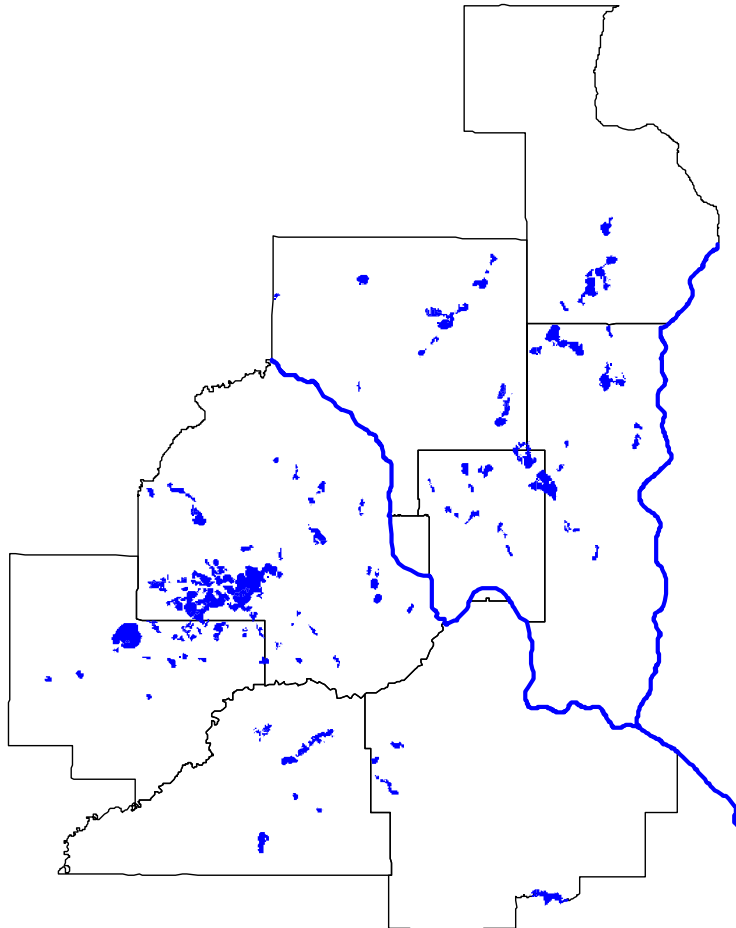


BOATING IN THE TWIN CITIES METROPOLITAN AREA: CURRENT STATUS AND TRENDS SINCE 1984



THE 1996 BOATING STUDIES WERE A COOPERATIVE RESEARCH PROJECT OF THE LAKE MINNETONKA CONSERVATION DISTRICT AND THE MINNESOTA DEPARTMENT OF NATURAL RESOURCES, BOATING SAFETY PROGRAM, DIVISION OF FISH AND WILDLIFE, AND TRAILS AND WATERWAYS UNIT

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SUMMARY

INTRODUCTION

Boating—which includes fishing from a boat—is one of the primary ways Twin Cities residents enjoy local lakes and rivers that contribute so much to the quality of life in the metro area. Keeping track of boating opportunities and boating conditions is, thus, an important task. This study describes Twin Cities boating opportunities and conditions in 1996, and how boating has changed since the mid 1980s.

The study has five objectives:

Estimate the total number of boats on waters and trace those boats to their means of access.

Describe the boating experience from the perspective of boaters.

Provide information to guide public access programs by assessing the use of public launch facilities and evaluating their quality through boater interviews.

Obtain boaters' perspectives about the effectiveness of techniques to prevent the spread of exotics species (Eurasian watermilfoil and zebra mussels), and about the related topic of personal behaviors that could influence the movement of the species.

Describe the patterns of boating use, including boating activities and boating equipment.

The 1996 boating study was a cooperative research project of the Lake Minnetonka Conservation District (LMCD) and the Minnesota Department of Natural Resources (MN DNR). Funding was provided by LMCD and three MN DNR programs: Boating Safety, Water Access, and Exotic Species.

BOAT NUMBERS AND SOURCES

The Twin Cities metropolitan area has nearly 74,000 acres of boating water on two large rivers and 102 lakes, each over 100 acres in size.

Most (94 %) of this boating surface-water area is at least minimally accessible through public access, up from 91 percent in 1984. Waters that are at least minimally accessible through public access may not have adequate access, according to guidelines adopted for the Twin Cities metro area in the early 1980s (guidelines based on the number of vehicle/boat-trailer parking spaces). Judged by these guidelines, 71 percent of the job of providing adequate public access is now complete, up from 50 percent in 1984.

The major boating resources are the most popular, as evidenced by how intensely they are used. The most intensely used resources are the St. Croix River and Lake Minnetonka, which together account for 43 percent of metro boating.

Little change in boating numbers was experienced between the mid 1980s and 1996 on the St. Croix, Lake Minnetonka and most of the other classes of lakes used in this study.

Lake Minnetonka has a relatively even mix of boating access sources. On the other lakes, public access is the largest contributor, followed by riparian residents and marinas/private accesses.

Since 1984, Minnetonka has experienced a drop in the contribution to total boating of marinas/private accesses, and a gain in the combined contribution of riparian residents and municipal docks. On other lakes the contribution of marinas/private accesses fell, while the public access contribution increased, and the riparian residents contribution showed no significant change.

Public accesses were normally used to near capacity (parking lots full) on weekend/holiday afternoons in 1996, as well as in 1984. The weekend/holiday demand for public access is no doubt strong enough to warrant further access expansion.

PERCEPTION OF BOATING EXPERIENCE

The intensity of boating use (boats per acre of water) in the Twin Cities is four to five times higher than in Minnesota's most popular vacation lake regions, such as the central lakes region (Crow Wing, Cass County) or west lakes region (Douglas, Otter Tail, Becker County).

A sizable portion of metro area boaters report regularly changing their behavior to avoid crowds (the portion ranges from 18% to 34% and depends on the type of behavioral change). These boating-related changes, however, are not much different from changes made to accommodate crowds in other activities, including shopping, going to work, and going out to dinner. In short, living in a large metropolitan area means taking account of other people when you engage in a wide range of work and leisure activities.

About one in five boaters reports encountering 'too many boats' in the 1996 study. Similar responses were elicited by a separate question on perceived crowding of the lake/river.

Although it is not uncommon for metro area boaters to feel crowded, it is important to recognize that the large majority of boaters—on any lake or river, or on any day of the week, or from any source—neither feel crowded nor report traveling through areas with too many boats.

Since 1984, perceptions of crowding have not changed a great deal. These perceptions are consistent with the minor changes experienced in actual boat numbers.

When boaters were asked to indicate the degree to which 14 conditions and situations were a problem, two items stand apart as the top-ranked problems: presence of Eurasian watermilfoil and use of personal watercraft (jet skis).

On Lake Minnetonka, the perceptions of milfoil as a problem increased markedly from 1992 (the first time this issue was surveyed) to 1996 for boaters from public access and marina/private access. Riparian residents thought milfoil was a serious problem in both years.

Nearly all boaters are 'satisfied' or 'very satisfied' with their most recent boating experience, and nearly all boaters would return to boat again if conditions were similar to the ones they just experienced.

Public access users give high marks to the quality of public launching facilities, just as they did in 1984.

Some 30 percent of boaters indicated they had one type of problem or another using the public

access. The primary type of problem boaters identified had to do with the size of the access: not enough parking spaces, not enough room to maneuver on land or in water near the ramp, and insufficient number of launch lanes/ramps.

Public access boaters were asked if they thought 12 possible facility improvements were needed, and none of the 12 was judged as 'needed' by more than 20 percent of boaters. The most requested improvements related to trash and toilets.

BOATING SAFETY AND ENFORCEMENT

Boating restrictions are common on metro lakes and rivers. The most common type of restriction deals with speed/no wake/area, which restricts craft speed (wake generation) in certain areas, such as near shore.

The speed/no wake/area restriction has high recognition among boaters compared with other restrictions.

Nearly 40 percent of boaters think the existing speed/no wake/area restrictions that are in place are needed, which is the highest of the restriction groups.

When restrictions were not present, boaters did not indicate a large expressed need for any of the types of restrictions.

Recognition of the speed/no wake/area restriction is quite high for the St. Croix and Lake Minnetonka, and drops quite a bit for the other waters. The expressed need for this restriction is relatively high for Lake Minnetonka, but is very low for the St. Croix.

About 20 percent of boaters saw an enforcement officer on their last trip. On the larger waters (St. Croix, Minnetonka, remaining large boating lakes and Mississippi), boaters see enforcement officers more frequently than on the numerous smaller lakes.

About four percent of boaters reported being checked by an enforcement officer, and nearly two-thirds of the checks were on people who were fishing.

About one-third of boaters report having completed a formal boating safety course, a portion that is unchanged since 1984.

Some 43 percent of boaters thought that requiring boat operators to complete a safety course was a good idea. People who have completed such a course were much more likely to agree with this requirement than those who have not.

Just over one-fourth of boaters report that alcoholic drinks in one form or another were on board during their last outing. Most boating parties (55%) have only non-alcoholic drinks on board. For those taking some form of drink on board, the mix of types has not changed a great deal since 1984.

Wearing life jackets (personal flotation devices) is far more prevalent in 1996 than in 1984. In 1996 children are the most likely to wear such a device and adults are the least likely.

Most boats (85%) are equipped with some form of safety equipment other than personal flotation devices. Lights, fire extinguishers and horns are the most common forms.

PREVENTING THE SPREAD OF EXOTIC SPECIES

In terms of perceived effectiveness, two techniques to prevent the diffusion of exotics—such as Eurasian watermilfoil and zebra mussels—stand above the others in boater’s minds: (1) information delivered at boat landings, either in the form of signs or inspection-education programs; and (2) enforcement, including laws to make the transport of exotics illegal and road checks to enforce those laws.

Concerning the inspection-education program at boat launches, the people who would be directly affected by this technique (public access boaters) gave a considerably lower effectiveness rating to the technique than did riparian residents.

Regarding personal behaviors that could influence the spread of exotic species, nearly all boaters who remove boats from lakes and streams do a few simple things almost all the time: conduct a visual inspection of their boat and equipment, clean off vegetation and mussels, and drain water from the boat. Actions that are less simple, and require more time and effort, are not done nearly as frequently: disposing of leftover bait on shore, allowing the boat to dry five days before launching into another waterbody, rinsing the boat with hot or high pressure water, and flushing the motor’s cooling system with clean water.

CHARACTERISTICS OF THE BOATING TRIP

Boat riding and fishing are the two major activities on metro area lakes.

Public access boaters predominately fish, while riparian residents mainly participate in boat riding, and marina/private access users distribute the bulk of their time relatively evenly between boat riding, fishing and sailing.

The two large resources (St. Croix and Minnetonka) are primarily boat riding waters. The other lake and river resources have large and comparable amounts of fishing and boat riding.

Between 1984 and 1996, boat riding experienced a sizable gain, while water skiing experienced a major loss. Fishing was slightly larger in 1996 than 1984. Both sailing and canoeing decreased.

Motor sizes, on average, are 100 horsepower. Riparian residents tend to have larger motors than the other boating sources. The larger waters (St. Croix, Minnetonka, and Mississippi River) have motor sizes quite a bit larger than the other lake resources.

Motor sizes have increased 20-30 horsepower since 1984.

The St. Croix, Minnetonka and Mississippi River represent the Twin Cities’ market for big boats over 20 feet in length. For the remaining lakes, few boats are over 20 feet.

Boaters coming through public access, who trailer their boats, have substantially smaller boats (15.9 feet in length on average) than boaters from other sources (19.4 feet on average).

INTRODUCTION

Minnesotans are avid boaters, as evidenced by the state having the highest per capita boat ownership in the nation. About half of Minnesota's boaters live in the Twin Cities metropolitan area. Twin Cities' boaters find the nearby lakes and rivers convenient and enjoyable places for after work and weekend outings. Boating on Twin Cities' waters, however, is different than boating in other parts of the state. The primary difference is the large number of Twin Cities' boaters compared with the size of the water resource. Lake and river boating in the metropolitan area is more congested and, as a result, more regulated than in other parts of the state. In short, the experience of boating in the metropolitan area is distinctive. A principal goal of this 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.

Twin Cities' waters are highly desirable home locations, and a large share of boaters are launching from their back yards. For those who do not own lakeshore, a commercial marina industry has developed, especially on the largest waters, and offers opportunities for seasonal dockage and for-fee launch ramps. The public sector also provides boating opportunities—primarily through free public accesses—for those who do not live on the water. The magnitude and mix of boats on any water depends on the corresponding magnitude and mix of these various means of access to the water. Boat numbers on a waterbody are effectively controlled by the numbers of lake homes, commercial operations, and public access opportunities. When some people perceive a problem with boat numbers or other aspects of boating, they many times will look to development controls for the solution. Depending on their interests, they may select a specific means of access to limit, and conflicts will naturally arise with the constituency for that means of access. This boating study is designed to measure the total number of boats on waters and trace those boats to their means of access. Such measurements ensure that phantom conflicts, produced by inaccurate perceptions, can be dispelled, and that participants in the remaining conflicts can at least be reasonably well informed and share a common information base.

As noted above, the public sector provides boating opportunities through free public access. Many levels of government—local, county and state—manage free public accesses in the Twin Cities. A primary purpose of this study is to provide information to guide public access programs by assessing the use of these facilities and evaluating their quality through boater interviews.

Twin Cities' waters are a public resource, owned in common by all Minnesotans. Threats to the integrity of these resources call for public action that in most cases is synonymous with government action. Such a potential threat is exotic species in the form of Eurasian watermilfoil and zebra mussels. Boaters have an important role with respect to these species because they are capable of spreading them. A portion of the boating study is devoted to asking boaters about the effectiveness of techniques to prevent the spread of these species, and about the related topic of personal behaviors that could influence the movement of the species from one waterbody to another.

This document is a general summary on boating status and trends. Trends in boating are assessed from 1984 to 1996. For all lakes except Minnetonka, 1984 is the only previous date of study. Minnetonka was part of the 1984 study and has been studied four other times between 1984 and 1996. Findings are presented in five sections:

- Boat numbers and sources of boats;
- Perception of boating experience, including crowding, on-water problems, trip satisfaction, and quality ratings of public access facilities;
- 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 resource classes (groupings of lakes), not individual lakes (with the exception of Lake Minnetonka), because the studies were not designed for lake-by-lake results. These resource 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 1996 and 1984 and follow the conclusions through for the class(es). Lakes are listed by resource class in Appendix A. Results for the St. Croix and Mississippi River are presented separately.

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

The 1996 studies were funded by three programs in the MN DNR: water access, boating safety and exotic species. The study of Lake Minnetonka conducted in 1996 was funded equally by the Lake Minnetonka Conservation District and the MN DNR. The study of other lakes and rivers in the Twin Cities was funded solely by the MN

Figure 1

Metro Boating Study Lakes & Rivers

 Mississippi & St. Croix Rivers

Lakes

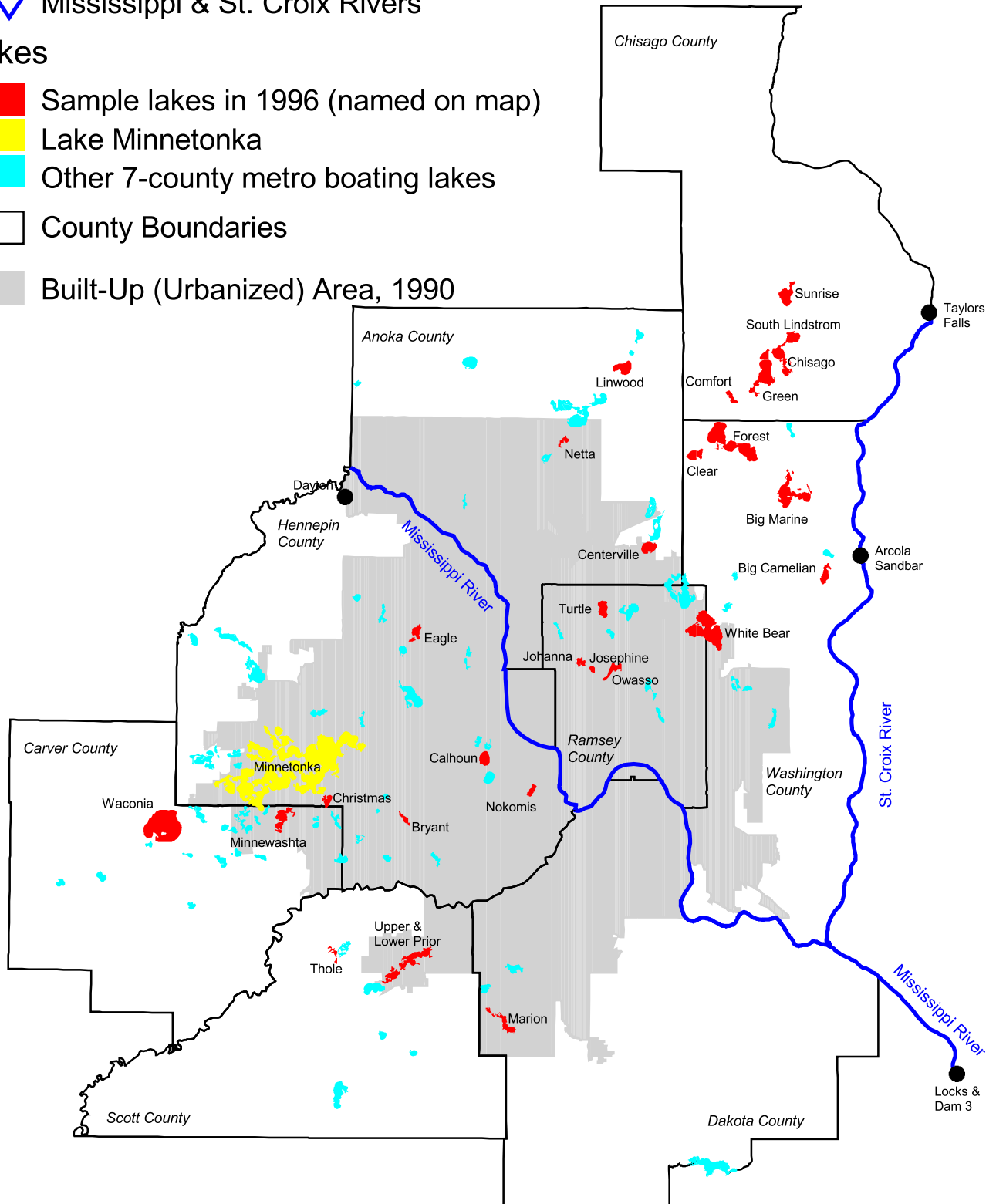
 Sample lakes in 1996 (named on map)

 Lake Minnetonka

 Other 7-county metro boating lakes

 County Boundaries

 Built-Up (Urbanized) Area, 1990



DNR. Both studies shared techniques and survey instruments so results could be compared and combined.

METHODOLOGY

The multiple goals of the metropolitan boating studies are accomplished with a variety of information collection techniques. Lakes in the Twin Cities area have been classified according to resource size, location with respect to settlement patterns (built-up or rural areas), and whether the lake has a free public access. The six classes are:

- Lake Minnetonka (has public access)

- Remaining large (high-use) boating lakes (all have public access)

- Lakes with public access in the densely settled built-up portion of the Twin Cities (approximated by the urbanized area on Figure 1)

- Lakes without public access in the densely settled built-up portion of the Twin Cities

- Rural area lakes with public access (near fringe or outside the urbanized area on Figure 1)

- Rural area lakes without public access

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 1996 include the 1984 sample lakes plus five lakes in southern Chisago County. A complete census, however, of the largest resources is taken for study; this includes Lake Minnetonka and the remaining large (high-use) boating lakes. For each study lake, boats in use (including those anchored and beached) are counted and classified by type from the air. Boat counts are made in the afternoon, when boating is at a peak. 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 the class.

Boaters on the sample waters are surveyed to gather information from about their behavior and perceptions. In 1996, surveys were conducted in-person at public launch facilities, and at marinas and private launch facilities. Riparian residents on the sample lakes were surveyed by mail. Their names and addresses were gathered from property records. Aerial counts and 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, means of access and days of the week.

In 1996, seven weekday and seven weekend/holiday flights were conducted for sample lakes other than Minnetonka. On Minnetonka, 12 weekend/holiday and 8 weekday flights were conducted. Overall, 3391 surveys were completed, including 1345 public access interviews, 958 marina/private access interviews and 1088 riparian resident mail surveys. In 1984, 4 to 6 weekend/holiday aerial counts (depending on the lake) and 3 weekday counts were made. Overall, 2051 surveys were completed, including 1279 public access interviews, 81 marina/private access interviews and 691 riparian resident interviews. Surveys were conducted on the Mississippi and St. Croix rivers in 1996 (not in 1984) for public access, marina and private access boaters. The rivers were not part of the aerial counts, however. Aerial boat counts of the rivers are made every two years by the Minnesota-Wisconsin Boundary Area Commission (with cooperators from Minnesota DNR, Wisconsin DNR, Army Corps of Engineers and National Park Service) and these counts are used herein. River survey results are presented separately from lake results. River surveys cannot be combined with the lake surveys because the contributions to boating by means of access and day of week on the rivers are not known, so appropriate weighting of surveys (described above) cannot be done.

The 1996 studies attempted to produce comparable data with past studies for trend assessment purposes and to a large extent results are comparable. In some instances, however, some particulars precluded comparability. These are presented in detail in Appendix A.

