of behavior of other boaters. In general, trip satisfaction is contingent on the behavior of other boaters—as noted for anglers—and on perceptions of crowding.

When boaters were asked to judge whether they experienced 11 potential problems with other boaters on their trip, none of the 11 was judged by a majority of boaters as a 'moderate', 'serious' or 'very serious' problem. Although not judged by a majority of boaters, one problem was by far the most frequently reported: use of personal watercraft (jet skis). The next most frequently indicated problem was noise, followed by careless/inconsiderate boat operation, boats operating too fast/close to shore/docks, and high wakes. The use of personal watercraft also led the list of problems boaters had with other boaters in the Twin Cities metro area in a 1996 study.

Most boaters (86%) did not encounter 'too many boats' on their trip. Some 14 percent of boaters did encounter 'too may boats', and a similar portion of boaters (15%) judged conditions as crowded. Perceptions of crowding have risen since 1985, when only 5 percent of boaters judged conditions as crowded. The rise in perception of crowding is not consistent with the stable boat numbers on the lakes. But boaters can feel crowded for reasons other than the sheer number of boats, and it may be that a combination of factors— personal watercraft; larger, faster-moving boats; more noise—are giving rise to more crowding. Personal watercraft are new since the 1985 study, boats are larger and more powerful than in 1985, and more boaters are engaging in boat riding and fewer in fishing than in 1985 (see section below on characteristics of the boating trip).

PUBLIC ACCESS FACILITIES

The use of public accesses has changed since 1985, and public accesses—it appears—are becoming more and more an asset that all lake interests take advantage of, including riparian residents and commercial boating-related interests. In 1998, riparian residents and resort-campground guests are estimated to account for nearly 40 percent (38%) of traffic through the public accesses, up from 17 percent in 1985. The reason for change in the use of public accesses is unknown, but one hypothesis comes to mind: the increasing size of boats and motors (see section below on characteristics of the boating trip), and associated need to launch/land these boats at a well designed access facility.

Boaters give high marks to public access facilities for launching and landing a boat. Positive ratings ('good' to 'excellent') comprise 84 percent of boater ratings, while few boaters give negative ratings (3%). The current high ratings represent a continuation of such ratings since 1985, when boaters rated the facilities virtually the same.

There are problems, however, in the use of the public access facilities. The leading problems have to do with the perceived small size of many parts of the access facility: insufficient parking spaces, not enough maneuvering room on land/water near the ramp, and insufficient number of launch lanes. None of these specific problems was all that common. The top-ranked problem was identified by less than 10 percent of access users (8%).

When asked what improvements are needed at access sites, boaters suggested improvements that solve their use problems. The top-ranked improvements had to do with expanding the size of the facility: more parking spaces in the lot and move launch lanes/ramps. Other improvements suggested by over 10 percent of users included a beacon light visible from the lake, trash containers and toilets.

The majority of all boaters (56%), and nearly half of riparian residents (46%) use additional lakes near the lake where they were surveyed, and access to these additional lakes is dominated by public access.

A large portion of public access users (64%) have at some time in their past found a public access parking lot full on the lake they were surveyed (Figure 28). On average, this happened twice in the last year. Most of these were able to find a way onto the lake. They either went to another access on the lake, parked on the road, or parked elsewhere.

When asked in the survey whether an additional public access was needed on the lake they were surveyed, 14 percent of all boaters thought additional public access was needed, 72 percent did not think additional access was needed, and 14 percent were uncertain. Public access boaters were more likely to indicate a need for additional access (25%), but still a majority (52%) did not see a need for more access. Few riparian residents saw a need for more access (5%). The primary reason given for additional access need had to do with congestion at the present access(es) on the lake. Of boaters on lakes presently without public access (mainly riparian resident boaters), 8 percent saw a need for an access, 72 percent did not, and 20 percent were uncertain.

BOATING SAFETY AND ENFORCEMENT

Special boating restrictions are not very common on north central lakes. Existing restrictions—on the sample lakes surveyed in this study—are speed, no wake restrictions in channel areas on the Gull and Whitefish chains of lakes and 5 other lakes. Few boaters (2%) believe that the current level of boating restrictions is 'too restrictive', somewhat more (15%) believe it is 'not restrictive enough', and the majority (60%) believe it is 'about right'.

The demand for new restrictions is minor except for one type, which was indicated by a large portion (44%) of boaters: restrictions on the use of personal watercraft (jet skis). Other possible restrictions (time, horsepower and boat type/size) were demanded by few boaters.

Enforcement officers are much more likely to be seen on the large lakes and Mille Lacs than on the smaller lakes. Public access boaters see an enforcement officer more than boaters using commercial access and far more than riparian resident boaters. About five percent of boaters report being checked by an officer, and most of the boaters who were checked were fishing (73%).

Formal safety courses have been completed by one-fifth of all boaters, a portion that does not appear to have changed materially since 1985. Boaters having completed a formal safety course are more likely than other boaters (75% compared with 30%) to believe all boaters should be required to complete a safety course. Overall, 39 percent believe all boaters should be required to complete such a course.

Requiring an operators license for motorboat operators is not all that popular, and is supported by only 27% of boaters.

Since the 1985 study, Minnesota enacted a law that makes it illegal to operate a motorboat after consuming too much alcohol, very much like the alcohol restrictions on driving an automobile. In 1998, about one-quarter of boaters report having some type of alcoholic drinks on board during their trip. Most boaters have no alcohol on the boat: either they have only non-alcoholic drinks on board (52%), or have no drinks of any type (24%). Basically the same pattern of drinks on board prevails in 1998 as in 1985.

Most boats (88%) are equipped with some form of safety equipment (e.g., lights, fire extinguishers and horns) other than personal flotation devices. The small portion of boats without any safety equipment (12%) may not need any, because no safety equipment other that personal flotation devices is required for boats less that 16 feet long operated during daylight hours.

PREVENTING THE SPREAD OF EXOTIC SPECIES

Exotic species such as Eurasian watermilfoil and zebra mussels are not a prevalent problem in the north central boating region at the present time. In the Twin Cities metro area, where exotic species are a significant problem, boaters have been queried about the effectiveness of various means to prevent the further spread of exotics by boaters. The five most effective means identified by metro boaters were included in the north central surveys to assess if north central boaters

agreed with metro boaters. The results indicate that there is agreement. The following means are considered effective by north central and metro boaters: information delivered at boat landings, either in the form of signs or inspection-education programs; enforcement, including laws to make the transport of exotics illegal and road checks to enforce those laws; and information delivered directly to boaters in fishing and boating regulations documents.

CHARACTERISTICS OF THE BOATING TRIP

There are two main activities on north central lakes: fishing and boat riding. The former is slightly larger than the latter. Activities have changed since 1985. The major changes have been a sizable drop in fishing and a sizable gain in boat riding. Notable changes of a lesser magnitude are the decrease in water skiing and the increase in 'other activities.' About 2 percent of 'other' is personal watercraft use, which was not measured in 1985.

The changes experienced between 1985 and 1998 are moving the boating activity patterns of this region closer to that of the Twin Cities metro area, where boat riding is slightly larger than fishing. The larger lakes (except Mille Lacs) have activity patterns in 1998 very much like those in the Twin Cities. It is interesting to note that water skiing also showed a decrease in the Twin Cities metro area between 1984 and 1996.

The most common type of craft in 1998 is runabouts, followed closely by fishing boats (run-abouts have a deck and windshield; fishing boats are open; a fishing boat is a type of craft, and is not related to the activity of fishing). Pontoons are the next most common type of boat. Craft types have changed since 1985: runabouts have increased and fishing boats have decreased. Fishing boats were the most common type of craft in 1985.

Boat lengths now average around 17 or 18 feet, and lengths have increased an average of two feet since 1985.

Most craft have a motor, and only about 4 percent are non-motorized.

Motor sizes average just over 90 horsepower; the median is lower at 70 horsepower. Motor sizes have nearly doubled since 1985. An increase in motor sizes was also experienced in the Twin Cities between 1984 and 1996, although the increase was less dramatic in the Twin Cities.

Boaters, as a group, are familiar with the lake at which they were surveyed. The median length of use of the lake is 14 years. Few boaters (4%) have started boating in the last year on the lake where they were surveyed.

The public and commercial accesses serve two geographic markets. One is the local market (within 25 miles of home, about a half-hour drive) and the other is the more distant 'tourist' market. The local market is the smaller and accounts for about one-quarter of access use. The Twin Cities is the major tourist market.

The Twin Cities metro area is also the main origin of seasonal lakehome boaters on these lakes. It accounts for about two-thirds of seasonal lakehome boating.

INTRODUCTION

The north central lake region is one of Minnesota's premier water-recreation areas. The region supports a thriving water-oriented resort industry and one of Minnesota's largest concentration of seasonal lakehomes, both of which attest to the attractiveness of the lakes in the area. It also contains Mille Lacs, a 132,000 acre body of water that is one of the top walleye fisheries in the state. The lake region is the closest northern-forest lake concentration to the Twin Cities metropolitan area, from which it draws its major source of tourists and seasonal lakehome owners.

This boating study has three broad goals: (1) describe the boating experience, which includes boating activities, perceptions of conditions on the water, and safety and enforcement concerns; (2) measure the total number of boats on lakes and trace those boats to their means of access; and (3) provide information to guide public access programs by assessing the use of these facilities and evaluating their quality through boater interviews. This study is an update of a study done in 1985, and changes since 1985 are presented throughout the report.

The first goal of the study is to describe the boating experience and see to what extent it has changed. To ensure that boating remains an enjoyable and safe activity is the motivation underlying this aspect of the study. Most of the use of lakes in the north central lake region originates in the Twin Cities metropolitan area. The boating conditions on north central lakes are far different than boating in the Twin Cities, however, which is a primary reason people travel to these lakes. One major difference is the far lower intensity of boating use on these northern lakes. Although the intensity of use is less, there are signs that boating conditions are changing in the region and becoming more 'urban-like' in certain aspects (e.g, boating activities, perceived crowding).

The second study goal is to measure the total number of boats on lakes and trace those boats to their means of access. Such measurements ensure that people can at least be reasonably well informed and share a common information base when addressing any boating concerns involving the number and source of boats on the water. Boaters gain access to lakes through their own lakehomes, as well as through facilities provided at commercial sites, such as resorts and private campgrounds. The public sector also provides boating opportunities—primarily through free public accesses—for those who do not live on the water or avail themselves of the commercial opportunities.

As indicated above, the public sector provides boating opportunities through free public access. The third goal of this study is provide information to guide public access programs by assessing the use of these facilities and evaluating their quality through boater interviews. Many levels of government—local, county, state and federal—manage free public accesses in the north central region.

This document is a general summary. For those wanting more detail on study results, technical documents, including survey tabulations with breakdowns, and data files are available from the MN DNR.

In this document, boating status and trend findings are presented in six sections:

- Boat numbers and sources of boats;
- Perception of boating experience, including trip satisfaction, on-water problems, and crowding;
- Perception of public accesses, including quality, use problems, improvements needed, and desire for additional access;
- Boating safety and enforcement, including boating restrictions, enforcement presence, safety courses, beverages consumed on boats, and safety equipment;
- Preventing the spread of exotic species; and
- Characteristics of the boating trip, including boating activities, boating equipment, and boater characteristics.

Study results for lakes are presented for lake classes (groupings of lakes), not individual lakes (except for Mille Lacs), because the studies were not designed for lake-by-lake results. Lake classes are defined in the next section on methodology. If one is interested in how a particular lake looks according to the information presented in this report, find the class of the lake in 1998 and 1985 and follow the conclusions through for the class(es). Lakes are listed by class in Appendix A.

Three MN DNR programs provided resources for this study: water recreation, boating safety and fisheries. Fisheries contributed by having creel clerks distribute surveys to public and commercial access boaters on Mille Lacs, and helping to design the Mille Lacs boater survey instruments.

METHODOLOGY

The multiple goals of the north central boating study are accomplished with a variety of information collection techniques. Lakes have been classified according to size and clarity, and whether the lake has a free public access. The lake classification based on size and clarity is the one developed by the public access program to prioritize lakes for access. The study covers those lake priority classes that incorporate the principal water recreation resource: lakes over 145 acres in size that support permanent fish populations (Figure 1). The six lake classes are:

Mille Lacs (has public access)
Remaining large boating lakes (Gull and Whitefish chains and Pelican—all have public access)
Priority A lakes with public access
Priority B lakes with public access
Priority C lakes with public access
Priority A, B and C lakes without public access

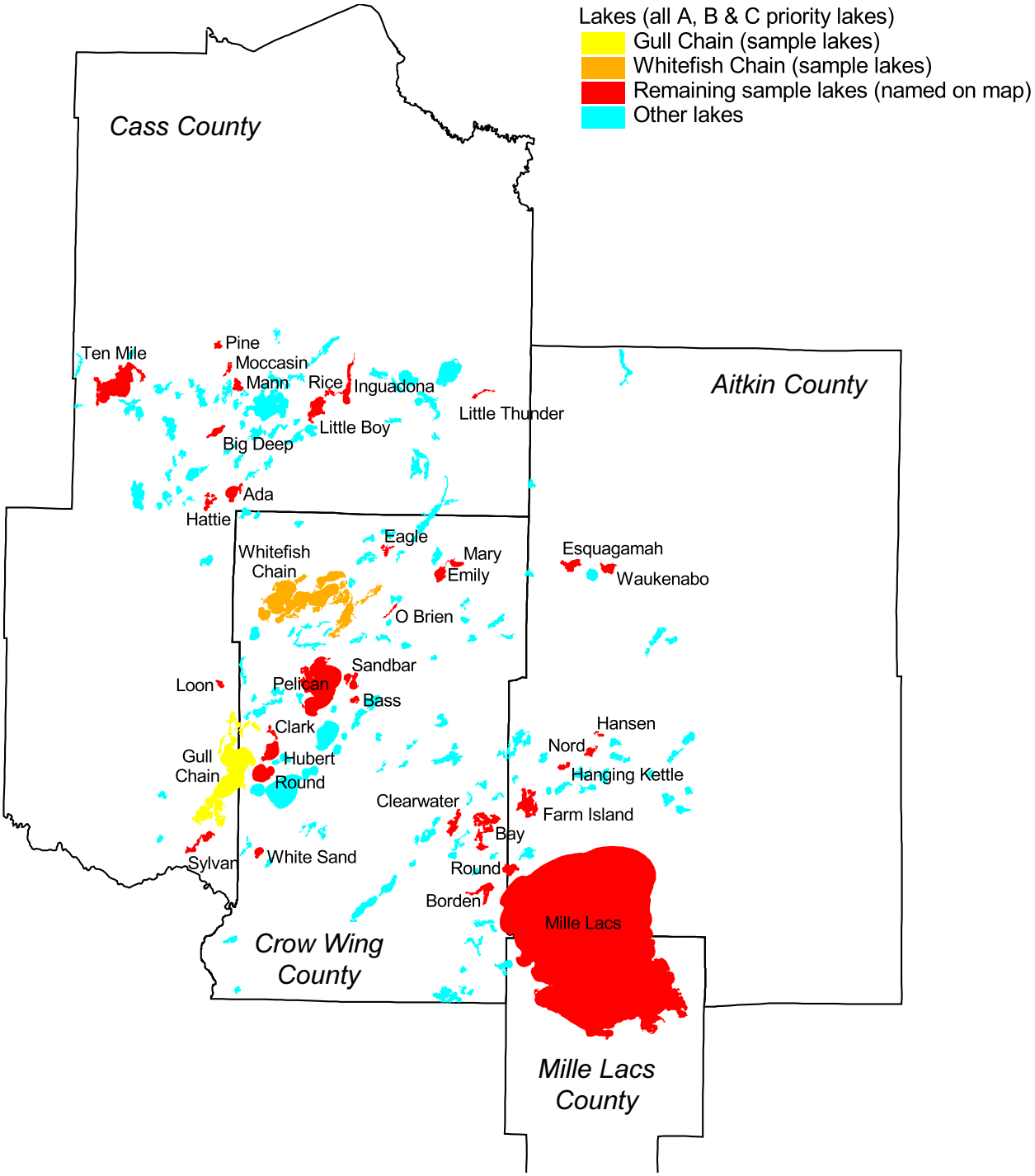
Priority A lakes are distinguished from B and C lakes by their larger size and greater clarity. Size and clarity progressively decrease from A to B to C lakes.

Within each class, a sample of the lakes is taken for study (see Appendix A for a listing of sample lakes). The sample lakes in 1998 include the 1985 sample lakes plus a few new lakes. A complete census, however, of the largest resources is taken for study; this includes Mille Lacs and the remaining large boating lakes (Gull and Whitefish chains, and Pelican). For each study lake, boats in use (including those anchored and beached) are counted and classified by type from the air. Except for Mille Lacs, boat counts are made in the afternoon, when boating is at a peak. For Mille Lacs, boat counts are made when boat numbers are expected to be near their peak: between 10 AM and noon on weekend/holidays and between 4 and 6 PM on weekdays. Aerial observation (including photographs) are also used to measure the contribution of different means of access to boating numbers. Aerial measurements made on sample lakes for a class are expanded to population estimates based on the water surface area of all the lakes in the class.

