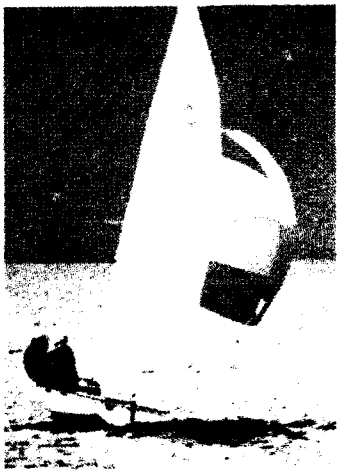
(2)

US Army Corps of Engineers

NATURAL RESOURCES
TECHNICAL SUPPORT PROGRAM

MISCELLANEOUS PAPER R-92-5

RECREATIONAL USE OF CHICKAMAUGA LOCK, TENNESSEE, AND RECREATIONAL BOATERS' PERCEPTIONS OF LOCK USE CONFLICTS



by

Michael E. Patterson, William E. Hammitt

Department of Forestry, Wildlife, and Fisheries
University of Tennessee
Knoxville, Tennessee

and

John P. Titre, Jr.

Environmental Laboratory

DEPARTMENT OF THE ARMY
Waterways Experiment Station, Corps of Engineers
3909 Halls Ferry Road, Vicksburg, Mississippi 39180-6199

December 1992
Final Report

ENVIRONMENTAL LABORATORY

Prepared for DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, DC 20314-1000

and U.S. Army Engineer District, Nashville
Nashville, Tennessee 37202-1070

Destroy this report when no longer needed. Do not return it to the originator.

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	December 1992	Final report

4. TITLE AND SUBTITLE
Recreational Use of Chickamauga Lock, Tennessee, and Recreational Boaters' Perceptions of Lock Use Conflicts

5. FUNDING NUMBERS

6. AUTHOR(S)
Michael E. Patterson, William E. Hammitt,
John P. Titre, Jr.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
University of Tennessee, Department of Forestry, Wildlife, and Fisheries, Knoxville, TN 37996;
U.S. Army Engineer Waterways Experiment Station, Environmental Laboratory, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199

8. PERFORMING ORGANIZATION REPORT NUMBER
Miscellaneous Paper R-92-5

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers,
Washington, DC 20314-1000;
U.S. Army Engineer District, Nashville,
Nashville, TN 37202-1070

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
Available from National Technical Information Service, 5285 Port Royal Road Springfield, VA 22161.

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

Recreational use of the Chickamauga Lock has more than doubled since 1984, when 3,139 recreational craft used the lock. Forty percent of the total annual use occurs during the month of June. The most common reason for heavy use during the month is to attend special events, although other locks in the Tennessee River Navigation System have also shown an increase in recreational use since 1984. Overall, the study suggests a low level of conflict between recreational and commercial users. Conflict among recreational users appears to be even less of a problem. The biggest source of conflict at the current time is not the actual delays, but recreational boaters' inability to predict whether the lock will be available for use prior to arriving at the dam. Nearly one half of the boaters indicated that this is a common problem during special events. The Corps can reduce this source of conflict to some extent by using an FM repeater to

(Continued)

14. SUBJECT TERMS		15. NUMBER OF PAGES
Conflict	Recreational boating	82
Lock usage		16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED		

13. (Concluded).

announce the estimated time of recreational and commercial lockages. A majority of the respondents supported this management alternative. The second most popular management alternative was the construction of a separate lock for commercial traffic.

PREFACE

The work reported herein was conducted for the U.S. Army Engineer District, Nashville, and was published and distributed under the Natural Resources Technical Support (NRTS) Program. The NRTS is managed under the Environmental Resources Research and Assistance Programs (ERRAP), Mr. J. L. Decell, Manager. Dr. A. J. Anderson was Assistant Manager, ERRAP, for the NRTS.

This report was prepared by Messrs. Michael E. Patterson and William E. Hammitt of the University of Tennessee, Department of Forestry, Wildlife, and Fisheries, and Mr. John P. Titre, Jr., of the EL, WES. Technical reviewers were Messrs. Jim E. Henderson and Chris W. White of the EL.

The work was conducted under the supervision of Mr. H. Roger Hamilton, Chief, Resource Analysis Group; Dr. Conrad J. Kirby, Chief, Environmental Resource Division; and Dr. John Harrison, Director, EL.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander was COL Leonard G. Hassell, EN.

This report should be cited as follows:

Patterson, Michael E., Hammitt, William E., and Titre, John P., Jr. 1992. "Recreational Use of Chickamauga Lock, Tennessee, and Recreational Boaters' Perceptions of Lock Use Conflicts," Miscellaneous Paper R-92-5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

CONTENTS

CONVERSION FACTORS, NON-SI TO SI UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI units as follows:

Multiply	By	To Obtain
feet	0.3048	meters
miles (US statute)	1.609347	kilometers
tons (2,000 pounds, mass)	907.1847	kilograms

RECREATIONAL USE OF CHICKAMAUGA LOCK AND RECREATIONAL BOATERS' PERCEPTIONS OF LOCK USE CONFLICTS

PART I: STUDY OVERVIEW

Organization of the Report

This report is organized into six parts. PART I, STUDY OVERVIEW, contains the study goals and an executive summary of study findings. PART II, TECHNICAL APPROACH, presents the framework for viewing conflict in recreational settings that was used as the basis for this study and also discusses study limitations. PART III, STUDY AREA, describes the study area. PART IV, METHODS, describes the sampling procedure and survey instrument. PART V, RESULTS, is a detailed presentation of the study findings. (Tables showing results are presented in APPENDIX I.) PART VI, DISCUSSION OF FINDINGS, provides an interpretation of the results in light of study objectives.

Purpose

The purposes of this study were (1) to describe recreational boating use patterns at Chickamauga Lock, (2) to determine recreational boaters' perceptions of the extent and severity of conflicts between lock users, and (3) to identify recreational boater support for management alternatives that could reduce the level of conflict. The results of this study extend beyond Chickamauga Lock and can be applied in a general sense to other lock and/or conflict situations.

Scope

The scope of this study included a mail questionnaire survey of recreational boaters who either have used or are interested in using Chickamauga Lock. The survey focused on use of Chickamauga Lock, perceptions of problems and conflicts at the lock, and support for various management alternatives to alleviate perceived problems. The study area was defined as Chickamauga Reservoir from Chickamauga Dam upstream to Watts Bar Dam. Boaters were contacted

at the lock and at marinas upstream from the lock. A total of 308 boaters were contacted during May and June, 1989. Two hundred eighty-nine boaters (94 %) expressed willingness to participate in the mail questionnaire survey.

Lock use statistics were obtained from two sources within the U.S. Army Corps of Engineers (CE). Data on past use of the lock (1977-1988) were obtained from the computerized Performance Monitoring System (PMS). Data on recreational lockages for the month of June 1989 were provided by Chickamauga Lock operators.

Study Need

Identification and resolution of user conflicts before these problems enter the political and legal arena are important to recreation managers. Once the political stage is reached, recreation managers and planners often have little control over the situation (Hammitt 1988). Currently, the US Army Corps of Engineers has no information on the degree of perceived conflict between recreational and commercial lock users. This study is needed to provide information on the existing level of conflict from the recreationists' standpoint. Additionally, information from this study can be used to help determine, from a recreational standpoint, whether or not an upgrade or modification of lock facilities is justified.

Statement of the Problem

Navigation on the Tennessee River is supported by 10 locks from Kentucky Lock in western Kentucky to Fort Loudoun Lock in eastern Tennessee (Figure 1). The primary users of the lock are commercial barge operators and recreational boaters. Commercial traffic has priority at the lock. Under current U.S. Army Corps of Engineers policy, when the two types of users are competing for limited space in the lock, only one recreational lockage is allowed for every three commercial lockages. As a result, there is a potential for recreational users to be delayed by commercial use of the lock.

Of the 10 locks in the Tennessee River Navigation System, the potential for delays and user conflicts is greatest at Chickamauga Lock for two reasons. The first reason is simply the amount of recreational traffic that the lock handles. For the last two years (1987-1988), Chickamauga Lock has handled more recreational craft than any other lock in the system.

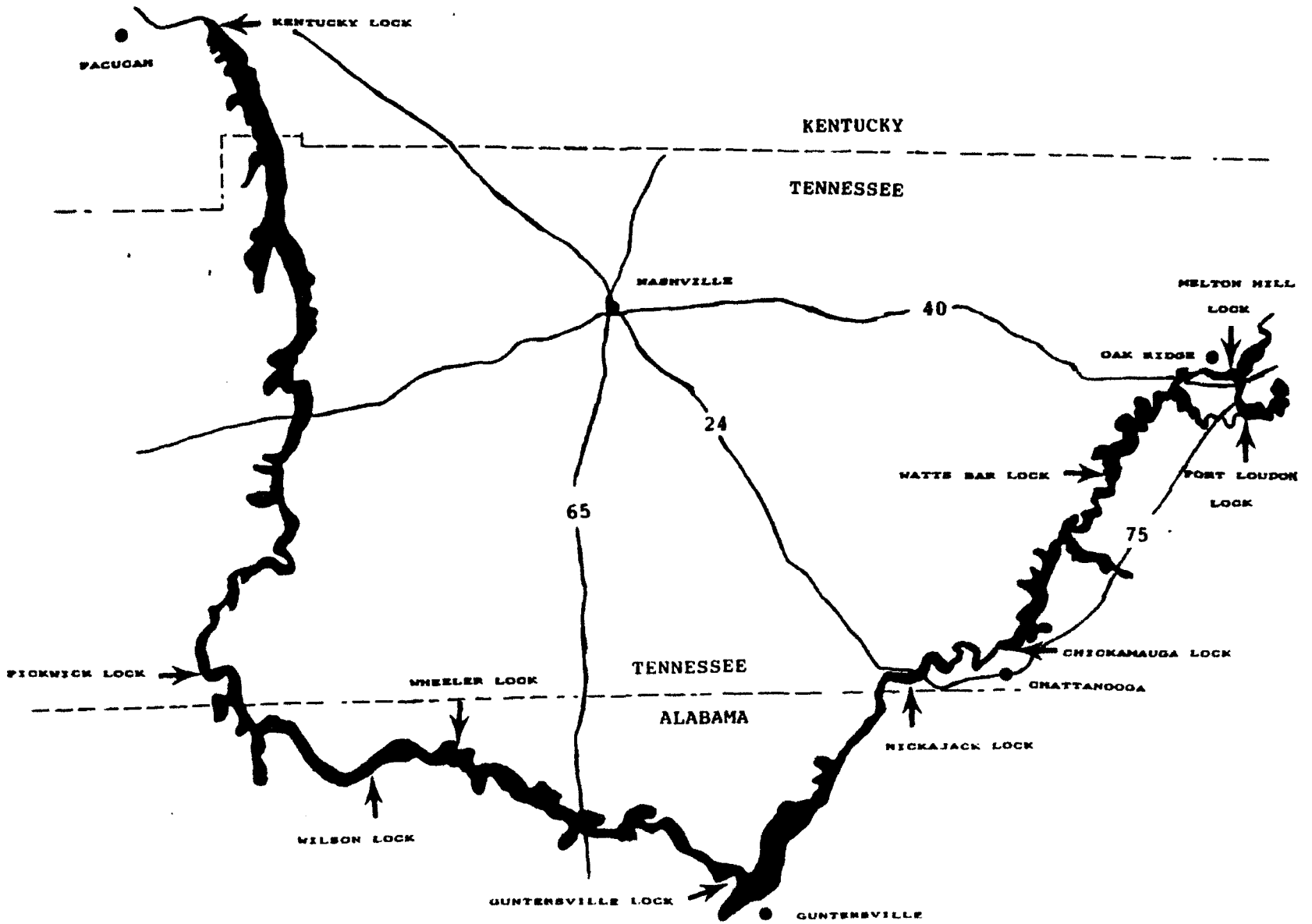


Figure 1. Map of Tennessee River Navigation System

The second reason is the small size of the lock chamber. Unlike the six downstream locks which are at least 600 by 110 ft,* Chickamauga Lock is only 360 ft by 60 ft. This has a major impact on commercial use of the lock. While the downstream locks can handle up to four barges at a time, Chickamauga lock can handle only one barge per lockage. Thus, although Chickamauga has ranked seventh in terms of the total number of commercial tows and barges handled during each of the last four years (only the three upstream locks received less commercial traffic), Chickamauga has ranked second or third in terms of the total number of individual commercial lockages.

The average tow size at Chickamauga is 4.8 barges, and individual commercial lockages may take up to one hour to complete. Since the current policy is three commercial lockages for every recreational lockage when competition occurs, three hour delays are a distinct possibility for recreational boaters. These long delays may cause frustration, greatly reduce the quality of the boating trip, and lead to unsafe boating practices.

Specific Study Objectives

Data on the amount of traffic, length of delay, and recreational boaters' opinions about these delays are necessary to determine the degree of conflict between recreational and commercial users and to determine if remedial measures are necessary. The objectives of this study were to

1) Determine historical recreational use trends at Chickamauga Lock.
2) Identify daily and seasonal recreational use patterns at Chickamauga Lock.
3) Project future use of the lock.
4) Determine recreational boaters' perceptions of problems and conflicts at Chickamauga Lock.
5) Identify techniques for reducing perceived problems.