For those wanting a more complete description of methodology, each study has a technical document that presents the full methodology. These documents are available through the MN DNR.

BOAT NUMBERS AND SOURCES

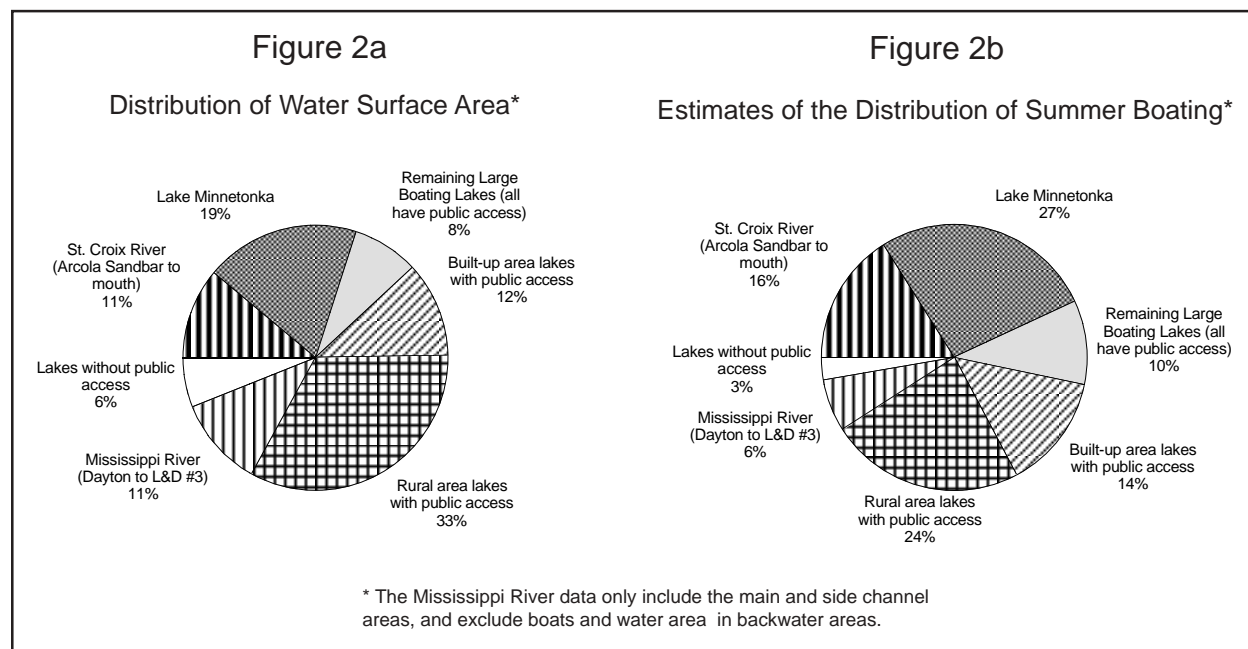
Amount and Intensity of Boating

The Twin Cities metropolitan area has nearly 74,000 acres of boating water on two large rivers and 102 lakes, each over 100 acres in size (Table 1). This boating resource is comprised of a few major resources and numerous smaller ones. The major resources account for 30 percent of boating acres and include Lake Minnetonka in the western part of the metro area and the St. Croix River in the east (Figure 2a). Five other large lakes contribute another 8 percent of the resource. Within the densely-settled built-up portion of the metro area (approximated by the urbanized area on Figure 1) there are 41 additional lakes, most of which (33 of the 41) have at least one public access. Outside the built-up area (near the

Lake/River Class	Total Number of Lakes/Rivers	Total Acres of Lakes/Rivers
Lake Minnetonka	1	14,034
Remaining large boating lakes (all have public access)	5	5,896
Built-up area lakes with public access	33	8,687
Built-up area lakes without public access	8	1,934
Rural area lakes with public access*	45	24,585
Rural area lakes without public access*	10	2,550
<i>Lake Subtotal</i>	<i>102</i>	<i>57,686</i>
St. Croix River (Arcola Sandbar to mouth)	1	8,215
Mississippi River (Dayton to L&D #3)+	1	7,950
<i>Grand Total</i>	<i>104</i>	<i>73,851</i>

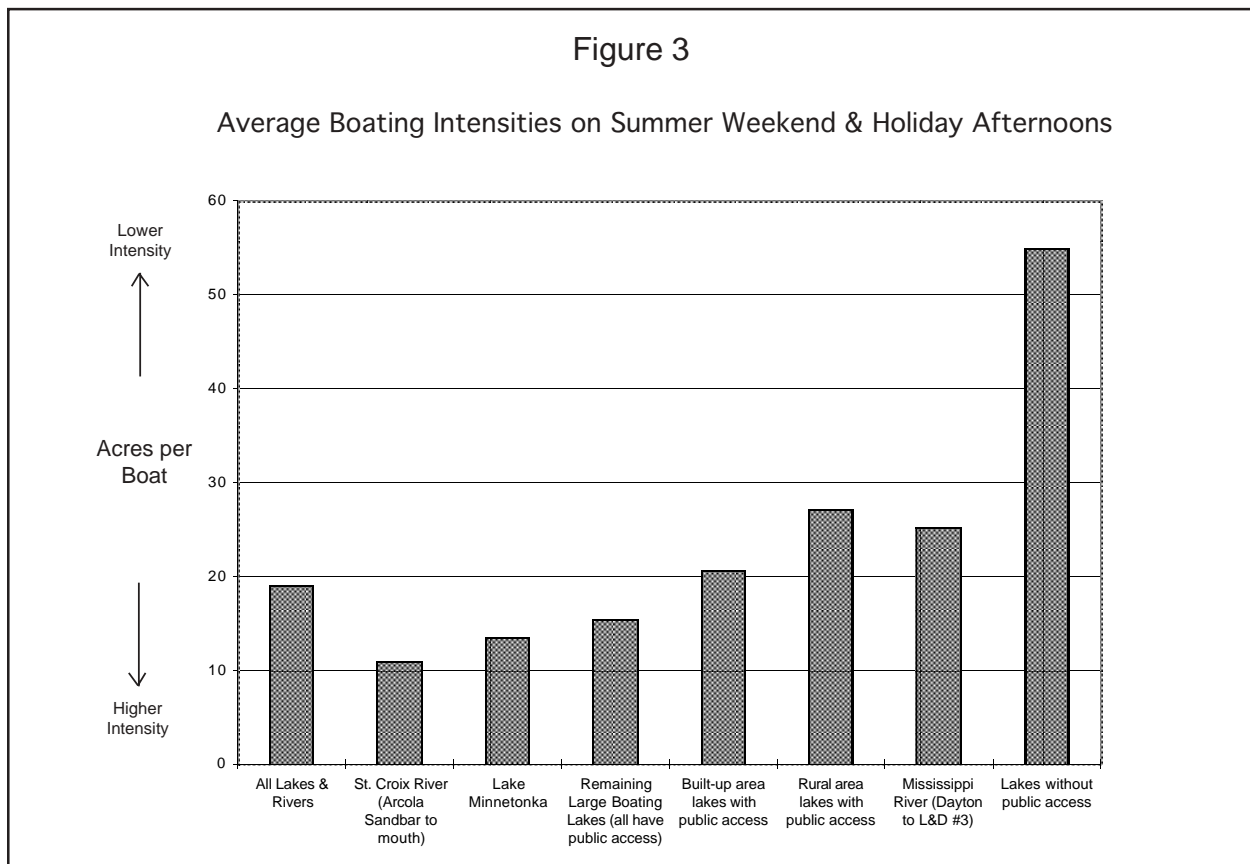
* There are 4 Chisago County lakes with public access and 1 without public access in the 'rural' classes; these lakes cover 3644 acres and 810 acres, respectively.

+ Excludes the backwater areas not covered by aerial photos used to count boats.



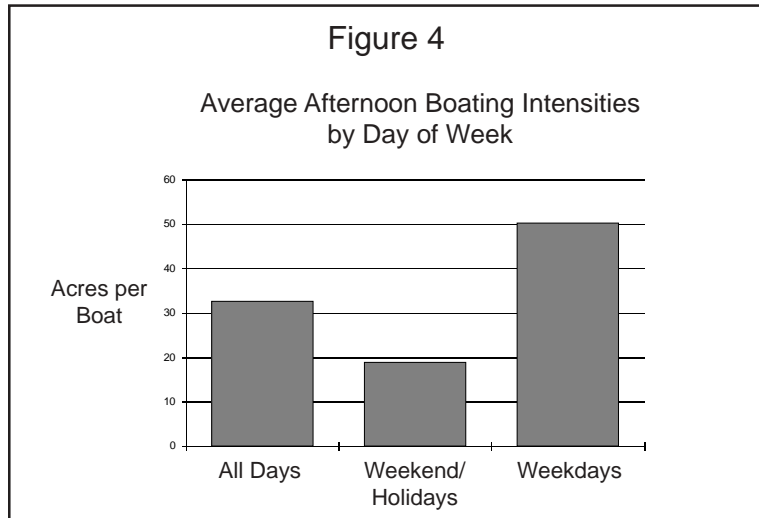
fringe of the urbanized area and beyond) are 55 rural lakes, 45 of which have at least one public access. The remaining boating resource is the Mississippi River. Overall, 94 percent of the boating surface water area is at least minimally accessible through public access, up from 91 percent in 1984. Of the 28 lakes in the seven-county metro area without public access in 1984, 17 are still without a public access (Table 1 shows 18 lakes without public access; this includes one study lake outside the seven-county metro area in Chisago County). Waters that are *at least minimally accessible through public access* may not have *adequate access*, according to guidelines adopted for the Twin Cities metro area in the early 1980s (guidelines based on the number of vehicle/boat-trailer parking spaces; see Reference 1). Judged by these guidelines, 71 percent of the job of providing adequate public access is now complete. This is up from 50 percent in 1984. The guidelines referenced here are applicable in the absence of surface water zoning (e.g., slow, no wake areas). With surface water zoning, the quantity of public access provided can increase above these guidelines.

The major boating resources are the most popular, as evidenced by how intensely they are used. The most intensely used resource (least acres per boat) is the St. Croix River, followed closely by Lake Minnetonka (Figure 3). Together Minnetonka and the St. Croix account for 43 percent of metro boating (Figure 2b). The five other



large lakes are the next most popular (Big Marine, Lower Prior, Upper Prior, Minnewashta, and White Bear). These five lakes, when combined with Minnetonka and the St. Croix, account for half (51%) of all metro boating. Lakes in the built-up part of the metro area are used more intensively than their rural counterparts. Lakes without public access have the least intensity of use, basically because boating is restricted to lakeshore residents. The Mississippi River is used about as intensively as the rural lakes with public accesses.

Weekends are the popular time to participate in boating, as well as in most outdoor recreation pursuits. A weekend or holiday, on average, has 2.5 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.



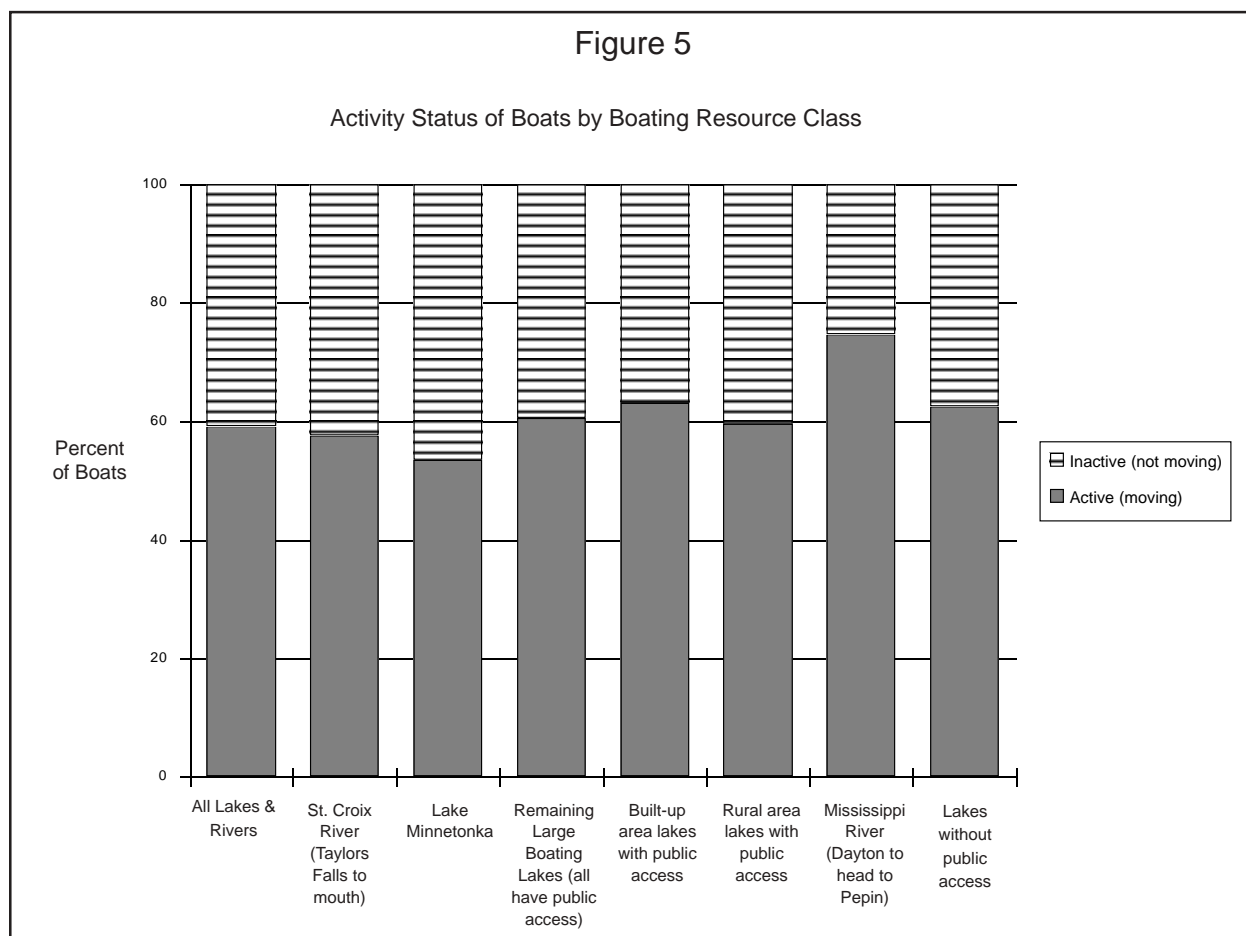
The variation in intensity of weekday use by resource class basically follows the pattern of weekend/holiday use.

Intensity of use (acres per boat as shown on Figure 3) 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 stationary boats. A previous study on Lake Minnetonka found that the most intensively used areas had the lowest portion of moving boats (Reference 2). Fewer moving boats moderate the effect of a large number of boats on congestion. On Minnetonka, the portion of boats that are moving was relatively constant at lower intensities of use (densities of 10 acres per boat or more), but fell off rapidly at higher intensities of use (densities of 10 acres per boat or less).

All of the resource classes have intensities of use above 10 acres per boat (Figure 3). Consistent with the Minnetonka findings, there is little variation across the resource classes in the portion of boats that are moving (Figure 5). Since the portion of boats that are moving varies little, intensity of use (Figure 3) by itself is an effective measure of congestion.

Changes in intensity of use from 1984 to 1996 can only be examined for weekends/holidays, because there were too few weekday observations in 1984 to form a valid

Figure 5



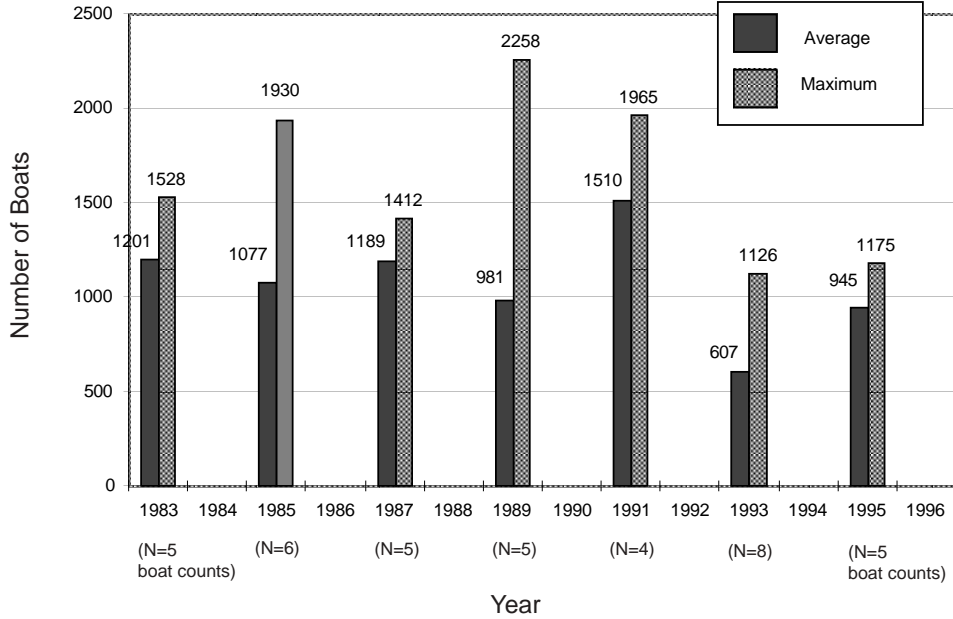
comparison. Weekend/holiday trends by themselves, however, provide a good indication of trends in use, although having parallel weekday trend information would be most helpful in corroborating trends.

The 1996 study distributed sampling equally between weekend/holidays and weekdays in order that both weekday and weekend/holiday trends can be assessed in the future. The 1996 study also recorded baseline measures that account for the quantity of boating on a waterbody. Trends in these measures help substantiate trends in boating use numbers. The measures are: number of riparian residences on a lake, number of vehicle/trailer parking spaces at public accesses, number of spaces (slips and buoys) at marinas, number of private launch operations, and number of municipal dock spaces. Previous work established how one unit of one measure (e.g., a riparian residence) compares with one unit of another measure (e.g., a vehicle/trailer parking space) in terms of contribution to boating (Reference 4). This previous work will be updated using the 1996 study results.

The comparison of 1996 with the early to mid 1980s reveals little change in boat numbers. Neither the St. Croix (Figure 6) nor Lake Minnetonka (Figure 7) has a

Figure 6

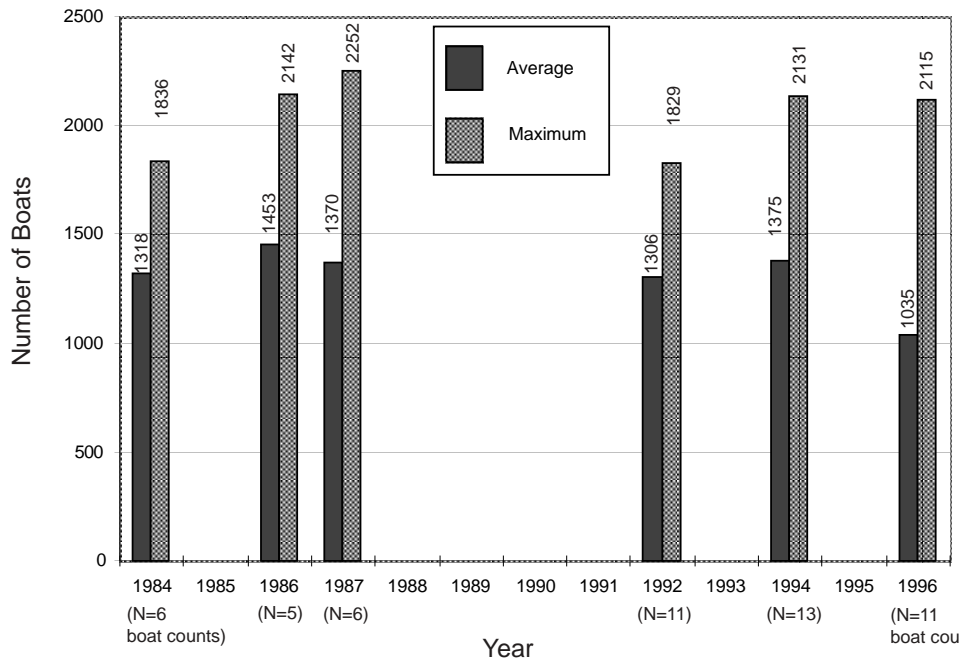
Lower St. Croix River Weekend/Holiday Afternoon Aerial Boat Counts*
(Taylors Falls to Mouth)



* Counts beginning between noon. and 6 p.m.