Boaters on the sample lakes are surveyed to gather information about their behavior and perceptions. In 1998, surveys were conducted using in-person, hand-off and mail-back surveys at public launch facilities, and at commercial accesses (resorts and private campgrounds). Riparian residents on the sample lakes were surveyed by mail. Riparian resident names and addresses were gathered from property records.

Figure 1

North Central Boating Study Lakes



Surveys are conducted on both weekdays and weekends and holidays. To ensure that the opinions of one group of boaters are not over- or under-represented when combined with another group, survey results are weighted by the contribution of each group to boating use. Survey results are weighted by all the combinations of lake class (six classes listed above), means of access (public access, commercial access and riparian resident) and days of the week (weekdays and weekend/holidays).

In 1998, the walleye fishing opener plus seven other weekend/holiday flights and four weekday flights were conducted for the sample lakes. Overall, 3146 surveys were completed, including 991 public access mail-back surveys, 930 commercial access mail-back surveys and 1255 riparian resident mail surveys. In 1985, the walleye fishing opener plus six weekend/holiday flights and 3 weekday flights were conducted. Overall, 904 surveys were completed, including 207 public access interviews, 143 commercial access interviews and 554 riparian resident interviews.

The 1998 study attempted to produce comparable data with the 1985 study for trend assessment purposes and to a large extent data are comparable. In some instances, however, some particulars precluded comparability. These are noted in the text when they are encountered.

For those wanting a more complete description of methodology, a technical document that presents the full methodology is available through the MN DNR.

BOAT NUMBERS AND SOURCES

Amount and Intensity of Boating

The north central region has nearly 300,000 acres of boating water on 205 lakes (Table 1). These lakes comprise the major recreational boating and fishing waters of the region. They are the primary focus of shoreland development for tourist accommodations and residential housing. All of the lakes are over 145 acres in size and have permanent fish populations. Almost half of the total water acreage of these lakes is on Mille Lacs, one of Minnesota's premier walleye fisheries. Other than Mille Lacs, the large lake group includes two lake chains (Gull and Whitefish) and Pelican. The remaining lakes are smaller and more numerous. Priority A lakes are distinguished from B and C lakes by their larger size and greater clarity. Size and clarity progressively decrease from A to B to C lakes.

Table 1

Boating Waters of the North Central Study Area
(water access priority classes A, B and C)

	Number of lakes	Acres of lakes
Large Lakes:		
Mille Lacs	1	132,516
Gull Chain	7	10,906
Whitefish Chain	12	14,791
Pelican	1	8,468
Priority A lakes with public access	46	58,507
Priority B lakes with public access	68	31,881
Priority C lakes with public access	27	8,708
Priority A, B and C lakes without public access	43	12,407
Total	205	278,184

The large majority of lakes had at least minimal public access in 1998. Minimal public access is not synonymous with adequate public access. Minimal access only involves the presence of a public access launch facility, while adequate access incorporates the number, size and location of facilities, as well as facility characteristics such as good launching depth and amenities such as a dock to ease launching and landing.

Of the 205 lakes covered by the study, 162 are at least minimally accessible through free public access and 43 are not (Table 1). This represents an expansion of public access since 1985—the year of the previous boating study—when 70 lakes did not have public access (Table 2). Between 1985 and 1998 just over half the lake acreage not accessible through free public access became at least minimally accessible.

The large lakes (excluding Mille Lacs) are slightly more popular for boating than the other lakes, as evidenced by how intensely they are used (Figure 2). The most intensely used resources (least acres per boat) are the large lakes of the Gull and Whitefish chains, and Pelican. The large lakes account for 28 percent of boating (excluding Mille Lacs) and 23 percent of the water surface area (Figure 3). Within the large lakes, Gull and Whitefish chains are used the most intensively on weekends (63 to 75 acres per boat) and Pelican the least intensively (131 acres per boat). Mille Lacs, not surprisingly given its very large size, is used the least intensively on a per-acre basis, and is well below all the other categories (489 acres per boat). The other lake groupings share about the same intensity of use, and their proportion of boating is approximately the same as their proportion of water surface area. Lakes without public access experience about the same intensity of use as lakes with public access, even though (as

Table 2

Changes in Public Access Status of Boating Waters in the North Central Study Area
(water access priority classes A, B and C)

	Year 1985		Year 1998	
	Number	Percent	Number	Percent
Lakes with public access	135	66	162	79
Lakes without public access	70	34	43	21
Total	205	100	205	100

Figure 2

Average Boating Intensities on Summer Weekend & Holiday Afternoons
(excluding Mille Lacs)

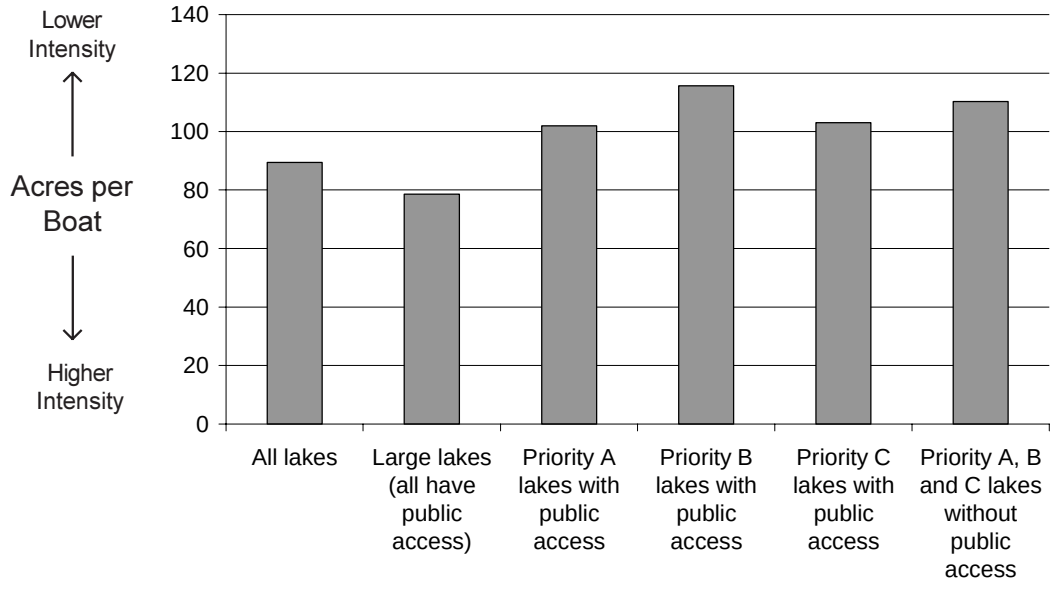
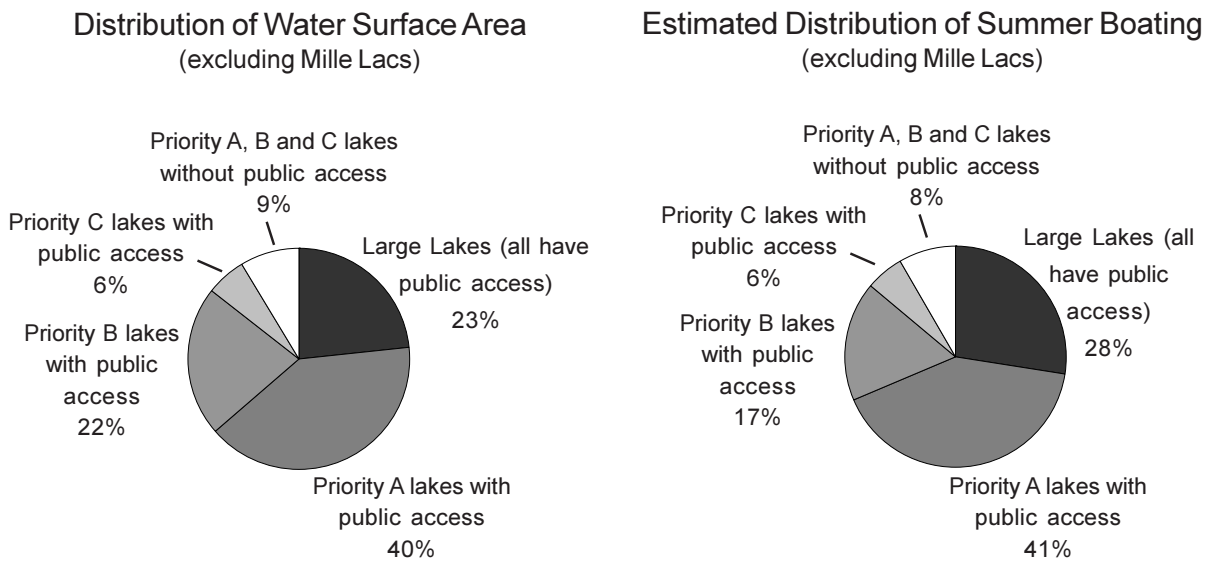


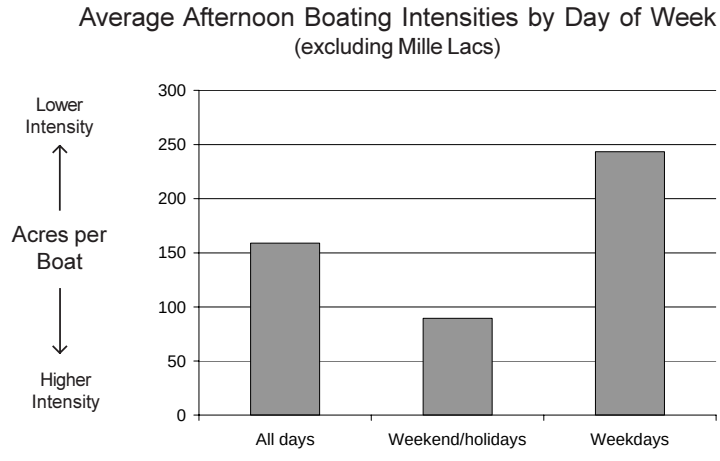
Figure 3



noted later in the section on source of boating use) adding a public access to a lake increases boating. Across the lake groupings on Figure 2, however, the presence or absence of public access is not the dominant factor in boating intensities; other sources of use (e.g., resorts and lakeshore homes) are dominant, a topic discussed more fully below.

Weekends are the popular time to participate in boating, as well as in most outdoor recreation pursuits. A weekend or holiday, on average, has between 2.5 and 3.0 times as much boating as a weekday (Figure 4). Weekdays, however, because they are more numerous that weekends and holidays, account for about half of all boating.

Figure 4

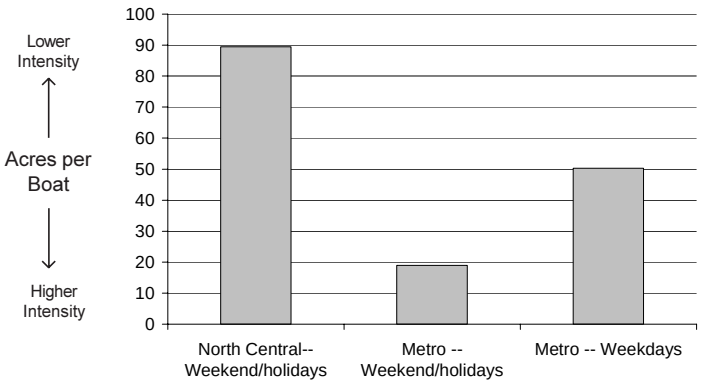


Boating intensities at peak times on weekend/holiday afternoons average about 90 acres per boat, and are about 80 acres per boat on the more intensively used large lakes. On weekdays, afternoon

intensities are about 250 acres per boat. Such boating intensities are typical of Minnesota's rural lake regions and comprise part of their attraction for vacationers looking for relatively uncongested waters. Intensities are far higher (4 to 5 times) in the Twin Cities metro area (Figure 5). Even weekdays in the metro area have intensities that exceed weekends in the north central area.

Figure 5

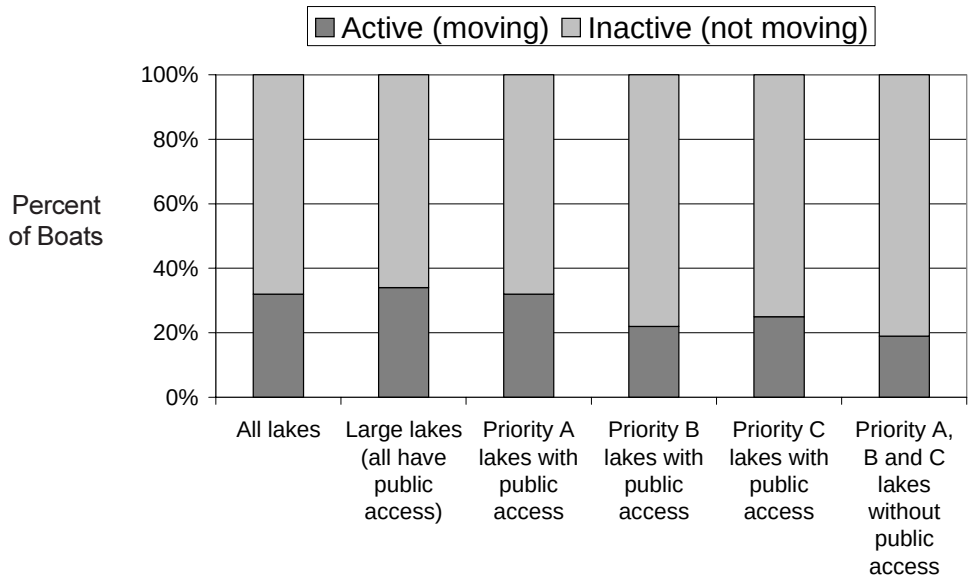
Regional Comparison of Summer Afternoon Boating Intensities: North Central in 1998 versus Metro in 1996
(excluding Mille Lacs)



Intensity of use (acres per boat as shown on Figure 2 and 5) is one dimension of boating congestion. A second dimension is the movement of boats. Moving boats, in effect, consume more area and, thus, contribute more heavily to congestion than

Figure 6

Activity Status of Boats as Observed from the Air by Boating Resource Class
(excluding Mille Lacs)



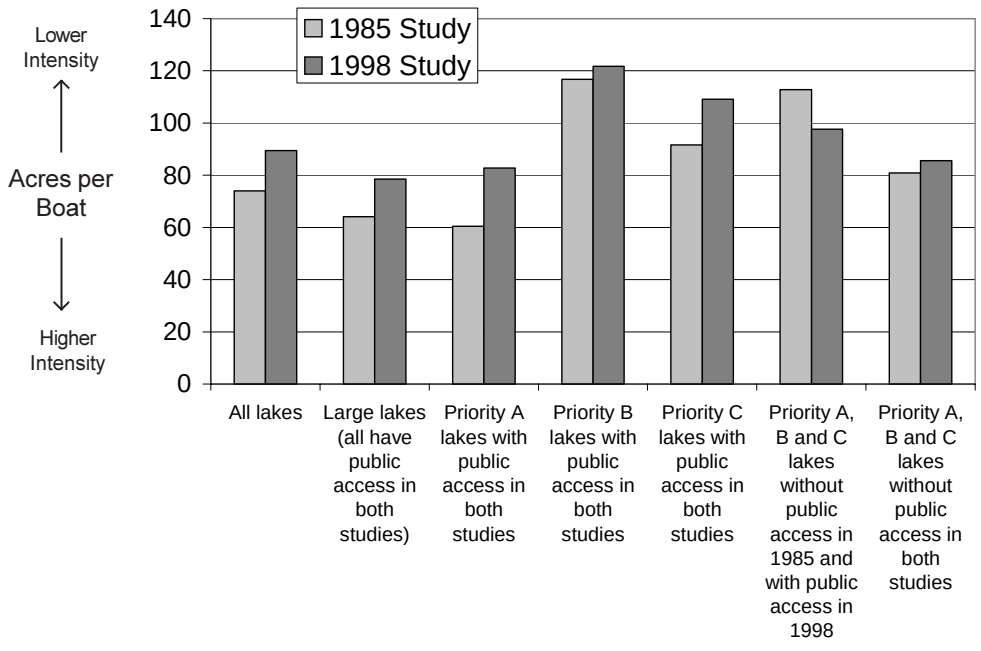
stationary boats. The portion of moving boats is about one-third, and is slightly higher for the larger lakes (Figure 6). This portion is basically unchanged since 1985. Mille Lacs also has approximately one-third moving boats in 1998. The portion of moving boats is substantially higher in the Twin Cities metro area (about two-thirds are moving) a factor that—in conjunction with higher boat densities—adds to the congestion of metro waters.

Changes in intensity of use from 1985 to 1998 can only be examined for weekends/holidays, because there were too few weekday observations in 1985 and 1998 to form a valid comparison. Weekend/holiday trends by themselves, however, provide a good indication of trends in use.