Executive Summary

Recreational use of Chickamauga Lock has more than doubled since 1984 when 3139 recreational craft used the lock. Over the past three years, the increase in use has occurred primarily during May, June, and July.

---

* A table of factors for converting non-SI units of measurement to SI units is presented on page 4.

Recreational use of the lock is not evenly distributed throughout the year. Forty percent of the total annual use occurs during the month of June. Heavy use during this month is primarily due to two special events (the Annual Raft Race and the River Bend Festival) which are held in the city of Chattanooga.

The most common reason boaters gave for using the lock was to attend the special events that are held in or below the city of Chattanooga. It is likely that a large portion of the increase in use over the past 10 years is due to increased interest in special events, particularly the River Bend Festival. However, some of the increase in lock use is probably attributable to a general increase in boating activity during the period. Seven of eight other locks in the Tennessee River Navigation System also have shown an increase in recreational use since 1984.

If future growth in recreational use of the lock follows the pattern set over the past 10 years, recreational use of the lock will likely reach 15,000 craft by 1993. However, this projection should be considered unreliable since it is based only on past use trends. Such a projection cannot account for the changes in boating facilities which are planned on both sides of Chickamauga dam. Additionally, while past increases in use are thought to be largely associated with increased interest in special events, the study results suggest that recreational use of the lock during special events may be reaching a saturation point, and that future increases in use may be distributed to less heavily trafficked periods.

Overall, the study results suggest a low level of conflict between recreational and commercial users of the lock at the current time. Less than 30 % of the recreational users felt that commercial delays were a common problem during typical weekends and less than 20 % felt that such delays were a common problem during special events.

Conflict among recreational users appears to be even less of a problem. Even during special events, only 23 % of the respondents perceived recreational delays to be a common problem. Additionally, less than one-quarter of the respondents felt that behavior of other recreationists was a common problem.

The results also suggest that it may be possible to use quantitative measures associated with delays (frequency of delays and length of delays) as indicators of the level of perceived conflict. However, the thresholds suggested in this study should be viewed as tentative findings.

The biggest source of conflict at the current time is not the actual delays, but recreational boaters' inability to predict whether or not the lock will be available for use prior to arriving at the dam. Almost 40% of the boaters indicated that this is a common problem during special events. Additionally, this was the only issue for which the number of boaters who felt it was a common problem exceeded the number who felt it was rarely a problem.

The US Army Corps of Engineers can reduce this source of conflict to some extent by using an FM repeater to announce the estimated time of recreational and commercial lockages. Almost 80 % of the study respondents supported this management alternative. The second most popular management alternative was construction of a separate lock for commercial traffic; 64 % of the study respondents supported this action.

PART II: TECHNICAL APPROACH

Conflict is often seen only as competition among users for scarce resources (Hammitt 1988). Considering the nature of the problem in question, this view may be, to a large extent, true. For most recreationists, lock use is probably not a goal in itself, but rather a means of reaching specific *recreational opportunities.* However, even in this situation, a space allocation perspective by itself is too limited to adequately address the issue of conflict.

An appropriate approach for viewing recreational conflict was presented by Jacob and Schreyer (1980) who defined conflict as "goal interference attributed to another's behavior." As this definition implies, conflict goes beyond simple measures such as length of delays. More important than this type of quantitative measure are boaters' qualitative evaluations of conditions. Rather than knowing that boaters are delayed an average of 30 minutes, managers need to know if boaters consider this to be a long or a short delay, and if the delay is so lengthy that it interferes with their recreational goals.

Another key aspect of Jacob and Schreyer's definition is that goal interference is <u>attributed</u> to some entity. Originally, recreational conflict research focused on conflict between users. However, Little and Noe (1984) pointed out that there may be a number of entities which recreationists identify as being the source of conflict including: other users, managers, and the community.

Most relevant to this study are conflicts between recreational and commercial users, conflicts among recreational users, and conflicts between recreational users and lock management. Potential conflicts between recreational and commercial users were addressed in this study by examining recreational boaters' perceptions about the frequency and length of delays caused by commercial use of the lock. These same issues were examined when considering conflict among recreational users. Additionally, boaters' perceptions about crowding and the behavior of other boaters were examined.

Conflict between recreational boaters and lock management was not considered in the original study plans. However, during pre-survey discussions with marina owners, three potential management related problem areas were identified. These were the inability of recreational boaters to predict when the lock will be available for use by recreational craft, the danger of

getting trapped on the wrong side of the dam on the return trip, and the number of recreational boats allowed in the lock at one time. All three of these issues were examined in the survey.

Before continuing with a discussion of the study, it is necessary to recognize study assumptions and limitations. The first limitation is the fact that sampling was conducted during a limited time frame (May-June). This means it is possible that some lock user groups were not surveyed. For example, if some boaters only use the lock during October, to see the Fall colors in the scenic gorge, we would not have contacted them at the lock during our study.

Additionally, the heavy rains during June of this year may have influenced the study results. The water level in Chickamauga reservoir rose so high during some sampling periods that water was being released over the spillway at a rate exceeding 100,000 cu ft/sec. This apparently caused some individuals to avoid the lock during these periods, as reflected by the fact that use of the lock during June 1989 was lower than the use levels recorded for the last three years. Thus the attitudes of boaters who used the lock during these periods may not be representative of the attitudes of the entire boating population. However, we attempted to reduce the effects of the two problems just described by contacting boaters at marinas as well as at the lock.

A third limitation of the study is the fact that it represents an assessment of conditions at one point in time. Thus, although the study provides information regarding the current level of conflict, it does not provide any insight into the rate at which the level of conflict is changing. Given the rate of change in recreational use of the lock over the last five years, knowing the rate of increase in the level of conflict would be quite useful in determining the need for conflict management strategies. Unfortunately, there was no way to obtain this information.

Another study limitation is the fact that users were asked to report the frequency and length of delays. Previous research (Shelby and Colvin 1982) suggests that visitors do not always accurately report actual conditions encountered. A related problem is the fact that boaters were asked about the 'average' experience rather than a specific experience. While this was the most appropriate approach for assessing the overall level of conflict, it is not the best way to determine how specific levels of various factors (e.g. length of delay) influence boaters' perception of conflict. These final two

limitations suggest that conclusions drawn about the effects of specific levels of the quantitative variables examined (frequency and length of delays) should be viewed as tentative findings.

PART III: STUDY AREA

Chickamauga Dam is one of 10 dams in the Tennessee River Navigation System (Figure 1). It is located on the Tennessee River on the outskirts of Chattanooga, Tennessee. Chickamauga dam is located at river mile 471, approximately 46 miles upstream from Nickajack Dam and 58 miles downstream of Watts Bar Dam.

The lock at Chickamauga Dam has a single chamber that measures 360 ft. long by 60 ft. wide. It was opened to navigation in 1940. Currently, the lock serves both recreational and commercial users of the river. In 1988, this lock was used by 7149 recreational craft. Four major special events in the Chattanooga area encourage recreational boaters to use the lock. These are the Annual Raft Race (June), the River Bend Festival (June), the Fall Color Cruise (October), and Christmas on the River (December). An additional attraction is a scenic gorge below the city of Chattanooga, which is sometimes promoted as "the Grand Canyon of the east."

Commercial use of the lock in 1988 amounted to approximately 2.5 million tons. This is relatively low compared to the six downstream locks (5.2 to 32.4 million tons). Two factors contributing to the low volume of commercial traffic are the upstream location of the lock, and the small size of the lock chambers at Chickamauga and the two other upstream dams (Tennessee Valley Authority (TVA) 1988). Currently, these three upstream locks have an annual capacity of only 5-6 million tons, while the downstream locks can handle 30-35 million tons.

Between Chickamauga Dam and Watts Bar Dam, there are 46 public launch ramps and 14 marinas with boat mooring facilities. The existing marinas provide approximately 1100 floating slips and 750 dry storage berths (TVA 1988). Between Chickamauga Dam and Nickajack Dam, there are only three marinas with boat mooring facilities and only 14 public ramps. The marinas are Ross's Landing (in the city of Chattanooga), Walker's Landing (river mile 438), and Hale's Bar (river mile 431). The first two marinas have mooring facilities for only 10-15 boats while the third has approximately 50 slips.

Originally, the study area was to include Watts Bar Dam. However, due to the lower amount of traffic at Watts Bar (in 1988 it handled only about two-thirds the amount of commercial tonnage and one-third the number of recreational craft that Chickamauga handled) and the lock master's opinion that

conflicts were not a problem at the current time, data collection was limited to Chickamauga Lock.

PART IV: METHODS

Sampling Procedure

The study population consisted of past and present recreational users of Chickamauga Lock. Sampling was conducted at the lock during periods of high use (weekends and special events). Due to the possibility that some boaters avoid the locks during peak use periods, sampling also was conducted at six launch sites (five marinas and one public ramp). Due to the limited number of downstream marinas, their small size, and/or their distance from the lock, sampling was conducted only at upstream marinas. The marinas selected ranged from Chickamauga Marina (less than one mile from the lock) to Shady Grove Marina (over 16 miles from the lock) (Figure 2). Recreational boaters were contacted in these areas during May and June. Specific sampling dates and numbers of boaters contacted are presented in Table 1.

At marinas, boaters were asked to participate in a short (2-3 minute) on-site interview. The on-site interview included questions dealing with past use of Chickamauga Lake and Lock (Appendix II). Boaters were then asked if they would be willing to participate at a later date in a longer mail survey. If they were, their names and addresses were obtained. Eight people (5 %) were unwilling to participate in the on-site interview and another twelve people (8 %) declined to participate in the mail survey. A total of 156 people participated in the on-site interviews and 145 people agreed to participate in the mail survey. In addition, two boaters at Lake Shore Marina were mailed questionnaires after they encountered a researcher wearing an identification tag and expressed a desire to participate in the study.

At the lock, boaters were contacted in the process of locking through. Due to the limited amount of time, it was not possible to conduct the on-site survey. Boaters at the lock were asked if they would be willing to complete a mail-questionnaire. Volunteers were then asked to provide their name and address. All 142 individuals contacted at the lock expressed willingness to participate in the study.

Mail Questionnaire

The questionnaire had a color cover, was 10 pages long, and measured 7 in. x 10 in. (Appendix III). It was designed to obtain information on:

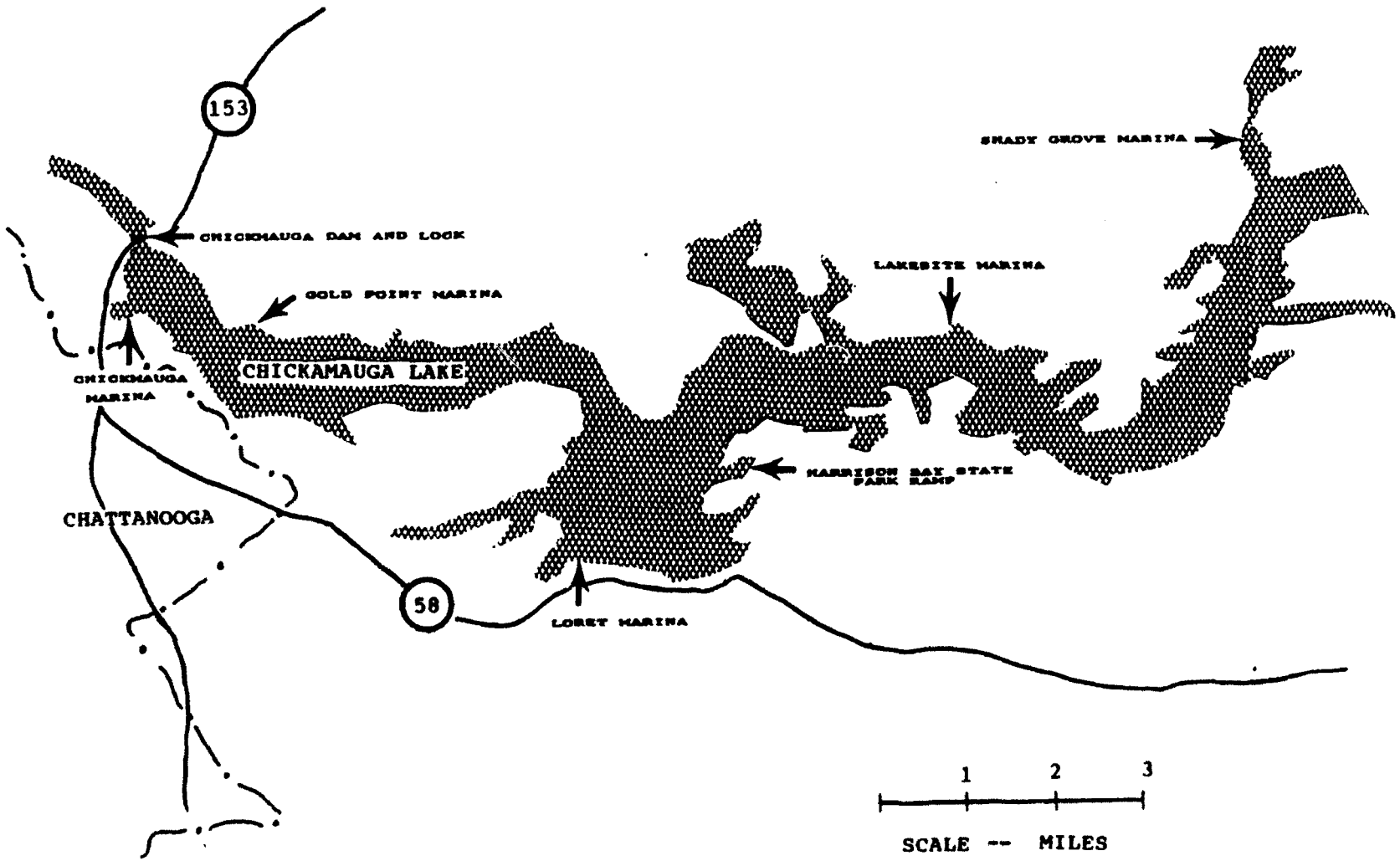


Figure 2. Map of sampling sites for Chickamauga Lock recreational boater survey

(1) general use of Chickamauga Lake, (2) use of Chickamauga Lock, (3) perceptions of problems and conflicts at the lock during typical weekends, (4) perceptions of problems and conflicts at the lock during special events, (5) support for management alternatives to reduce conflicts, and (6) respondent characteristics. A survey package was mailed to respondents within 7 days of the on-site contact. In addition to the 10-page questionnaire, the survey package contained a postage-paid return envelope and a cover letter that explained the purpose of the study, assured confidentiality, and stressed the importance of the reply. After the initial mailing, three follow-up reminders were mailed at intervals of 7-10 days. The second follow-up mailing contained a replacement questionnaire while the first and third mailings were postcard reminders.