Figure 7

Lake Minnetonka Weekend/Holiday Afternoon Aerial Boat Counts



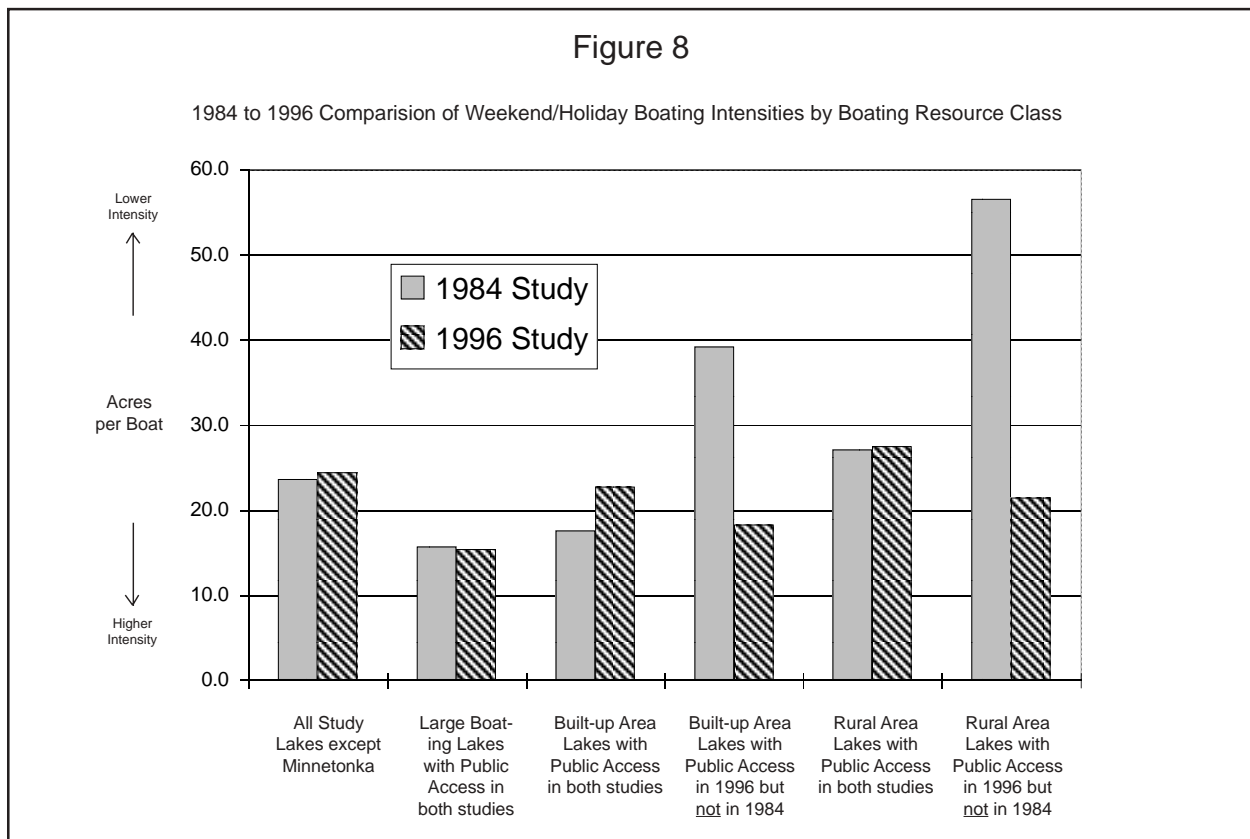
significant upward or downward trend. The 1993 boating season on the St. Croix was just plain lousy, which accounts for the low boat counts that year. The 1995 St. Croix boat counts have precedents. The boat counts on Minnetonka in 1996 were the lowest average recorded since 1984. Although low, the 1996 average is not significantly lower (at the 5% level of statistical significance) than the 1994 average, which was the second highest average recorded since 1984

The other lakes also exhibited little overall change (Figure 8). The only classes of lakes that exhibited a significant change were those associated with the addition of a public access. Otherwise, boating use was stable (no statistically significant change).

Source of Boating Use

Boaters gain access to water through a variety of means:

- 1) public access—free public boat launches and associated parking areas.
- 2) marinas and private access—marina slips and buoys, for-fee launch ramps, boat rentals, and various forms of on-land storage of boats with ready launching capabilities.
- 3) riparian resident—water-front property owners.



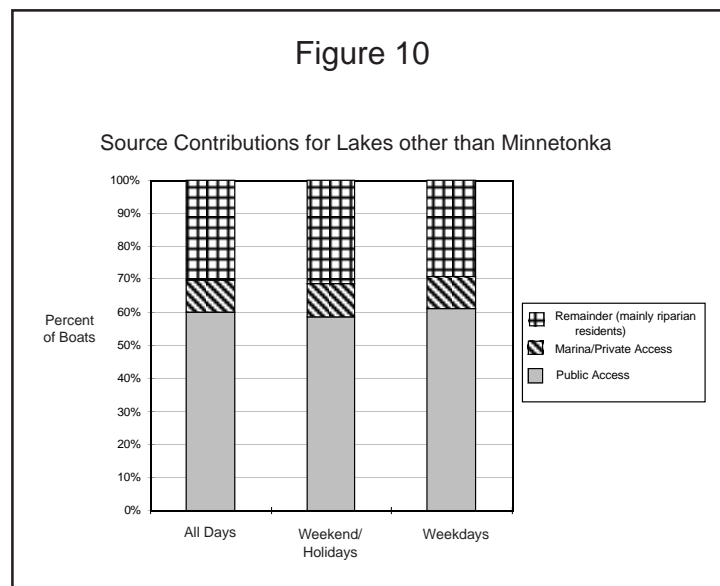
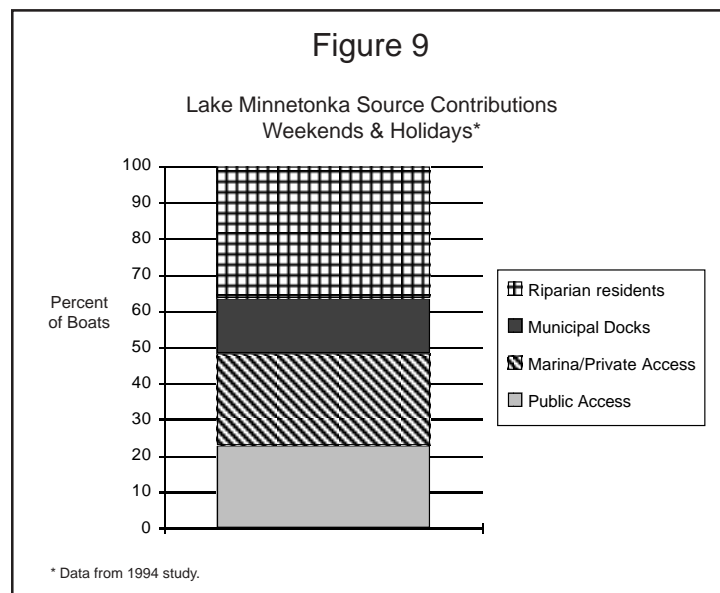
- 4) municipal dock—dock spaces and buoys rented to residents of a municipality by the local government (found on Lake Minnetonka).

There are additional ways to get on the water, such as road ends, but these are not believed to be important contributors to boat numbers. On Lake Minnetonka, effort was made in 1994 to quantify the contribution of such means of access. It was found that less than one percent of boats (0.6%) can be traced to these undesignated means of access.

Lake Minnetonka has a relatively even mix of boating sources (Figure 9). Riparian residents are the major contributor, followed by marina and private access, public access, and municipal docks. On the other lakes, public access is the largest contributor. Riparian residents are next, followed by marinas and private accesses (Figure 10).

Since 1984, Minnetonka has experienced a drop in the contribution of marinas and private accesses, and a gain in the combined contribution of riparian residents and other (municipal docks) (Figure 11). Residents and municipal docks can not be separated in the measurements, so only the combined contribution of the two can be assessed. The contribution of public accesses has been in the 18-25 percent range since 1984.

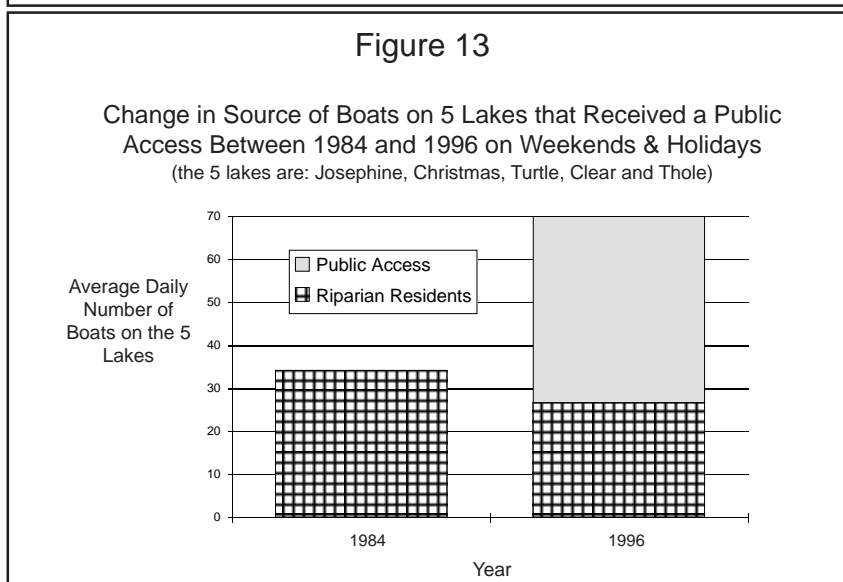
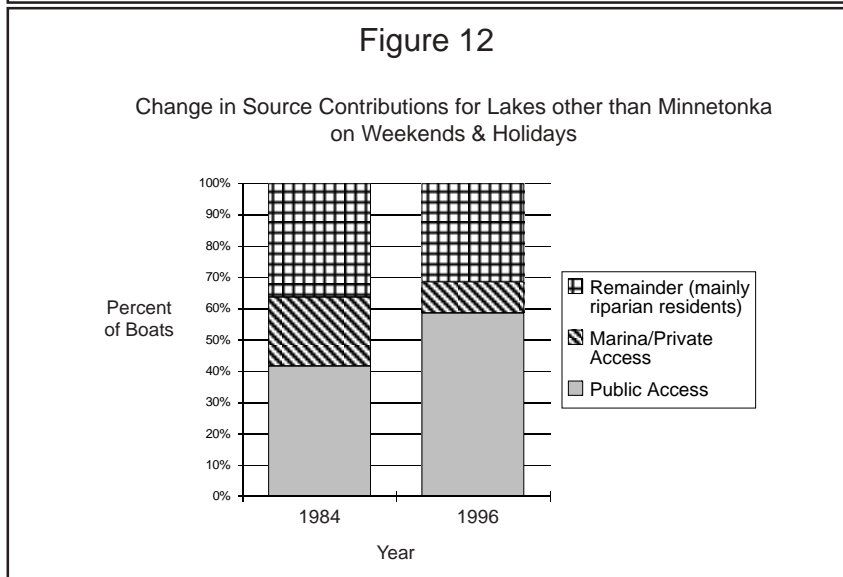
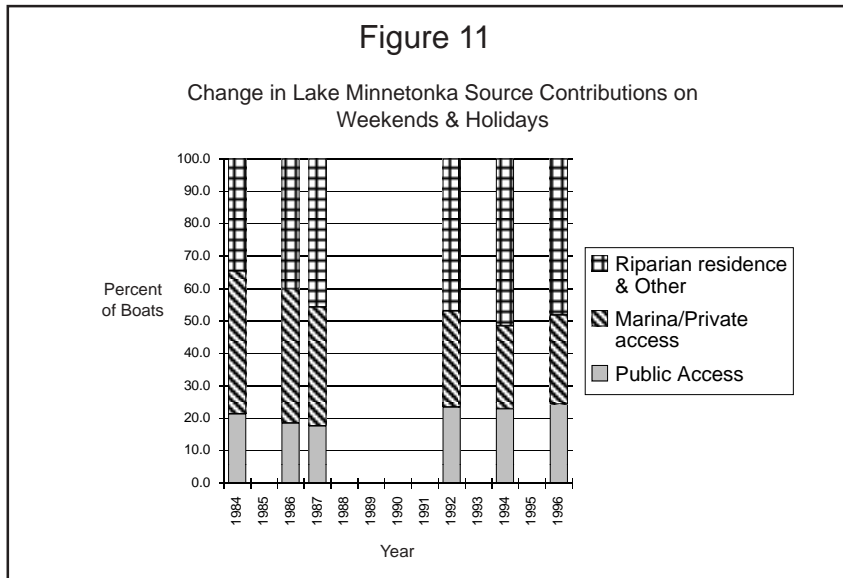
Similar to the Minnetonka experience, the contribution of marinas and private accesses fell since 1984 on other lakes (Figure 12). Public access showed an increase in contribution, which is consistent with



the known expansion of public accesses over the period. Riparian residents showed no significant change.

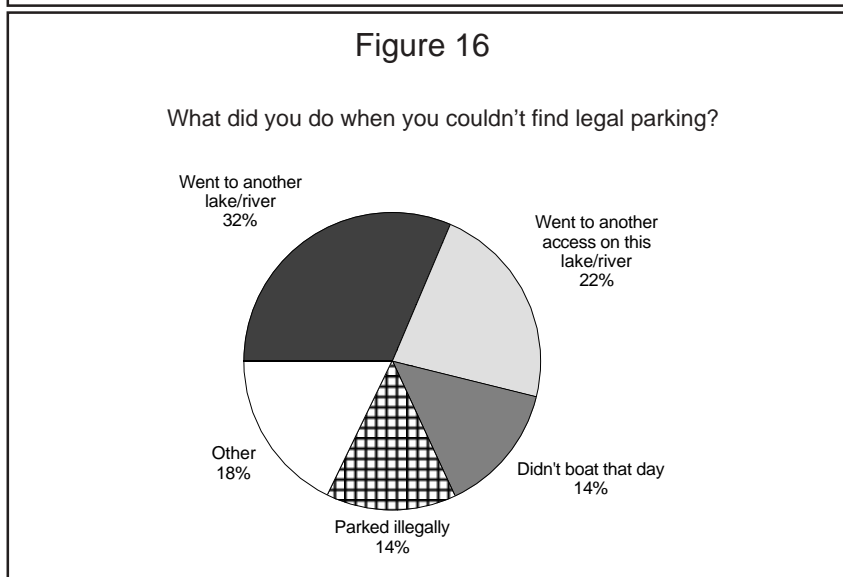
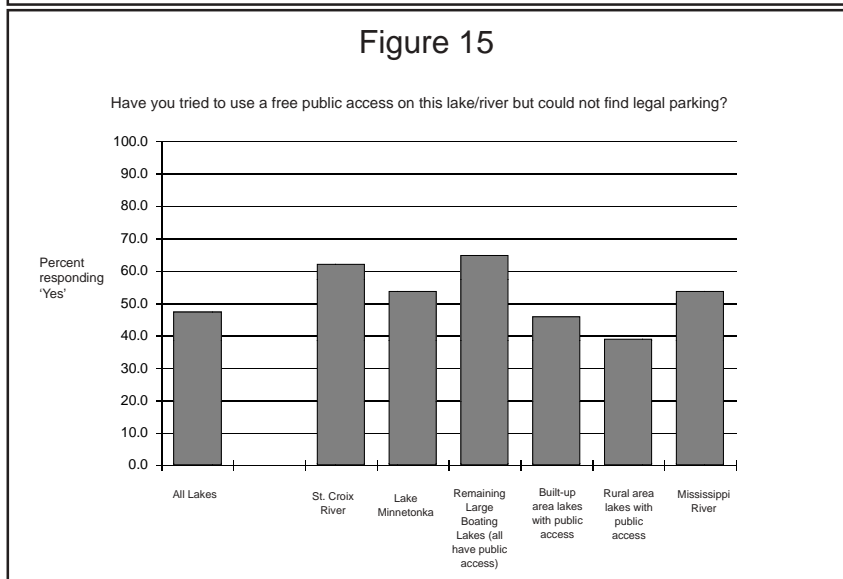
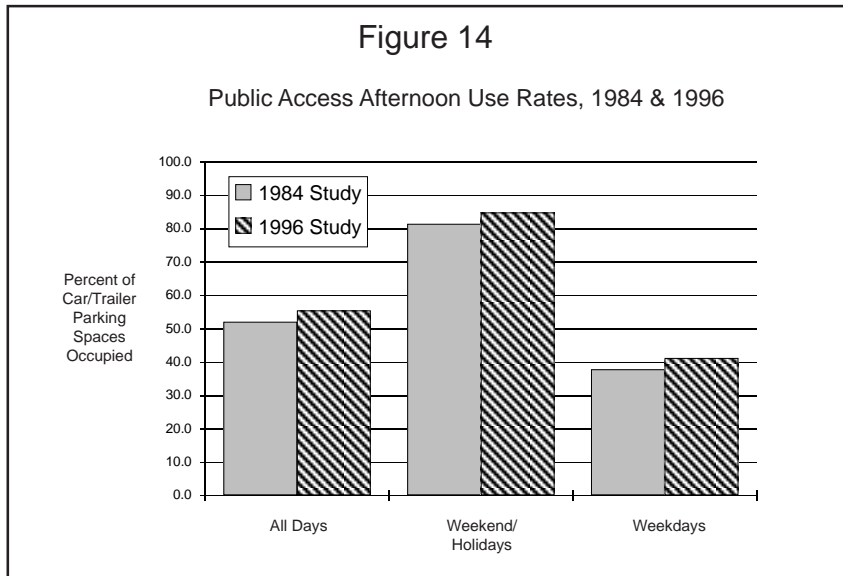
The effect on boat numbers of adding a public access can be seen on the five sample lakes that received an access since 1984 (Figure 13). On weekends and holidays, the average number of boats increased due to the access, and the riparian contribution stayed largely the same (no statistically significant change in riparian contribution).

As noted above, the public access contribution has increased on lakes overall, consistent with the increase in public accesses. In 1984, public accesses were near capacity (parking lots full) on a typical weekend/holiday afternoon (Figure 14). The same occurred in 1996. Any additional public accesses built since 1984 were quickly used to near capacity on a regular basis on weekends. The weekend/holiday demand



for public access is no doubt strong enough to warrant further access expansion. Weekdays, however, are still used well below capacity, and getting on the water through a public access on most weekdays should not be much of a problem.

The fact that public access are routinely full (or nearly full) on weekends means that boaters regularly have a hard time launching and finding parking for their vehicle and trailer. Nearly half of all boaters interviewed at public access report not being able to find legal parking at the lake or river where they were interviewed (Figure 15). These boaters were unable to find legal parking some 2-3 times in the last 12 months. When not able to find legal parking, the majority of boaters got on the water through a different access or went to a different lake/river that day (Figure 16). Some parked illegally, and about the same number did not boat that day.



PERCEPTION OF BOATING EXPERIENCE

Crowding

Boating in the Twin Cities metropolitan area, a major metropolitan area by U.S. standards, is different than in other parts of Minnesota. The principal difference is the number of people participating in boating relative to the size of the water resource. The intensity of boating use (boats per acre of water) in the Twin Cities is four to five times higher than in Minnesota's most popular vacation lake regions, such as the central lake region (Crow Wing-Cass County) or west lakes region (Douglas, Otter Tail, Becker County). In fact, the *weekday* use intensity on Twin Cities waters (when use is low in the Twin Cities) exceeds by a considerable margin the *weekend/holiday* use of lakes in the most popular vacation lake areas (when use is high in those areas).

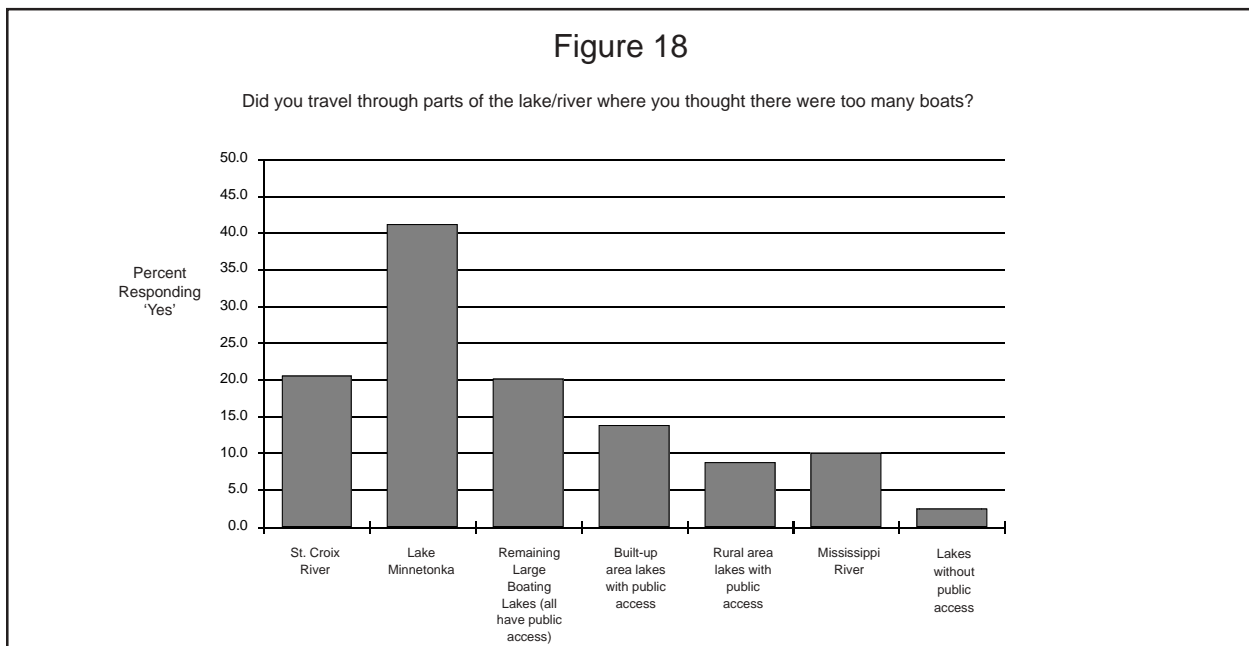
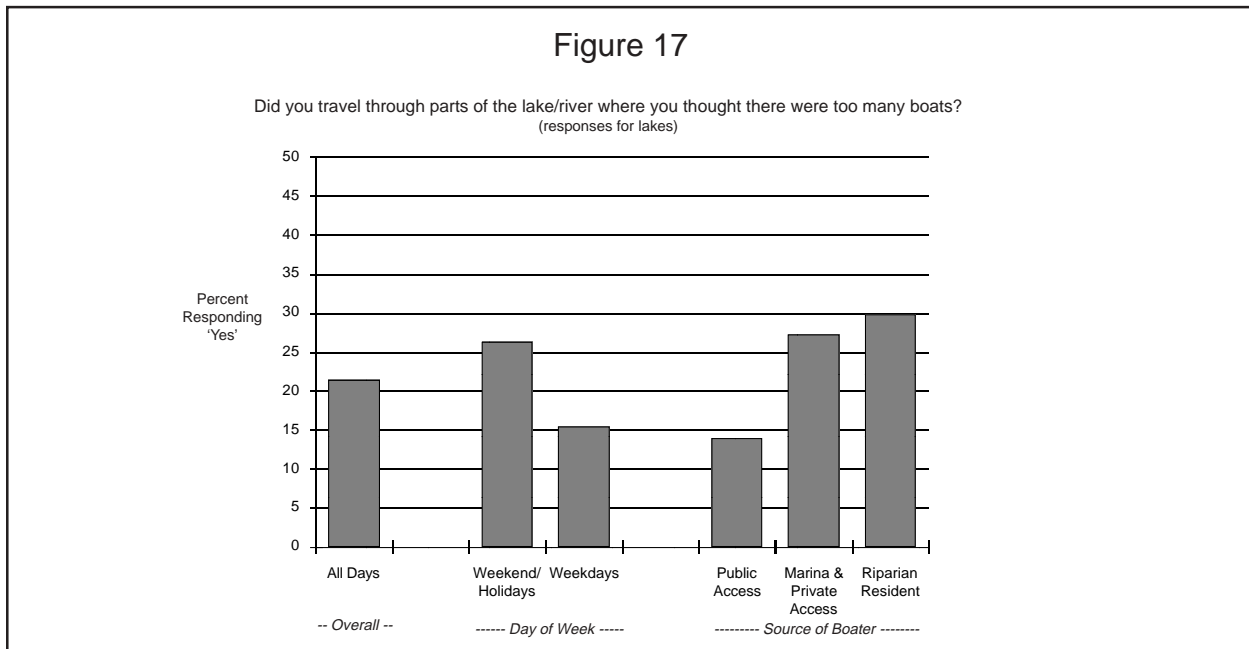
A sizable portion of metro area boaters report regularly changing their behavior to avoid crowds (Table 2) (see Reference 5). About one-third say they regularly change the time they boat to avoid crowds and about one-fifth report they change location.