The comparison of 1998 with 1985 reveals little change in boat numbers. For lakes overall and for each boating resource class except one, the 1998 boating intensities were slightly smaller than in 1985 (Figure 7). The one exception is the group of lakes that received public access between 1985 and 1998. This group had a slightly higher boating intensity in 1998 than 1985. None of these slight differences are statistically different (at the 5% level of statistical significance), however, reiterating

Figure 7

1985 to 1998 Comparison of Weekend/Holiday Boating Intensities by Boating Resource Class
(excluding Mille Lacs)

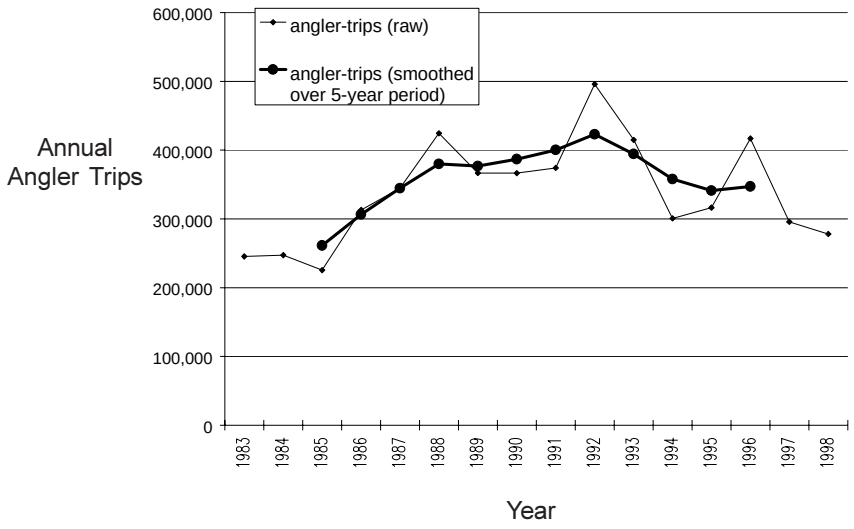


the conclusion that there is little evidence of any trend since 1985.

Mille Lacs, too, showed little evidence of an overall change between the mid 1980s and 1998. Fishing trips on Mille Lacs—which is almost exclusively a fishing lake from a boating perspective—rose from the mid 1980s to the early 1990s and fell thereafter, producing both little net change and no significant upward or downward linear trend over the period (Figure 8).

Figure 8

Open-Water Season Fishing on Mille Lacs
1983 to 1998*



* Source: MN DNR, Section of Fisheries.

In the Twin Cities metro area, changes over about the same time period (1984 to 1996) also found little change in boating intensities among lake and river resource classes, except for those lakes that received a public access between the studies.

Source of Boating Use

Boaters gain access to water through three primary means:

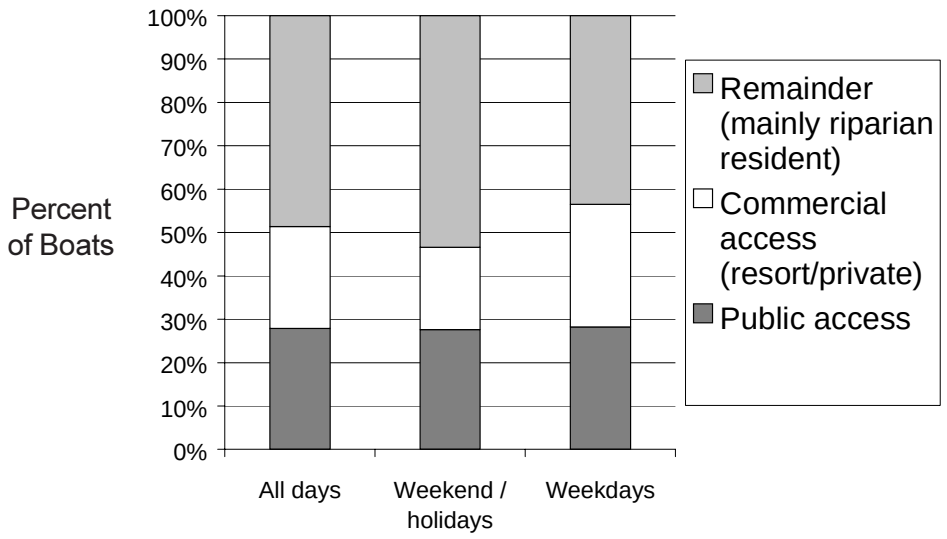
1) public access—free public boat launches and associated parking areas.
2) commercial access—resorts, campgrounds, marinas and for-fee private accesses.
3) riparian residence—waterfront property owners.

The contributions of pubic and commercial accesses are measured directly during the aerial flights. These contributions are subtracted from the total number of boats on the water—also counted during the aerial flight—to compute a remainder, or boats from unaccounted for sources. Nearly all of the remainder is believed to derive from riparian residents. Attempts in the metro area to find any significant nonriparian sources in this remainder were not successful.

In 1998, public access contributed just under 30 percent of boats (28%) (see Figure 9). Commercial accesses contributed another 23 percent and all other sources (mainly riparian residents) contributed nearly half (49%). Public access contributions are about the same on weekends/holidays and weekdays, while commercial access contributions are a larger share on weekdays, and the remainder (mainly riparian residents) contributions are correspondingly a smaller share on weekdays.

Figure 9

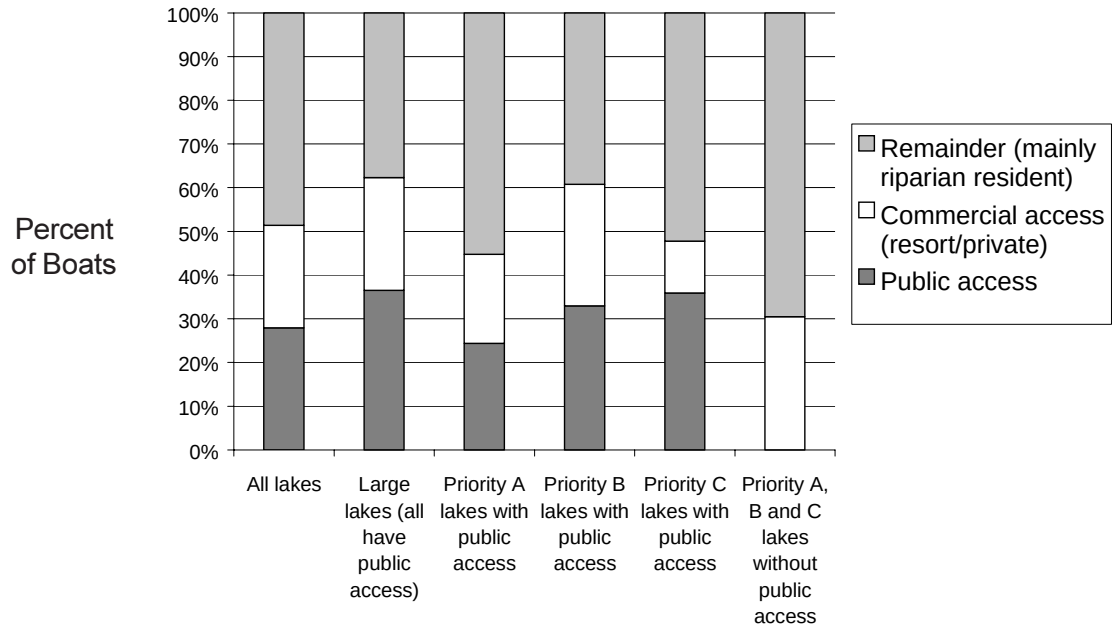
Source Contributions to Boats on the Water
(excluding Mille Lacs)



On lakes with public access, the public access contribution varies from 24 to 37 percent; the commercial access from 12 to 28 percent and the remainder from 38 to 55 percent (Figure 10). On lakes without public access, the remainder category (mainly riparian residents) contributes the large majority of boating use (70%), with the balance accounted for by commercial access (30%).

Figure 10

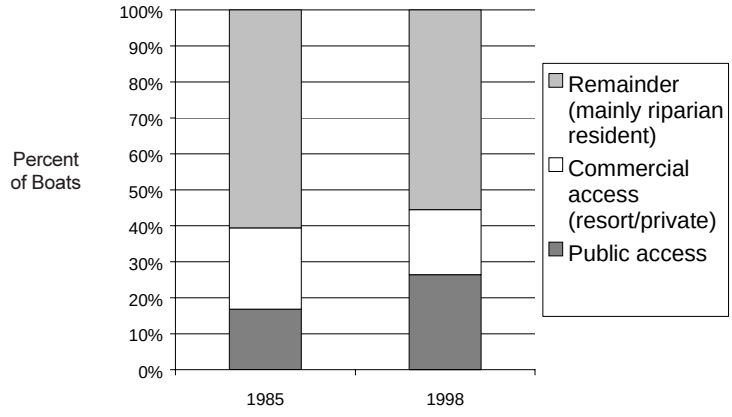
Source Contributions to Boats on the Water by Boating Resource Class
(excluding Mille Lacs)



Between 1985 and 1998, the contribution of public accesses on weekends grew and commercial access fell, while the remainder (mainly riparian resident) showed little change (Figure 11). The remainder, although smaller in 1998, was not statistically different than in 1985 (at the 5% level of statistical significance); public and commercial access changes were statistically different. A similar pattern of change was experienced in the Twin Cities metro area between 1984 and 1996: public access contribution went up, commercial access went down, and the riparian resident contribution stayed about the same.

Figure 11

Change in Source Contributions to Boats on the Water on Weekends & Holidays
(excluding Mille Lacs)

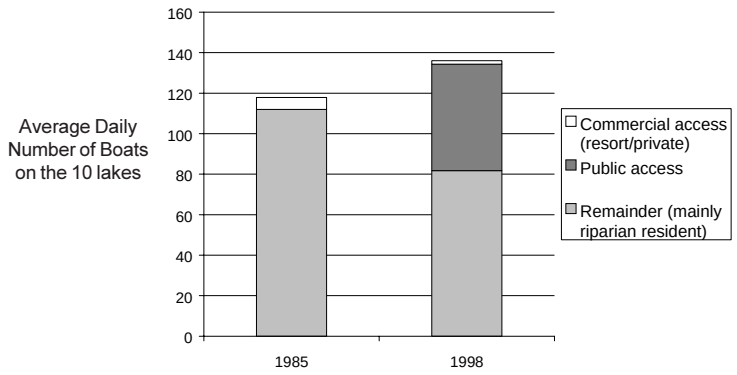


The rising contribution of public access is due largely to the expansion in number of public accesses between 1985 and 1998. As noted above, the number of lakes with public access went from 135 in 1985 to 162 in 1998. For lakes with public access in both 1985 and 1998, the number of boats on the water attributable to public access did not change significantly. The increase in public access contribution to total boats in the Twin Cities metro area between 1984 and 1996 had these same causes.

On those lakes that received a public access between 1985 and 1998, the number of boats from the accesses increased, of course, although the remainder category (mainly riparian resident) continued to be the largest contributor (Figure 12). The decrease in number of boats from the remainder source between 1985 and 1998 is what would have been expected from this source if it followed the same pattern as other lakes in the region. The decrease should not be attributed to the arrival of public access. The remainder source across the entire study area contributed fewer boats in 1998 than in 1985. Its proportional drop across the entire study area is nearly the same as that shown on Figure 12 for those lakes that received a public access. The fact that this remainder source contributed about the same *percentage* (not *number*) of boats in 1985 and 1998—a conclusion noted above—is due to the corresponding drop in total number of boats on the water (i.e., a drop in the base of the percentage).

Figure 12

Change in Weekend/Holiday Source of Boats on 10 Lakes* that Received a Public Access Between 1985 and 1998



* The 10 Lakes are: Borden-180020, Clearwater-180038, Inguadona/Rice-110120/110162, Round-102040, Esquagamah-101470, Moccasin-110296, Hanging Kettle-101700, Bass-180256, and Pine-110292.

THE BOATING EXPERIENCE

Trip Satisfaction

Trip satisfaction tends to be high for recreators who willingly engage in an activity under conditions with which they are familiar. Boaters in this north central study fit this profile for high trip satisfaction. Regarding familiarity, boaters, as a group, are familiar with the lakes at which they were surveyed. Half have been boating for 14 or more years on the lake, and only 4 percent were recent arrivals to the lake (Table 3).

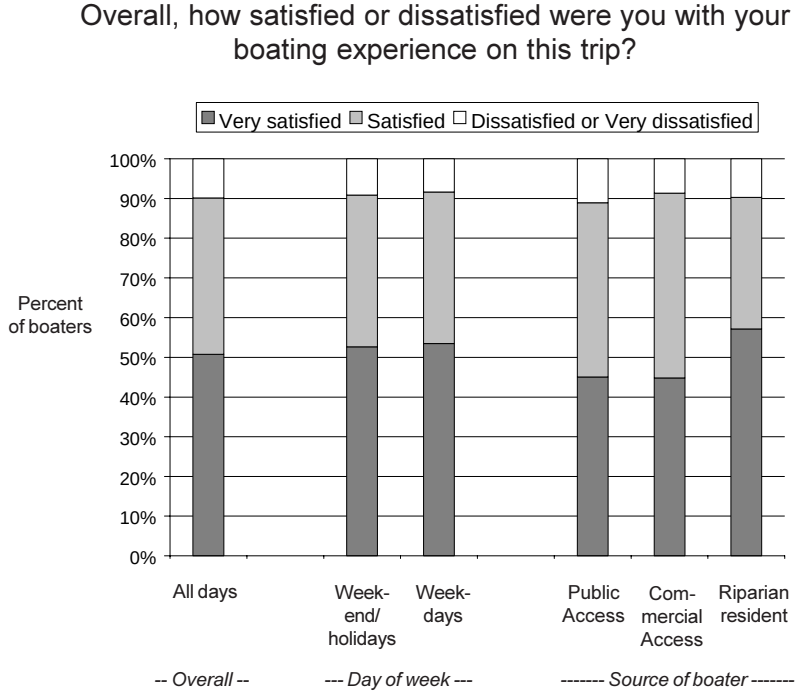
Table 3

How many years have you been boating on this lake?
('this lake' is the lake at which the boater received the survey)

	Median years	Percent new boaters (less than one year)
All boaters	14	4
Source of boater:		
Public access	10	5
Commercial access	10	9
Riparian resident	20	0

Boaters are relatively satisfied, too. Just over half of all boaters report being 'very satisfied' with their outing, while another 40

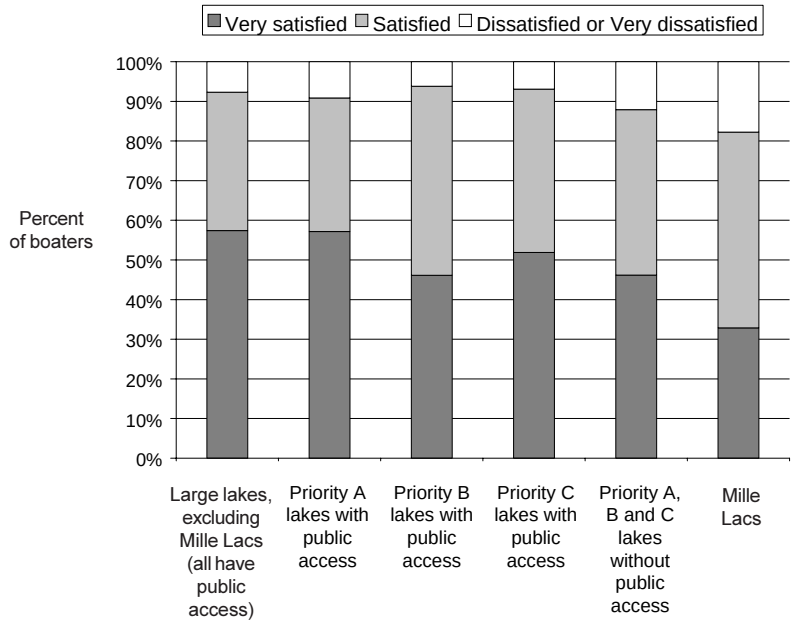
Figure 13



percent report being 'satisfied' (Figure 13). Only 10 percent are 'dissatisfied' to any extent. Satisfaction is as high on weekends/holidays as on weekdays. Riparian residents exhibit the highest levels of satisfaction among the sources of boaters, and seasonal residents have slightly higher levels than permanent residents. Satisfaction also tends to be high across the different classes of lakes (Figure 14). The large lakes (excluding Mille Lacs) and priority A lakes have higher satisfaction than the other classes. Mille Lacs has the lowest levels of satisfaction, even though some 80 percent of boaters are 'satisfied' or 'very satisfied'; dissatisfaction on Mille Lacs is reported by nearly 20 percent of boaters.