Two hundred eighty-nine questionnaires were mailed. Four were returned due to undeliverable addresses. The response rate for the remaining 285 questionnaires was 76%.

Secondary Data

Data on past use of Chickamauga Lock were obtained from the U.S. Army Corps of Engineers Performance Monitoring System. Information obtained included annual use summaries 1977-1988; monthly use summaries 1985-1988; and data from individual lockages for June 1988. Data on recreational lockages for June 1989 were recorded by lock operators at Chickamauga Dam. The information recorded included time of lockage, size of lockage, and number of different types of boats in the lockage.

PART V: RESULTS

Past Lock Use Records

Annual use trends

Annual use levels at Chickamauga Lock during the last 12 years (1977-1988) are presented in Figure 3. Total use in 1977 was 3922 lockages and total use in 1988 was 5128 lockages. In 1988, 45 % of the lockages were for recreational traffic, 54 % were for commercial traffic, and the remainder were for other types of traffic.

Recreational traffic through the lock has increased every year since 1984 (Figure 4). The number of recreational craft using the lock has more than doubled during this period. The average annual percent increase in the number of recreational craft during this period was 23.8% (Table 2). The average annual increase in the number of recreational craft between 1984 and 1987 was 1226 boats per year. However, the annual increase dropped sharply in 1988. During 1988, there was an increase of only 333 recreational boats.

Seven other locks in the Tennessee River Navigation System have shown a similar trend in recreational use between 1984 and 1988. (Kentucky Lock was not included in this analysis due to its closure during the summer of 1986.) The average percent increase in recreational traffic at these locks ranged from 9.1 % to 34.5 % (Table 2). Melton Hill Lock was the only lock to show a net decrease in use during this period.

Between 1977 and 1988, commercial use levels at Chickamauga Lock have been cyclical, but the number of lockages during the last four years is greater than at the beginning of the period (Figure 5). Most years show only slight changes in use, except for 1987 when the number of commercial lockages increased 54 %. However, in 1988, the number of commercial lockages dropped back down to a level similar to that recorded for 1984-1986.

Use patterns

Commercial use of the lock is evenly distributed throughout the year (Figure 6). Most recreational use of the lock occurs during the month of June (Figure 6). For the last three years, over 40% of the annual recreational use of the lock has occurred during this month. Table 3 shows the fluctuations in monthly use levels between years. Three months (May, June, and July) have consistently shown large increases in use levels over the last three years.