These boating-related changes, however, are not much different from changes made to accommodate crowds in other activities, including shopping, going to work, and going out to dinner. In short, living in a large metropolitan area means taking account of other people when you engage in a wide range of work and leisure activities. To expect boating to be different than other activities in the metropolitan setting is unrealistic.

Activity	Time Changed Regularly (percent)	Place Changed Regularly (percent)
Shop for groceries	45	12
Shop for items other than groceries	42	22
Go out to dinner	40	40
Boat near home	34	18
Usually recreate outdoors near home	32	21
Go to movies	27	17
Commute to or from work	25	(not asked)
Commute to work	(not asked)	17
Commute from work	(not asked)	20

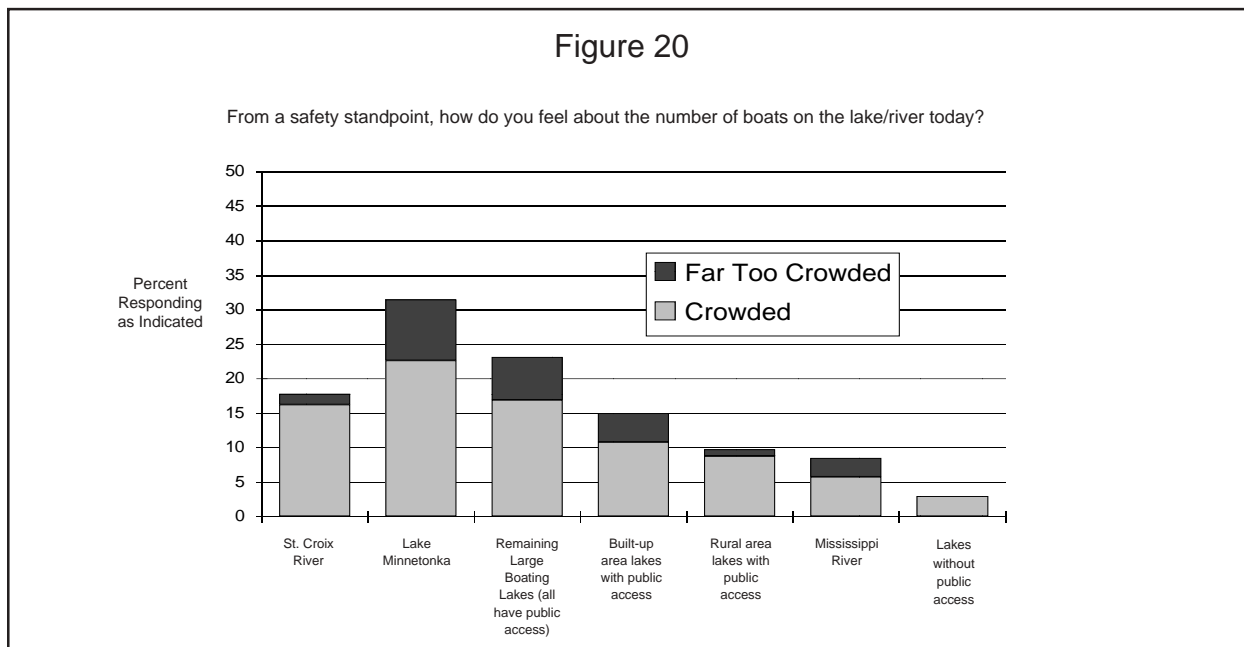
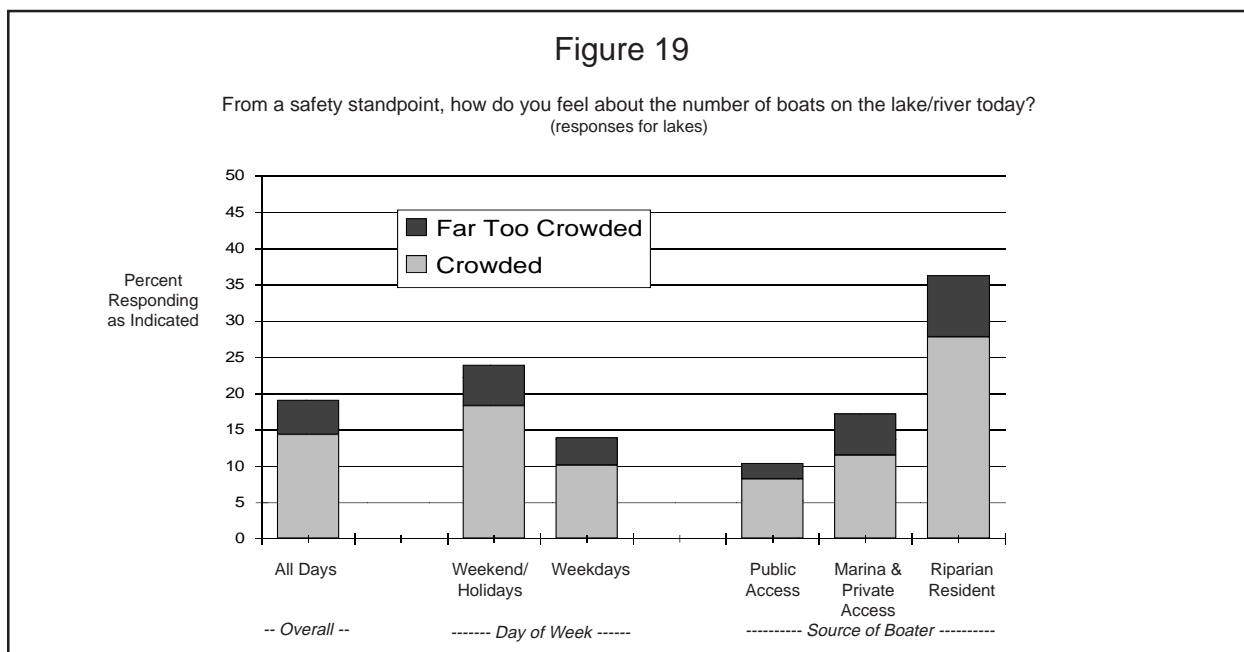
It is not uncommon for boaters to report finding 'too many boats' in some place on their most recent trip. Overall, about one in five boaters reports encountering 'too

many boats' in the 1996 study (Figure 17). Boaters are more likely to report this on the more congested weekends/holidays than on weekdays. Public access boaters are least likely to experience 'too many boats', while riparian residents are most likely. Boaters on the more intensively used waters (those on the left of Figure 18) are more likely to report this than those on the less congested, less intensively used waters. Lake Minnetonka, for whatever reason, has far more boaters reporting 'too many boats' than waters that are about equally congested, such as the St. Croix or the remaining large boating lakes. Perhaps Minnetonka's numerous narrow channels that boaters regularly navigate contribute to perceptions of 'too many boats'.

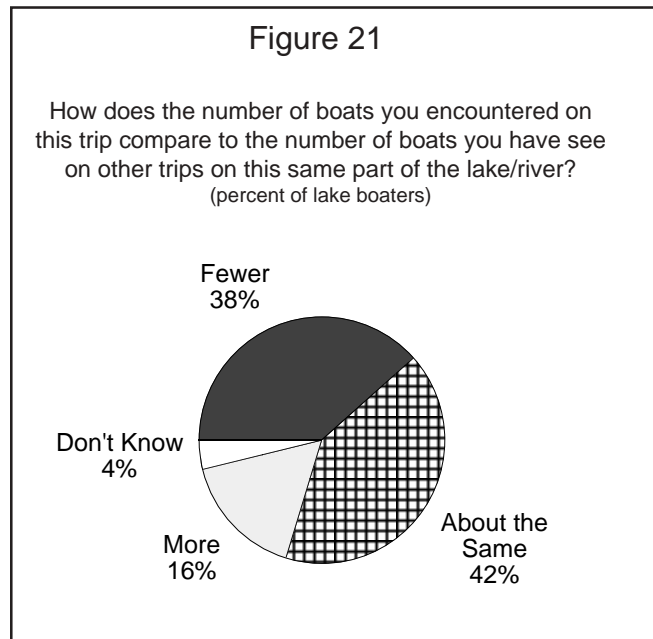


A similar question on perception of crowding elicited the same pattern of responses (Figures 19 and 20). Those boaters not reporting boating conditions as ‘crowded’ or ‘far too crowded’ gave responses of ‘about right’ or ‘few boats’. Once again, Lake Minnetonka stands apart from the other waters.

Although it is not uncommon for metro area boaters to feel crowded, it is important to recognize that the large majority of boaters—on any lake or river, or on any day of



the week, or from any source—neither feel crowded nor report traveling though areas with too many boats. One primary reason so many boaters see conditions this way is that they set their ‘expectations’ to the number of boats they have encountered in the past. When they encounter the large number of boats they expected, they are not likely to report ‘too many boats’ or ‘far too crowded’. In fact, many boaters have their expectations set for conditions that are more crowded than those they actually encounter. Nearly forty percent of boaters (38%) encountered fewer boats than ‘usual’, compared with only 16 percent who encountered more (Figure 21). Another 42 percent encountered about the same number as ‘usual’.



Since 1984, perceptions of crowding have not changed a great deal (Table 3). Public access boaters’ perceptions are virtually the same, while riparian residents showed an increase. Some waters, including Minnetonka, decreased, while others increased, and still others showed little change. These perceptions are consistent with the minor changes experienced in actual boat numbers.

Table 3

Trends in perception of crowding: percent of boaters judging conditions as ‘crowded’ or ‘far too crowded’*

	'Crowded' & 'Far Too Crowded' 1984	'Crowded' & 'Far Too Crowded' 1996	Change (1984 to 1996)
Overall (lakes)	16	20	4
Source of Boater (lakes)			
Public Access	8	10	2
Riparian Resident	23	36	14
Waterbody			
Lake Minnetonka	45	37	-8
Remaining Large Boating Lakes	10	23	14
Built-up area lakes with public access	19	17	-3
Rural area lakes with public access	6	10	4
Lakes without public access	(insufficient data in 1996 for comparison)		

* Excludes marina/private access boaters because of small number of interviews in 1984.

On lakes that had an increase in actual boat numbers from 1984 to 1996 (those that added a public access) perceptions of 'crowded' and 'far too crowded' conditions rose to levels experienced on similar lakes with public access (Table 4). This is what would have been expected.

	----- 5 lakes that received access -----		'Crowded' & 'Far Too Crowded' on Similar Lakes With Public Access, 1996
Source of Boater	'Crowded' & 'Far Too Crowded' <u>1984</u>	'Crowded' & 'Far Too Crowded' <u>1996</u>	
Riparian Resident	8	34	31
Public Access	(no access in 1984)	5	4

Problems

Boaters were asked to indicate how much of a problem 14 conditions and situations were on their most recent trip. Responses could range from 'not a problem' to 'slight problem' to 'moderate problem' to 'serious problem' to 'very serious problem'.

In terms of problem ranking, there was a large degree of agreement across sources of boaters and boating waters. Problem rankings are very similar for lake public access, marina/private access and riparian resident boaters, as is the case for river public access and marina/private access boaters (Table 5). The top 5-6 ranked items are shared by the different boater groups. Lake residents, not surprisingly, are more sensitive to lake noise than boaters not living on the lake. Zebra mussels and Eurasian milfoil are only ranked for the lakes and rivers on which they occur.

Within the top-ranked problems, two items stand apart from the rest: presence of milfoil and use of personal watercraft. This is shown for lake public access users and marina/private access users on Figure 22; results are similar for other boating groups. Milfoil and personal watercraft far exceed any other potential problem. The next group of items, having to do with boater conduct and speed-related problems, are far

Table 5

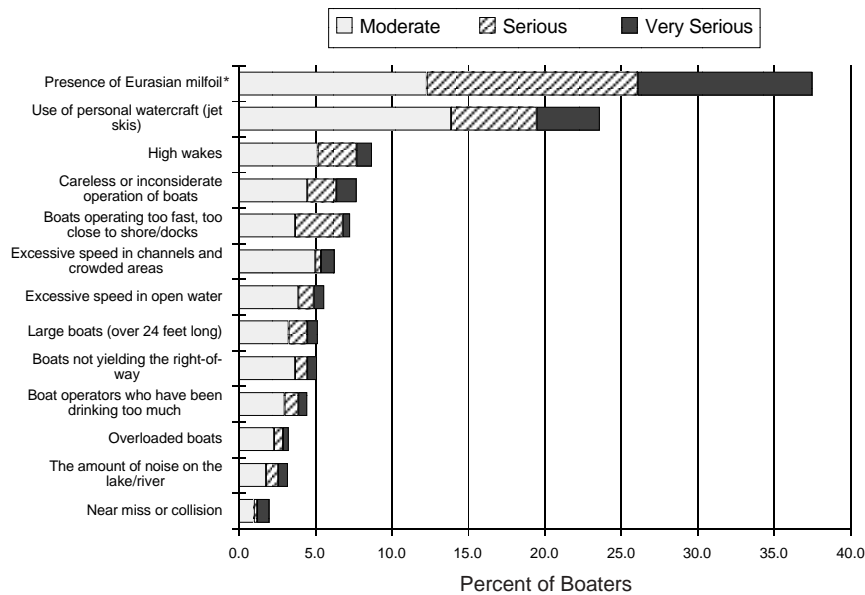
Problem ranking by different groups of boaters

Problem Rank (rank = 1 means largest problem)	Lake public access, private access and marina boaters	Lake resident boaters	River public access, private access and marina boaters
1	Presence of Eurasian milfoil*	Presence of Eurasian milfoil*	Use of personal watercraft (jet skis)
2	Use of personal watercraft (jet skis)	Use of personal watercraft (jet skis)	Presence of Eurasian milfoil*
3	High wakes	The amount of noise on the lake/river	Careless or inconsiderate operation of boats
4	Careless or inconsiderate operation of boats	Boats operating too fast, too close to shore/docks	High wakes
5	Boats operating too fast, too close to shore/docks	Careless or inconsiderate operation of boats	Excessive speed in channels and crowded areas
6	Excessive speed in channels and crowded areas	High wakes	Boats not yielding the right-of-way
7	Excessive speed in open water	Excessive speed in open water	Presence of zebra mussels*
8	Large boats (over 24 feet long)	Excessive speed in channels and crowded areas	Boats operating too fast, too close to shore/docks
9	Boats not yielding the right-of-way	Boats not yielding the right-of-way	The amount of noise on the lake/river
10	Boat operators who have been drinking too much	Boat operators who have been drinking too much	Boat operators who have been drinking too much
11	Overloaded boats	Near miss or collision	Excessive speed in open water
12	The amount of noise on the lake/river	Overloaded boats	Near miss or collision
13	Near miss or collision	Large boats (over 24 feet long)	Large boats (over 24 feet long)
14			Overloaded boats

*Only ranked if present in the waterbody

Figure 22

Problems judged as 'moderate', 'serious' or 'very serious' by public access, private access and marina boaters

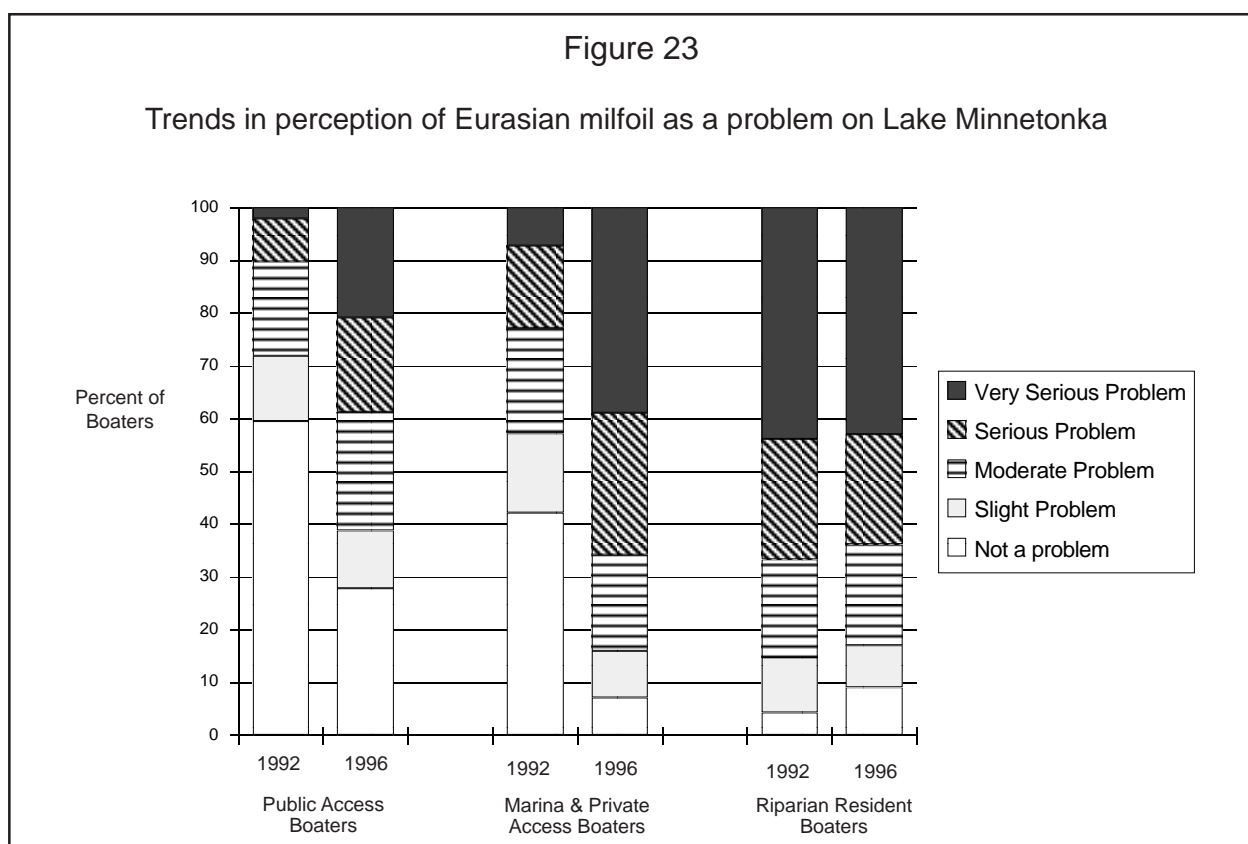


* Only ranked if present in the waterbody

less frequently recognized as a 'moderate', 'serious' or 'very serious' problem.

Eurasian milfoil is a recent arrival in the Twin Cities. On Lake Minnetonka, boaters have had a few years to become accustomed to the presence of milfoil, and it is worthwhile to document how this familiarity has affected their judgment on milfoil as a problem.

The first time Minnetonka boaters were asked about milfoil was in 1992, shortly after its arrival. Then, most riparian residents judged it as a serious or very serious problem (Figure 23). In 1996 they still do. There has been little change in their evaluation of milfoil. What has changed from 1992 to 1996 is the evaluation of other boaters. Neither public access nor marina/private access boaters thought milfoil was much of a problem in 1992. By 1996, their perceptions of milfoil as a problem had increased markedly, approaching the perception of riparian residents. It is likely that the investment by public agencies in milfoil awareness helped modify boater perceptions.