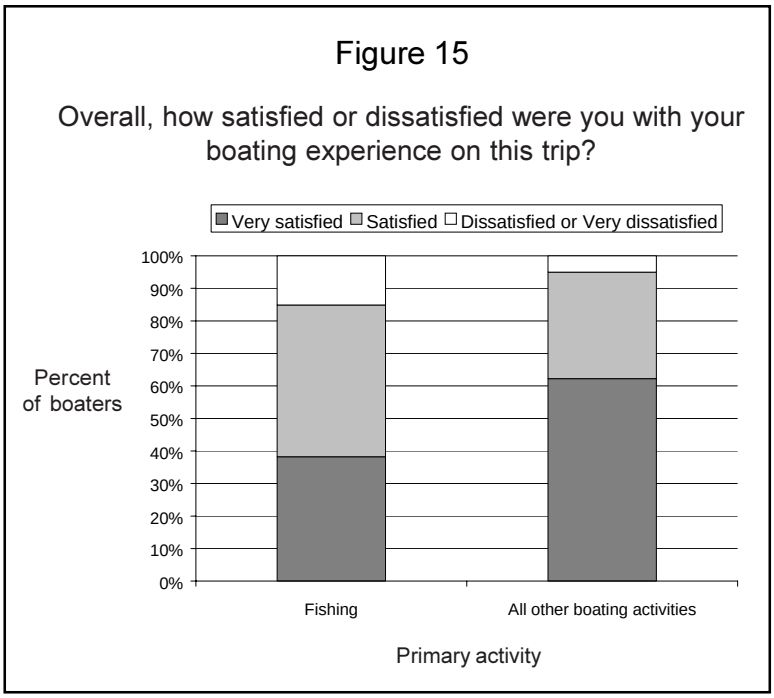
Figure 14

Overall, how satisfied or dissatisfied were you with your boating experience on this trip?



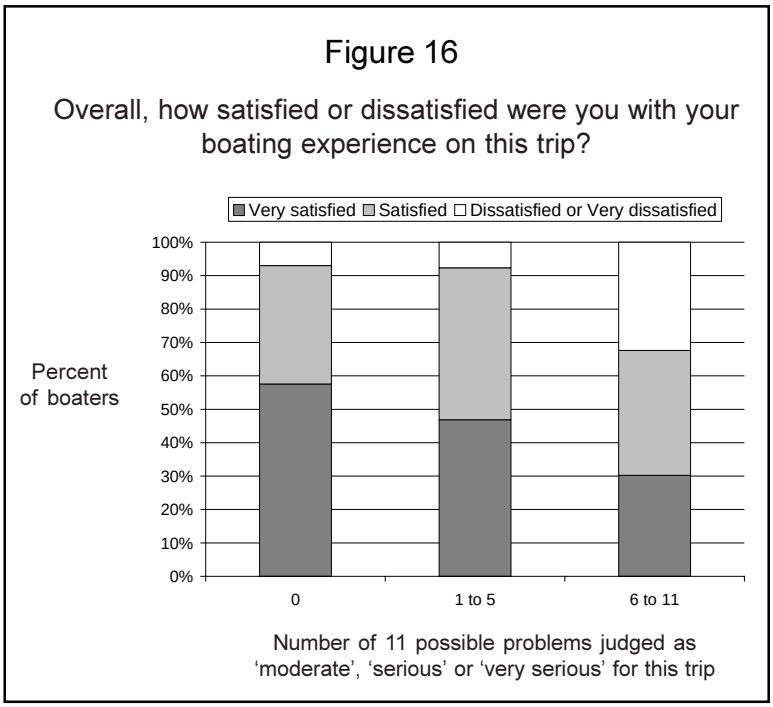
Anglers as a group—both on Mille Lacs and other lakes—report substantially lower levels of satisfaction with their trips (Figure 15). Because Mille Lacs is almost exclusively a fishing lake, lower angler satisfaction leads to the lower overall trip satisfaction on Figure 14. When asked in the survey as to what contributed to their dissatisfaction, 147 anglers wrote in reasons. The leading reason had to do with fishing quality (e.g., 'poor fishing', 'caught no/few fish', 'no fish to catch'). Another reason for angler trip dissatisfaction was equally important to that of fishing quality on lakes other than Mille Lacs. This other reason had to do with the behav-

ior of other boaters. It was reported as, for example, 'jet skis', 'high wakes', and 'incompetent boaters'. A third reason—mainly reported by Mille Lacs anglers—had to do with wave, wind and weather, which sometimes make boating and fishing difficult.



As noted above for anglers, trip satisfaction is contingent on the behavior of other boaters. In another part of the survey, boaters were asked what problems they encountered with other boaters on their trip. When the number of problems with other boaters becomes sufficient in number and severity, trip satisfaction drops. A few problems (1 to 5) of 'moderate' or greater severity has a modest effect on trip satisfaction; more problems of this same severity noticeably lowers trip satisfaction (Figure 16). More is said about specific problems in the next section of this report.

Trip satisfaction is also affected by perceptions of crowding. When people judge the number of boats on the lakes as 'too many' their overall satisfaction declines (Table 4). Crowding is discussed more fully below following the next section on problems encountered with other boaters.



Crowding and problems with other boaters definitely lower trip satisfaction, but it is important to keep one point in

mind: satisfaction still far out weighs dissatisfaction even for boaters who experience these crowded conditions and problems with other boaters.

Table 4

Overall, how satisfied or dissatisfied were you with your boating experience on this trip?

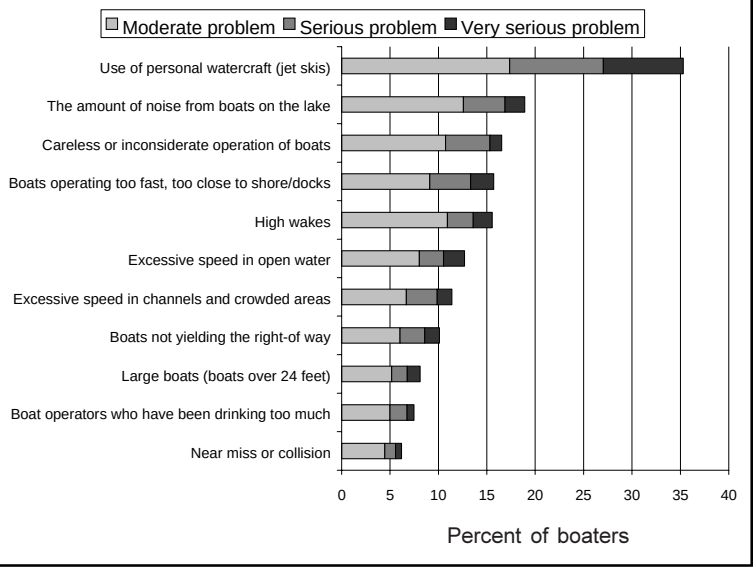
	All boaters (percent)	Boaters who encountered too many boats (percent)	Boaters who *did not* encounter too many boats (percent)
Very satisfied	51	37	53
Satisfied	39	45	38
Dissatisfied	8	16	7
Very dissatisfied	2	2	2
Don't know	0	1	0
Total	100	100	100

Problems with Other Boaters

Boaters were asked to judge whether they experienced problems with other boaters on their trip. Of the 11 potential problems, none was judged by a majority of boaters as a 'moderate', 'serious' or 'very serious' problem (Figure 17). Although not judged by a majority of boaters, one problem was by far the most frequently reported: 'use of personal watercraft (jet skis)'. It received 35 percent 'moderate' or more serious responses, and it was the only problem with elevated numbers of 'serious' and 'very serious' responses. The next most frequently indicated problem was noise, followed by careless/inconsiderate boat operation, boats operating too fast/close to shore/docks, and high wakes. The remaining six behaviors of other boaters were judged by fewer than 15 percent of boaters as a 'moderate' or more serious problem.

Figure 17

Problems judged by boaters as 'moderate', 'serious' or 'very serious'



The pattern of problem identification displayed on Figure 17 is widely shared among the different sources of boaters (public access, commercial access and riparian resident) and across the different lake classes. There are a few notable exceptions, however. Problems were more frequently indicated on the large lakes (excluding Mille Lacs) and less frequently indicated

on Mille Lacs. Boaters engaging in canoeing and sailing were more likely than other boaters to encounter problems with other boaters (specifically: noise, high speeds, careless operation, and use of personal watercraft) and boaters using personal watercraft were less likely to encounter problems with other boaters (few problems with their own activity, high wakes and noise).

For this same set of potential problems concerning the behavior of other boaters, the use of personal watercraft also led the list of problems in the Twin Cities metro area in a 1996 study. Fewer boaters in the metro area (24% metro versus 35% in this study), however, judged the problem as of 'moderate' or greater seriousness.

Experiencing problems caused by other boaters makes boaters feel more crowded (crowding is the next topic below). When other boaters get "close" enough to cause a 'moderate', 'serious' or 'very serious' problem, the likelihood of encountering 'too many boats' on the trip goes up (Table 5). For example, for boaters who judged large boats (boats over 24 feet) as a 'moderate' or more serious problem, 43 percent encountered 'too many boats' on their trip, compared with only 12 percent who encountered 'too many boats' and judged this problem as 'slight' or

Table 5

Effect of problems with other boaters on a boater encountering 'too many' boats
(numbers in table are: percent of boaters encountering 'too many boats')

Item concerning other boaters	**A** Item judged as 'moderate', 'serious' or 'very serious' problem (% encountering 'too many boats')	**B** Item judged as 'slight' or 'not a' problem (% encountering 'too many boats')	Difference (A minus B)
Large boats (boats over 24 feet)	43	12	31
Boats not yielding the right-of way	41	11	29
Near miss or collision	40	12	29
Boat operators who have been drinking too much	37	11	27
High wakes	36	10	26
Excessive speed in channels and crowded areas	36	12	24
The amount of noise from boats on the lake	34	9	25
Excessive speed in open water	33	12	21
Careless or inconsiderate operation of boats	32	11	21
Boats operating too fast, too close to shore/docks	31	11	20
Use of personal watercraft (jet skis)	23	10	13

nonexistent. Overall, boaters were some 25 percent more likely to have encountered 'too many boats' if they judged a problem caused by another boater as of 'moderate' or greater seriousness.

Crowding

As noted above, boaters have a good deal of familiarity with the lake on which they are boating. This familiarity gives boaters a sound basis for judging 'usual' or 'normal' boating conditions for the time they choose to boat. When asked to judge the number of boats encountered on their current trip against this 'usual' number, the largest group (45%) indicated the number was about the same, another 26 percent indicated either 'slightly fewer' (14%) or 'slightly more' (12%), and 25 percent indicated either 'substantially fewer' (16%) or 'substantially more' (9%) (Figure 18). Overall, some 71 percent of boaters had their 'usual' expectations largely met ('about the same' plus 'slightly more/fewer' responses).

Figure 18

How does the number of boats you encountered on this trip compare to the number of boats you have seen on other trips on this same part of the lake?*
(percent of boaters)

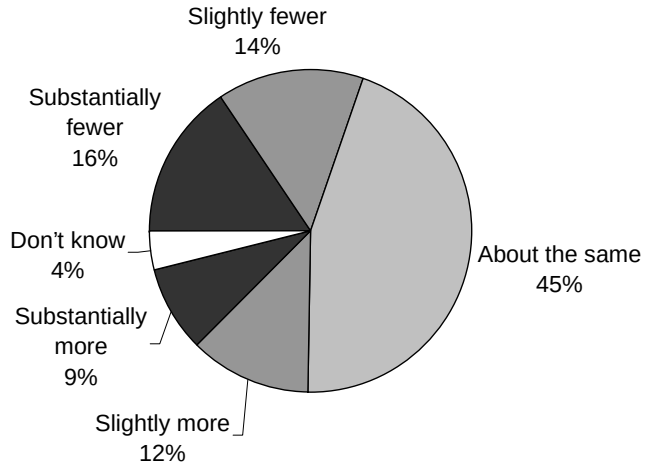


*Chart excludes the 5% of boaters who have not visited this lake before.

A boater's comparison of 'usual' number of boats with boats encountered on this current trip has a strong influence on their perception of congestion and crowding on the lake (Table 6). When the number of boats encountered today versus usual is 'substantially fewer' or 'slightly fewer', only a small portion of boaters indicate they encountered 'too many boats' on the trip (2 to 5%), and an equally small portion indicate that the lake is 'crowded' or 'far too crowded' (2 to 6%). When the number encountered today rises to 'slightly more' and 'substantially more', perceptions of congestion and crowding increase markedly. A majority of boater who encountered 'substantially more' boats than usual find 'too many boats' on the

lake (53%) and 'crowded' or 'far too crowded' conditions (59%).

Table 6

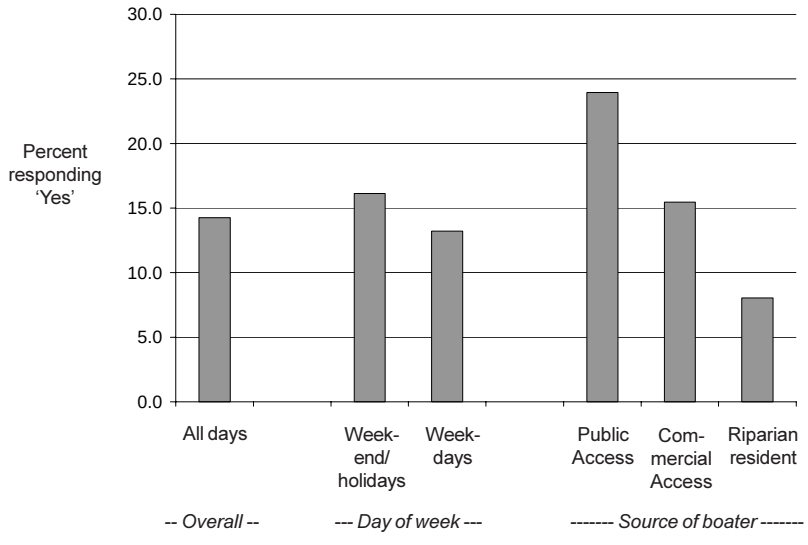
Effect of 'usual' boat-number expectations on perceptions of congestion and crowding

	Percent of boaters who encountered 'too many boats' today	Percent of boaters who judged the number of boats as 'crowded' or 'far too crowded' today
All boaters	14	15
Number of boats today versus usual?		
Substantially fewer	2	2
Slightly fewer	5	6
About the same	11	11
Slightly more	30	31
Substantially more	53	59
Don't know	14	8
Have not boated here before	7	8

Most boaters (86%) did not encounter 'too many boats' on their trip, while the balance (14%) did (Figure 19). Slightly more encountered 'too many boats' on weekend and holidays compared with weekdays. Public access boaters encountered 'too many boats' more frequently than commercial access boaters, who in turn encountered 'too many boats' more frequently than riparian resident boaters. The reason for this pattern among sources of boater is unknown. Public access boaters did not follow the two patterns (identified above) that are associated with higher perceptions of

Figure 19

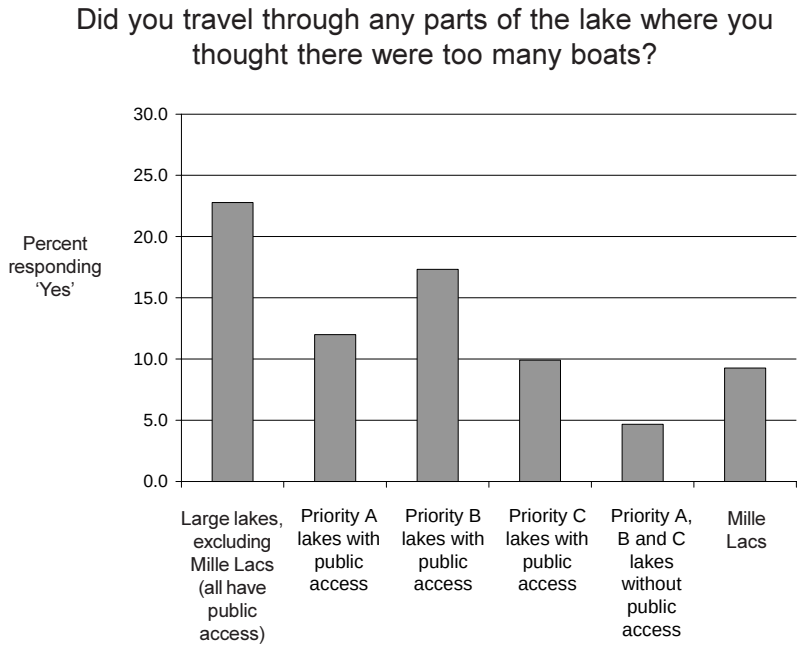
Did you travel through any parts of the lake where you thought there were too many boats?



crowding and congestion. They neither were more likely to encounter more boats than usual compared with commercial access and riparian resident boats, nor did they experience more problems with other boaters than commercial access and riparian resident boaters. In addition, this difference between sources of use was not found in the 1985 study (data from 1985 are presented below).

Across the lake classes, the highest frequency of 'too many boats' is found on the large lakes (excluding Mille Lacs) and the lowest frequency is found on the lakes without public access (Figure 20).