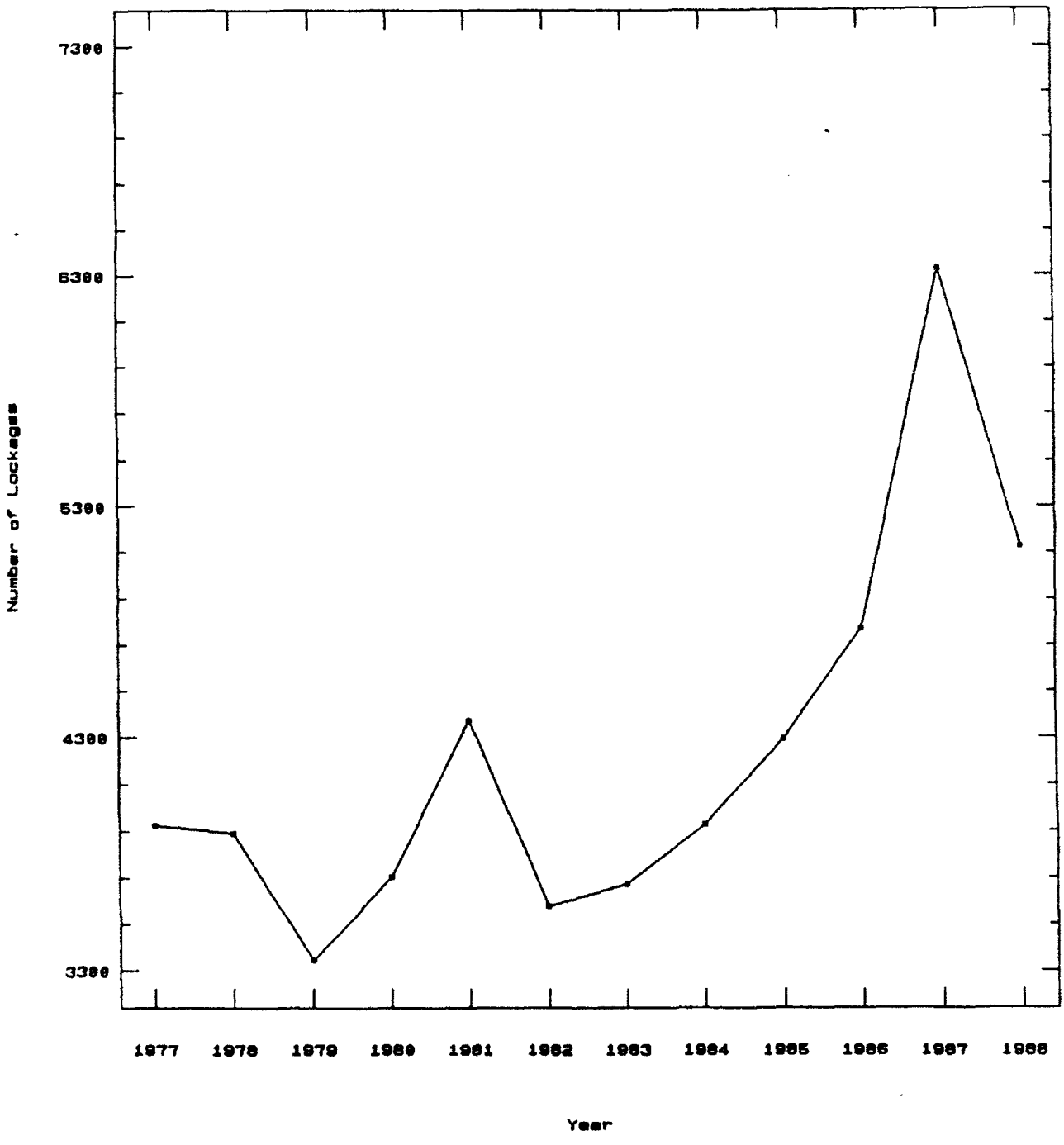


Figure 3. Annual use levels at Chickamauga Lock, 1977-1988

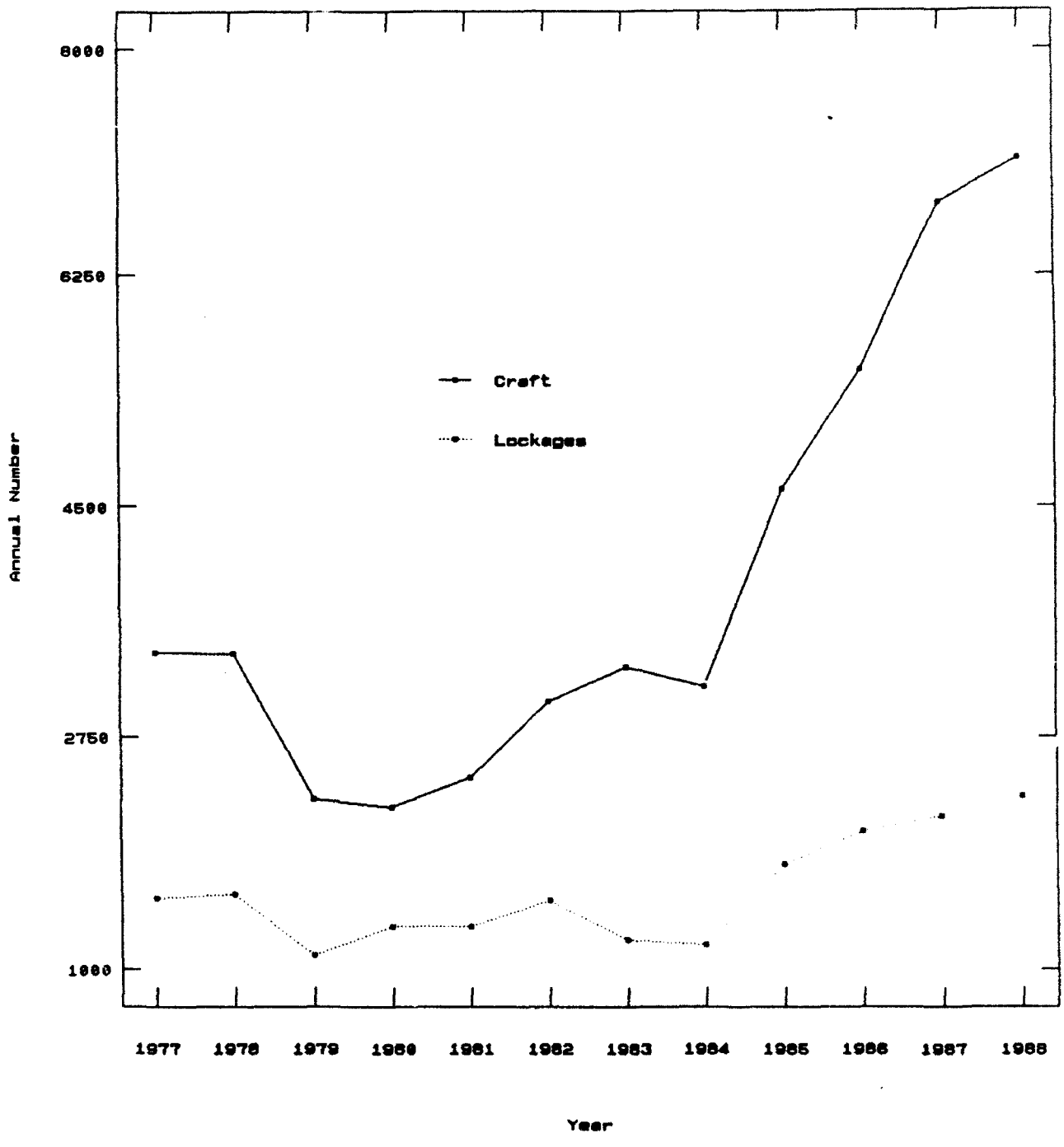


Figure 4. Recreational use of Chickamauga Lock, 1977-1988

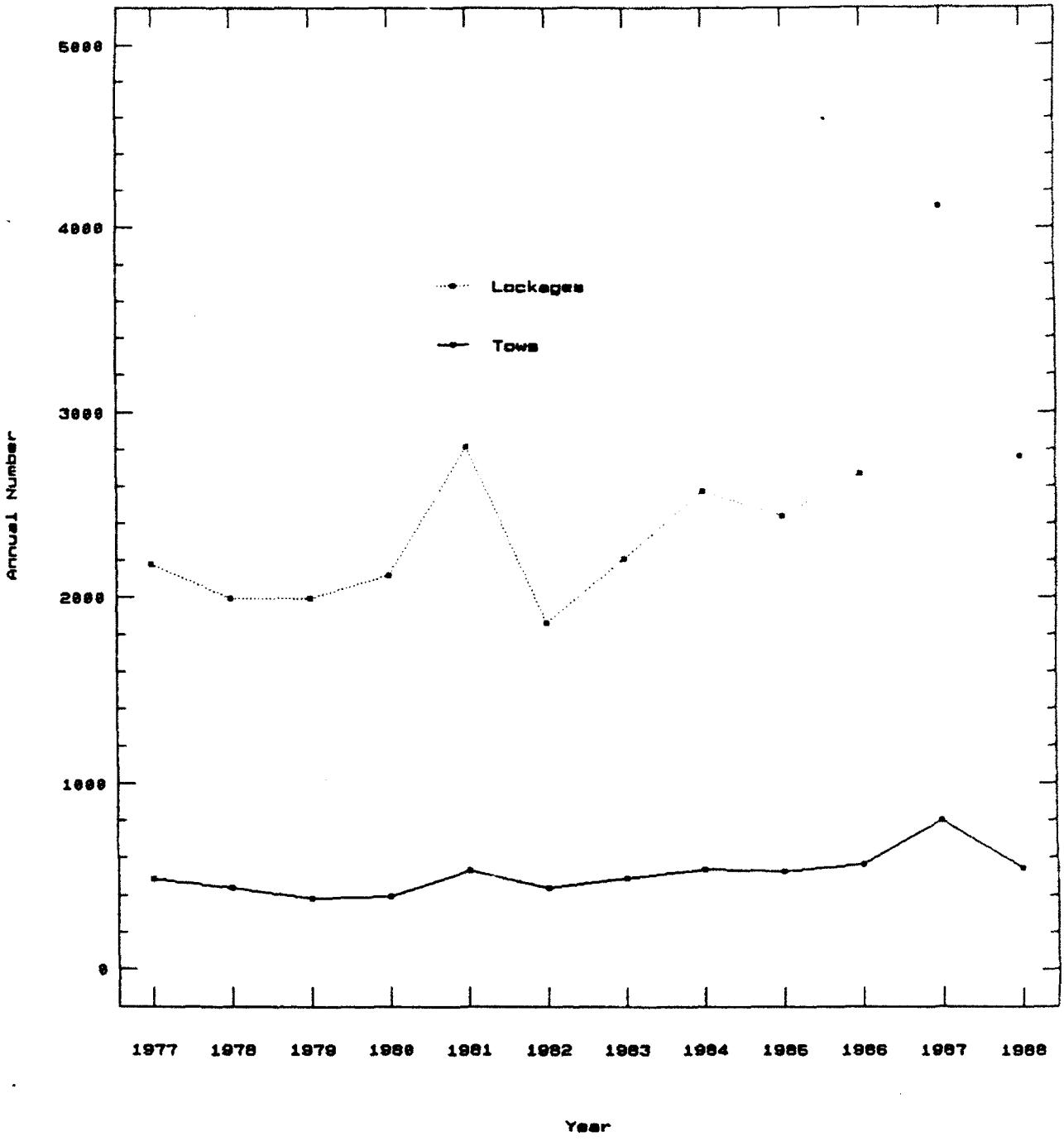


Figure 5. Commercial use of Chickamauga Lock, 1977-1988

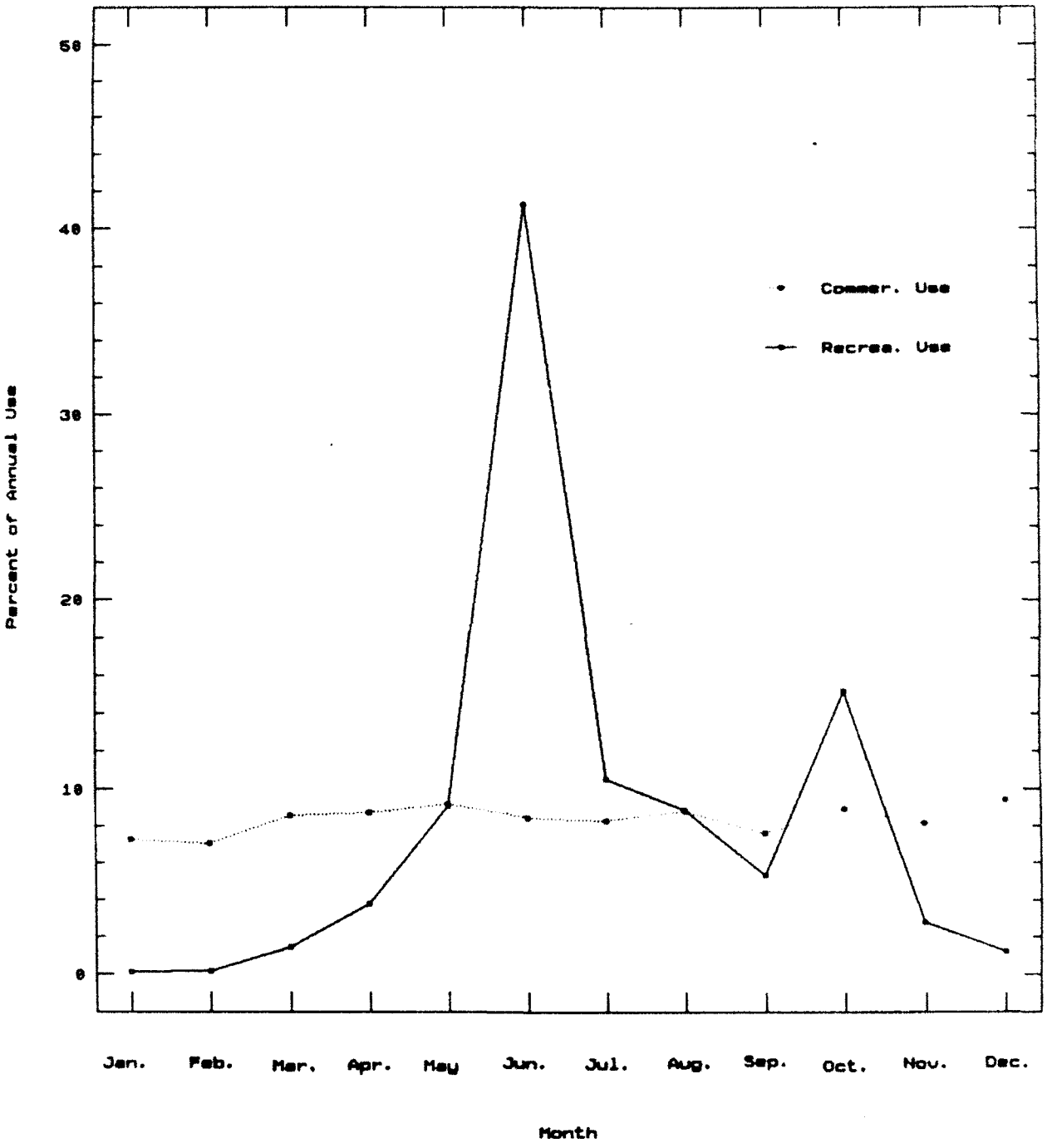


Figure 6. Monthly distribution of commercial and recreational use of Chickamauga Lock

Other months have shown only slight increases in use or have shown an irregular pattern of increases and decreases. Only September and November have shown a net decrease in use since 1985.

The use patterns described in the remainder of this section are based on data for the month of June. Commercial use of the lock appears to be evenly distributed throughout the week. Seventy-one percent of the commercial lockages in June of 1988 occurred during the week (Monday-Friday) and 29% occurred during the weekend (Saturday-Sunday). As might be expected, recreational traffic is heavier during the weekend than during individual week days (Table 4). The greatest use occurred on the day of the annual raft race (511 craft locked through).

On a daily basis, recreational use of Chickamauga Lock begins to increase at about 0900 hours and remains relatively constant until approximately 2200 hours (Table 5). The amount of time per day devoted to recreational lockages during June 1988 ranged from 1-13 hours during the weekdays (Monday-Friday) to 8-16 hours on the weekends (Table 6).

Characteristics of recreational lockages

The average size of recreational lockages in June 1989 was 4.6 boats. Forty-three percent of the recreational lockages contained only one boat. The largest single lockage contained 55 boats. The most common types of boats using the lock were runabouts, cabin cruisers, and house boats (Table 7). The average length of recreational lockages in 1988 was 23 minutes.

According to PMS data, recreational boaters in 1988 were delayed prior to entering the lock during 63% of the recreational lockages. On average, the maximum waiting time (start of lock - arrival time of first boat having to wait) for those having to wait before entering the lock was 22.17 minutes, or the equivalent of one recreational lockage.

Boater Characteristics

Socioeconomic characteristics

The boaters' socioeconomic characteristics are presented in Table 8. Ninety-one percent of the respondents were male. Age of respondents ranged from 17 to 72 years. The average age was 42 years. Respondents were well educated, the median education level being 15 years. Average household income was also high; 69% of the respondents had a household income of $40,000 or more.

Boating experience

Eighty-six percent of the respondents had boated on Chickamauga Lake prior to 1989. For those who had boated on the lake during previous years, the average experience level was 14.5 years. Boaters are most active in the summer (x=26.9 days) and least active in the winter (x=4.8 days) (Table 9).

Seventy-seven percent of the respondents stated that they had used Chickamauga Lock at least once previously. The average lock use experience level was 9.9 years. Twenty-one percent of the respondents had been using the lock for more than 15 years. The respondents use the lock most frequently in the summer (x=8.2 times) and least frequently in the winter (x=0.4 times) (Table 10).

Origin of boaters

Eighty percent of the boaters contacted during the study were residents of Tennessee (Table 11). Another 18 % were residents of Georgia and 1 % were from Alabama. Most Georgia boaters (75 %) were from the four counties which border Tennessee in the vicinity of Chattanooga (Table 11). Only 3 % of the entire sample population were from the Atlanta region (Table 11).

The following data were collected only for boaters who had previous lock use experience. The type of boats most frequently used by these respondents were runabouts, cabin cruisers, and house boats (Table 12). Sixty-eight percent of the respondents were marina users while 13 % launched boats from public ramps (Table 13). The average distance from respondents' residence to the location of the launch site was 13.7 miles. Less than 10 % of the respondents live more than 30 miles from their launch site.

The data in the preceding paragraph describing launch facilities used by boaters may be biased since sampling was conducted at five marinas and only one public ramp. Therefore, the following discussion considers only boaters who were contacted at the lock. The majority of these boaters (61 %) were from marinas (Table 13). The most frequently cited marina (35 %) was Lake Shore (Table 8). The percentage of ramp users was somewhat higher than indicated above, but was still less than 20 % of the total number of users (Table 13).

A final way to examine the origin of boaters is to look at the percentage of boaters contacted at various launch sites who indicated that they use the lock. At least 50 % of the boaters contacted at the five marinas indicated that they have used the lock previously (Table 15). The percentage was highest for marinas nearest the lock (72 - 87 %) and lowest for marinas

farthest from the lock (50 - 57 %). Finally, the percentage of boaters using the lock was lowest (37.5 %) for boaters contacted at Harrison Bay State Park ramp. This may reflect the distance from the lock as well as the fact that most of the ramp users appeared to be primarily interested in fishing. As indicated in the following section, few individuals use the lock to reach better fishing areas.

Reasons for using Chickamauga Lock

The following data were collected only for boaters who had previous lock use experience. The most common reason for using the lock is to attend special events. Sixty-six percent of the respondents stated that this was frequently a reason for lock use (Table 16). In part, this may reflect the sampling scheme. Forty-eight percent of the respondents with previous lock use experience were contacted at the lock during the Raft Race or the River Bend Festival. However, even when this group is removed, the most common reason for using the lock is to attend special events.

"To see the scenic gorge" is the next most popular reason for using the lock; 25 % stated that this is frequently a reason for using the lock and 58 % indicated that this is sometimes a reason for using the lock. Twenty percent of the respondents indicated that dining at downstream restaurants is a frequent reason for using the lock and 39 % stated it is sometimes a reason for using the lock. The novelty of using the lock and the desire to boat in areas not often used were cited by more than 50 % of the respondents as reasons for using the lock. Only a few boaters (14 %) frequently use the lock as a means of escaping crowded conditions on Chickamauga Lake, while the majority of respondents (54 %) indicated that this is never a reason for lock use. Most respondents (>79 %) never use the lock to reach better fishing areas or to attend football games.

Boaters' Perceptions - Typical Weekends

Boater reported delays

Table 17 shows recreational boaters' estimates of how often they are delayed at the lock by commercial traffic. Fourteen percent of the boaters indicated that they have never been delayed. Overall, 61 % indicated that they are delayed by commercial traffic on no more than one out of every four attempts to use the lock.

The average reported length of commercial delays was 72.9 minutes. Almost 90% of those encountering delays felt that these delays detracted from the quality of the boating experience (Table 18). Over one-third indicated that the delays detracted greatly from the experience. Examining length of the delays versus the effect on trip quality suggests that delays of 60 or more minutes tend to have a large negative impact on trip quality while shorter delays have only a slight adverse effect. Only twenty-three percent of the boaters who reported average delays of 60 minutes or less indicated that these delays detract greatly from the quality of the boating trip (Figure 7). However, 63 % of the boaters reporting average delays of more than 60 minutes indicated that these delays detracted greatly from trip quality.

Delays caused by recreational use of the lock are less common. Thirty-nine percent of the respondents indicated that they have never encountered such delays and only 14 % indicated that they encounter this type of delay more than 25 % of the time (Table 19). For those who have encountered recreational delays, the average reported length of delays was 37.6 minutes. While 65 % of the respondents indicated that these delays detracted from the quality of the experience, only 11 % indicated that the delays detracted greatly from the experience (Table 20).

Boaters' perceptions of problems

Less than 30 % of the boaters felt that delays due to commercial traffic are a common (often-almost always) problem during weekends (Table 21). A slightly larger group (32 %) felt these delays are rarely (seldom-never) problems, and the rest described these delays as sometimes a problem. The vast majority of respondents (75 %) think that delays due to recreational traffic are rarely a problem (Table 21).

The uncertainty associated with being able to determine when the lock will be available for use by recreational craft appears to be a more extensive problem. Forty-three percent of the respondents described the inability to predict when the lock will be available for use as a common (often-almost always) problem and 32 % listed the possibility of getting caught on the wrong side of the dam as a common problem (Table 21). However, in both cases, slightly more than one-third of the respondents felt that these were rarely (seldom-never) problems.