Satisfaction

Irrespective of problems and crowding, nearly all boaters are ‘satisfied’ or ‘very satisfied’ with their most recent boating experience. Satisfaction is high for all sources of boaters and on all lakes and rivers (Figures 24 and 25). Few are dissatisfied to any extent. Furthermore, nearly all boaters would return to boat again if conditions were similar to the ones they just experienced (Table 6).

Figure 24

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

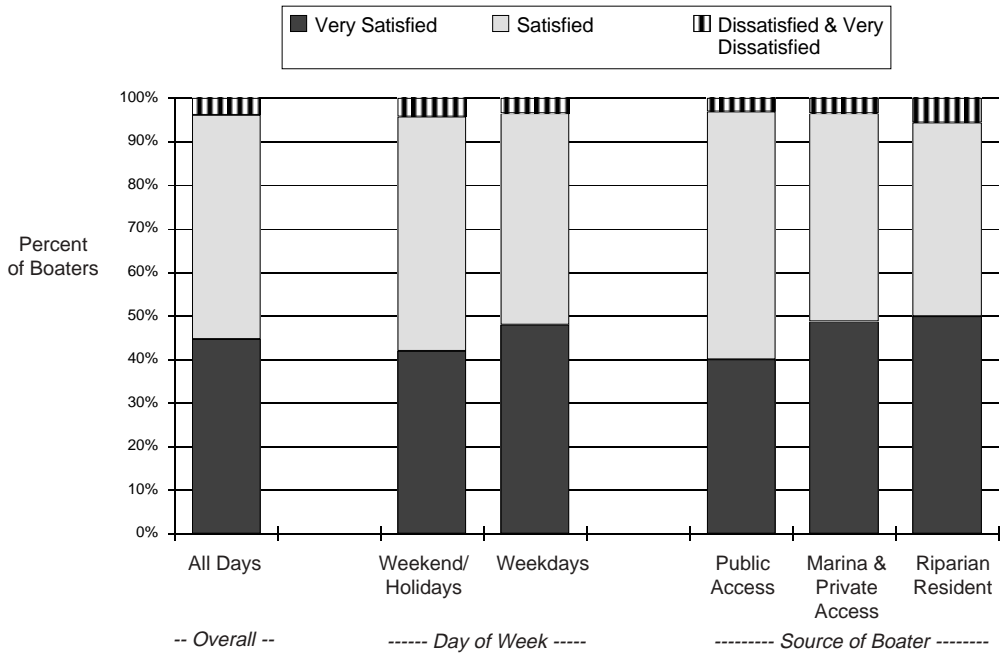
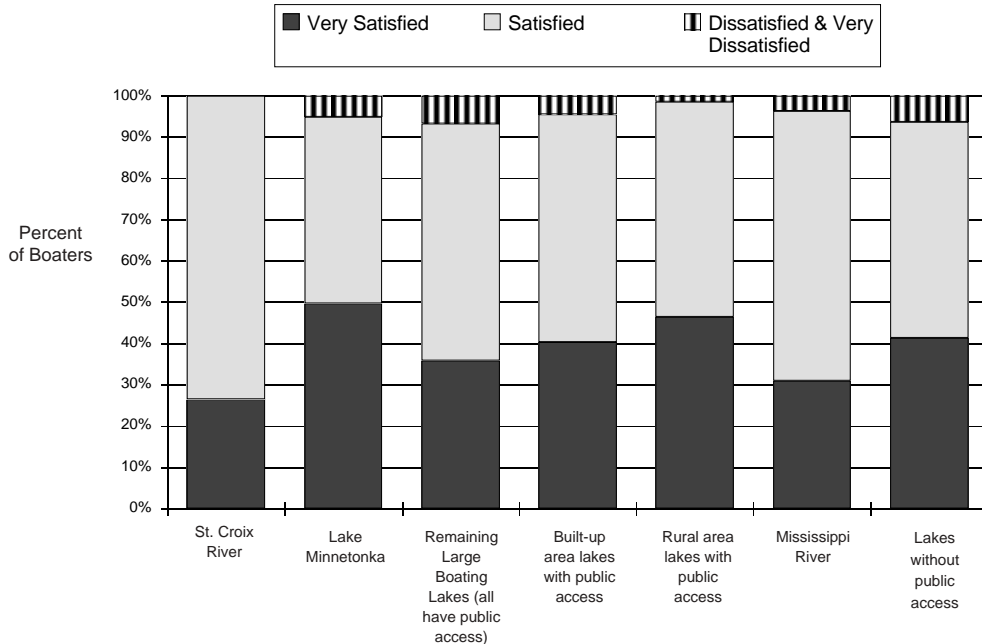


Figure 25

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



One reason satisfaction is so high is because boaters have chosen to boat under conditions with which they are familiar. Not many people (golfers excepted) willingly engage in an activity that makes them miserable.

The group of boaters who choose to boat under Twin Cities conditions represent the large majority of boaters who reside in the metro area. In other words, those choosing to boat in the metro area are not a small group who are tolerant of metro boating conditions. In a previous study, it was found that 85 percent of metro residents who have registered boats, have boated in

the Twin Cities (Reference 4). And the largest group of those who don't boat in the Twin Cities do not keep their boats near home (boats kept at seasonal lake home or marina outside the metro area). Metro boaters, once they start boating in the Twin Cities, also continue boating. Only about one percent discontinue boating in the Twin Cities each year. Some boaters drop out because of a lifestyle change (purchase a lake home), while others drop out because of factors related to metro boating conditions, such as crowding and fishing. In summary, the metro area offers boating opportunities that the large majority of boaters are able to enjoy.

Satisfaction is related to boating conditions, however. When boaters encounter 'too many boats', their satisfaction levels dip and their willingness to return drop. Boaters who encounter 'too many boats' have quite a bit lower 'very satisfied' responses compared with other boaters (Figure 26). Similarly, about 10 percent of boaters who find 'too many boats' would not return if the same number of boats was encountered (Figure 27). Virtually every boater who did not encounter too many boats would return. Although encountering too many boats affects satisfaction and willingness to return, it is important to note that satisfaction levels and willingness to return remain high even when boaters encounter 'too many boats'.

Would you come back to this lake/river if you knew there were going to be about the same number of boats?	
	Percent Responding 'YES'
Overall (lakes)	94
Day of Week (lakes)	94
Weekend/Holiday	94
Weekday	95
Source of Boater (lakes)	
Public Access	97
Marina & Private Access	96
Riparian Resident	89
Waterbody	
St. Croix River	94
Lake Minnetonka	92
Remaining Large Boating Lakes	95
Built-up area lakes with public access	93
Rural area lakes with public access	97
Mississippi River	96
Lakes without public access	98

Figure 26

Effect of encountering 'too many boats' on trip satisfaction

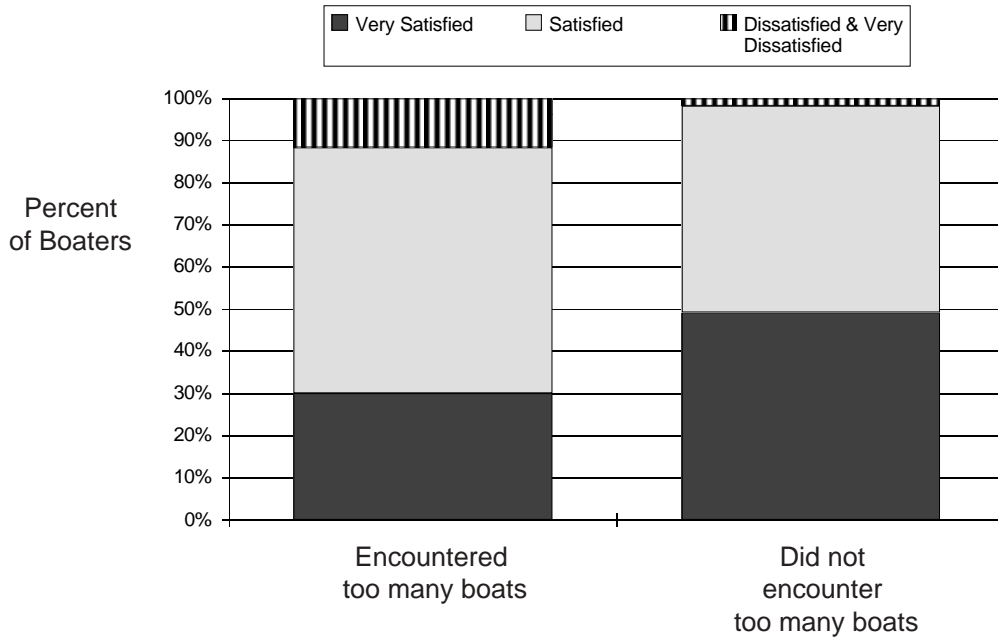
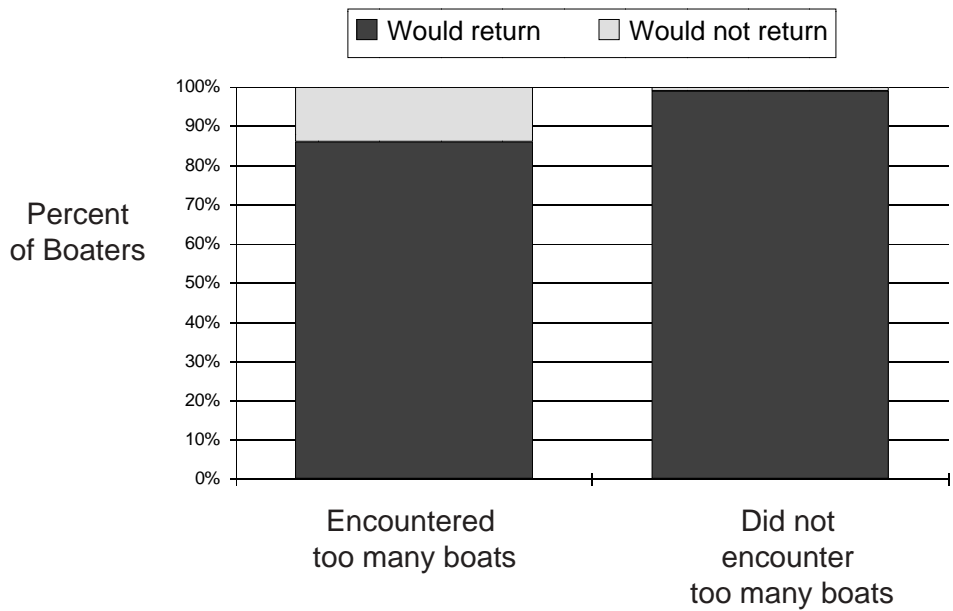


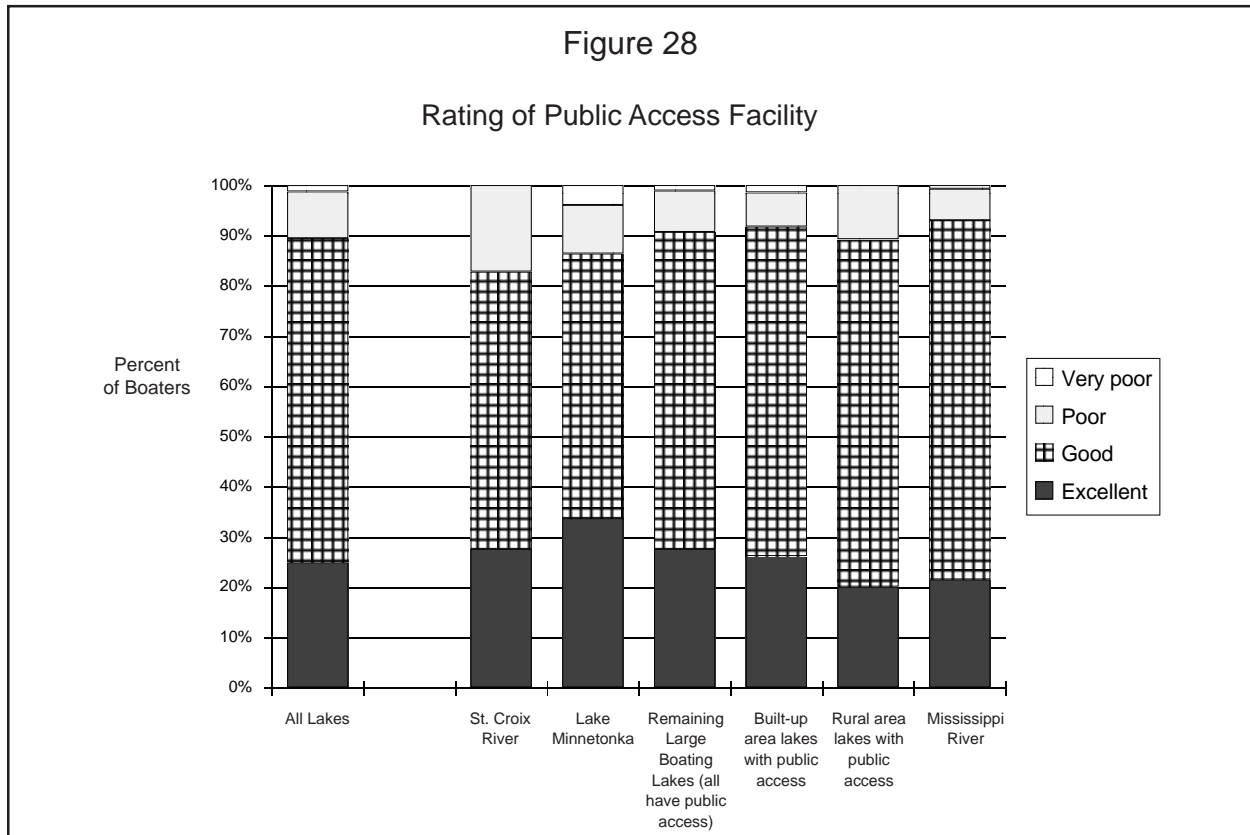
Figure 27

Effect of encountering 'too many boats' on willingness to return



Public Access Quality

Public access users give high marks to the quality of public launching facilities, just as they did in 1984 (Figure 28). Nearly 90 percent rate the public access as ‘good’ or ‘excellent’. Few boaters give ratings of ‘poor’ or ‘very poor’. The higher negative ratings for the St. Croix may be real, but they may also be due to the small number of interviews (only 29 public access interviews).



A significant contributor to the negative ratings of an access is encountering a problem in its use. The 30 percent of boaters who indicated they had one type of problem or another using the access were much more likely to give ‘poor’ or ‘very poor’ ratings to the access (Figure 29).

There was not much variation in the frequency of problem identification from one resource to another (Figure 30). The primary type of problem boaters identified had to do with the size of the access (Figure 31). As noted earlier, public accesses are regularly full and congestion is a normal occurrence at some times of the week. Problems related to size/congestion of the facility include: not enough parking spaces, not

Figure 29

Effect on public access rating of encountering a problem in using the access

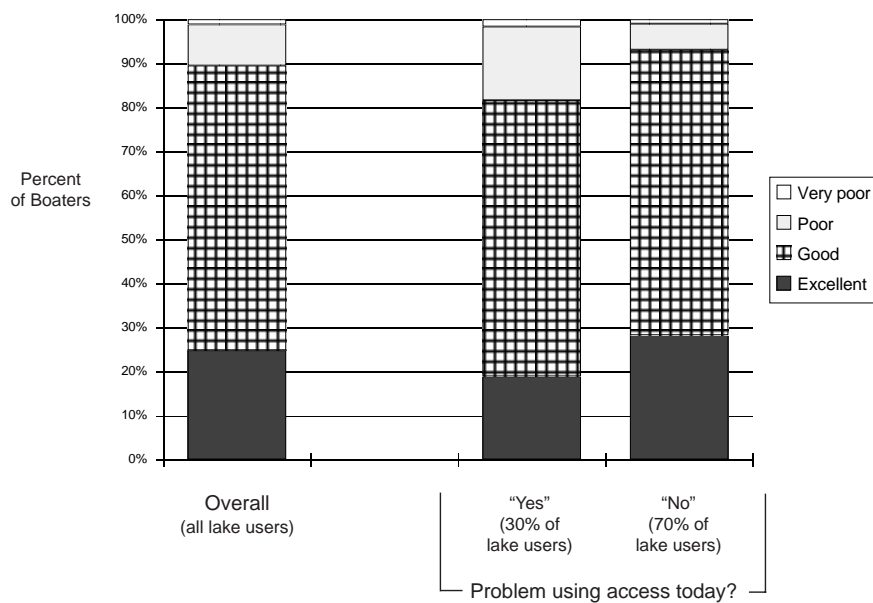
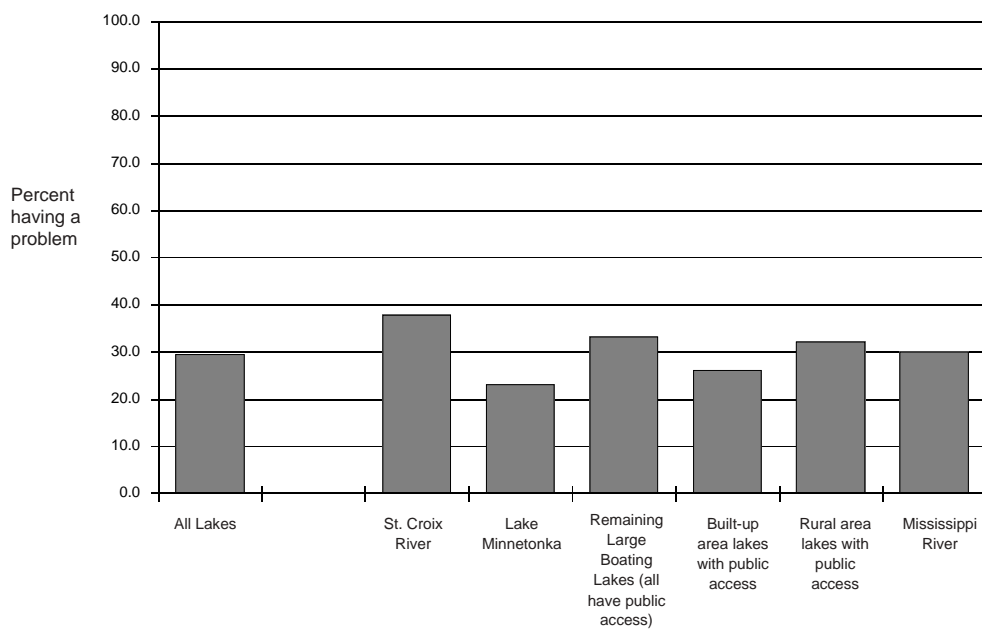
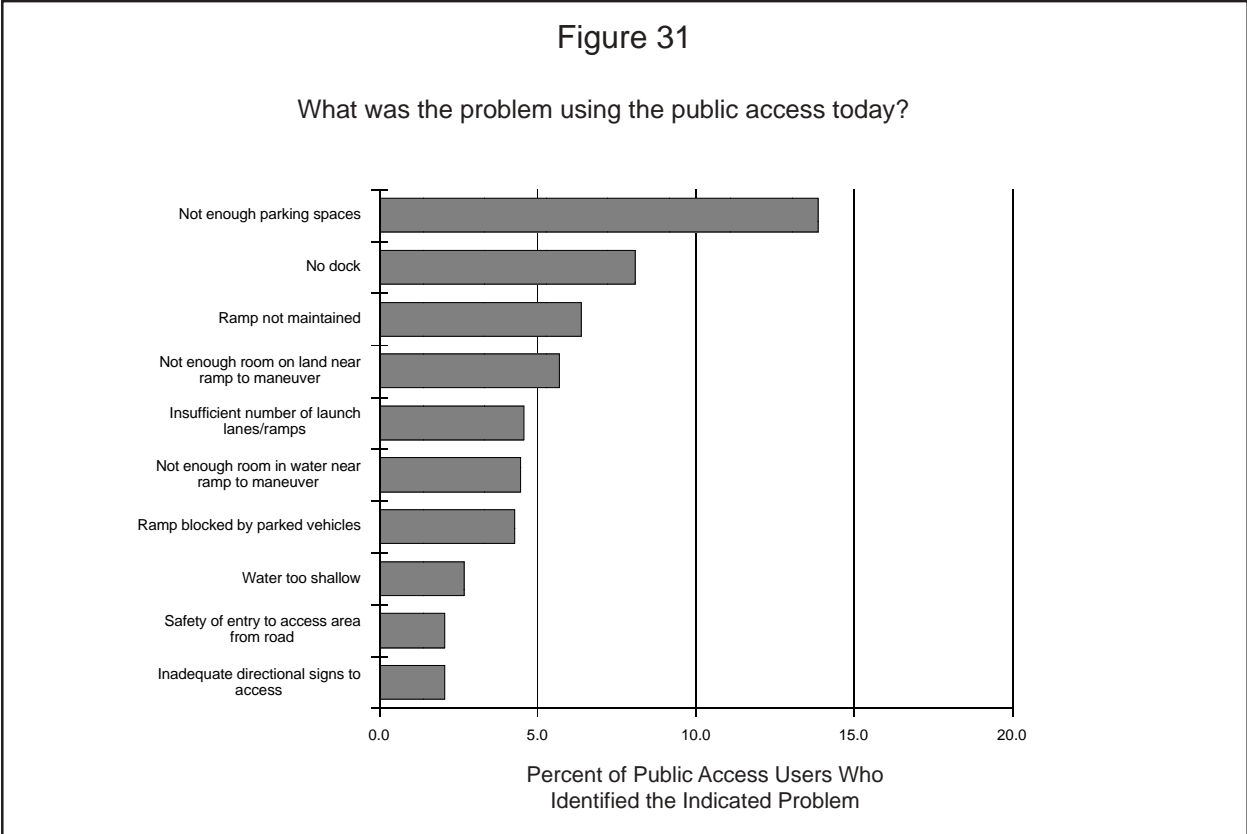


Figure 30

Did you have any particular problem using this access today?