Figure 20



The pattern of responses described above for 'too many boats' is the same as the pattern for 'crowded' and 'too crowded responses' across days of week, sources of use (Figure 21) and lake classes (Figure 22). Of the crowded responses, most are reported as 'crowded' and few as 'far too crowded'.

Figure 21

From a safety standpoint, how do you feel about the number of boats on the lake on this trip?

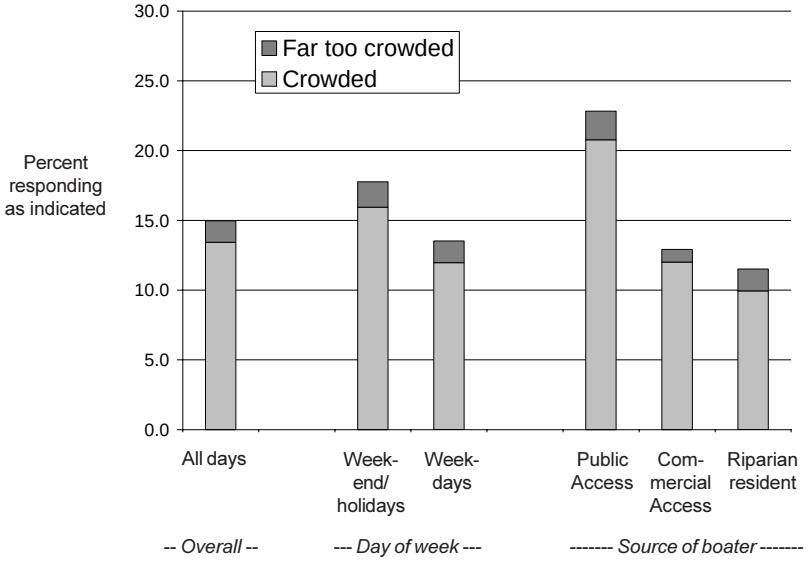
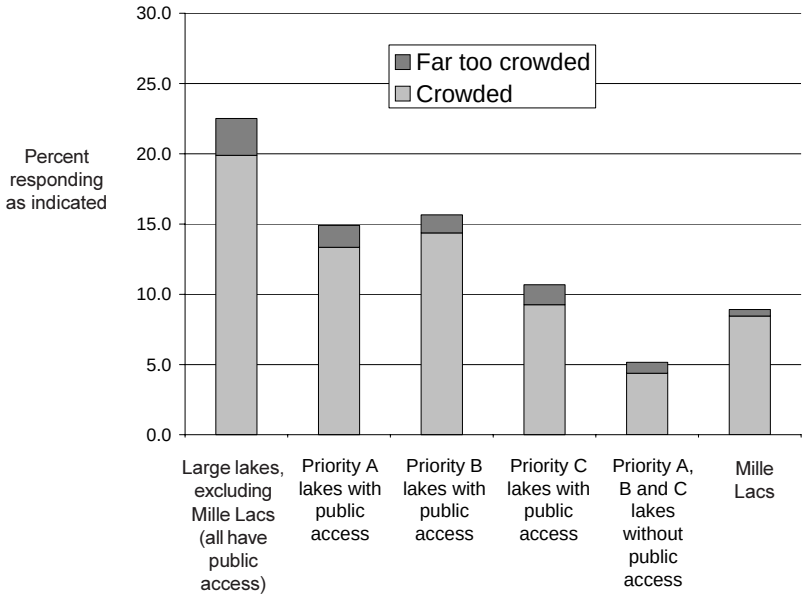


Figure 22

From a safety standpoint, how do you feel about the number of boats on the lake on this trip?



There has been an increase in perceptions of crowding between 1985 and 1998 (Table 7). Overall, 10 percent more boaters judge conditions as 'crowded' or 'far too crowded' in 1998 than in 1985. Increases are recorded for each source of use and for each lake class. The increase is largest for public access users.

Table 7

Trends in perception of crowding: percent of boaters judging conditions as 'crowded' or 'far too crowded'

	'Crowded' & 'Far too crowded' 1985	'Crowded' & 'Far too crowded' 1998	Change (1985 to 1998)
Overall	5	15	10
Source of boater			
Public access	2	23	21
Commercial access	3	13	10
Riparian resident	6	12	5
Lake Class			
Large lakes, excluding Mille Lacs (all have public access)	8	23	14
Priority A lakes with public access	7	15	7
Priority B lakes with public access	4	16	12
Priority C lakes with public access	(no data)	11	-
Lakes without public access	0	5	5
Mille Lacs	0	9	9

The rise in perception of crowding is not consistent with the stable boat numbers on the lakes. But boaters can feel crowded for reasons other than the sheer number of boats. To reiterate from previous discussion, when boaters encounter problems with other boaters, they are more likely to feel crowded. It may be that more problems with other boaters (such as personal watercraft; larger, faster-moving boats; more noise) are giving rise to more crowding. Personal watercraft are new since the 1985 study, boats are larger and more powerful than in 1985 (see section below on boating equipment) and more boaters are engaging in boat riding and fewer in fishing than in 1985 (see section below on boating activities). It may be that the combination of these changes has—at a minimum— contributed to the increase in crowding perceptions.

Irrespective of their perception of the number of boats, the large majority of boaters would return to boat under the same conditions (Table 8). Virtually all boaters (98%) who did not encounter too many boats would return if the numbers would be the same. This return rate falls to 80 percent for boaters who encountered too many boats, leaving 20 percent who would think twice before returning.

Table 8

Would you boat again if you knew there were going to be about the same number of boats as on this trip?

	All boaters (percent)	Boaters who encountered too many boats (percent)	Boaters who did not encounter too many boats (percent)
Yes	95	80	98
No	2	8	1
Don't know	3	12	1
Total	100	100	100

PUBLIC ACCESS FACILITIES

Quality of Facilities

Boaters give high marks to public access facilities. Positive ratings ('good' to 'excellent') comprise over 80 percent of boater ratings (Figure 23). Few boaters give negative ratings of 'poor' or 'very poor'. High ratings extend across the lake classes. The current high ratings represent a continuation of such ratings since 1985, when boaters rated the facilities virtually the same.

There are problems, however, in the use of the public access facilities. Just over 20 percent of public access boaters indicated that they had some type of problem using the public access (Figure 24). Nearly 30 percent of Mille Lacs access users reported a problem. These problems have a noticeable effect on access ratings (Table 9). They lower the positive ratings, and raise the middling and poor ratings.

Access users identified specific problems. The leading problems have to do with the perceived small size of many

Figure 23

How would you rate this public access for launching and landing a boat?

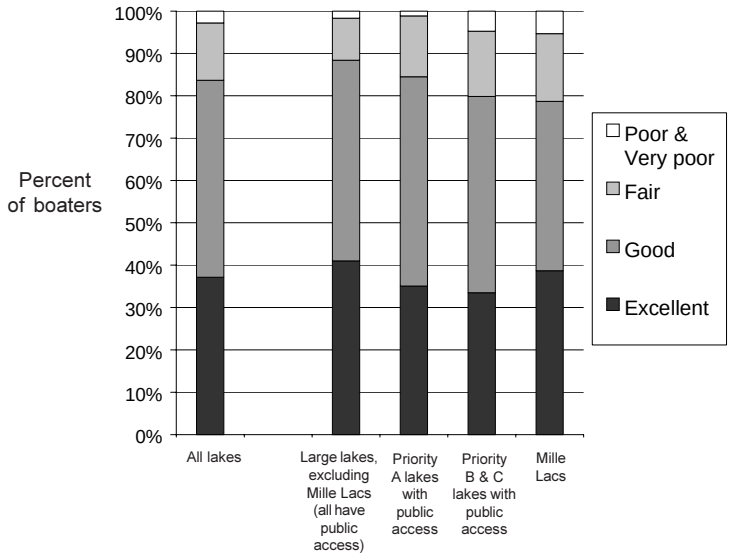
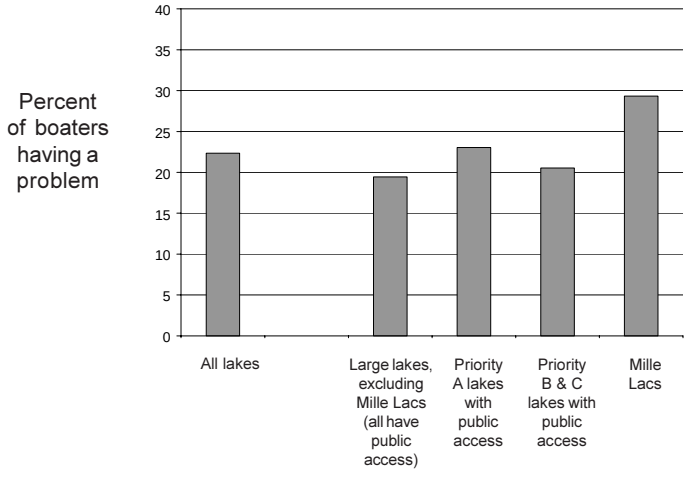


Figure 24

Did you have any particular problems using this access on this boating trip?



parts of the access facility: insufficient parking spaces, not enough maneuvering room on land/water near the ramp, and insufficient number of launch lanes (Figure 25). Additional problems have to do with shallow water, difficulty of landing/launching due to wind and waves, and lack of a dock. None of these problems, however, was all that common. The top-ranked problem was identified by less than 10 percent of access users (8%), and it was the only problem identified by over 5 percent of users. Mille Lacs access users differed somewhat from the other lake users. They were more likely to identify shallow water and difficulty of landing/launching do to wind and waves as problems than other lake users, and were less likely to report insufficient parking spaces as a problem.

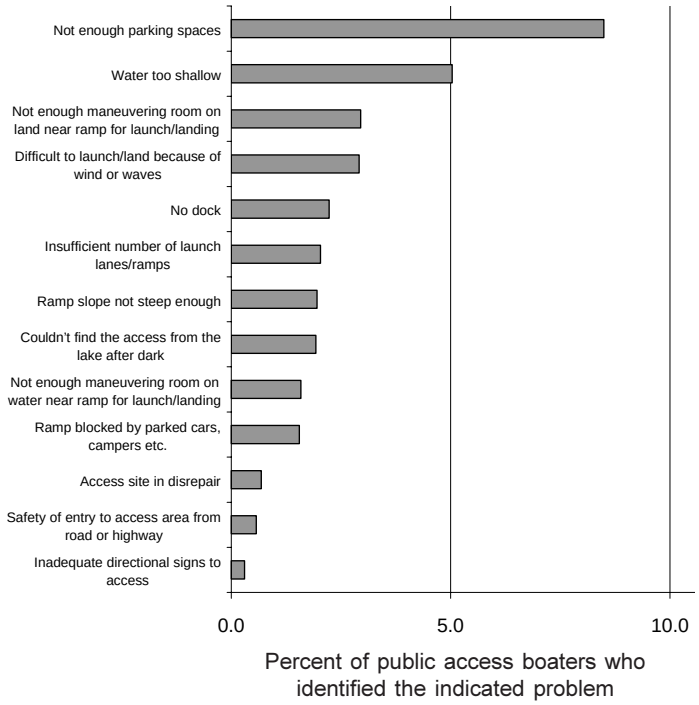
Table 9

How public access ratings are affected by problems in the use of the access

	All users (percent)	*Problem using the access? 'Yes'* (percent)	*'No'* (percent)
Excellent	37	25	41
Good	47	47	47
Fair	14	20	11
Poor & Very poor	3	9	1
Total	100	100	100

Figure 25

What was the problem using the public access today?



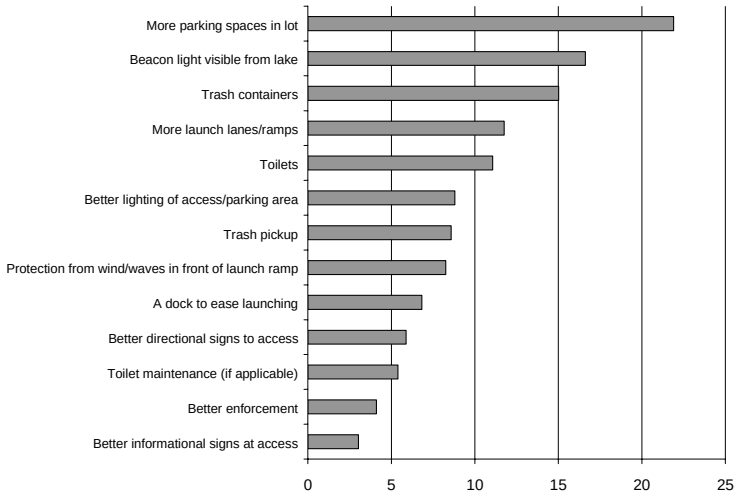
Improvements to Facilities

When asked what improvements are needed at access sites, boaters suggested improvements that solve their use problems. The top-ranked improvement had to do with expanding the size of the facility: more parking

spaces in the lot (22% of users) (Figure 26). This was accompanied by another high-ranked, size-related improvement calling for move launch lanes/ramps (12% or users). Other improvements suggested by over 10 percent of users included: a beacon light visible from the lake, trash containers and toilets. Mille Lacs access users, once again, differed from other lakes users. They were more likely to indicate the protection from wind/waves near ramp (19% of Mille Lacs users) and the trash container improvement (31%), and less likely to indicate the improvement regarding more parking spaces (12%).

Figure 26

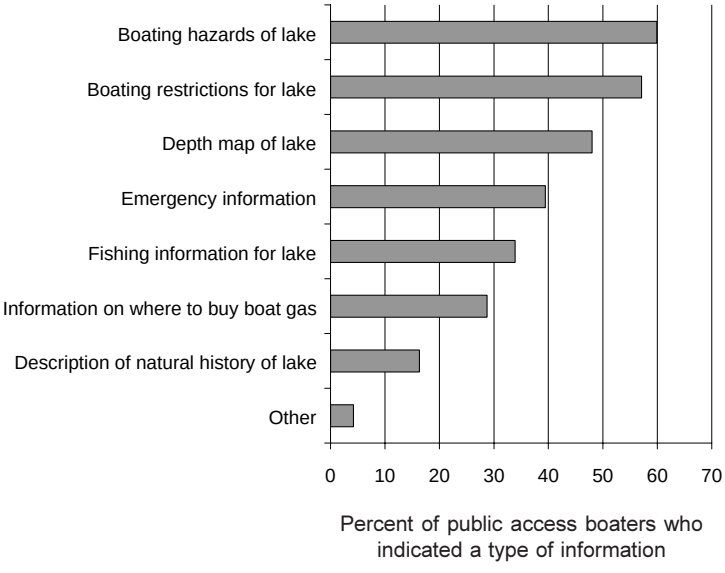
Which of the following improvements do you feel are needed at this launch site?



Access users were also queried about the types of information that should be available at public access sites to enhance their boating experience. The highest-ranked types of information had to do with boating safety (hazards) and boating restrictions (Figure 27). These were the only two types reported by a majority of access users. The next ranked type of information was a depth map of the lake, followed by emergency information. Fishing informa-

Figure 27

What types of information should be available at public boat accesses to enhance your boating experience?



tion was not commonly requested (34%), even by anglers (39%), although Mille Lacs boaters were somewhat higher (47%). Few boaters showed interest in natural history information of the lake.

Use of Facilities

In the past, the large majority of public access users fit the profile of a traditional user: someone who trailers their boat to the access, launches/lands the boat at the access, and uses the access lot for parking their vehicle-trailer while they are on the water. Boaters who lived on the lake occasionally used the access to get their boat in and out of the water, especially to launch in spring and land in the fall. People staying at resorts and private campgrounds generally were not large users of the access, because most resorts/campgrounds provide their own launch facilities.

The portion of traditional users has decline (Table 10). Between 1985 and 1998, traditional users decreased from 83 percent to 62 percent of the traffic through public accesses. Accounting for more of the traffic between 1985 and 1998 are riparian residents and resort-campground guests. These latter two are now estimated to account for nearly 40 percent (38%) of traffic through the accesses, up from 17 percent in 1985. Public accesses—it appears—are becoming more and more an asset that all lake interests take advantage of, including riparian residents and commercial boating-related interests. Once again, Mille Lacs is different. Public access users on Mille Lacs are almost all of the traditional type (96%).

Table 10

Who are the users of public access?

	--Percent of public access use-- 1985	1998
Traditional public access user	83	62
Lakeshore home owner	14	25
Resort-campground guest	3	13
Total	100	100

The reason for change in the use of public accesses is unknown, but one hypothesis comes to mind: the increasing size of boats and motors (see later section on boating equipment), and associated need to launch/land these boats at a well designed access facility. If this hypothesis is true, and if the upward trend in boat sizes and motors continues, public access facilities may become increasingly important to lakeshore residents and resorts/campgrounds on the lakes.

On a related topic, the majority of boaters (56%) use additional lakes near the lake where they were surveyed (Table 11). This includes nearly half of riparian residents (46%). Access to these additional lakes is dominated by public access, indicating that many more boaters than just those surveyed at public access have a stake in public access facilities (Table 12).