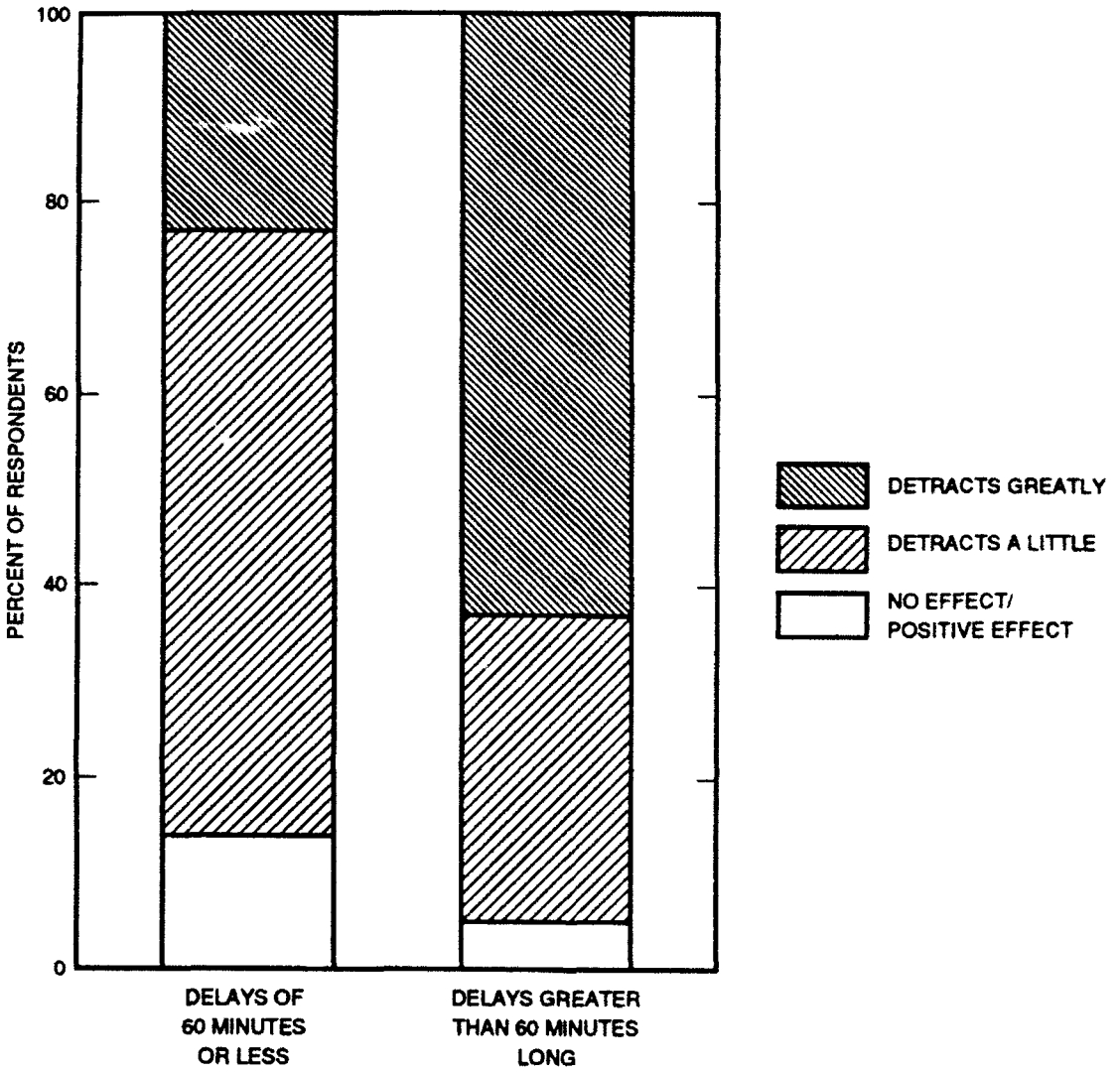


Figure 7. Length of commercial delay versus effect on recreational boaters' trip quality during typical weekends at Chickamauga Lock

Behaviors of other boaters (rowdy or obnoxious behavior, intoxication, and unsafe boating practices) were not perceived to be commonplace problems by most boaters (Table 21). In each case, the majority of boaters (at least 59 %) felt that these are infrequent (seldom-never) problems. Similarly, the number of boaters allowed in the lock at one time is not seen as a problem by most boaters (Table 21).

Avoidance of lock

Thirty-eight percent of all respondents indicated that they specifically avoid the lock on some occasions during typical weekdays or weekends. The most frequently cited reason for avoiding the lock was the possibility of getting trapped on the wrong side of the dam (Table 22). Sixty-five percent of those who have specifically avoided the locks indicated that this was one reason for doing so. The amount of time required to lock through was also listed as a reason for avoiding the lock by a majority of respondents (56 %). On the other hand, the presence (too crowded) and behavior (unsafe boating practices and rowdy behavior) of other boaters do not influence most respondents' decision to avoid the lock (Table 22).

Boaters' Perceptions - Special Events

Boater reported delays

Table 23 suggests that delays due to commercial traffic are slightly less common during special events than during typical weekends. One-third of the respondents reported never encountering such delays. Overall, 71 % indicated that they are delayed by commercial traffic during no more than one out of every four attempts to use the lock during special events. Eighty-six percent of those who were delayed by commercial traffic reported that delays detracted from the quality of the trip experience (Table 24). Forty-one percent indicated that these delays detracted greatly from the experience (Table 24). The average reported length of delays was 84.4 minutes. As with commercial delays during typical weekends, examination of length of delay versus the effect on trip quality suggests that delays greater than 60 minutes tend to detract greatly from the quality of the boating trip, while shorter delays usually have only a slight adverse impact. Only 15 % of respondents who reported average delays of 60 minutes or less felt that these delays detracted greatly from the trip experience, while 73 % of those experiencing delays of more than 60 minutes indicated the delays greatly detracted from trip quality (Figure 8).

Delays due to the amount of recreational traffic are more common during special events than on typical weekends. Only 22% of the respondents indicated that they have never encountered such delays (Table 25). However, the majority of boaters (60 %) still indicated that they encounter this type of delay on no more than one out of every four attempts to use the lock. For

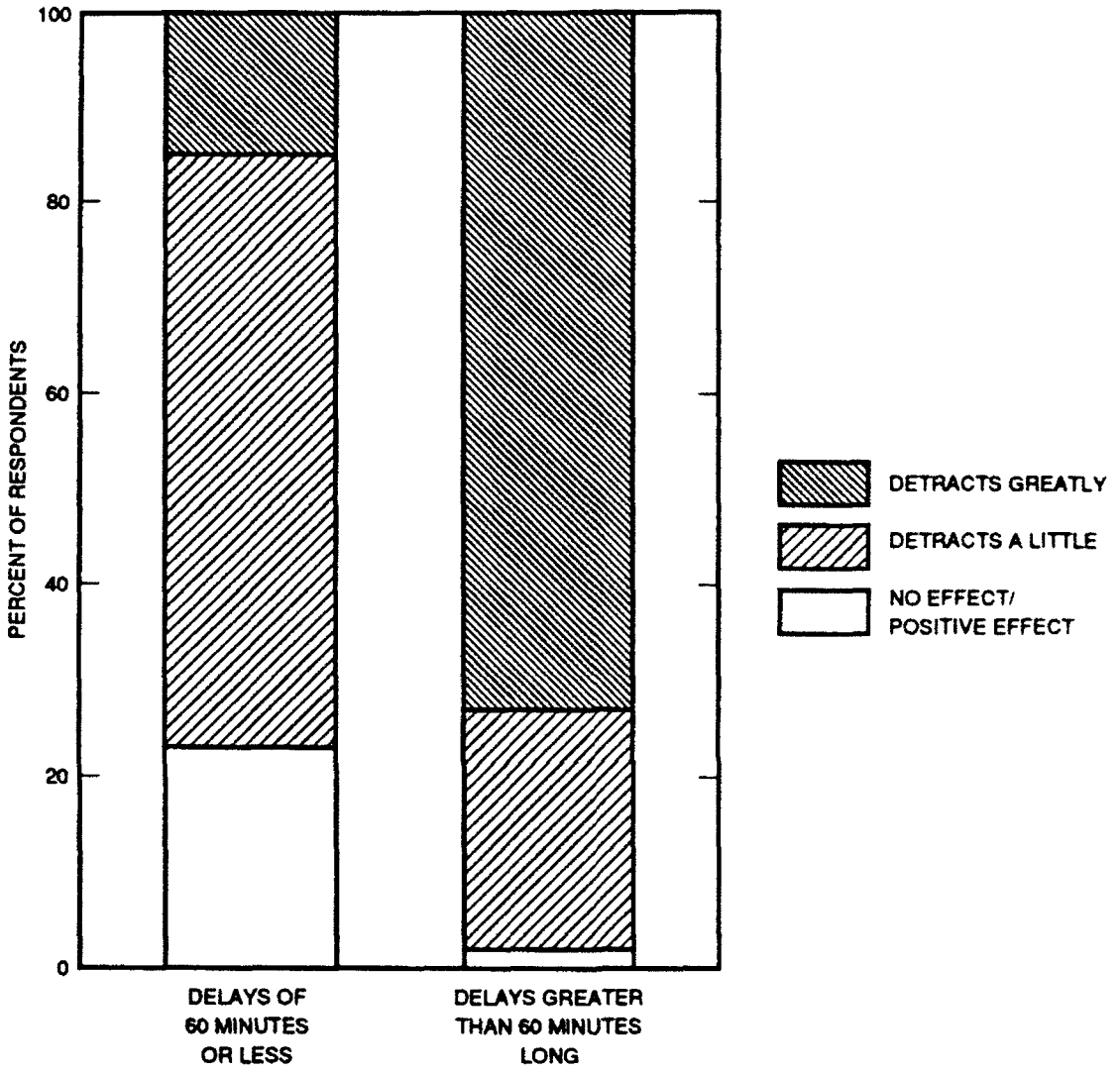


Figure 8. Length of commercial delay versus effect on recreational boaters' trip quality during special events at Chickamauga Lock

those who have experienced delays, average reported length of delays was 48.6 minutes, only sightly longer than the length of delays during typical weekends. Although 76 % of the respondents indicated that delays due to recreational traffic detracted from the boating experience, only 20 % indicated that these delays detracted greatly from the quality of the boating trip (Table 26). Only 12 % of the boaters who reported average delays of 60 minutes or less indicated that these delays detracted greatly from trip quality,

while 77 % of the respondents reporting delays of more than 60 minutes indicated that delays detracted greatly from the experience (Figure 9).

Boater perception of problems

Only 20 % of the boaters felt that delay due to commercial traffic is a common (often-almost always) problem (Table 27). A much larger group (44%) felt that this type of delay is an infrequent (seldom-never) occurrence. Even fewer boaters (23 %) believe that recreational delays are a common problem, and twice as many (46 %) believe that recreational delays are rarely a problem during special events (Table 27).

Similar to the results observed in the previous section, the responses indicate that the uncertainty associated with determining when the lock will be available for use by recreational craft is viewed as a problem by many boaters. Thirty-nine percent of the respondents described the possibility of getting trapped on the wrong side of the dam for hours as a common problem and 38 % described the inability to predict when the lock would be available for use as a common problem (Table 27). However, in both cases, approximately one-third of the respondents indicated that these are rarely problems.

Again, behaviors of boaters (rowdy or obnoxious behavior, intoxication, and unsafe boating practices) are perceived to be rare problems by most (>52 %) boaters (Table 27). Finally, the number of boats allowed in the lock at a single time is not of concern to most boaters (Table 27).

Avoidance of lock

Forty-four percent of all boaters indicated that they specifically avoid the lock on some occasions during special events. As with avoidance during typical weekends, the danger of getting trapped on the wrong side of the dam was a factor in most respondents' (67 %) decision to avoid the lock during special events (Table 28). However, unlike the results for typical weekends, the level of crowding was also a leading reason for avoiding the lock during special events (Table 28). The length of time required to lock through also was listed as a reason for avoiding the lock by most (65 %) of the respondents who avoid the lock. However, for most boaters, the behavior (unsafe boating practices, rowdy behavior) of others is not a reason for avoiding the lock during special events (Table 28).