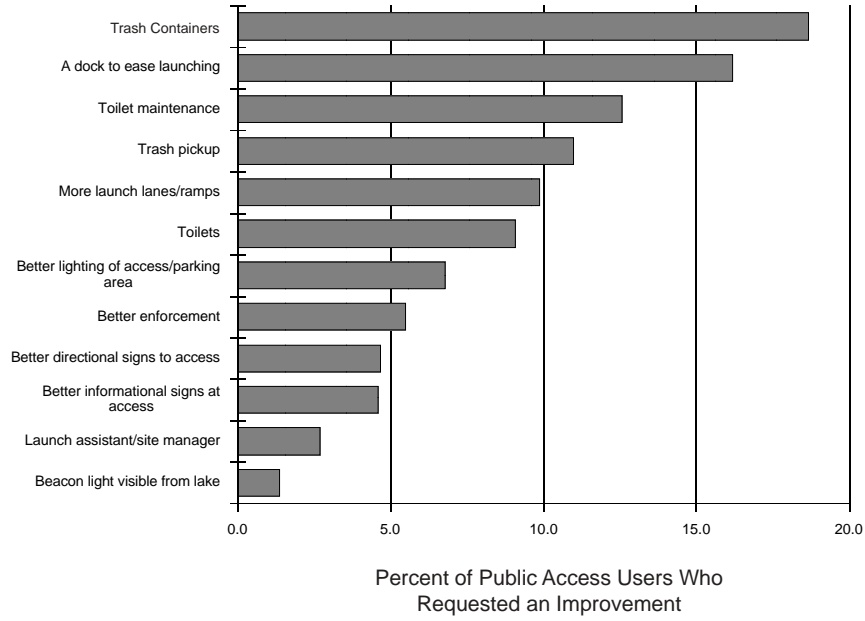
enough room to maneuver on land or in water near the ramp, and insufficient number of launch lanes/ramps. Beyond problems related to size/congestion, two others stood out: no dock and ramp not maintained.

Public access boaters were asked if they thought certain facility improvements were needed. None of the 12 possible improvements was judged as ‘needed’ by more than 20 percent of boaters (Figure 32). The list of possible improvements did not include a solution to the general size/congestion problem noted above. Had the list included such a solution, it probably would have been the leading improvement requested by boaters.

The most requested improvements related to trash and toilets. A dock to ease landing was also a popular improvement. No other improvement garnered more than 10 percent of boaters who thought it was needed. There is a large commonalty in requested improvements from one resource class to another.

Figure 32

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



BOATING SAFETY AND ENFORCEMENT

Boating Restrictions

Boating restrictions are common on metro lakes and rivers. The most common type of restriction deals with speed/no wake/area, which restricts craft speed (wake generation) in certain areas, such as near shore. For the 30 sample lakes in the 1996 study, 17 have this type of restriction (Table 7). Both rivers have this restriction, too. The other types of restrictions are much less common. Time restrictions deal with when certain activities (such as water skiing) and operating conditions (such as speed limits) are permitted. The horsepower restrictions occurs on 2 sample lakes (Calhoun and Nokomis), where only electric motors are permitted. No sample lakes currently have boat type/size restrictions, but they are included because they were a type of restriction boaters could opt for in the future.

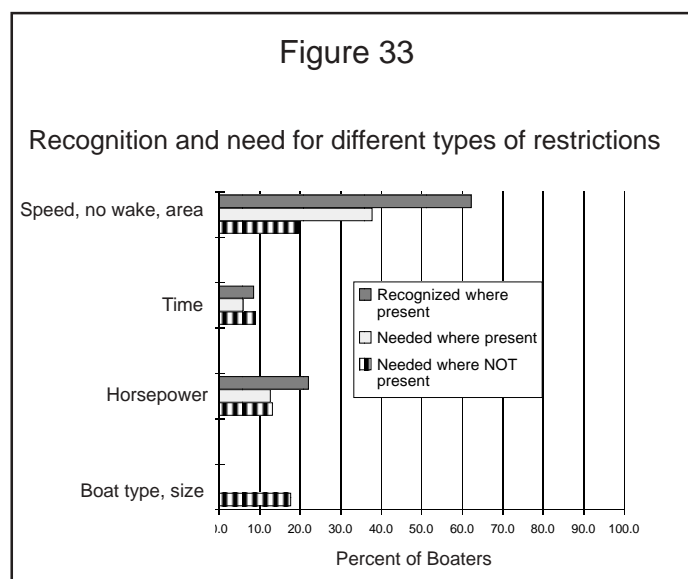
Table 7

Existing boating restrictions on sample lakes and rivers in 1996

	Lakes with <u>restriction</u>	Lakes without <u>restriction</u>	Total <u>Lakes</u>	Rivers with <u>restriction</u>	Rivers without <u>restriction</u>	Total <u>Rivers</u>
Speed/No wake/Area	17	13	30	2	0	2
Horsepower	2	28	30	0	2	2
Time	7	23	30	1	1	2
Boat type/Size	0	30	30	0	2	2

Boaters were asked to indicate the type of boating restrictions in force on the lake/river on which they just completed their trip. Boaters were next asked what restrictions were needed on this water, even if none was in existence now. The results of these questions are shown on Figure 33.

The speed/no wake/area restriction has high recognition among boaters



compared with other restrictions, although nearly 40 percent of boaters on restricted waters did not report its existence. The time and horsepower restrictions are not widely known, perhaps because they have little impact on most boaters and therefore are not at the front of most boater’s minds. Nearly 40 percent of boaters think the existing speed/no wake/area restrictions that are in place are needed, which is the highest of the restriction groups. The time and horsepower restrictions have little expressed need, probably because so few boaters understand their presence and the rationale for their presence. Even for the speed/no wake/area, the expressed need is low, indicating that large numbers of boaters either do not understand the rationale for this restriction or do not accept the rationale. To be effective, restrictions must be understood and accepted, since compliance in most situations is voluntary; enforcement personnel cannot be everywhere all the time.

When restrictions were not present, boaters did not indicate a large expressed need for any of the types of restrictions. The expressed needs were in the range of 9-20 percent of boaters.

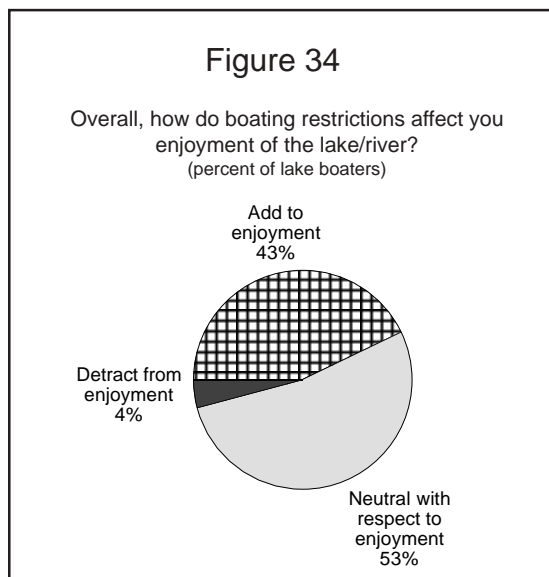
For the primary restriction (speed/no wake/area), riparian residents have a higher recognition than other boaters (Table 8). Riparian residents also have a much higher expressed need for the restriction where it is present. Where not present, however, riparian residents have only a slightly higher expressed need than other boaters.

	----- Recognized where present	Percent of Boaters Needed where present	----- Needed where NOT present
Overall (lakes)	62	38	20
Source of Boater (lakes)			
Public Access	50	22	18
Marina & Private Access	72	44	16
Riparian Resident	75	57	24
Waterbody			
St. Croix River	79	19	n/a
Lake Minnetonka	84	55	n/a
Remaining Large Boating Lakes	59	27	39
Built-up area lakes with public access	43	24	26
Rural area lakes with public access	46	26	13
Mississippi River	52	18	n/a
Lakes without public access	n/a	n/a	15

Recognition of the speed/no wake/area restriction is quite high for the St. Croix and Lake Minnetonka, and drops quite a bit for the other waters. The expressed need for this restriction is relatively high for Lake Minnetonka. At the other extreme, it is very low for the St. Croix. For whatever reason, St. Croix boaters do not indicate the need for this restriction, even though most recognize its presence. This suggests that either St. Croix boaters do not understand the rationale for the restriction or do not accept the rationale. For the other waters, expressed need is generally between Minnetonka and the St. Croix.

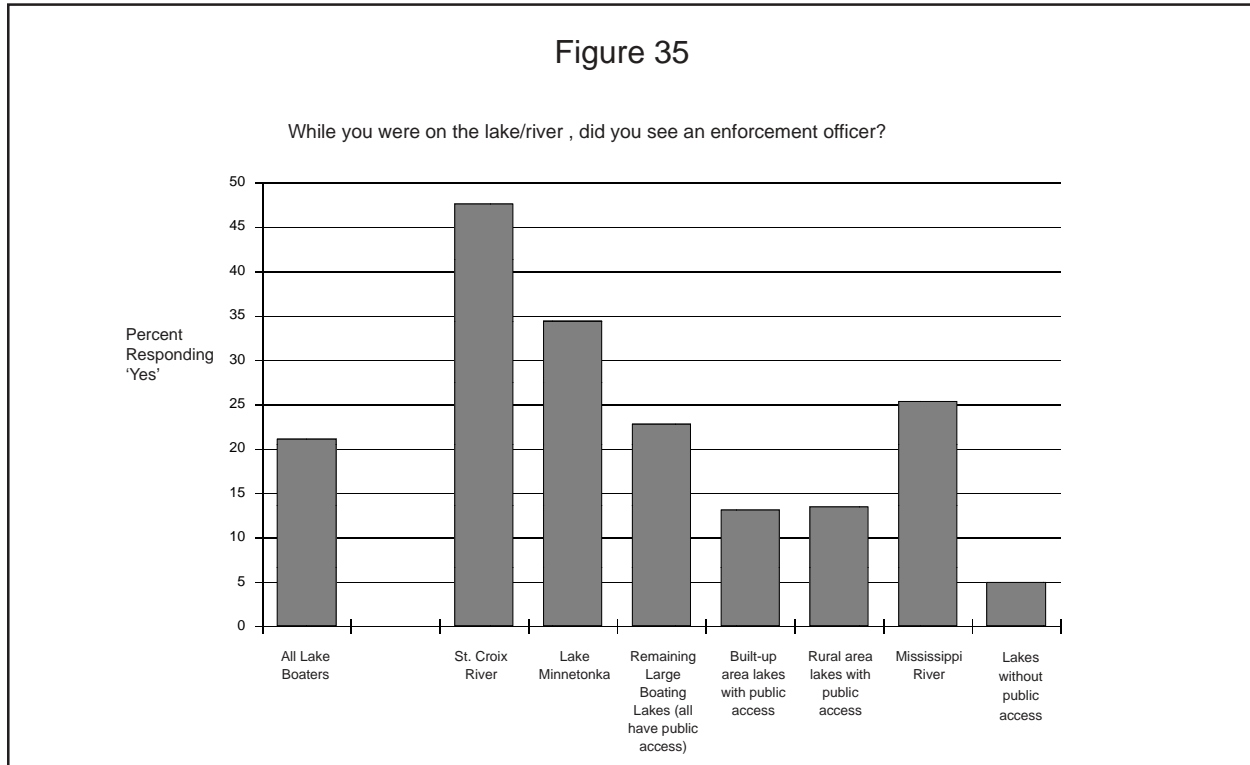
The expressed need for the speed/no wake/area restriction, where it is not present, is not particularly strong, except on the remaining large boating lakes, where 39 percent of boaters think it is needed.

One potential reason boaters may not want a boating restriction is because it interferes with the enjoyment of their activity. This is not the case, however. Few boaters believe that existing restrictions detract from their enjoyment (Figure 34). The largest number believe restrictions are neutral with respect to enjoyment (neither add to nor detract from enjoyment), with the sizable remainder believing they add to enjoyment. This pattern of responses is basically the same across sources of boaters and boating waters.

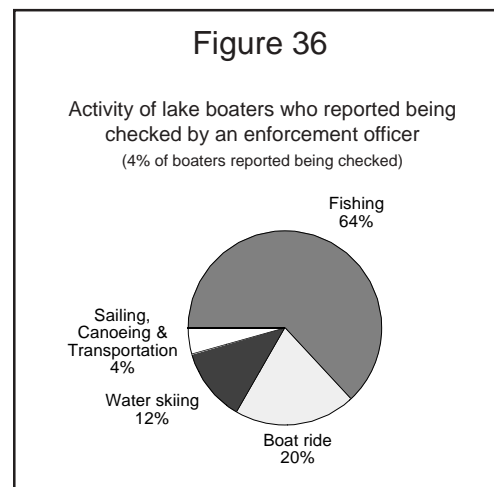


Enforcement Presence

Enforcement officers are seen regularly on some waters and not on others. Overall, about 20 percent of boaters saw an enforcement officer on their last trip (Figure 35). On the larger waters (St. Croix, Minnetonka, remaining large boating lakes and Mississippi), boaters see enforcement officers more frequently than on the more numer-

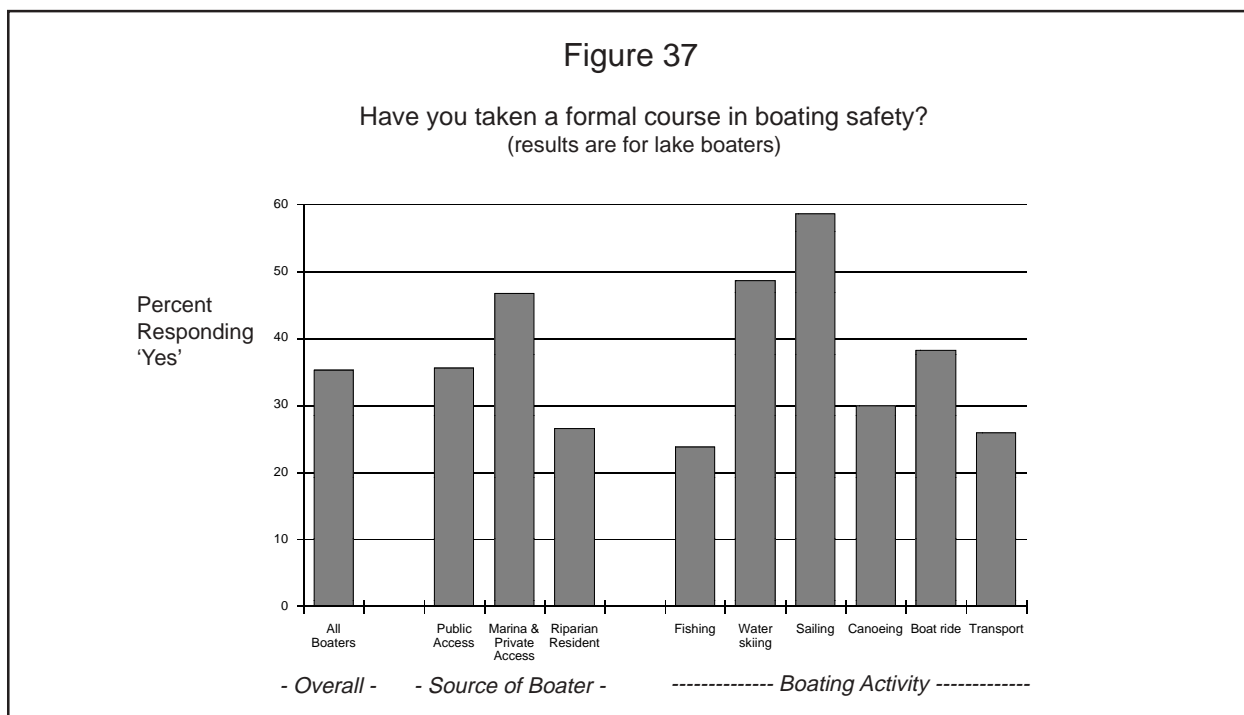


ous smaller lakes. Except for the Mississippi River, these waters are the most intensely used (most congested) resources. About 4 percent of boaters reported being checked by an enforcement officer, and nearly two-thirds of the checks were on people who were fishing (Figure 36).



Safety Courses

About one-third of boaters report having completed a formal boating safety course (Figure 37), a portion that is unchanged since 1984 (Table 9). Public access and marina/private access boaters are more likely to have completed a safety course than riparian residents. Sailors are the most likely to have completed such a course, perhaps because safety is incorporated in the basic training for sailing which many sailors take. Anglers are the least likely to have completed such a course.



Boaters were asked if all boat operators should be required to complete a safety course. Some 43 percent thought that requirement was a good idea (Table 10). People who have completed such a course were much more likely to agree with this requirement than those who have not. Even among those who have completed a safety course, however, 40 percent do

Table 9
Percent of boaters having completed a formal boating safety course, 1984 and 1996*

	1984	1996	Change (1984 to 1996)
Overall (lakes)	32	32	0
Source of Boater (lakes)			
Public Access	40	36	-4
Riparian Resident	24	27	2

* Excludes marina/private access boaters because of small number of interviews in 1984.

not believe it should be required for all boat operators.

Types of Beverages on Board

Since the 1984 study, Minnesota has enacted a law that makes it illegal to operated a motorboat after consuming too much alcohol, very much like the alcohol restrictions on driving an automobile. Just over one-fourth of boaters report that alcoholic drinks in one form or another were on board during their last outing (Figure 38). Most boating parties (55%) have only non-alcoholic drinks on board. This pattern of responses does not change much by source of boater (Table 11). The pattern also does not change appreciably by activity, except for canoeing and transportation, where alcoholic drinks and drinks of any type are less common.

For those taking some form of drink on board, the mix of types has not changed a great deal since 1984 (Table 12). There is an indication that boating parties with only alcoholic beverages are down considerably, although the portion with some alcoholic drinks is down a small amount from 35 percent in 1984 to 30 percent in 1996. Parties

Table 10

Should all boat operators (powered & unpowered) be required to complete a boating safety course?

	Percent Responding 'Yes'
All Boaters	43
Boaters having taken such a course	60
Boaters not having taken such a course	32

Figure 38

Beverages on Board
(percent of lake boaters)

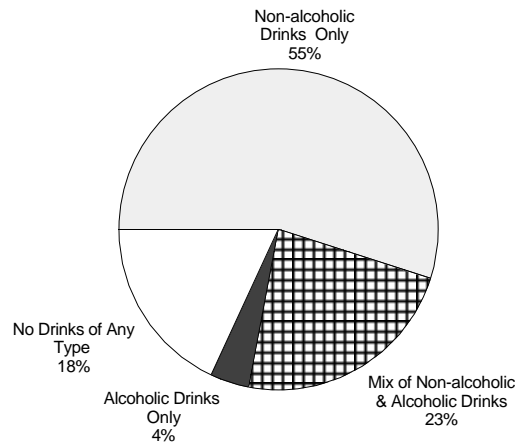


Table 11

Beverages on Board by Source of Boater and Activity
(percent of lake boaters)

	Percent of Boaters				Total Percent
	Non-alcoholic Drinks Only	Mix of Non- alcoholic & Alcoholic Drinks	Alcoholic Drinks Only	No Drinks of Any Type	
Overall (lakes)	55	23	4	18	100
Source of Boater (lakes)					
Public Access	61	20	3	16	100
Marina & Private Access	50	33	4	13	100
Riparian Resident	50	21	5	25	100
Primary Activity (lakes)					
Fishing	69	18	4	10	100
Waterskiing	60	25	1	14	100
Sailing	47	34	5	14	100
Canoeing	32	1	3	65	100
Boat Ride	45	27	5	23	100
Transportation	43	14	5	38	100

with only non-alcoholic drinks on board seem to be up a small amount.

Safety Equipment

Wearing life jackets (person flotation devices) is far more prevalent in 1996 than in 1984; it increased overall by nearly a factor of four over the 12 years between the studies. In 1996 children are the most likely to wear such a device, with teens next, and adults last (Figure 39). Less than half (43%) of adults wear a life jacket. The portion of adults and teens wearing a life jacket increases when the activity is fishing and canoeing. For children, the percent wearing a life jacket is largely constant across activities.

Most boats (85%) are equipped with some form of safety equipment other than personal flotation devices (Table 13). Lights, fire extinguishers and horns are the most common forms. The small portion of boats without any safety equipment (about 15%) may not need any, because no safety equipment other than personal flotation devices is required for boats less than 16 feet long operated during daylight hours.

Table 12

Percent of boaters having certain drinks on board, 1984 and 1996*
(only includes boaters who have some type of drink on board)

	1984	1996	Change (1984 to 1996)
Non-alcoholic Drinks Only	65	70	5
Mix of Non-alcoholic & Alcoholic Drinks	24	25	1
Alcoholic Drinks Only	11	5	-6
Total Percent	100	100	0

* Excludes marina/private access boaters because of small number of interviews in 1984.