A large portion of public access users (64%) have at some time in their past found a public access parking lot full on the lake they were surveyed (Figure 28). On average, this happened twice in the last year. Most of these were able to find a way onto the lake. They either went to another access on the lake (especially prevalent for Mille Lacs), parked on the road or parked elsewhere (Figure 29). Some 14 percent went to another lake. Few (5%) did not boat that day.

Table 11

Percent of boaters that boat on other lakes within 50 miles of this lake

	Percent
All boaters	56
Source of boater	
Public access	72
Commercial access	59
Riparian resident	46

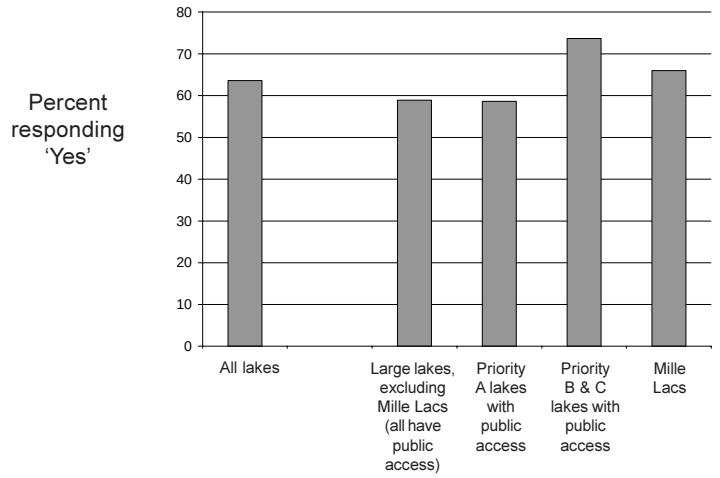
Table 12

How do you gain access to these other lakes?
(a boater could check more than one means of access)

Means of access	Percent
Free public access launch site	79
Resort, marina or private launch site	15
My home or cabin	15
Friend or relative's home/cabin	14
Other	7

Figure 28

Have you ever tried to use free public access on this lake and found the access parking lot full?



Need for Additional Facilities

Full parking lots and congested facilities (noted earlier) give boaters reasons to want additional public access facilities. This want, or perceived need, for additional public access was examined in the survey for the lake at which the boaters were surveyed. Overall, some 14

percent of all boaters though additional public access was needed, 72 percent did not think additional access was needed, and 14 percent were uncertain (Table 13). Public access boaters were more likely to indicate a need for additional access (25%), but still a majority (52%) did not see a need for more access. Few riparian residents saw a need for more access (5%). On lakes presently without public access, 8 percent of boaters using these lakes (mainly riparian residents) saw a need for an access, 72

Figure 29

What did you do when you found the public access parking lot full?

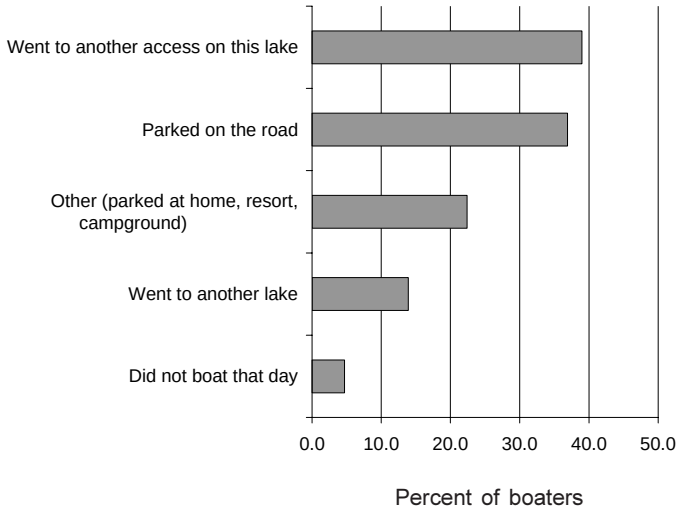


Table 13

Do you think an additional (or initial) public access is needed on this lake?

	---------- percent of boaters ----------			
	'Yes'	'No'	'Don't know'	Total
All boaters	14	72	14	100
Source of boater				
Public access	25	52	23	100
Commercial access	17	60	23	100
Riparian resident	5	91	4	100
Lake category				
Large lakes, ex Mille Lacs (all have public access)	14	67	19	100
Priority A lakes with public access	9	80	12	100
Priority B lakes with public access	17	70	13	100
Priority C lakes with public access	14	71	14	100
Lakes without public access	8	72	20	100
Mille Lacs	23	67	10	100

percent did not, and 20 percent were uncertain.

The primary reason—shared across all the lake classes and Mille Lacs—given for additional access need had to do with congestion at the present access(es) on the lake (Table 14). Secondary reasons had to do with landing/launching in certain types of weather, location of the access on the wrong part of the lake, and shallowness of the present access. The weather and shallow-water reasons were more important for Mille Lacs access users than users on other lakes.

Table 14

Why is an additional public boat access needed?
(reasons given by the 14% of boaters who indicated a need for more access)

Reason	Percent giving reason
Present access is too congested	56
Present access is too difficult to launch/land a boat in certain weather	26
Present access is on wrong part of lake	23
Present access is too shallow	22
Present access is too far off main roads	6
Other	22

BOATING SAFETY AND ENFORCEMENT

Boating Restrictions

The special boating restrictions that occur on north central lakes are all speed, no wake restrictions in channel areas. Of the 54 sample lakes on which boaters were surveyed in the study, 24 have such a restriction (Table 15). Both the Gull and Whitefish chains of lakes (19 total lakes), and 5 other lakes have this restriction.

Table 15

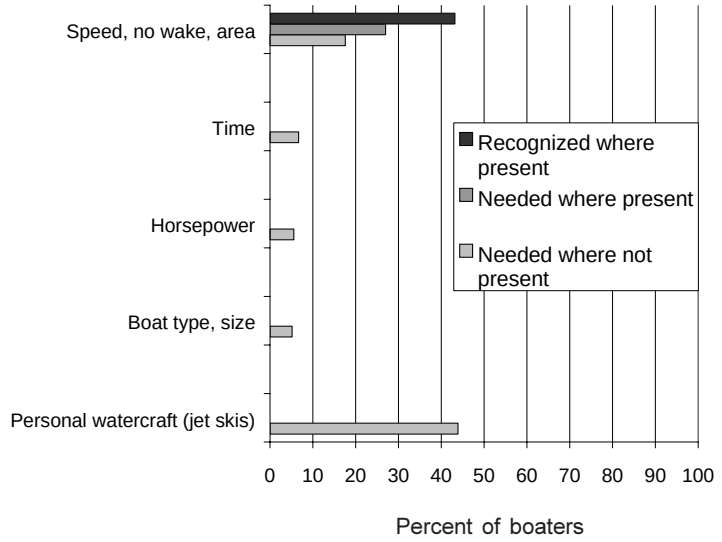
Existing Boating Restrictions on Sample Lakes in 1998

	Lakes with restriction	Lakes without restriction	Total lakes
Speed/No wake/Area	24	30	54

Boaters were asked whether they were aware of the special boating restrictions on the lake where they were surveyed. Just over 40 percent (43%) of boaters were aware of the speed, no wake restriction on the lakes where it existed (Figure 30). Awareness may be lowered by the fact that the restrictions only apply to channels, where some boaters may not travel.

Figure 30

Recognition and need for different types of restrictions



In addition to awareness, boaters were asked whether the existing restrictions were needed. On those lakes with the speed/no wake restrictions, 27 percent of boaters indicated the restriction was needed. Furthermore, boaters were asked if a variety of additional restrictions were

needed. On those lakes presently without a speed/no wake restriction, 18 percent of boaters thought the restriction was needed. Other possible restrictions (time, horsepower and boat type/size) were indicated by few boaters. The only potential restriction that was indicated by a large portion of boaters concerned the use of personal watercraft (jet skis). This desire to restrict personal watercraft is one more indication of the opinion a large portion of boaters have of personal watercraft use. As noted above, personal watercraft use was the leading problem boaters were having with other boaters. Personal watercraft use only represents a few percent of the boating use on these lake (see section below on activities).

Few boaters (2%) believe that the current level of boating restriction—which is not very extensive—is 'too restrictive', somewhat more (15%) believe it is 'not restrictive enough', and the majority (60%) believe it is 'about right' (Figure 31). A fair portion of boaters simply do not feel they know enough about this topic to give an opinion. These perspectives are widely shared among sources of boaters and across lakes classes.

Most boaters (68%) believe the current restrictions have little or no effect on their enjoyment of boating (Figure 32). More boaters believe existing restrictions add to their enjoyment (28%) than detract from their enjoyment (4%). These views are widely shared among sources of boaters and across lakes classes.

Figure 31

Overall, how restrictive do you think boating restrictions are on this lake?
(percent of boaters)

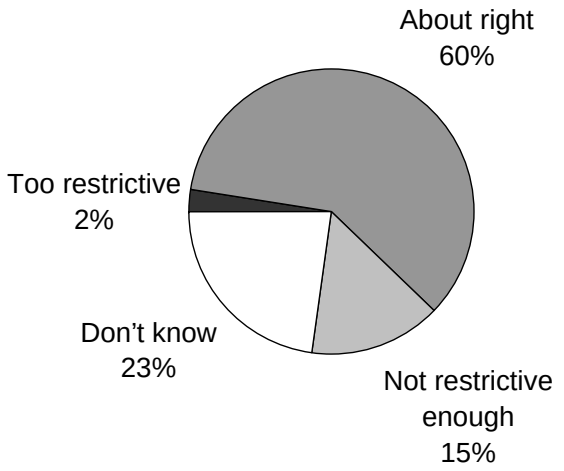
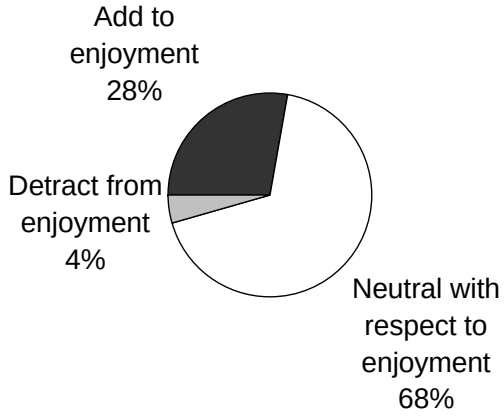


Figure 32

Overall, how do boating restrictions affect your enjoyment of the lake?
(percent of boaters)

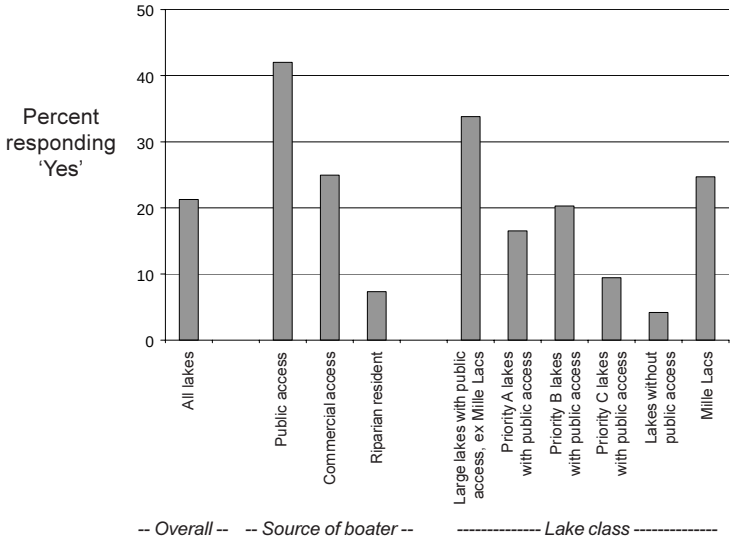


Enforcement Presence

Enforcement officers are much more likely to be seen by certain boaters. Public access boaters see an enforcement officer more than boaters using commercial access and far more than riparian resident boaters (Figure 33). Boaters on the large lakes and Mille Lacs are more likely to see an enforcement officer than boaters on the smaller lakes. About five percent of boaters report being checked by an officer. Most of these boaters were fishing (73%) (Figure 34).

Figure 33

While you were on the lake on this trip, did you see an enforcement officer?

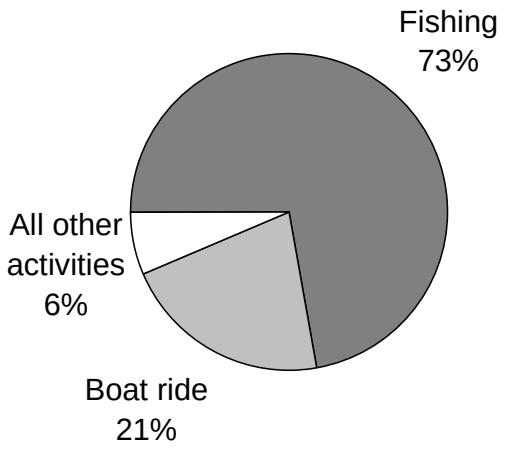


Safety Courses

Formal safety courses have been completed by one-fifth of all boaters (Table 16). Boaters using public and commercial accesses are somewhat more likely to have completed a course than riparian resident boaters. The portion having completed a course does not appear to have changed materially since 1985. In 1985 this question was asked without specifying the 'formal' qualifier for the safety course. The 'formal' qualifier probably leads to a smaller portion of boaters

Figure 34

Activity of boaters who reported being checked by an enforcement officer
(5% of boaters reported being checked)



having completed a course.

Boaters having completed a formal safety course are more likely than other boaters (75% compared with 30%) to believe all boaters should be required to complete a safety course (Table 17). Overall, 39 percent believe all boaters should be required to complete such a course.

Requiring an operators license for motorboat operators is not all that popular. It is supported by only 27% of boaters (Table 18). Boaters having completed a safety course are more likely than other boaters to support this license requirement, although less than half of those having completed a safety course support the license requirement.

Types of Beverages on Board

Since the 1985 study, Minnesota enacted a law that makes it illegal to operate a motorboat after consuming too much alcohol, very much like the alcohol restrictions on driving an automobile. In 1998, about one-quarter of boaters report having some type of alcoholic drinks on board during their trip (Figure 35). Very few have only alcoholic drinks (1%). Most boaters have no alcohol on the boat: either they

Table 16

Boaters having completed a 'course' (1985 survey) or 'formal course' (1998 survey) in boating safety

	1985 (percent)	1998 (percent)	Change 1985 to 1998
All boaters	23	20	-3
Source of boater			
Public access	18	24	6
Commercial access	27	22	-5
Riparian resident	23	16	-7

Table 17

Boaters who believe all boat operators (powered and unpowered) should be required to complete a boating safety course

	Percent
All boaters	39
Boaters having taken a formal safety course	75
Boaters not having taken a formal safety course	30

Table 18

Boaters who believe all motorboat operators should be required to obtain an operator's license

	Percent
All boaters	27
Boaters having taken a formal safety course	43
Boaters not having taken a formal safety course	23

have only non-alcoholic drinks on board (52%), or have no drinks of any type (24%). Riparian residents are more likely than boaters from public and commercial accesses to have no drinks on board.

Since 1985, boaters who take drinks on board are more likely to take a mix of alcoholic and non-alcoholic beverages (Table 19). The changes are not dramatic, however, and basically the same pattern of drinks prevail in 1985 and 1998: boaters with non-alcoholic drinks are the largest group by far, followed by those with a mix of drinks, and—at a distant third—boaters with only alcoholic drinks.

Safety Equipment

Most boats (88%) are equipped with some form of safety equipment other than personal flotation devices (Table 20). Lights, fire extinguishers and horns are the most common equipment types. The small portion of boats without any safety equipment (12%) may not need any, because no safety equipment other that personal

Figure 35

Beverages on Board
(percent of boaters)

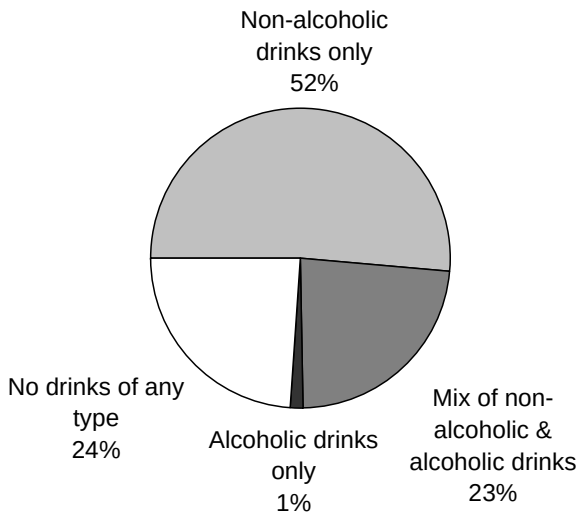


Table 19

Percent of boaters having certain drinks on board
(only includes boaters who have some type of drink on board)

	1985	1998	Change 1985 to 1998
Non-alcoholic drinks only	70	68	-3
Mix of non-alcoholic and alcoholic drink:	24	30	7
Alcoholic drinks only	6	2	-4
Total percent	100	100	0

Table 20

Percent of Boats with Various Types of Safety Equipment, Other than Personal Flotation Devices

	Percent
Fire extinguisher	70
Horn	61
Lights	83
Visual signal (flag, flare gun)	17
None of the above	12

flotation devices is required for boats less that 16 feet long operated during daylight hours.