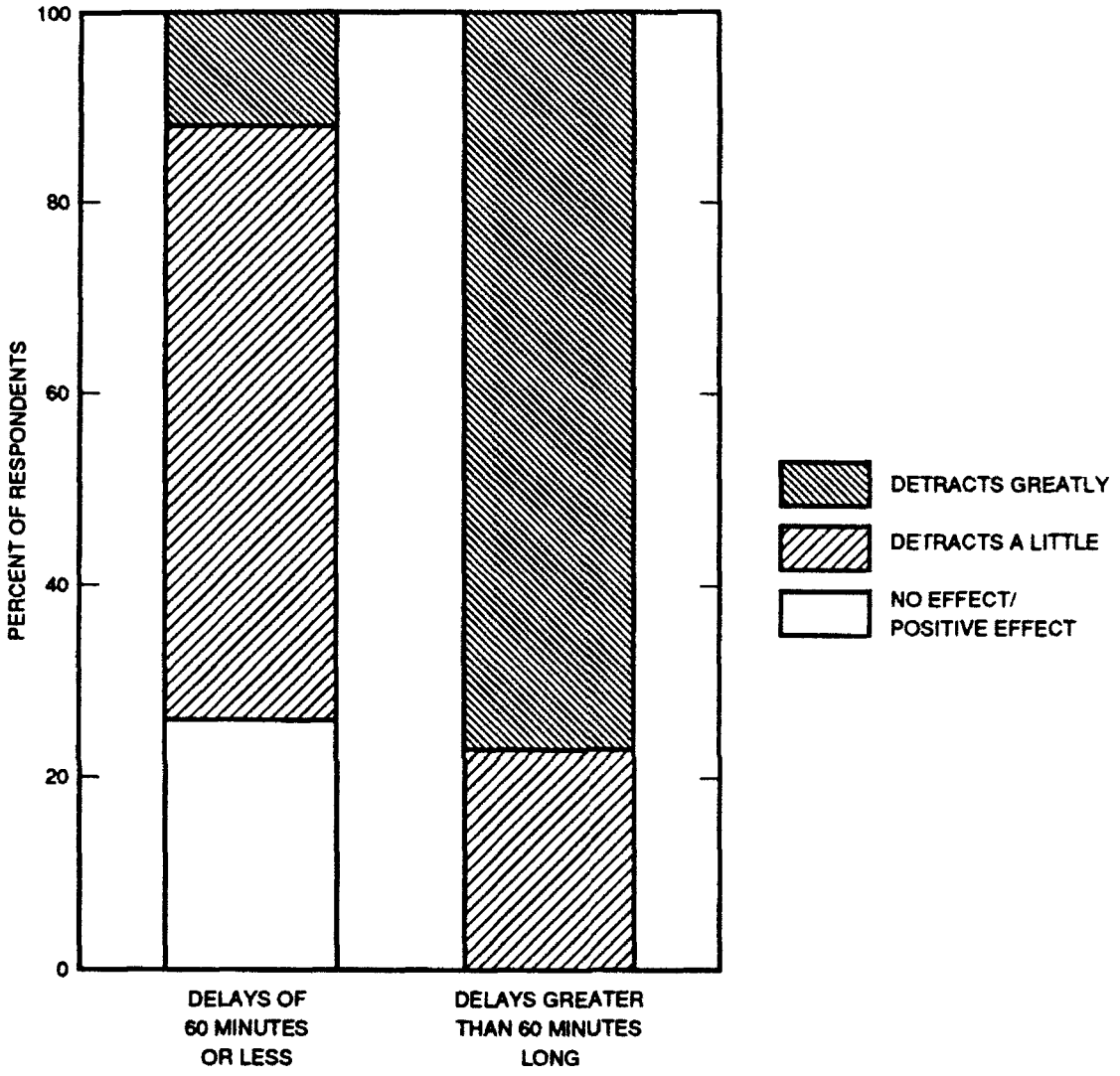


Figure 9. Length of recreational delay versus effect on recreational boaters' trip quality during special events at Chickamauga Lock

Support for Potential Management Actions

The two management alternatives receiving the most support (79 % of the respondents) were the two proposing the use of FM repeaters to announce estimated times of lockages (Table 29). Widespread support for these two alternatives seems reasonable in light of the fact that so many boaters see the uncertainty of lock availability as a problem. The other alternative aimed at reducing this uncertainty (scheduling regular periods for

recreational lock use) also was supported by a majority (62 %) of boaters. However, 21 % were opposed to this alternative.

The third most popular alternative was construction of a separate lock for commercial traffic (Table 29). However, 15 % of the respondents opposed this alternative. Creating more ramps downstream and enlarging the size of the existing lock were supported by approximately half of the respondents, while creating more ramps upstream was supported less than half of the respondents.

Future Use of the Lock

Most respondents (54 %) who have used the lock in the past indicated that their future lock use level would be similar to the current use level (Table 30). Thirty-seven percent expect to use the lock more frequently in the future and 9 % intend to use the lock less frequently. Those indicating that use would increase in the future included boaters with a long history of lock use as well as boaters who have been using the lock only a short time. Almost 50 % of those who stated that use of the lock will increase in the future have been using the lock for at least six years.

Forty-nine percent of the respondents who had not used the lock previously indicated that they do intend to use the lock in the future. Those who expressed an interest in future use of the lock included boaters with extensive experience on the lake as well as new-comers. Fifty-eight percent of those who indicated that they would use the lock in the future have been boating on Chickamauga Lake for six or more years.

Table 31 suggests that changes in the length of delays at the lock will likely affect future use levels. Seventy-three percent indicated that they would use the lock more frequently if average waiting time decreases by 30 %, and 70 % indicated that they would use the lock less frequently if average waiting time increased by 30 %. The responses also suggest that construction of additional marinas and other docking facilities below Chickamauga Dam would lead to increased use of the lock (Table 31). On the other hand, changes in the number of launch ramps on either side of the dam would appear to have little impact on lock use (Table 31). However, this may reflect the fact that most boaters in the survey were marina users. Forty-three percent of the ramp users indicated that lock use would decrease in the future if more ramps were

available downstream. On the other hand, 74 % of the ramp users indicated that use of the lock would not change if more ramps were built upstream.

Future recreational use of the lock was forecasted for the next five years by projecting trends based on changes in use over the last 10 years (1979-1988). Trends in overall lake use and historic changes in lock use relative to changes in marina capacities could have improved these projections. However, data on use levels of Chickamauga Lake have not been collected since 1980 and, from the available records, it was not possible to determine size of marinas at various years. Two models were used to forecast use: a quadratic model and a linear model. The quadratic model (Figure 10) appeared to fit the data the best and also had the lowest mean absolute error. According to this projection, use will exceed 10,000 recreational craft per year by 1990, and 15,000 craft by 1993.

Additional Comments

The final section of the questionnaire included a blank space along with a request for respondents to use the remaining space for any additional comments they would like to make. Comments made by at least 2 % of the respondents (4 people) are summarized below. One of the largest group of comments were praises for Chickamauga Lock operators. Four percent of the respondents (6 % of boaters with previous lock use experience) commented on the fact that they found lock operators friendly, courteous, and/or helpful. Another 4 % of the respondents complained that it is often difficult to communicate with lock operators. These complaints dealt with both the difficulty in raising the lock operators by radio and the perception of some respondents that there was no response when they pulled the cord to signal that they were ready to use the lock.

Four percent of the respondents felt that there is a need to educate boaters about proper procedures for using the lock. The boaters who made this comment included people with lock use experience as well as some who have never used the lock before. Comments regarding the need for better or more numerous mooring posts within the lock chamber were made by 3 % of the boaters. Two percent of the boaters complained about the amount of debris in the lock. All of these were boaters who were contacted at the lock during a weekend following heavy rains. Finally, two percent of the respondents had additional complaints about commercial use of the lock.

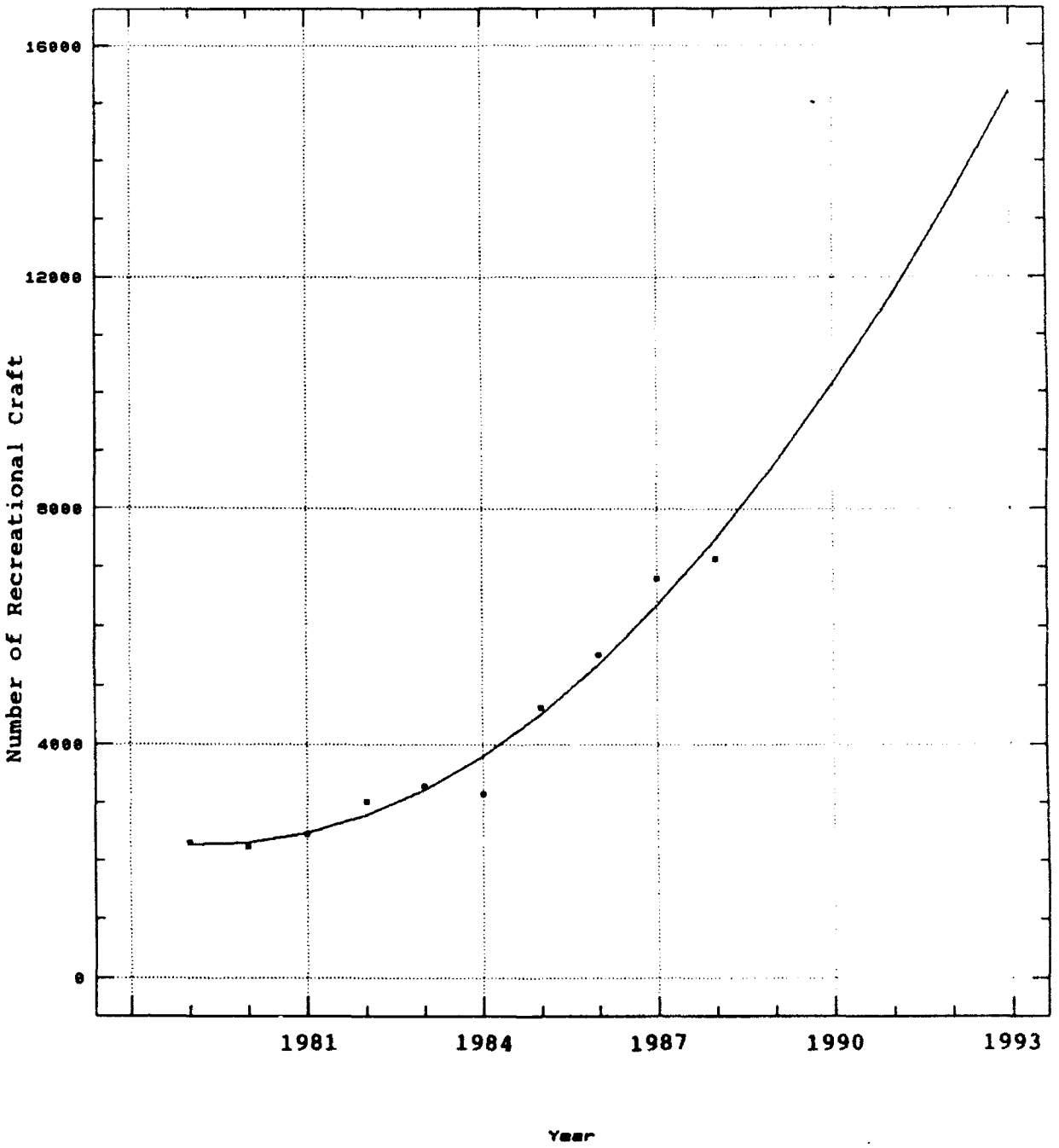


Figure 10. Projection of future recreational use of Chickamauga Lock for the next 5 years based on use trends for the past 10 years (1979-1988)

PART VI: DISCUSSION OF FINDINGS

Reasons for Using The Lock

Boaters are apparently using the lock as a means to take advantage of unique opportunities on the downstream side of the dam rather than as a means to escape crowded conditions on Chickamauga Lake; 54 % stated that escaping crowds was not a reason for lock use while more than 60 % stated that boating in an area not often used was a reason that they used the lock. These unique opportunities on the downstream side of the lock are primarily special events (e.g. the River Bend Festival) and the opportunity to boat through the scenic gorge.

Use Patterns

Origin of users

The draft of the land management plan for Chickamauga Reservoir described the reservoir as "... of extremely significant local and regional importance, but only marginally significant outside the region" (TVA 1988, p.40). Our study supports the idea that, from a recreational use standpoint, the lock is primarily a regional resource. Eighty percent of those contacted during the study were from Tennessee. Another 14 % were from four counties in Georgia which border Tennessee. Although it was initially thought that some of the increase in lock use in recent years might be due to an influx of boaters who were displaced from crowded lakes in the Atlanta region, this does not appear to be the case. Only 3 % of the boaters contacted during this study were from counties in the Atlanta region.

Most boaters contacted at the lock (61 %) originated from commercial marinas. Fifty-two percent of the marina users contacted at the lock were from the two marinas closest to the lock (Chickamauga Marina and Lakeshore Marina). Use of the lock appears to drop off among marina users farther upstream than Loret marina. Thus, lock users primarily originate from commercial marinas within 7 river miles of the lock.

Ramp users are the second most common type of boater; this group comprised approximately 18 % of the lock users. However, this group was so small, it was not realistic to examine the relationship between distance from the lock and lock use.

Distribution of use

Not unexpectedly, recreational use of the lock is heavier on weekends than on weekdays. On a daily basis, recreational use appears to be relatively constant between 0900 hours and 2200 hours, with little use occurring after 2200 and before 0900. Forty percent of all recreational use occurs during June. In June 1988, 2944 recreational craft used the lock. This was 2.8 times more use than was received during the next most heavily used month (October). Thus problems are most likely to occur during June. The high level of use during June is most likely due to the two special events held during this month (the annual raft race and River Bend Festival).

Use trends

The most common reason boaters gave for using the lock was to attend special events. It seems likely that a large portion of the increase in use over the past 10 years is due to increased interest in special events, especially the River Bend Festival which is held during 10 days in June. The festival began as a series of street concerts in 1981, but by 1987, River Bend had become one of the top 10 of 5000 festivals held across the United States (Chattanooga Times 1987, 1988). Growth in attendance at this event is shown in Table 32.

However, some of the increase in lock use is probably attributable to a general increase in boating activity during this period. Seven of eight other locks in the Tennessee River Navigation System have shown an increase in use similar to that observed at Chickamauga Lock since 1984. The annual percent increase in use at the seven other locks has ranged from 9.1 to 34.5 % compared to the 23.8 % increase in use observed at Chickamauga.