Figure 39

Percent of Boaters Wearing Life Jackets
(results are for lakes)

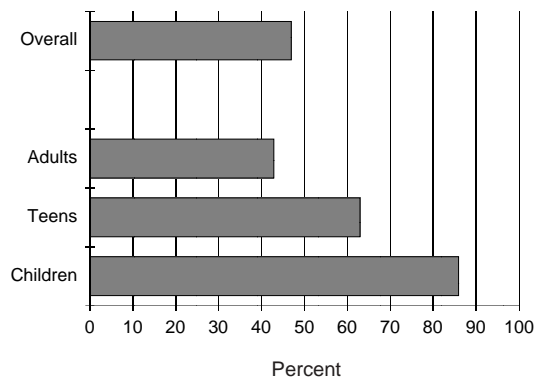


Table 13

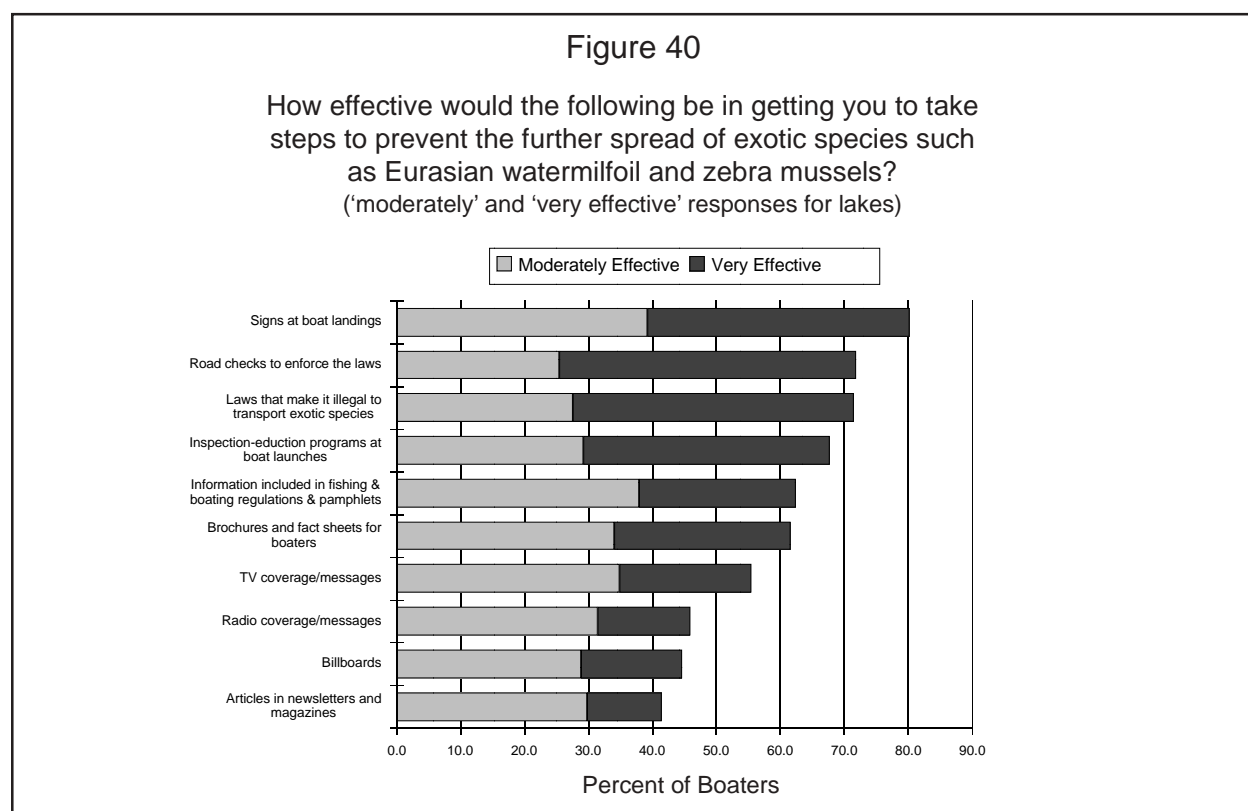
Percent of Boats with Various Types of Safety Equipment, Other Than Personal Flotation Devices
(results are for lakes)

	Percent
Fire extinguisher	58.9
Horn	49.6
Lights	74.0
Visual signal	22.5
None of the above	14.7

PREVENTING THE SPREAD OF EXOTIC SPECIES

As noted above, boaters believe that exotic species are a leading problem on Twin Cities’ lakes and rivers. Preventing the further spread of exotics is, thus, a major concern of boaters. Boaters were asked, as part of the study, to evaluate the effectiveness of different techniques in getting themselves and other boaters to take steps to prevent the diffusion of exotics such as Eurasian watermilfoil and zebra mussels.

Two types of techniques stand apart from the others in boater’s minds. These two types have the highest ‘very effective’ rankings and the highest combined ‘very effective’ and ‘moderately effective’ ratings. One type is the information delivered at boat landings, either in the form of signs or inspection-education programs (Figure 40). The other type is related to enforcement, and includes laws to make the transport of exotics illegal and road checks to enforce those laws. The next most effective techniques are information delivered directly to boaters in fishing and boating regulation documents, or in the form of brochures and fact sheets targeted to the boater audience. Boaters gave the lowest effectiveness ratings to techniques that are not directly delivered to them in boating-related settings. These included media messages delivered via television, radio, billboards, and articles in newspapers and magazines.



There was widespread agreement on the effectiveness of the various techniques across sources of boaters and boating waters, with one exception. The exception was the inspection-education program at boat launches. The people who would be directly affected by this program (public access boaters) gave a considerably lower effectiveness ranking to this technique (ranked 6th out of 10 techniques) than did riparian residents, who had this as their 2nd most effective technique (Table 14). The information delivered by signs at boat launches was the highest ranked technique for both public access and riparian resident boaters.

Table 14

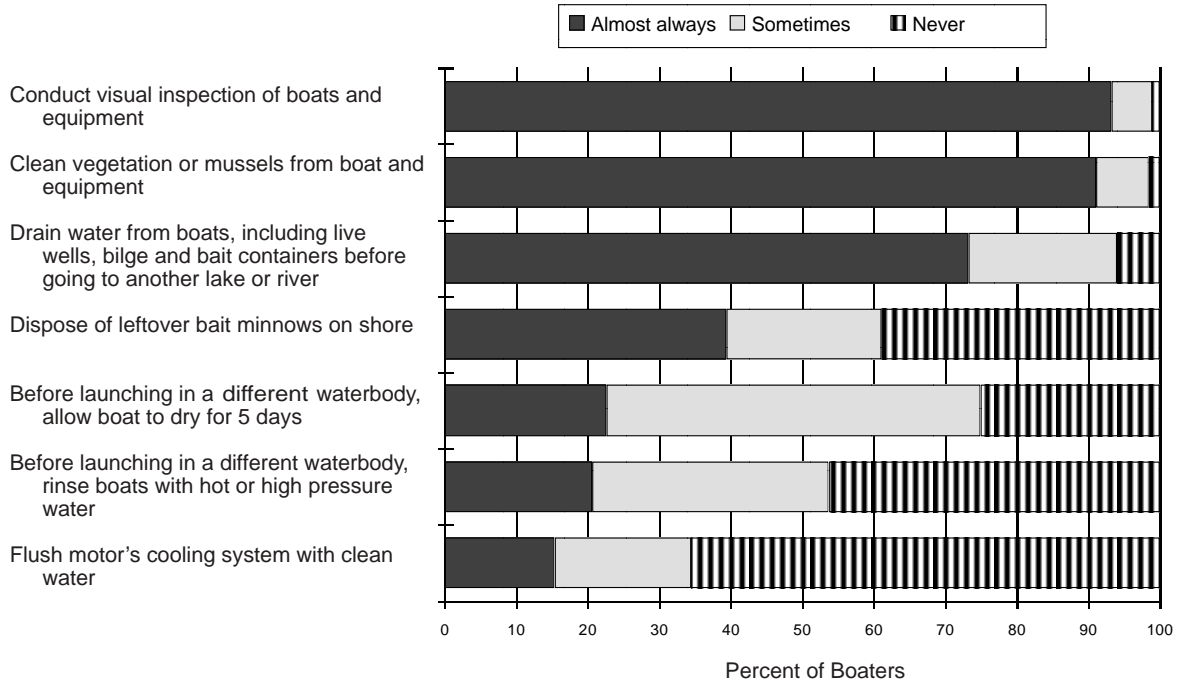
Differing opinions on effectiveness of inspection-education program
at boat launches
(results are for lakes)

	----- Percent of Boaters -----			Rank among 10 effectiveness items (1=most effective)
	Moderately Effective	Very Effective	Total of Moderately and Very Effective	
Lake Public Access Boaters	30	28	58	6
River Public Access Boaters	33	19	52	6
Lake Riparian Resident Boaters	27	53	80	2

Boaters were also asked what actions they take after removing a boat from a lake or stream to prevent the spread of exotics. Nearly all boaters that remove boats do a few simple things almost all the time (Figure 41). They conduct a visual inspection of their boat and equipment, clean off vegetation and mussels, and drain water from the boat. Actions that are less simple, and require more time and effort, are not done nearly as frequently. Such actions include disposing of leftover bait on shore, allowing the boat to dry five days before launching into another waterbody, rinsing the boat with hot or high pressure water, and flushing the motor’s cooling system with clean water. The overall pattern of responses shown on Figure 41 was consistent across sources of boaters and boating waters.

Figure 41

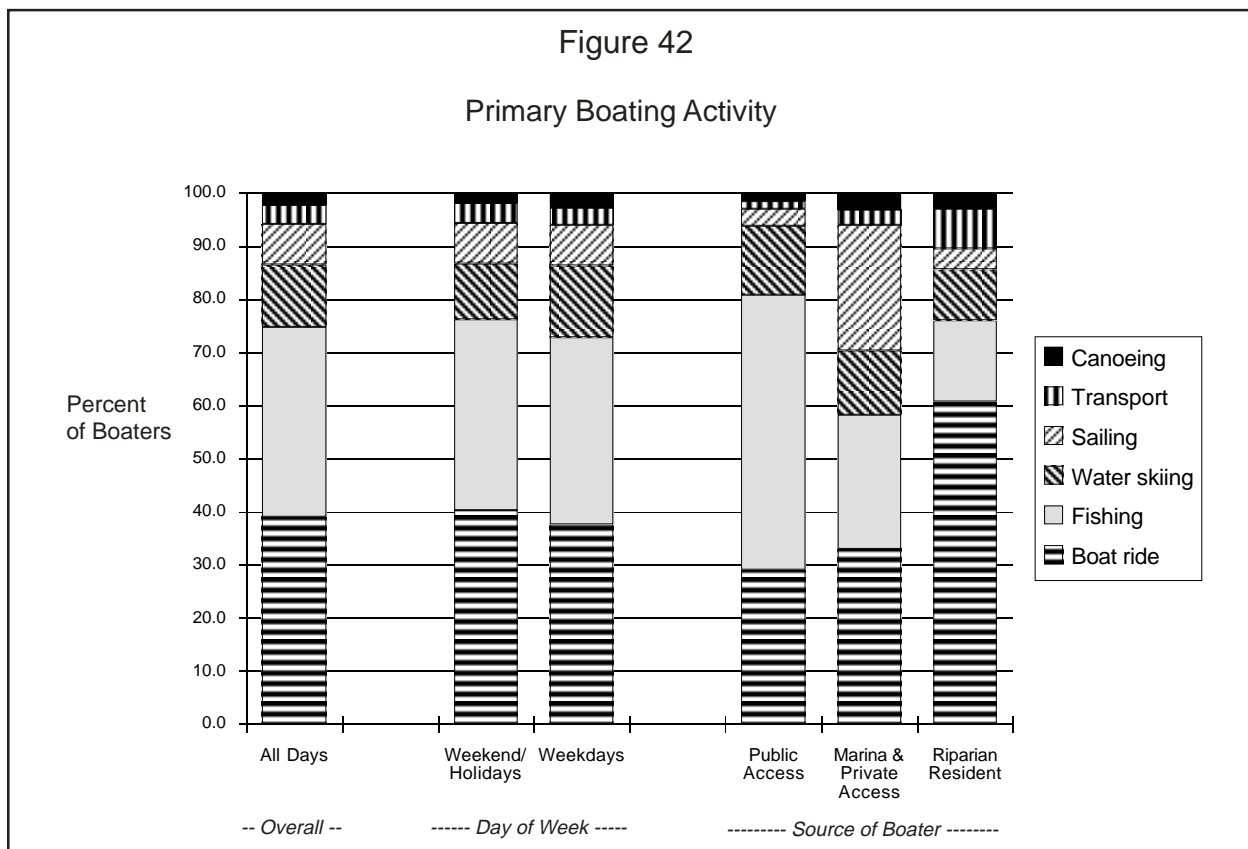
After removing boats from a lake or stream, how often do you do any of the following?
(results are for lakes)



CHARACTERISTICS OF THE BOATING TRIP

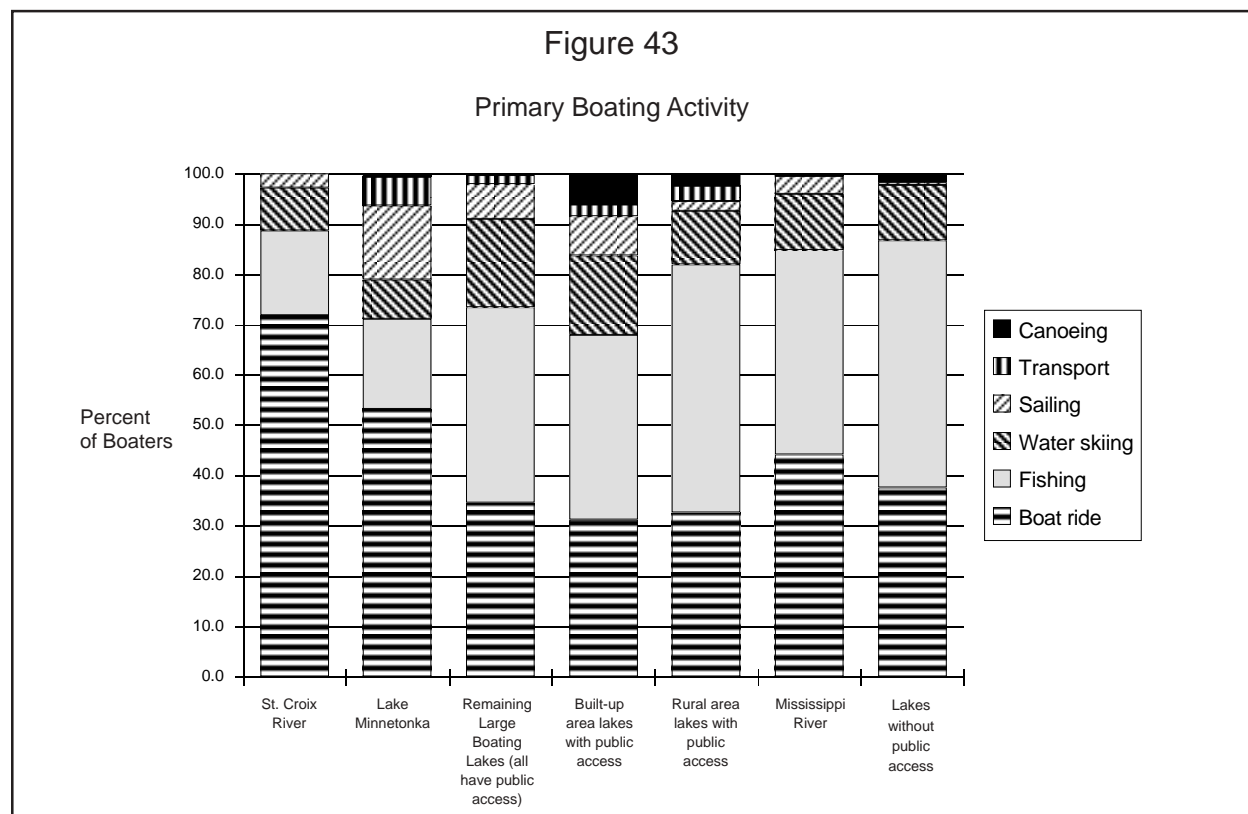
Activity

There are two major activities on metro area lakes. One is boat riding and the other is fishing (Figure 42). Together these two account for some three-fourths of activity time. The next largest activity is water skiing, followed by sailing. Canoeing and transport are the remaining two activities; both are small and combined they account for about 5 percent of activity time. Differences between weekday and weekend/holiday activities are small.



Large differences exist in the activity profiles of the different sources of users. Public access boaters predominately fish, with about half of activity time spent fishing. Boat riding and water skiing are secondary activities. Riparian residents mainly participate in boat riding, and do little fishing. Marina/private access users distribute the bulk of their time relatively evenly between boat riding, fishing and sailing. Sailing is primarily a marina/private access activity. The other sources have only small sailing components.

The different resources are used in different ways. The two large resources (St. Croix and Minnetonka) are primarily boat riding waters (Figure 43). This is especially true for the St. Croix where just over 70 percent of activity time is spent on boat riding. On Minnetonka, just over half of all activity time is boating riding, while fishing and sailing each account for about 15 percent of boater time.



The other lake and river resources have large and comparable amounts of fishing and boat riding. The lakes have more fishing than boat riding, while the Mississippi River has more boat riding than fishing.

Boating activities changed from 1984 to 1996. Boat riding experience a sizable gain, while water skiing experienced a major loss (Table 15). Fishing was slightly larger in 1996 than 1984. Both sailing and canoeing decreased. This pattern of change was

Table 15
Boater Activities in 1984 and 1996*

	1984 (percent)	1996 (percent)	Change (1984 to 1996)
Boat ride	29.0	40.8	11.8
Fishing	35.1	38.4	3.3
Water skiing	21.7	11.7	-10.0
Transport	2.6	3.7	1.1
Sailing	7.7	3.5	-4.2
Canoeing	3.9	2.0	-1.9
Total	100.0	100.0	0.0

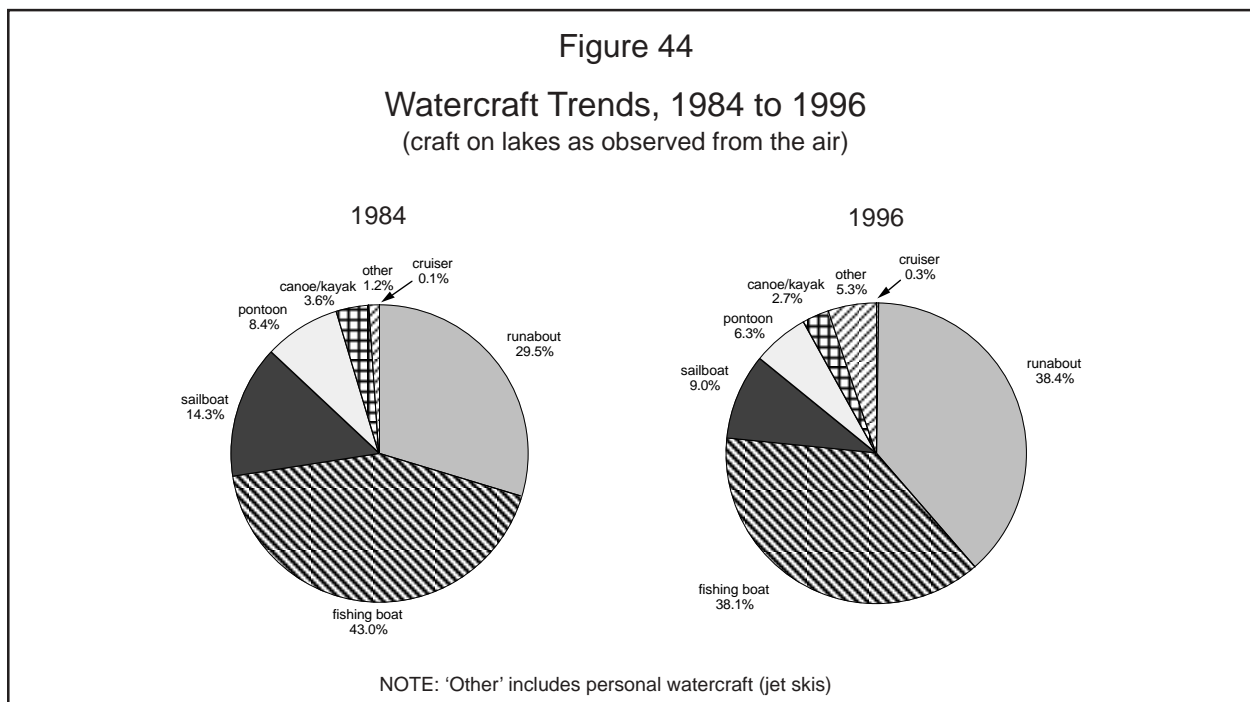
* Excludes marina/private access boaters because of small number of interviews in 1984.

closely followed by both public access users and riparian residents, indicating that it is probably a general boating trend.

Why water skiing fell is unknown, but two possible factors come quickly to mind. One factor is the smaller number of teens and young adults produced by the aging of the baby boomers and the smaller size of the next generation. Water skiing is a highly physical activity that most likely has sharply decreasing participation with age. Comparable activities are probably downhill skiing and tennis, both of which have had trouble keeping participation up because of demographic changes. The other factor is the rising popularity of personal watercraft, which may have cut into the water thrill market that includes water skiing. The drop in water skiing is largely compensated for by the increase in boat riding. Personal watercraft use is considered ‘boat riding’ in this study. Boaters who water ski own the base equipment for boat riding; to increase boat riding and decrease water skiing is easy and inexpensive.