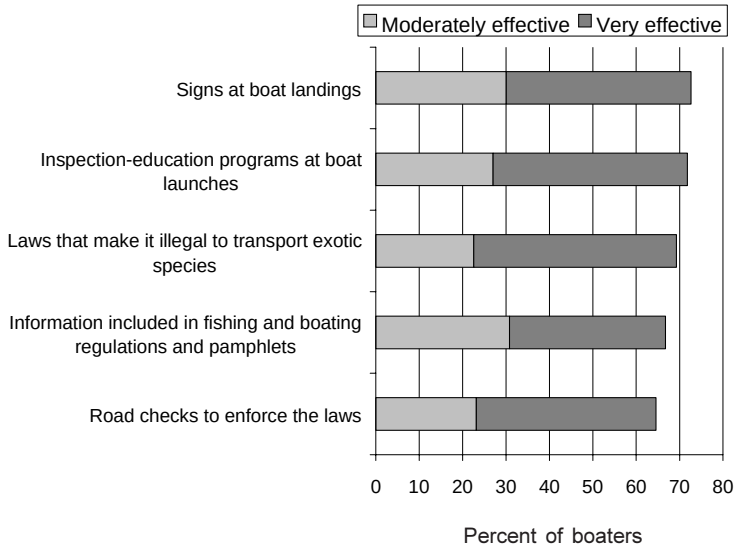
PREVENTING THE SPREAD OF EXOTIC SPECIES

Exotic species such as Eurasian watermilfoil and zebra mussels are not a prevalent problem in the north central boating region at the present time. There is interest, understandably, in ensuring that this situation does not change.

In the Twin Cities metro area, where exotic species are a significant problem, boaters have been queried about the effectiveness of various means to prevent the further spread of exotics by boaters. The five most effective means identified by metro boaters were included in the north central surveys to assess if north central boaters agreed with metro boaters. The results indicate that they do. All of these means were given high 'very effective' and 'moderately effective' ratings by boaters, similar to results in the metro area (Figure 36). The means are of three types. One type is the information delivered at boat landings, either in the form of signs or inspection-education programs. The second type is related to enforcement, and includes laws to make the transport of exotics illegal and road checks to enforce those laws. And the third type is information delivered directly to boaters in fishing and boating regulations documents. There was excellent agreement across sources of boaters and lakes classes on the effectiveness of these means to prevent the spread of exotic species.

Figure 36

How effective would the following be in getting you to take steps to prevent the further spread of exotic species such as Eurasian watermilfoil and zebra mussels?
('moderately' and 'very effective' responses)



CHARACTERISTICS OF THE BOATING TRIP

Activity

There are two main activities on north central lakes: fishing and boat riding. The former is slightly larger than the latter for all lakes combined (Figure 37). On the larger lakes (excluding Mille Lacs), however, boat riding is more popular than fishing, and the two activities are the same size on the priority A lakes with public access (Figure 38). Mille

Figure 37

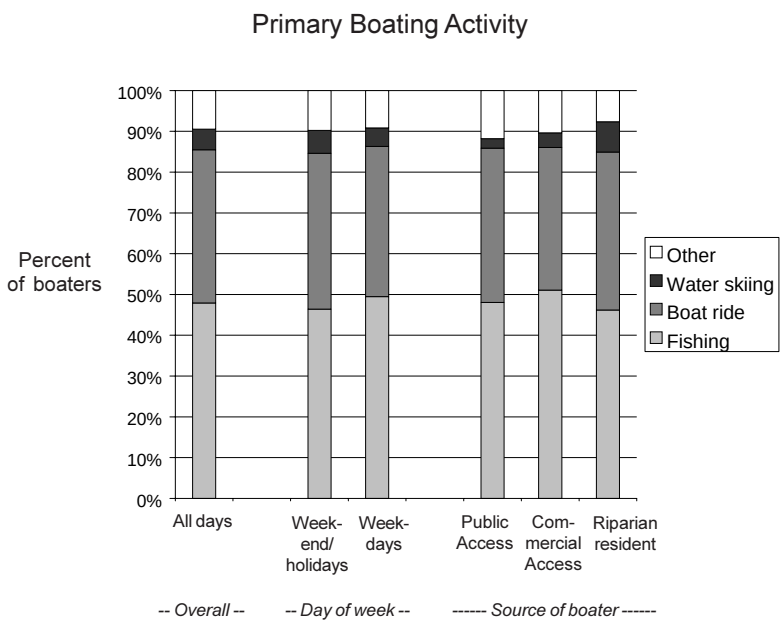
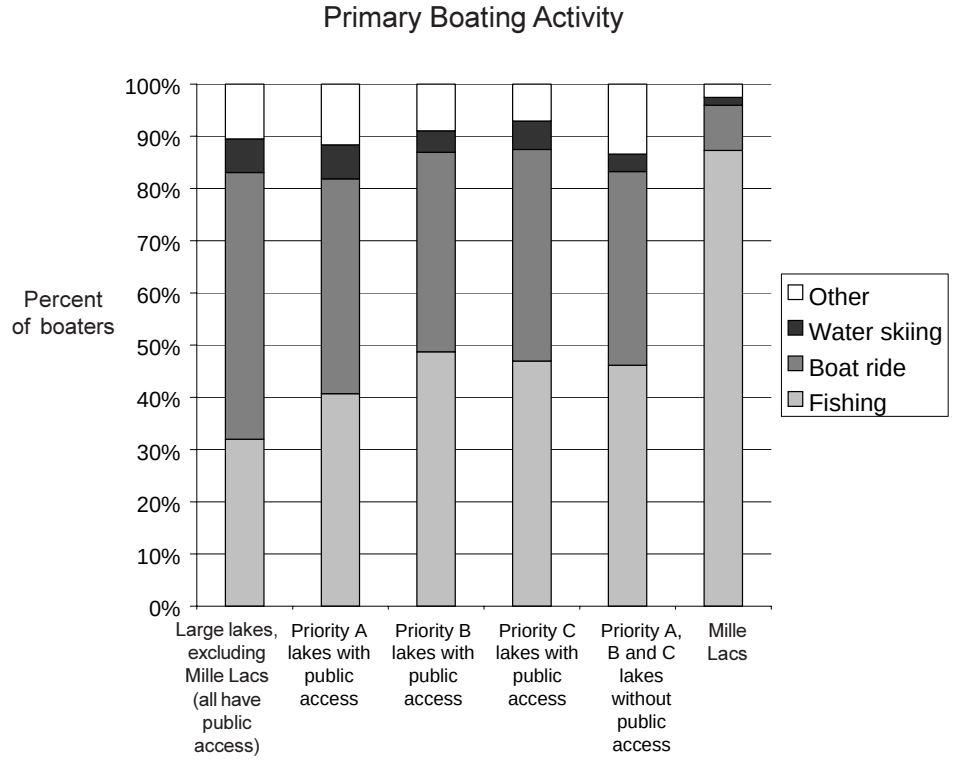


Figure 38



Lacs is almost exclusively a fishing lake. The activity pattern of fishing and boat riding is relatively constant by day of week and source of boater. All other activities are comparatively small. Water skiing accounts for about 5 percent of activity time.

Table 21

Boater Activities in 1985 and 1998

	1985 (percent)	1998 (percent)	Change (1985 to 1998)
Fishing	61	48	-14
Boat ride	26	38	12
Water skiing	10	5	-5
Transportation	1	2	1
Canoeing	1	1	0
Sailing	1	1	0
Other*	0	5	5
Total	100	100	0

* Includes the use of personal watercraft in 1998 (2%); personal watercraft use was not surveyed in 1985.

Activities have changed since 1985. The major changes have been a sizable drop in fishing and a sizable gain in boat riding (Table 21). Notable changes of a lesser magnitude are the decrease in water skiing and the increase in 'other activities.' About 2 percent of 'other' is personal watercraft use, which was not measured in 1985.

The changes experienced between 1985 and 1998 are moving the activity patterns of this region closer to that of the Twin Cities metro area, where boat riding is slightly larger than fishing. The larger lakes (except Mille Lacs) have activity patterns in 1998 very much like those in the Twin Cities. It is interesting to note that water skiing also showed a decrease in the Twin Cities metro area between 1984 and 1996.

The fishing decreases were experienced across the board (Table 22). Each source of use and each lake class (except Mille Lacs) showed a drop in fishing as a portion of activity time. The boat riding increase was equally pervasive, with each source of use and each lake class (save Mille Lacs again) showing an increase (Table 23).

Table 22

Fishing changes, 1985 to 1998
(percent of boaters with fishing as the primary activity)

	1985 (percent)	1998 (percent)	Change (1985 to 1998)
Overall	61	48	-14
Source of use			
Public access	86	48	-38
Commercial access	62	51	-11
Riparian resident	58	46	-12
Lake Class			
Large lakes, ex Mille Lacs (all have public access)	46	32	-14
Priority A lakes with public access	58	41	-17
Priority B & C lakes with public access	70	48	-22
Lakes without public access	66	46	-20
Mille Lacs	75	87	12

Table 23

Boat ride changes, 1985 to 1998
(percent of boaters with boat riding as the primary activity)

	1985 (percent)	1998 (percent)	Change (1985 to 1998)
Overall	26	38	12
Source of use			
Public access	11	38	26
Commercial access	23	35	12
Riparian resident	28	39	10
Lake Class			
Large lakes, ex Mille Lacs (all have public access)	41	51	10
Priority A lakes with public access	27	41	14
Priority B & C lakes with public access	17	39	21
Lakes without public access	24	37	13
Mille Lacs	16	9	-7

Boating Equipment

The type of craft most used for boating in 1998 is runabouts, followed closely by fishing boats (Table 24) (runabouts have a deck and windshield; fishing boats are open; a fishing boat is a type of craft, and is not related to the activity of fishing). Pontoons are the next most common type of boat. They are more common among riparian residents than public and commercial access boaters. Pontoons are less common on Mille Lacs. Fishing boats are more common on the smaller lakes and runabouts are more common on the larger lakes.

Table 24

Watercraft in 1998
(craft types as reported in the boater surveys)

	Percent
Runabout	39
Fishing boat	35
Pontoon	15
Cruiser	5
Canoe/kayak	2
Personal watercraft (jet ski)	2
Sail	1
Other	2
Total	100

Craft types have changed since 1985. The primary changes are the increase in runabouts (including cruisers, which were lumped with runabouts in 1985), and the decrease in fishing boats (Table 25). Secondary changes are the small increase in pontoons and the increase in 'other', which includes personal watercraft, a craft type not measured in 1985. Craft changes since 1985 are generally consistent across sources of boaters and lake classes.

Table 25

Watercraft Trends, 1985 to 1998
(craft types as reported in the boater surveys)

	1985 (percent)	1998 (percent)	Change (1985 to 1998)
Runabout & cruiser	33	43	11
Fishing boat	52	35	-17
Pontoon	12	15	3
Canoe/kayak	2	2	0
Sail	1	1	0
Other*	1	4	3
Total	100	100	0

* Includes personal watercraft (jet skis) in 1998 (2%); personal watercraft were not surveyed in 1985.

Boat lengths now average around 17 or 18 feet, and are relatively constant across sources of boaters and lake

classes (Table 26). Motor sizes average just over 90 horsepower; the median is lower at 70 horsepower. Motor sizes vary by source of boater—with public and commercial access boaters having larger motors than riparian residents—and by lake class, with the larger motors tending to be on the larger lakes. Overall, motor sizes are comparable to those found in the Twin Cities metro area.

Table 26

Boat Lengths and Motor Sizes

	Average feet	Median feet	Average horsepower	Median horsepower
Overall	18	17	93	70
Source of boater				
Public access	18	17	114	90
Commercial access	19	18	101	85
Riparian resident	17	17	77	55
Lake Class				
Large lakes, ex Mille Lacs (all have public access)	18	18	116	90
Priority A lakes with public access	18	17	87	65
Priority B lakes with public access	18	17	90	60
Priority C lakes with public access	18	17	108	70
Lakes without public access	19	16	50	35
Mille Lacs	17	17	89	75

Most craft have motors (Table 27). Only about 4 percent are non motorized. The most common craft has one gas-burning motor. Craft with two motors are not uncommon, however, and represent 40 percent of all boats. Two-motor combinations are more likely to be gas with electric than two gas motors.

Both craft length and motor sizes have shown increases since 1985 (Table 28). Lengths are up a foot or two across the board, and motor sizes, too, are up across

Table 27

Type and Mix of Motors on Boats

	Percent of boats
One motor	
Gas	55.8
Electric	0.4
Subtotal	56.1
Two motors	
Gas & electric	31.8
Gas & gas	8.5
Subtotal	40.3
No motors	3.6
Total	100.0

Table 28

Trends in Boat Lengths and Motor Sizes, 1985 to 1998*

	1985 Average feet	1998 Average feet	Change in feet 1985 to 1998	1985 Average horsepower	1998 Average horsepower	Change in horsepower 1985 to 1998
Overall	16	18	2	46	93	46
Source of boater						
Public access	16	18	2	47	114	68
Commercial access	15	19	3	53	101	48
Riparian resident	16	17	1	44	77	33
Lake Class						
Large lakes, ex Mille Lacs (all have public access)	17	18	1	72	116	44
Priority A lakes with public access	16	18	2	48	87	39
Priority B & C lakes with public access	15	18	2	30	94	64
Lakes without public access	16	19	4	27	50	23
Mille Lacs	16	17	1	46	89	43

* Numbers in table are rounded, so computations do not always 'appear' correct.

the board. The increase in motor size represents nearly a doubling since 1985. An increase in motor sizes was also experienced in the Twin Cities between 1984 and 1996, although the increase was less dramatic in the Twin Cities.

Boater Characteristics

Boaters, as a group, are familiar with the lake at which they were surveyed. The median length of use of the lake is 14 years, and is larger for riparian residents than for public and commercial access boaters (Table 29). Mille Lacs boaters have a comparatively long history of use. Few boaters (4%) have started boating in the last year

Table 29

How many years have you been boating on this lake?
('this lake' is the lake at which the boater received the survey)

	Median years	Percent new boaters (less than one year)
All boaters	14	4
Source of boater		
Public access	10	5
Commercial access	10	9
Riparian resident	20	0
Lake Class		
Large lakes, ex Mille Lacs (all have public access)	10	5
Priority A lakes with public access	15	3
Priority B lakes with public access	12	1
Priority C lakes with public access	11	1
Lakes without public access	11	15
Mille Lacs	18	1

on the lake where they were surveyed.

The public and commercial accesses serve two geographic markets. One is the local market (within 25 miles of home, about a half-hour drive) and the other is the more distant 'tourist' market. The former accounts for about one-quarter of access use; it accounts for less on Mille Lacs and the smaller lakes (Table 30). The other market is the 'tourist' market, and it is evident from median travel distances in the 90 to 130 miles range, which is the distance of this lake region to its main 'tourist' origin in the Twin Cities. Both the public and commercial accesses are primarily serving a tourist market.

The Twin Cities metro area is also the main origin of seasonal home boaters on these lakes (Table 31). The local region (central region) is the next largest origin. Together the local region and the Twin Cities metro account for 80 percent of seasonal home boating.