Future lock use

Future use of the lock is likely to increase for a number of reasons. First, there were more current users who expected lock use to increase in the future (37 %) than there were users who indicated that future use would decrease (9 %). Also, 49 % of the boaters we contacted who did not currently use the lock indicated that they plan to use the lock in the future. Additionally, while upstream marinas are currently at capacity, many plan to expand. All five of the marinas used as sampling sites reported being at capacity, and managers at all five hope to expand their facilities over the next five years. The same is true of Lake Shore Marina (the origin of 35 % of the marina users contacted at the lock).

Additionally, new waterfront developments are planned downstream. One is a freshwater aquarium that will feature restaurants and shops. This development is unlikely to have permanent storage slips, but day use piers are expected. However, official plans for waterfront development have not yet been submitted to TVA. Also proposed downstream are two new commercial marinas; one with 40-50 permanent slips and the other with 100 slips. Both of these would be within the city of Chattanooga. TVA has received plans for both marinas, however, these plans have not yet been approved.

Forecasts based on past use trends suggest that annual recreational use of the lock will reach 10,000 craft by 1990 and 15,000 craft by 1993. However, this forecast should be considered unreliable for two reasons. First, these projections are based on past use trends only, and cannot adequately address the potential changes in boating facilities described above.

Secondly, while much of the past increase in use appears to have been due to special events, especially those held during June (the raft race and the River Bend Festival), this trend may be changing. For the last three years (1986-1988) the annual increase in use during June has been steadily declining (Table 3), despite the fact that attendance at the River Bend Festival has been increasing (Table 32). Additionally, in 1988, larger increases in use occurred during the months of May and July (no special events scheduled) than during June. These data may indicate that lock use during special events, at least those held during the month of June, are reaching a saturation point, and that some boaters may be opting to use the lock during less heavily trafficked periods. This idea is supported by the facts that: (1) 30 % of the boaters who have used the lock during previous special events indicate that they currently avoid the lock during some special events because the lock is too crowded and (2) 82 % of these individuals expect frequency of future lock use to remain the same or increase.

Delays and Perceived Conflict

Commercial delays

Delays resulting from commercial use of the lock were slightly less common and were seen by recreationists as less of a problem during special events than during typical weekends. This may be due to the limited number of special event days and the fact that commercial use of the lock is evenly distributed throughout both the year and the week. However, since the dates

of these special events are well publicized beforehand, it is also possible that commercial users arrange their schedules so that they avoid the lock during these periods as much as possible.

The results suggest that delays of less than 60 minutes in length have little or no adverse effect on the quality of the boating trip. However, when delays exceed 60 minutes, most boaters feel that trip quality is greatly impacted. Currently, the average reported length of commercial delays exceeds this 60 minute threshold ($x=73$ minutes during typical weekends and $x=84$ minutes during special events.) Thus when recreational boaters are delayed by commercial traffic, they are likely to feel delays greatly diminish trip quality.

However, the degree of conflict depends on not only the length of delays, but also on the frequency with which delays are encountered. We felt that the question which asked boaters to rate their perception of commercial delays (never a problem to almost always a problem) addressed both issues and reflected lock users' assessment of the extent of the problem at the current time. Table 33 suggests that this was the case. Boaters' perceptions about commercial delays were significantly related both to the frequency of delay ($P<0.0001$) and the length of delay ($P=0.0004$). Overall, the responses to this question suggest a low level of perceived conflict at the current time. Less than 30 % of the respondents felt that commercial delays were a common problem during typical weekends and less than 20 % felt that these delays were a common problem during special events.

Furthermore, the analysis presented in Table 33 indicates that boaters begin to consider commercial delays to be a common problem if these delays are encountered on more than 25 % of their attempts to use the lock and that boaters almost always consider these delays to be a common problem if they are encountered during 50 % or more of their attempts to use the lock. However, the study results indicate that even during weekends, when commercial delays are more common, only 39 % of the boaters encounter delays more than 25 % of the time and only 24 % encounter delays 50 % or more of the time. Overall then, this analysis, in addition to the analysis concerning the length of the delays, indicates that the low level of perceived conflict at the current time is mainly due to the fact that commercial delays are viewed as an infrequent occurrences.

Recreational delays

Delays resulting from recreational use of the lock during typical weekends are infrequent (less than 15% of the boaters reported encountering such delays on more than one out of every four attempts to use the lock) and are of relatively short duration (x=38 minutes). As a result, most boaters did not perceive these delays to be an extensive problem; 75 % stated that these delays are seldom to never a problem and only 6 % indicated that these are common problems. Additionally, only 11 % of the boaters felt these delays are detracting greatly from trip quality. Finally, even among those who specifically avoid the lock on weekends, only 25 % indicated that crowded conditions were a reason for doing so.

Recreational delays are more common during special events and are about 11 minutes longer than on typical weekends. Even so, these delays are not viewed as an extensive problem by most boaters; only 23 % described them as common problems. However, unlike typical weekends, the amount of recreational use the lock receives during special events is an important factor in the decision of most boaters (67 %) who avoid the lock during these periods. In summary, although the amount of recreational use the lock receives during special events is not viewed as a common problem by most lock users, use level is high enough so that about 28 % of the respondents consider it a reason to avoid the lock.

Delays and lock operation

As discussed earlier, an important aspect of understanding conflict in recreational settings is determining the entity to which goal interference is attributed. For example, problems resulting from delays can be attributed to other users or to the manner in which the lock is managed. The questionnaire specifically addressed two areas of potential conflict that might be attributed to lock operation. These were boaters inability to predict when the lock would be available for use and the potential for getting trapped on the wrong side of the dam during the return trip.

Of the eight potential problems rated by boaters, these were perceived to be the most extensive. These were the only issues that more than one-third of the boaters described as being common problems and the only issues for which the number of respondents in the 'often-almost always a problem' categories exceeded the number in the 'seldom-never a problem' categories. Also, the danger of getting trapped on the wrong side of the dam during the return trip was the most frequently cited reason for avoiding the lock. Taken with

the findings regarding commercial and recreational delays, these results suggest that the biggest source of conflict at the current time is not the actual delays themselves, but the uncertainty recreationists face in determining whether or not they will be able to use the lock, particularly on the return trip.

Other Potential Sources of Conflict

Four other potential sources of conflict were examined in the study. Three of these dealt with the behavior of other recreational boaters: rowdy or obnoxious behavior, unsafe boating practices, and intoxicated boaters. In no case did more than 21 % of the boaters perceive these behaviors to be common problems, and in all three cases, over 50 % of the boaters felt that these behaviors were seldom to never problems. Additionally, the majority of recreational boaters (> 75 %) who avoid the lock during typical weekends indicated that the behavior of others was not a factor in their decision to avoid the lock. However, this changed somewhat during special events. Approximately 40 % of those avoiding the lock during special events indicated that the behavior of others was a reason for doing so. However, this represents only about 17 % of all the boaters surveyed. In summary, conflict resulting from the behavior of other boaters does not seem to be an important issue at the current time.

The final source of conflict examined dealt with another aspect of lock operation: the number of boats allowed in the lock at one time. This does not seem to be a major issue at this time. Only 5 % of the boaters considered this to be a common problem during typical weekends and only 15 % considered this to be a common problem during special events.

Management Alternatives

The Corps of Engineers' ability to control between-user conflicts resulting simply from competition for scarce space is limited since the Corps cannot restrict the amount of use beyond the physical limitations imposed by the lock's maximum operating capacity. The two options the Corps has are enlarging the lock chamber or building a second lock. Slightly less than half of the boaters (49 %) supported the first option, although only 13 % opposed

it. More support was shown for the second option; 64 % of the boaters supported construction of a second lock.

However, the degree of conflict due to limited space and consequent delays appears to be relatively low at the current time. The biggest problem is the uncertainty associated with predicting lock availability. To some extent, the Corps can reduce this problem by using FM repeaters to announce the estimated time of the next recreational lockage and/or the next commercial lockage. There was wide spread support (almost 80 % of the boaters) for these management alternatives. Additionally, a repeater would likely reduce the boaters need to communicate with lock operators on the radio, thereby addressing a concern noted in the open ended portion of the questionnaire by 6 % of the current lock users.

A portion of the FM repeater message could also provide instructions on lock use procedures. This would serve as a method for educating first time users, and thus address a concern that 4 % of the respondents expressed in the open ended portion of the questionnaire.

A second possible means of removing the uncertainty associated with lock use is scheduling regular periods for recreational lockages. This was supported by a majority of the respondents (62 %), however, 21 % were opposed. Those opposed to this alternative may have seen it as an attempt to restrict recreational use of the lock rather than as a means for making use more predictable. Finally, another means of reducing the level of uncertainty, suggested by one of the study respondents, would be to install digital signs displaying the estimated time of the next lockage at both ends of the lock chamber.

A final way that the Corps could reduce recreational boaters' perception of conflict with commercial users is by amending the lock use priority policy so that there is a 1:1 ratio between commercial and recreational lockages. The benefits of this change, from the recreational standpoint, would be a reduction in the average length of delay. Since a commercial lockage takes between 45 and 60 minutes (H. Lawson pers. commun.), the amended policy should reduce the average length of delays for recreational boaters to some level below 60 minutes (the point that our study results suggests may be a threshold between delays that have little or no effect on trip quality and delays that detract greatly from trip quality).

Future Assessments of Conflict

This study examined the existing level of conflict at Chickamauga Lock. Overall, although some boaters believe that problems associated with delays and the behavior of other boaters are widespread, the majority of boaters do not view these as common problems. However, this assessment is only for one point in time, and the study did not provide insight into the rate at which perceptions are changing. Therefore, if recreational use of the lock continues to increase, or if commercial traffic increases, it may become necessary to re-assess boaters' perceptions of conflict.

Our experience during this study suggests that future surveys can be conducted relatively easily at the lock. We found that it was possible to contact boaters, inform them of the purpose of the study, and get their names and addresses in the short time available during lockages. Additionally, we found that boaters contacted at the lock were very cooperative; all boaters contacted at the lock agreed to participate in the mail survey and their overall response rate was 75 %.

In addition to describing current perceptions of conflict at the lock, the study results suggest that it may be possible to use quantitative measures associated with delays (frequency of delays and length of delays) as indicators of the level of perceived conflict. However, the thresholds suggested in this study should be viewed as tentative findings. This study was not designed to examine the relationship between quantitative measures and perceptions of conflict. Its limitations in this regard have already been described in the Technical Approach section.

If relationships between quantitative variables and perceived conflict are examined in a future study, either of the following approaches would be a more appropriate way of addressing this issue. One approach would be to ask about reactions to delays encountered during a specific trip, preferably the trip during which the boater was contacted. Additionally, rather asking about delays in general, some time frame should be set. For example frequency of delays over the past year.

A second technique for addressing this issue is the normative approach. Norms are evaluative standards that people use to evaluate conditions as acceptable or unacceptable (Graefe et al. 1984, Shelby, Vaske, and Harris 1988). This approach was first introduced to recreation research in 1978 (Vaske 1978, Shelby and Heberlein 1986), and has been used in a variety of

situations including identifying standards for number of encounters (Shelby 1981), identifying standards for perceived ecological impacts (Shelby, Vaske, and Harris 1988), and identifying standards for wildlife management practices (Vaske and Donnelly 1988). Methods for applying the normative approach have been described in detail in Shelby and Heberlein (1986) and Vaske et al. 1986).

REFERENCES

Graefe, A. R., Vaske, J. J., and Kuss, F. R. (1984). Social carrying capacity: an integration and synthesis of twenty years of research. Leisure Sciences 6:395-431.

Hammitt, W. E. 1988. The spectrum of conflict in outdoor recreation. In, Proc., Benchmark 1988: a National Outdoor Recreational and Wilderness Forum. USFS-SE Gen. Tech. Rep.

Jacob, G. R. and Schreyer, R. (1980). Conflict in outdoor recreation: a theoretical perspective. J. of Leisure Res 12:368-380.

Little, W. and Noe, F. P. (1984). A highly condensed description of the thought process used in developing visitor research for southeast parks. Xerox paper. Southeast Regional Office, NPS. Atlanta, GA.

Shelby, B. (1981). Encounter norms in backcountry settings: studies of three rivers. Journal of Leisure Research 13:129-138.

Shelby, B. and Colvin, R. (1982). Encounter measures in carrying capacity research: actual, reported, and diary contacts. Journal of Leisure Research 14:350-360.research.

Shelby, B. and Heberlein, T. A. (1986). Carrying Capacity in Recreation Settings. Corvallis, Oregon: Oregon State University Press.

Shelby, B., Vaske, J. J., and Harris, R. (1988). User standards for ecological impacts at wilderness campsites. Journal of Leisure Research 20:245-256.

Tennessee Valley Authority Resource Development Group. 1988. Draft Chickamauga Reservoir Management Plan. 213 pp.

Vaske, J. J. (1978). The relationship between personal norms, social norms, and reported contacts in the Brule River visitors' perception of crowding. Masters Thesis, University of Wisconsin, Madison.

Vaske, J. J. and Donnelly, M. P. (1988). Normative evaluations of wildlife management: a comparison of three publics. Paper presented at the National Recreation and Park Association Annual Congress, Indianapolis, October.