Boating Equipment

The craft people use on the water have also shown some changes (Figure 44). Runabouts are more common and fishing boats slightly less common (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). Sailboats and canoes are less common, consistent with the drops in activity time found in sailing and canoeing. The ‘other’ cat-



egory, which is predominately personal watercraft, grew substantially between 1984 and 1996.

Parallel to the drop in sailing and canoeing, which are mostly non-motorized, is the increase since 1984 in the portion of boats with motors. The portion grew some 10 percent. In 1996 most boats (59%) have one motor, which is almost always gas (Table 16). Two-motor craft are common, and account for nearly 30 percent of all boats. The combining of a gas and electric motor is about twice as common as the gas with gas combination.

Motor sizes, on average, are at the century mark (Table 17). Riparian residents tend to have larger motors than the other boating sources. The larger waters (St. Croix, Minnetonka, and Mississippi River) have motor sizes quite a bit larger than the other lake resources. Within these other lake resources, the larger lakes tend to have larger motors and the urban lakes tend to have larger motors than rural lakes.

Motor size is one thing that has definitely changed since 1984. There has been a consistent, across the board increase in horsepower in the 20-30 range since 1984 (Table 18).

Table 16

Type and Mix of Motors on Boats
(results are for lakes, 1996)

	Percent of Boats
One Motor	
Gas	57.4
Electric	1.3
Subtotal	58.6
Two Motors	
Gas & electric	19.9
Gas & gas	8.8
Subtotal	28.7
No Motors	12.7
Total	100.0

Table 17

Motor Sizes
(results are for lakes, 1996)

	Average Horsepower	Median Horsepower
Overall (lakes)	99	85
Source of Boater (lakes)		
Public Access	88	75
Marina & Private Access	102	85
Riparian Resident	119	90
Waterbody		
St. Croix River	184	150
Lake Minnetonka	142	140
Remaining Large Boating Lakes	99	85
Built-up area lakes with public access	87	65
Rural area lakes with public access	70	60
Mississippi River	130	110
Lakes without public access	60	50

Table 18

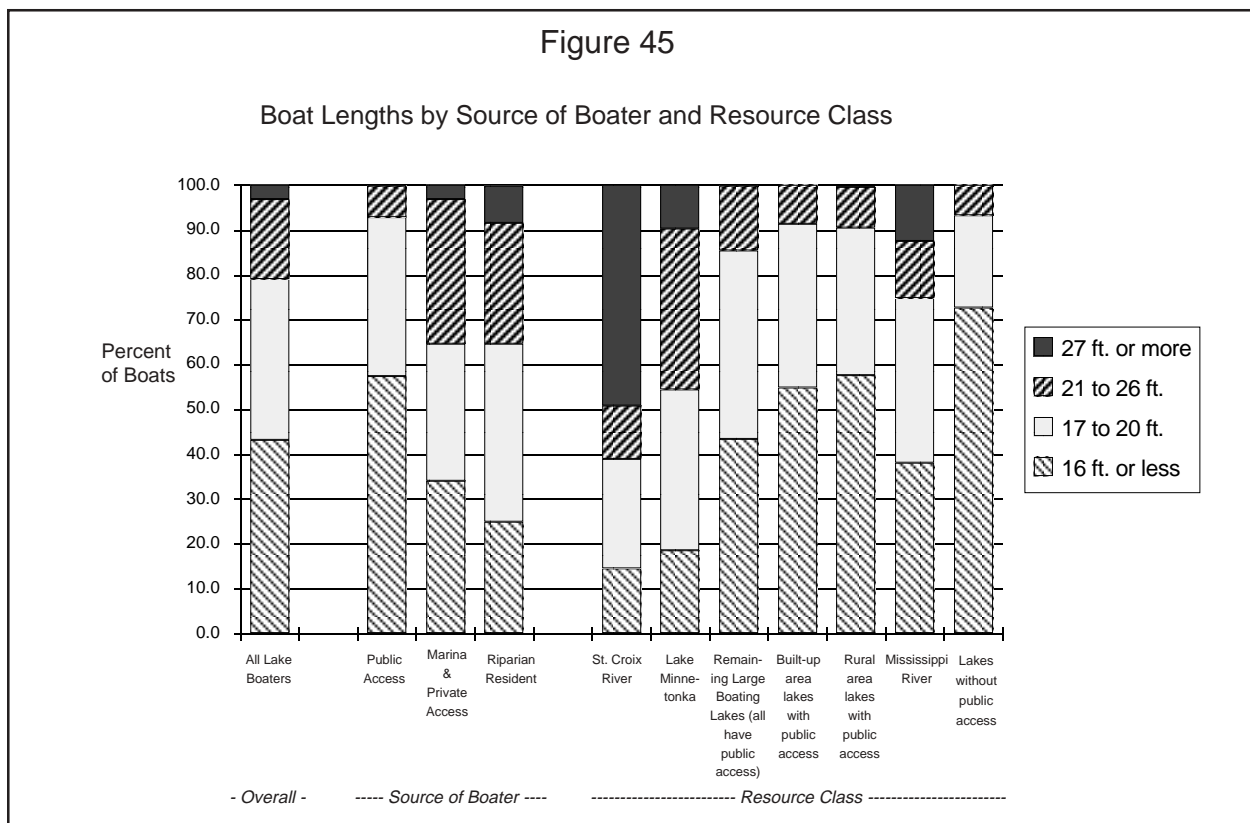
Trends in Motor Size, 1984 to 1996*

	Average Horsepower 1984	Average Horsepower 1996	Change (1984 to 1996)
Overall (lakes)	76	99	23
Source of Boater (lakes)			
Public Access	63	88	25
Riparian Resident	92	119	27
Waterbody			
Lake Minnetonka	130	158	28
Remaining Large Boating Lakes	64	98	34
Built-up area lakes with public access	71	88	17
Rural area lakes with public access	53	70	17
Lakes without public access	(insufficient data in 1996 for comparison)		

* Excludes marina/private access boaters because of small number of interviews in 1984.

As noted above the larger waters have larger motor sizes. They also have larger boats. Most of the boats on the St. Croix (60%) are over 20 feet in length, and nearly half on Lake Minnetonka are that length (Figure 45). To a lesser extent the Mississippi River has large boats; about 25 percent are over 20 feet. These large water resources represent the Twin Cities' market for big boats. For the remaining lakes, few boats are over 20 feet. The large majority (85-95%) of boats are 20 feet or less, with the majority of those being 16 feet or less.

Boaters coming through public access, who trailer their boats, have substantially smaller boats than the other boating sources.



Boater Characteristics

There is a remarkable consistency in the travel distances of public access and marina/private access boaters, and in the distances traveled to the different waterbodies (Table 19). Ten miles, plus or minus a mile or two, is what the typical metro boater travels to the lake or river.

Boaters are experienced with the waters they are using. Overall, half have been boating on the lake/river they were interviewed over 8 years (Table 20). Public access

boaters are the least experienced of the sources, although half have been boating on the resource they were interviewed for 5 or more years. Riparian residents are, by far, the most experienced with an average approaching 20 years. For the various resources, Minnetonka has a somewhat more experienced boater, while the larger lakes tend to have a slightly more experienced boater than the smaller lakes.

Boating is primarily an adult activity, with 75 percent of boaters in the adult range (Figure 46). The other 25 percent is split about evenly between teens and children. The average size of most boating parties is about 3, and is somewhat larger for riparian residents than for the other sources, and is somewhat larger for Minnetonka than for other resources (Table 21).

Table 19

Travel Distances to Public and Private Accesses and Marinas, 1996

	Average Miles	Median Miles
Overall (lakes)	12.0	8
Source of Boater (lakes)		
Public Access	11.6	8
Marina & Private Access	13.0	10
Waterbody		
St. Croix River	12.0	8
Lake Minnetonka	13.2	10
Remaining Large Boating Lakes	12.9	9
Built-up area lakes with public access	10.1	6
Rural area lakes with public access	11.6	12
Mississippi River	12.6	10
Lakes without public access	12.9	12

Table 20

Experience Boating on Lake/River of Most Recent Trip

	Average Years Boated on this Lake/River	Median Years Boated on this Lake/River
Overall (lakes)	12.2	8
Source of Boater (lakes)		
Public Access	8.8	5
Marina & Private Access	10.3	7
Riparian Resident	19.1	15
Waterbody		
St. Croix River	11.3	8
Lake Minnetonka	14.6	10
Remaining Large Boating Lakes	11.9	7
Built-up area lakes with public access	10.8	6
Rural area lakes with public access	10.9	6
Mississippi River	9.5	6
Lakes without public access	9.3	5

Figure 46

Age Composition of Boating Parties
(results are for lakes, 1996)

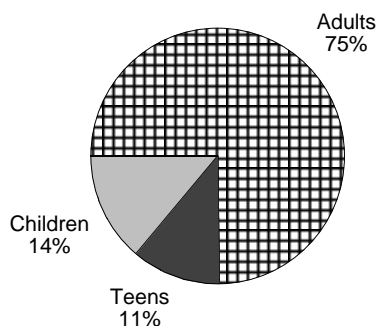


Table 21

Boating Party Sizes, 1996

	Average Party Size
Overall (lakes)	3.1
Day of Week (lakes)	
Weekend/Holidays	3.3
Weekdays	2.9
Source of Boater (lakes)	
Public Access	2.7
Marina & Private Access	3.0
Riparian Resident	4.0
Waterbody	
St. Croix River	3.1
Lake Minnetonka	3.5
Remaining Large Boating Lakes	3.2
Built-up area lakes with public access	2.8
Rural area lakes with public access	3.0
Mississippi River	2.8
Lakes without public access	2.8

REFERENCES

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3. Kelly, Tim. 1993. *An origin-destination model of recreational boating on the Twin Cities reaches of the Mississippi and St. Croix River* (Reprint 93-R028). Onalaska, Wisconsin: Environmental Management Technical Center.
4. Kelly, Tim and Ron Sushak. 1989. *Modeling the impact of riparian development on boating use*. MN DNR, Office of Planning.
5. Silker, Christine M. and Dorothy H. Anderson. 1995. *Changes in boating use patterns*. A report on Twin Cities' boating prepared for MN DNR by University of Minnesota, Department of Forest Resources.

Twin Cities Boating Studies

Lake Minnetonka: Study years are 1984, 1986, 1987, 1992, 1994 and 1996. All of these studies should be available from the Lake Minnetonka Conservation District. The MN DNR was involved in the 1984, 1992, 1994 and 1996 studies, and these are available from the MN DNR.

Other Twin Cities Lakes: Study years are 1984 and 1996. Both studies are available from MN DNR.

St Croix and Mississippi River: Study years used in this report are 1983, 1985, 1987, 1989, 1991, 1993 and 1995. The Mississippi River data series starts in 1989. All of these studies are available from the Minnesota-Wisconsin Boundary Area Commission.

APPENDIX A

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Particular problems encountered in data analysis	49

Sample Lakes & Rivers in 1996 and 1984 Boating Studies

<u>Lake Number</u>	<u>Lake Name</u>	<u>Class in '96*</u>	<u>Class in '84*</u>	<u>Lake Acres</u>	<u>Exotic Species+ (12/95)</u>
<i>Seven-County Twin Cities Area Lakes</i>					
270133	Minnetonka	Minnetonka	Cat 1	14,034	E. milfoil
100009	Minnewashta	Cat 1	Cat 1	763	E. milfoil
700026 & 700072	L & U Prior	Cat 1	Cat 1	1,146	E. milfoil
820052	Big Marine	Cat 1	Cat 1	1,577	
820167	White Bear	Cat 1	Cat 1	2,410	E. milfoil
620057	Josephine	Cat 2-PA	Cat 2-no PA	110	
270137	Christmas	Cat 2-PA	Cat 2-no PA	274	E. milfoil
620061	Turtle	Cat 2-PA	Cat 2-no PA	444	
270031	Calhoun	Cat 2-PA	Cat 2-PA	416	E. milfoil
270019	Nokomis	Cat 2-PA	Cat 2-PA	199	E. milfoil
270067	Bryant	Cat 2-PA	Cat 2-PA	199	E. milfoil
270111	Eagle	Cat 2-PA	Cat 2-PA	470	E. milfoil
620078	Johanna	Cat 2-PA	Cat 2-PA	211	
620056	Owasso	Cat 2-PA	Cat 2-PA	360	
20052	Netta	Cat 3-no PA	Cat 3-no PA	162	
820163	Clear	Cat 3-PA	Cat 3-no PA	400	
700120	Thole	Cat 3-PA	Cat 3-no PA	131	
820049	Big Carnelian	Cat 3-PA	Cat 3-PA	444	
20006	Centerville	Cat 3-PA	Cat 3-PA	464	
820159	Forest	Cat 3-PA	Cat 3-PA	2,206	
20026	Linwood	Cat 3-PA	Cat 3-PA	567	
190026	Marion	Cat 3-PA	Cat 3-PA	489	
100059	Waconia	Cat 3-PA	Cat 3-PA	3,196	E. milfoil
<i>Chisago County Lakes</i>					
130031	Sunrise	Cat 3-no PA	n/a	810	
130012 & 130028	Chisago,S Lindstrom	Cat 3-PA	n/a	1,594	
130041	Green	Cat 3-PA	n/a	1,830	E. milfoil
130053	Comfort	Cat 3-PA	n/a	220	
<i>Rivers</i>					
	St. Croix**	n/a	n/a	8,215	E. milfoil
	Mississippi***	n/a	n/a	7,950	E. milfoil & Z. mussels

* Class codes are as follows:

Minnetonka: Lake Minnetonka

Cat 1: Remaining large (high-use) boating lakes (all have public access)

Cat 2-PA: Built-up area lakes with public access

Cat 2-no PA: Built-up area lakes without public access

Cat 3-PA: Rural area lakes with public access

Cat 3-no PA: Rural area lakes without public access

** Arcola sandbar to mouth

*** Excludes the backwater areas not covered by aerial photos used to count boats

+ Eurasian water milfoil (E. milfoil) and zebra mussels (Z. mussels)

Remaining (non-sample) Boating Lakes in Seven-County Twin Cities Area

Lake Number	Lake Name	Class in '96*	Class in '84*	Lake Acres	Lake Number	Lake Name	Class in '96*	Class in '84*	Lake Acres
100012	Ann	Cat 2-PA	Cat 2-no PA	120	270160	Long (Little)	Cat 2-PA	Cat 2-PA	279
100044	Auburn	Cat 3-PA	Cat 3-PA	356	100006	Lotus	Cat 2-PA	Cat 2-no PA	254
620002	Bald Eagle	Cat 2-PA	Cat 2-PA	1,046	100007	Lucy	Cat 2-no PA	Cat 2-no PA	137
270098	Bass	Cat 2-no PA	Cat 2-no PA	175	20034	Martin	Cat 3-PA	Cat 3-PA	218
100019	Bavaria	Cat 3-PA	Cat 3-PA	201	700050	McMahon	Cat 3-PA	Cat 3-PA	136
820054	Bone	Cat 3-PA	Cat 3-PA	206	270104	Medicine	Cat 2-PA	Cat 2-PA	924
100084	Burandt	Cat 3-no PA	Cat 3-no PA	138	100029	Miller	Cat 3-no PA	Cat 3-no PA	145
270047	Bush	Cat 2-PA	Cat 2-PA	207	270070	Mitchell	Cat 2-PA	Cat 2-no PA	116
190006	Byllesby	Cat 3-PA	Cat 3-PA	1,480	700095	O'Dowd	Cat 3-PA	Cat 3-PA	256
270039	Cedar+	Cat 2-PA	Cat 2-PA	167	820103	Olson+	Cat 2-PA	Cat 2-PA	100
700091	Cedar	Cat 3-PA	Cat 3-PA	749	190031	Orchard	Cat 3-PA	Cat 3-PA	243
20042	Coon	Cat 3-PA	Cat 3-PA	1,507	20003	Otter	Cat 2-no PA	Cat 2-no PA	338
20084	Crooked	Cat 2-PA	Cat 2-PA	130	100042	Parley	Cat 3-PA	Cat 3-PA	470
190027	Crystal	Cat 2-PA	Cat 2-PA	290	20004	Peltier	Cat 3-PA	Cat 3-PA	483
820101	DeMontreville	Cat 2-PA	Cat 2-PA	156	620013	Phalen	Cat 2-PA	Cat 2-no PA	193
270181	Dutch	Cat 2-PA	Cat 2-PA	170	100053	Piersons	Cat 3-PA	Cat 3-PA	340
100121	Eagle	Cat 3-PA	Cat 3-PA	230	820122	Pine Tree	Cat 2-no PA	Cat 3-no PA	174
20133	East Twin	Cat 3-PA	Cat 3-PA	116	620046	Pleasant	Cat 2-no PA	Cat 2-no PA	585
820106	Elmo	Cat 3-PA	Cat 3-PA	317	20015	Randeau	Cat 3-no PA	Cat 3-no PA	594
270118	Fish	Cat 2-PA	Cat 2-no PA	221	270192	Rebecca	Cat 3-PA	Cat 3-PA	290
700069	Fish	Cat 3-PA	Cat 3-PA	175	100052	Reitz	Cat 3-PA	Cat 3-PA	111
20091	George	Cat 3-PA	Cat 3-PA	542	100002	Riley	Cat 3-PA	Cat 3-PA	296
620007	Gervais+	Cat 2-PA	Cat 2-PA	234	270191	Sarah	Cat 3-PA	Cat 3-no PA	586
270095	Gleason	Cat 2-no PA	Cat 2-no PA	167	100018	Schutz	Cat 3-no PA	Cat 3-no PA	140
270093	Glen	Cat 2-no PA	Cat 2-no PA	180	620073	Snail	Cat 2-PA	Cat 2-PA	195
20053	Ham	Cat 3-PA	Cat 3-PA	193	700054	Spring	Cat 3-PA	Cat 3-PA	690
270016	Harriet	Cat 2-PA	Cat 2-PA	337	820046	Square	Cat 3-PA	Cat 3-PA	193
100088	Hydessa	Cat 3-PA	Cat 3-PA	212	270078	Starring	Cat 2-PA	Cat 2-PA	155
270176	Independence	Cat 3-PA	Cat 3-PA	828	100045	Steiger	Cat 3-PA	Cat 3-PA	281
20022	Island	Cat 3-no PA	Cat 3-no PA	100	820153	Sunset	Cat 3-no PA	Cat 3-no PA	124
270081	Island	Cat 3-no PA	Cat 3-no PA	163	270042	Upper Twin	Cat 2-PA	Cat 2-PA	201
820104	Jane	Cat 2-PA	Cat 2-PA	159	100015	Virginia	Cat 2-PA	Cat 2-PA	121
620010	Keller	Cat 2-PA	Cat 2-PA	72	100048	Wasserman	Cat 3-PA	Cat 3-PA	277
270040	Lake of the Isles+	Cat 2-PA	Cat 2-PA	157	270117	Weaver	Cat 3-PA	Cat 3-PA	155
270182	Langdon	Cat 2-no PA	Cat 2-no PA	168	270184	Whaletail	Cat 3-PA	Cat 3-PA	582
620067	Long	Cat 2-no PA	Cat 2-PA	184	100041	Zumbra	Cat 3-PA	Cat 3-PA	221
270179	Long	Cat 3-PA	Cat 3-no PA	104					

* Class codes are as follows:
 Minnetonka; Lake Minnetonka
 Cat 1: Remaining large (high-use) boating lakes (all have public access)
 Cat 2-PA: Built-up area lakes with public access
 Cat 2-no PA: Built-up area lakes without public access
 Cat 3-PA: Rural area lakes with public access
 Cat 3-no PA: Rural area lakes without public access

+ Notes: Cedar (270039) and Lake of the Isles (270040) use Calhoun public access;
 Gervais (620007) uses Keller public access; and
 Olson (820103) uses DeMontreville public access.

Particular problems encountered in data analysis

1. When examining boating number changes between 1984 and 1996, weekdays were not included because there were only 3 weekday flights in 1984.
2. Calhoun and Nokomis were not used as sample lakes in built-up lake class with public access, leaving four sample lakes in this class in 1984. The reasons are: The 1984 contractor acknowledged trouble measuring the boating numbers on the two lakes; the two stood apart from the other sample lakes in the class in 1984, but not in 1996; the change the two experienced between 1984 and 1996 was to become more like the other lakes in this class; the other lakes in this class exhibited little change over the same period.
3. There were so few marina/private access interviews (N=81) in 1984 that change analyses are only based on public access and riparian resident interviews in 1984 and 1996.
4. There were no built-up area lakes without public access in the 1996 sample. All three of the lakes in this class in the 1984 sample received a public access by 1996. There were still a few of these lakes in the 1996 population, however. To ensure they were represented in the 1996 aggregate estimates of boating intensity, the 1984 intensity values were used for 1996. The reasons are: There was little change for any class between 1984 and 1996, so the expectation is that there would be little change for this class as well. From a practical perspective, the contribution of this class in 1996 to aggregate figures is minimal because the acres involved are so low (represents 3% of lake area).
5. Marinas located on the Mississippi River in Pool 3 send most of their traffic to the St. Croix River (see Reference 3). For this reason, interview responses for these marinas are reported under the St. Croix and not the Mississippi.
6. Survey results are weighted by source of boater, day of week and lake class, so that each survey represents an appropriate share of boating use when they are combined. Survey sampling was not proportional to use. Since source use estimates are not available for the St. Croix or Mississippi River, these surveys were not weighted and, thus, could not be combined with the lake surveys. This is the reason many tables and charts have overall figures that only include lakes.