Table 30

Travel Distances from Permanent Homes to Public and Commercial Accesses

	Median miles	Percent of boaters who are within 25 miles of their permanent home
All access boaters	115	22
Source of boater		
Public access	100	23
Commercial access	120	21
Lake Class		
Large lakes, ex Mille Lacs (all have public access)	130	24
Priority A lakes with public access	125	30
Priority B lakes with public access	100	28
Priority C lakes with public access	90	12
Lakes without public access	120	8
Mille Lacs	95	6

Table 31

Origins of Boaters from Seasonal Lakeshore Homes

State or Region	Percent
Minnesota (see map)	88
Metro Region	*67*
Central Region	*13*
Southeast Region	*4*
Southwest Region	*3*
Northwest Region	*1*
Northeast Region	*1*
Iowa	4
Illinois	1
Florida	1
Nebraska	1
Arizona	1
Texas	1
All other origins	3
Total	100

APPENDIX A

Lakes in the north central study area

Sample Lakes in 1985 & 1998 Boating Studies

Lake Number	Lake Name	1985 Category*	1998 Category*	Chain	Acres
480002	Mille Lacs	Mille Lacs	Mille Lacs		132,516
110305	Gull	Cat 1	Cat 1	Gull	9,541
110222	Margaret	Cat 1	Cat 1	Gull	230
180399	Nisswa	Cat 1	Cat 1	Gull	213
180398	Roy	Cat 1	Cat 1	Gull	306
110218	Upper Gull	Cat 1	Cat 1	Gull	345
180388	Love	Cat 1	Cat 1	Gull	88
110220	Ray	Cat 1	Cat 1	Gull	183
180310	Whitefish	Cat 1	Cat 1	Whitefish	7,969
180366	Arrowhead	Cat 1	Cat 1	Whitefish	285
180355	Bertha	Cat 1	Cat 1	Whitefish	353
180315	Big Trout	Cat 1	Cat 1	Whitefish	1,486
180356	Clamshell	Cat 1	Cat 1	Whitefish	238
180312	Cross	Cat 1	Cat 1	Whitefish	1,884
180271	Daggett	Cat 1	Cat 1	Whitefish	284
180269	Island	Cat 1	Cat 1	Whitefish	193
180266	Little Pine	Cat 1	Cat 1	Whitefish	384
180378	Lower Hay	Cat 1	Cat 1	Whitefish	720
180354	Pig	Cat 1	Cat 1	Whitefish	213
180311	Rush	Cat 1	Cat 1	Whitefish	782
180308	Pelican	Cat 1	Cat 1		8,468
110250	Ada	Cat 2-PA	Cat 2-PA		1,044
180034	Bay	Cat 2-PA	Cat 2-PA		2,435
10159	Farm Island	Cat 2-PA	Cat 2-PA		2,025
180373	Round	Cat 2-PA	Cat 2-PA		1,706
180251	Sandbar	Cat 2-PA	Cat 2-PA		974
110304	Sylvan	Cat 2-PA	Cat 2-PA		882
180020	Borden	Cat 2-NPA	Cat 2-PA		1,038
180038	Clearwater	Cat 2-NPA	Cat 2-PA		917
110120	Inguadona	Cat 2-NPA	Cat 2-PA	Inguadona	935
110162	Rice	Cat 2-NPA	Cat 2-PA	Inguadona	342
10204	Round	Cat 2-NPA	Cat 2-PA		736
110413	Ten Mile	(new in '98)	Cat 2-PA		4,640
180375	Hubert	(new in '98)	Cat 2-PA		1,344
110277	Big Deep	(new in '98)	Cat 2-NPA		532

*Class codes are as follows:
Mille Lacs: Mille Lacs
Cat 1: Remaining large boating lakes (all have public access)
Cat 2-PA: Priority A lakes with public access
Cat 2-NPA: Priority A lakes without public access
Cat 3-PA: Priority B lakes with public access
Cat 3-NPA: Priority B lakes without public access
Cat 4-PA: Priority C lakes with public access
Cat 4-NPA: Priority C lakes without public access

Sample Lakes in 1985 & 1998 Boating Studies (cont'd)

Lake Number	Lake Name	1985 Category*	1998 Category*	Chain	Acres
180374	Clark	Cat 3-PA	Cat 3-PA		309
180203	Emily	Cat 3-PA	Cat 3-PA	Emily	675
180185	Mary	Cat 3-PA	Cat 3-PA	Emily	491
110167	Little Boy	Cat 3-PA	Cat 3-PA		1,396
10117	Nord	Cat 3-PA	Cat 3-PA		414
10136	Waukenabo	Cat 3-PA	Cat 3-PA		819
10147	Esquagamah	Cat 3-NPA	Cat 3-PA		808
110232	Hattie	Cat 3-NPA	Cat 3-NPA		592
110296	Moccasin	Cat 3-NPA	Cat 3-PA		259
180227	O Brien	Cat 3-NPA	Cat 3-NPA		203
110282	Mann	(new in '98)	Cat 3-NPA		484
180296	Eagle	Cat 4-PA	Cat 4-PA		356
10132	Hansen	Cat 4-PA	Cat 4-PA		200
110009	Little Thunder	Cat 4-PA	Cat 4-PA		264
110226	Loon	Cat 4-PA	Cat 4-PA		220
180379	White Sand	Cat 4-PA	Cat 4-PA		441
10170	Hanging Kettle	Cat 4-NPA	Cat 4-PA		320
180256	Bass	Cat 4-NPA	Cat 4-PA		386
110292	Pine	Cat 4-NPA	Cat 4-PA		256

*Class codes are as follows:

Mille Lacs: Mille Lacs
Cat 1: Remaining large boating lakes (all have public access)
Cat 2-PA: Priority A lakes with public access
Cat 2-NPA: Priority A lakes without public access
Cat 3-PA: Priority B lakes with public access
Cat 3-NPA: Priority B lakes without public access
Cat 4-PA: Priority C lakes with public access
Cat 4-NPA: Priority C lakes without public access

Remaining (non-sample) priority A, B and C lakes in north central boating study area

Lake Number	Lake Name	1985 Category*	1998 Category*	Acres	Lake Number	Lake Name	1985 Category*	1998 Category*	Acres
180225	Adney	Cat 2-PA	Cat 2-PA	322	180305	Edward	Cat 2-PA	Cat 2-PA	2,844
180060	Agate	Cat 3-NPA	Cat 3-NPA	203	10123	Elm Island	Cat 4-PA	Cat 4-PA	656
110283	Baby	Cat 2-NPA	Cat 2-PA	736	180009	Erskine	Cat 4-PA	Cat 4-PA	186
110069	Bass	Cat 3-PA	Cat 3-PA	224	110351	Five Point	Cat 3-PA	Cat 3-PA	265
180306	Bass	Cat 3-PA	Cat 3-PA	455	10104	French	Cat 3-PA	Cat 3-PA	155
110308	Big Portage	Cat 2-PA	Cat 2-PA	956	180320	Gilbert	Cat 3-PA	Cat 3-PA	391
110073	Big Rice	Cat 3-PA	Cat 3-PA	2,656	110174	Girl	Cat 3-PA	Cat 3-PA	384
110412	Birch	Cat 2-PA	Cat 2-PA	1,262	180338	Gladstone	Cat 3-NPA	Cat 3-PA	457
180140	Black Bear	Cat 3-PA	Cat 3-PA	235	180226	Goodrich	Cat 3-NPA	Cat 3-NPA	398
110274	Black Water	Cat 2-PA	Cat 2-PA	761	180110	Grave	Cat 4-NPA	Cat 4-NPA	177
180117	Blackhoof	Cat 4-PA	Cat 4-PA	195	180287	Greer	Cat 4-PA	Cat 4-PA	384
180211	Blue	Cat 3-NPA	Cat 3-NPA	185	10099	Gun	Cat 3-PA	Cat 3-PA	735
110350	Bowen	Cat 3-NPA	Cat 3-PA	185	180070	Hamlet	Cat 3-NPA	Cat 3-NPA	313
110366	Brookway	Cat 3-NPA	Cat 3-NPA	182	10161	Hammal	Cat 3-NPA	Cat 3-PA	393
180014	Bull Dog	Cat 3-NPA	Cat 3-NPA	151	110242	Hand	Cat 3-PA	Cat 3-PA	316
180231	Butterfield	Cat 3-NPA	Cat 3-NPA	225	110199	Hay	Cat 3-NPA	Cat 3-PA	406
180018	Camp	Cat 2-NPA	Cat 2-PA	537	10179	Hickory	Cat 4-PA	Cat 4-PA	183
10209	Cedar	Cat 3-PA	Cat 3-PA	788	10142	Hill	Cat 2-PA	Cat 2-PA	898
110263	Child	Cat 3-NPA	Cat 3-NPA	295	180029	Holt	Cat 4-NPA	Cat 4-NPA	156
10093	Clear	Cat 2-PA	Cat 2-PA	590	110358	Horseshoe	Cat 3-PA	Cat 3-PA	245
180364	Clear	Cat 3-PA	Cat 3-PA	242	110472	Howard	Cat 3-NPA	Cat 3-NPA	384
180041	Crooked	Cat 3-PA	Cat 3-PA	462	110170	Hunter	Cat 3-NPA	Cat 3-NPA	181
180155	Crow Wing	Cat 3-PA	Cat 3-PA	373	110102	Island	Cat 3-PA	Cat 3-PA	390
10096	Dam	Cat 2-PA	Cat 2-PA	633	180183	Island	Cat 4-PA	Cat 4-PA	256
180314	Duck	Cat 3-PA	Cat 3-PA	160	180415	Jail	Cat 4-NPA	Cat 4-NPA	190
180099	Eagle	Cat 4-NPA	Cat 4-NPA	249	180293	Kego	Cat 3-PA	Cat 3-PA	299
180298	East Fox	Cat 3-PA	Cat 3-PA	234	110262	Kid	Cat 3-NPA	Cat 3-NPA	167
180407	East Twin	Cat 3-PA	Cat 3-PA	164	180361	Kimball	Cat 3-PA	Cat 3-PA	186
180396	Edna	Cat 3-PA	Cat 3-PA	156	110374	Larson	Cat 4-NPA	Cat 4-NPA	179
10213	Edna	Cat 4-NPA	Cat 4-NPA	272	110104	Laura	Cat 3-PA	Cat 3-PA	1,424

*Class codes are as follows:

Mille Lacs: Mille Lacs
Cat 1: Remaining large boating lakes (all have public acces
Cat 2-PA: Priority A lakes with public access
Cat 2-NPA: Priority A lakes without public access
Cat 3-PA: Priority B lakes with public access
Cat 3-NPA: Priority B lakes without public access
Cat 4-PA: Priority C lakes with public access
Cat 4-NPA: Priority C lakes without public access

Remaining (non-sample) priority A, B and C lakes in north central boating study area (cont'd)

Lake Number	Lake Name	1985 Category*	1998 Category*	Acres	Lake Number	Lake Name	1985 Category*	1998 Category*	Acres
110053	Lawrence	Cat 3-PA	Cat 3-PA	224	180371	Perch	Cat 3-PA	Cat 3-PA	284
110367	Lind	Cat 3-PA	Cat 3-PA	462	180186	Perry	Cat 4-NPA	Cat 4-NPA	160
180340	Little Hubert	Cat 3-NPA	Cat 3-NPA	192	110320	Pillager	Cat 3-PA	Cat 3-PA	213
180351	Little Pelican	Cat 3-PA	Cat 3-PA	402	10157	Pine	Cat 2-PA	Cat 2-PA	646
180139	Little Rabbit	Cat 3-NPA	Cat 3-PA	153	180261	Pine	Cat 4-PA	Cat 4-PA	391
110387	Little Webb	Cat 3-NPA	Cat 3-NPA	249	110411	Pine Mountain	Cat 3-PA	Cat 3-PA	1,657
180416	Lizzie	Cat 4-NPA	Cat 4-NPA	384	180088	Platto	Cat 3-PA	Cat 3-PA	1,768
10125	Lone	Cat 3-PA	Cat 3-PA	437	110383	Pleasant	Cat 2-PA	Cat 2-PA	907
180372	Long	Cat 2-PA	Cat 2-PA	6,178	180105	Pointon	Cat 3-NPA	Cat 3-NPA	193
110142	Long	Cat 2-PA	Cat 2-PA	926	110234	Ponto	Cat 3-PA	Cat 3-PA	380
180076	Long	Cat 3-NPA	Cat 3-NPA	196	180050	Portage	Cat 3-NPA	Cat 3-NPA	292
110258	Long	Cat 3-NPA	Cat 3-PA	229	110476	Portage	Cat 3-PA	Cat 3-PA	282
10089	Long	Cat 3-PA	Cat 3-PA	433	180093	Rabbit	Cat 2-PA	Cat 2-PA	840
180136	Long	Cat 3-PA	Cat 3-PA	1,389	10091	Rabbit	Cat 3-PA	Cat 3-PA	210
180342	Lougee	Cat 3-NPA	Cat 3-PA	217	180145	Rice	Cat 4-PA	Cat 4-PA	434
180403	Lower Cullen	Cat 3-NPA	Cat 3-PA	469	10146	Ripple	Cat 3-NPA	Cat 3-PA	676
180243	Lower Mission	Cat 2-PA	Cat 2-PA	739	110324	Rock	Cat 3-PA	Cat 3-PA	249
110129	Lower Trelipe	Cat 3-PA	Cat 3-PA	592	180016	Rock	Cat 4-NPA	Cat 4-PA	210
180126	Mahnomen	Cat 4-NPA	Cat 4-NPA	468	180184	Rogers	Cat 3-NPA	Cat 3-NPA	249
110261	Mc Keown	Cat 3-NPA	Cat 3-NPA	171	110043	Roosevelt	Cat 2-PA	Cat 2-PA	1,561
180377	Middle Cullen	Cat 3-PA	Cat 3-PA	405	180165	Ross	Cat 3-NPA	Cat 3-NPA	504
180294	Mitchell	Cat 3-PA	Cat 3-PA	460	10137	Round	Cat 2-PA	Cat 2-PA	645
10212	Moulton	Cat 4-PA	Cat 4-PA	282	180212	Ruth	Cat 2-PA	Cat 2-PA	623
110200	Mule	Cat 2-PA	Cat 2-PA	501	110361	Sanburn	Cat 3-PA	Cat 3-PA	224
180104	Nokay	Cat 2-PA	Cat 2-PA	782	180033	Scott	Cat 3-NPA	Cat 3-NPA	178
110307	Norway	Cat 4-PA	Cat 4-PA	498	180161	Sebie	Cat 4-PA	Cat 4-PA	180
180352	Ossawinnamakee	Cat 2-PA	Cat 2-PA	739	10120	Section 12	Cat 4-NPA	Cat 4-PA	167
180288	Ox	Cat 3-NPA	Cat 3-NPA	258	180090	Serpent	Cat 2-PA	Cat 2-PA	1,154
110355	Ox Yoke	Cat 3-PA	Cat 3-PA	199	180072	Shirt	Cat 4-NPA	Cat 4-NPA	220
180048	Partridge	Cat 3-PA	Cat 3-PA	185	180404	Sibley	Cat 4-NPA	Cat 4-PA	412

*Class codes are as follows:

Mille Lacs: Mille Lacs
Cat 1: Remaining large boating lakes (all have public acces
Cat 2-PA: Priority A lakes with public access
Cat 2-NPA: Priority A lakes without public access
Cat 3-PA: Priority B lakes with public access
Cat 3-NPA: Priority B lakes without public access
Cat 4-PA: Priority C lakes with public access
Cat 4-NPA: Priority C lakes without public access

Remaining (non-sample) priority A, B and C lakes in north central boating study area (cont'd)

Lake Number	Lake Name	1985 Category*	1998 Category*	Acres	Lake Number	Lake Name	1985 Category*	1998 Category*	Acres
180239	Silver	Cat 3-PA	Cat 3-PA	213	180096	Upper Long	Cat 2-PA	Cat 2-PA	793
10129	Sissabagamah	Cat 4-PA	Cat 4-PA	386	180242	Upper Mission	Cat 2-PA	Cat 2-PA	895
180028	Smith	Cat 2-NPA	Cat 2-NPA	486	110105	Upper Trelipe	Cat 3-PA	Cat 3-PA	426
10178	Spirit	Cat 2-PA	Cat 2-PA	523	180284	Velvet	Cat 3-NPA	Cat 3-NPA	167
180359	Star	Cat 3-NPA	Cat 3-NPA	153	110171	Wabede	Cat 2-NPA	Cat 2-PA	1,272
180169	Stark	Cat 3-PA	Cat 3-PA	228	110059	Washburn	Cat 2-PA	Cat 2-PA	1,768
180367	Stewart	Cat 4-NPA	Cat 4-NPA	254	110311	Webb	Cat 2-PA	Cat 2-PA	619
110371	Stony	Cat 2-PA	Cat 2-PA	523	180297	West Fox	Cat 2-NPA	Cat 2-NPA	510
10087	Sugar	Cat 4-PA	Cat 4-PA	466	180387	Whipple	Cat 3-NPA	Cat 3-PA	345
10092	Swamp	Cat 4-PA	Cat 4-PA	276	180001	Whitefish	Cat 4-NPA	Cat 4-NPA	760
10174	Thornton	Cat 4-NPA	Cat 4-NPA	186	110273	Widow	Cat 3-PA	Cat 3-PA	197
110177	Three island	Cat 3-PA	Cat 3-PA	168	10102	Wilkins	Cat 3-PA	Cat 3-PA	366
110062	Thunder	Cat 2-PA	Cat 2-PA	1,316	110502	Williams	Cat 3-PA	Cat 3-PA	188
180376	Upper Cullen	Cat 3-NPA	Cat 3-NPA	459	10115	Wladimiraf	Cat 4-NPA	Cat 4-PA	440
180170	Upper Dean	Cat 4-PA	Cat 4-PA	263	110201	Woman	Cat 2-PA	Cat 2-PA	5,360
180412	Upper Hay	Cat 2-PA	Cat 2-PA	640					

*Class codes are as follows:

Mille Lacs: Mille Lacs
Cat 1: Remaining large boating lakes (all have public acces
Cat 2-PA: Priority A lakes with public access
Cat 2-NPA: Priority A lakes without public access
Cat 3-PA: Priority B lakes with public access
Cat 3-NPA: Priority B lakes without public access
Cat 4-PA: Priority C lakes with public access
Cat 4-NPA: Priority C lakes without public access