Vaske, J. J., Shelby, B., Graefe, A. R., and Heberlein, T. A. (1986). Backcountry encounter norms: theory, method, and empirical evidence. Journal of Leisure Research 18:137-153.

Table 1

Sample Date, Sample Locations, and Number of Respondents Contacted for the Chickamauga Lock Study, 1989

Sample Date Contacted	Sample Locations	Number of Boaters
May 28	Lakesite Marina	19
May 29	Shady Grove Marina	28
June 3	Chickamauga Lock	11
June 4	Gold Point Marina	56
	Chickamauga Marina	
June 8	Harrison Bay State Park Ramp	35
	Loret Marina	
June 10	Chickamauga Lock	20
June 16	Chickamauga Lock	6
June 17	Chickamauga Lock	65
June 18	Chickamauga Lock	40
June 24	Loret Marina	26
	TOTAL	306

Table 2

Annual Percent Change in the Number of Recreational Craft Using Locks in the Tennessee River Navigation System Between 1984 and 1988

Lock	Annual % Change				Average % Change During Period
	1985	1986	1987	1988	
Chickamauga	47.9	19.2	23.2	4.9	23.8
Pickwick	90.4	21.1	15.1	11.5	34.5
Nickajack	17.9	16.9	20.4	41.4	24.2
Wilson	26.1	28.5	9.4	- 0.5	15.9
Fort Loudoun	33.4	5.2	11.7	9.7	15.0
Guntersville	21.9	15.9	15.6	0.4	13.4
Wheeler	18.2	16.6	10.1	3.1	10.9
Watts Bar	12.4	7.2	5.6	11.1	9.1
Melton Hill	-39.0	-33.7	20.3	14.1	- 9.6

Table 3

Between Year Fluctuation in Monthly Recreational Use of Chickamauga Lock

MONTH	Change in Number Compared to Previous Year's Use Level 1986	1987	1988	Total Change 1985-1988
January	- 6	12	- 1	5
February	5	2	0	7
March	30	30	- 4	54
April	70	0	84	154
May	67	254	137	458
June	616	392	126	1134
July	187	52	279	518
August	262	-39	26	249
September	-101	121	-224	-204
October	-274	347	68	141
November	- 60	142	-179	-97
December	94	-29	21	102

Table 4

Distribution of Recreational Lock Use By Period of Week During the Month of June

Period of Week	Total Lockages 1988	1989	Total Craft 1989
Weekday (Monday-Friday)	57.1	35.7	13.9
Weekend (Saturday-Sunday)	42.9	67.5	86.1

Table 5

Time of Arrival of Recreational Boats at Chickamauga Lock During The Month of June, 1988 and 1989.

Arrival Time	% of Total Lockages 1988	% of Total Lockages 1989	% of Total Boats 1989
0000-0059	3.0	2.5	3.81
0100-0159	1.8	1.3	1.43
0200-0259	0.8	0.9	0.88
0300-0359	0.4	0.6	0.14
0400-0459	0.2	0.0	0.00
0500-0559	0.0	0.3	0.07
0600-0659	1.0	0.0	0.00
0700-0759	2.4	1.3	1.02
0800-0859	2.2	2.2	1.90
0900-0959	4.2	4.1	5.31
1000-1059	4.4	4.4	4.83
1100-1159	5.6	8.1	7.82
1200-1259	6.5	6.2	4.90
1300-1359	6.0	6.9	5.44
1400-1459	6.5	6.9	6.19
1500-1559	6.2	7.5	7.82
1600-1659	7.1	8.1	7.01
1700-1759	6.7	7.8	9.12
1800-1859	5.8	7.8	9.73
1900-1959	6.9	8.1	4.42
2000-2059	6.9	4.4	7.69
2100-2159	6.7	4.7	6.26
2200-2259	4.8	3.4	1.56
2300-2359	4.0	2.5	2.65

Table 6

Amount of Time Devoted To Recreational Lockages

During June 1988

DAY OF MONTH	TOTAL HOURS	PERCENT OF DAY	
1	1.62	6.74	
2	1.52	6.32	
3	-----	-----	
4	13.48	56.18	Annual Raft Race
5	11.50	47.92	
6	3.80	15.83	
7	2.93	12.22	
8	2.95	12.29	
9	1.00	4.17	
10	4.12	17.15	
11	-----	-----	
12	8.05	33.54	
13	2.17	9.03	
14	2.07	8.61	
15	5.18	21.60	
16	4.23	17.64	River Bend Festival Starts
17	6.97	29.03	
18	9.48	39.51	
19	13.28	55.35	
20	8.58	35.76	
21	7.10	29.58	
22	10.25	42.71	
23	10.68	44.51	
24	13.13	54.72	
25	16.12	67.15	
26	10.92	45.49	River Bend Festival Ends
27	6.73	28.06	
28	2.22	9.24	
29	1.87	7.78	
30	1.95	8.13	

Time Locking Per Day = SUM(End of lock - Start of lock).

Table 7

Type of Recreational Boats Using Chickamauga Lock During June 1989

Type of Boat	N	Frequency
Runabout	676	51.1
Cabin Cruiser	355	26.8
Houseboat	150	11.3
Pontoon Boat	106	8.0
Bass Boat	26	2.0
Sailboat	9	0.7

Table 8

Chickamauga Lock Use Study Respondents' Socioeconomic Characteristics, 1989

Characteristic	Number of Respondents	Percent of Respondents
GENDER		
Male	198	90.8
Female	20	9.2
AGE (x = 41.6 yrs)		
<20	3	1.4
20-29	35	16.1
30-39	66	30.3
40-49	55	25.2
50-59	36	16.5
60+	23	10.6
EDUCATION (median = 15 yrs)		
0-12	59	27.1
13-16	112	51.4
17+	45	20.6
Missing	2	0.9
INCOME		
Less than $10,000	3	1.4
$10,000-$19,999	10	4.6
$20,000-$29,999	25	11.5
$30,000-$39.999	30	13.8
$40,000-$49,999	40	18.3
$50,000-$59,999	25	11.5
$60,000 +	68	31.2
Missing	17	7.8

Table 9

Chickamauga Lock Use Study Respondents' Level of Boating Experience

Boating Characteristic	Number of Respondents	Percent of Respondents
YEARS ON CHICKAMAUGA LAKE (x=14.5 yrs)		
<5	48	26.1
5 - 10	41	22.3
11 - 15	23	12.5
16 - 20	22	12.0
21+	50	27.2
DAYS PER SEASON		
Spring (Mar-May) (x=16.8)		
<5	28	15.6
5 - 10	52	29.1
11 - 15	31	17.3
16 - 20	29	16.2
21+	39	21.8
Summer (Jun-Aug) (x=26.9)		
<5	5	2.8
5 - 10	25	14.0
11 - 15	28	15.7
16 - 20	31	17.4
21+	89	50.0
Fall (Sep-Nov) (x=15.7)		
<5	42	23.5
5 - 10	44	24.6
11 - 15	31	17.3
16 - 20	30	16.7
21+	32	17.9
Winter (Dec-Jan) (x=4.8)		
<5	139	76.7
5 - 10	26	14.4
11 - 15	4	2.2
16 - 20	3	1.7
21+	9	5.0

Table 10

Chickamauga Lock Use Study Respondents' Level of Lock Use Experience

Boating Characteristic	Number of Respondents	Percent of Respondents
YEARS USING CHICKAMAUGA LOCK (x=9.9 yrs)		
<5	65	40.1
5 - 10	47	29.0
11 - 15	16	9.9
16 - 20	14	8.6
21+	20	12.3
TIMES PER SEASON Spring (Mar-May) (x=3.4)		
0	52	32.1
1 - 5	77	47.5
6 - 10	27	16.7
11 - 20	3	1.9
21+	3	1.9
TIMES PER SEASON Summer (Jun-Aug) (x=8.2)		
0	10	6.3
1 - 5	69	43.4
6 - 10	49	30.8
11 - 20	21	13.2
21+	10	6.3
TIMES PER SEASON Fall (Sep-Oct) (x=3.5)		
0	35	22.0
1 - 5	101	63.5
6 - 10	14	8.8
11 - 20	6	3.8
21+	3	1.9
TIMES PER SEASON Winter (Nov-Feb) (x= 0.4)		
0	139	86.9
1 - 5	19	11.9
6 - 10	1	0.6
11 - 20	1	0.6
21+	0	0.0

Table 11

County of Residence For Chickamauga Lake Study Respondents

Who Were From The State of Georgia

	N	% of Georgia Boaters	% of Total Boaters
COUNTIES ADJACENT TO TENNESSEE			
Whitefield County	16	30.2	5.6
Walker County	16	30.2	5.6
Catoosa County	7	13.2	2.4
Dade County	1	1.9	0.3
COUNTIES IN THE ATLANTA REGION			
Cobb County	5	9.4	1.7
Cherokee County	1	1.9	0.3
Forsyth County	1	1.9	0.3
Fulton County	1	1.9	0.3
INTERMEDIATE COUNTIES			
Floyd County	2	3.8	0.7
Chattooga County	1	1.9	0.3
Gordon County	1	1.9	0.3
Rabun County	1	1.9	0.3

Table 12

Type of Boats Respondents Most Frequently Use When

Locking Through Chickamauga Dam

Type of Boat	N	Percent
Runabout	49	31.8
Cabin Cruiser	38	24.7
Houseboat	34	22.1
Bass Boat	10	6.5
Pontoon Boat	13	8.4
Sailboat	2	1.3
>1 Boat Listed	8	5.2

Table 13

Type of Launch Sites Used By Study Respondents When Locking Through Chickamauga Dam

Type of Boat	N	Percent
ALL RESPONDENTS		
Marina	111	67.7
Public Ramp	21	12.8
Private Dock	11	6.7
Other (Unspecified)	5	3.0
>1 Type Listed	16	9.8
RESPONDENTS CONTACTED AT THE LOCK		
Marina	54	61.4
Public Ramp	16	18.2
Private Dock	9	10.2
Other	2	2.3
>1 Type Listed	7	8.0

Table 14

Marinas Used By Boaters Who Were Contacted at the Lock.

Marina	N	Approximate Distance From Lock	Percent	Cumulative Percent
Lake Shore	19	0.5	35.2	35.2
Chickamauga	9	0.5	16.7	51.9
Big Ridge	4	4.2	7.4	59.3
Chatt. Yacht Club	1		1.9	61.1
Loret	12	6.5	22.2	83.3
Harrison Bay	3	7.6	5.6	88.9
Harbor Lights	3	10.9	5.6	94.4
Lake Site	2	11.0	3.7	98.1
B and B	1	41.6	1.9	100.0

Table 15

Percent of Respondents At Each Launch Site Who Indicated That The Have Used Chickamauga Lock

Marina	N	Approximate Distance From Lock	Boaters That Have Used Lock (%)	Boaters That Have Not Used Lock (%)
Chickamauga	32	0.5	72.0	28.0
Gold Point	23	1.5	87.0	13.0
Loret	26	6.5	73.1	26.9
Harrison Bay	32	7.6	37.5	62.5
Lake Site	16	11.0	50.0	50.0
Shady Grove	28	16.9	57.1	42.9

Table 16

Boaters' Ratings of How Often Each of The Following Is a Reason For Using Chickamauga Lock

Reason	Never a Reason %	Sometimes a Reason %	Frequently a Reason %
To attend a special event	11.0	23.2	65.9
To see the scenic gorge	17.8	57.7	24.5
To eat at one of the downstream restaurants	40.5	39.3	20.2
Because it is a novel experience for myself or my guests	40.9	43.3	15.9
To boat in an area I do not often use	38.9	54.9	6.2
To escape crowds on Chickamauga Lake	53.7	32.7	13.6
To reach better fishing areas	79.5	13.7	6.8
To attend football games	95.1	3.7	1.2

Table 17

Percent of Attempts During Which Recreational Boaters Are Delayed By Commercial Traffic When Attempting To Use Chickamauga Lock During Typical Weekends

Percent of Attempts	Number of Boaters	Percent of Boaters	Cumulative Percent
0	21	14.4	14.4
1	2	1.4	15.8
2	1	0.7	16.4
5	10	6.8	23.3
10	30	20.5	43.8
15	1	0.7	44.5
18	1	0.7	45.2
20	9	6.2	51.4
25	14	9.6	61.0
30	10	6.8	67.8
33	1	0.7	68.5
35	4	2.7	71.2
40	7	4.8	76.0
50	18	12.3	88.4
60	5	3.4	91.8
70	2	1.4	93.2
75	3	2.1	95.2
80	2	1.4	96.6
90	2	1.4	97.9
94	1	0.7	98.6
100	2	1.4	100.0

Table 18

Effect of Commercial Delays on The Quality of The Boating Trip During Typical Weekends

Effect on Experience	N	% of Respondents
Detracted greatly from the quality of the boating trip	45	36.6
Detracted a little from the quality of the boating trip	64	52.0
Had no effect on the quality of the boating trip	11	8.9
Had a positive effect on the quality of the boating trip	3	2.4

Table 19

Percent of Attempts During Which Recreational Boaters Are Delayed By Recreational Traffic When Attempting To Use Chickamauga Lock During Typical Weekends

Percent of Attempts	Number of Boaters	Percent of Boaters	Cumulative Percent
0	57	39.0	39.0
1	3	2.1	41.1
2	3	2.1	43.2
5	12	8.2	51.4
10	28	19.2	70.5
15	2	1.4	71.9
20	11	7.5	79.5
25	9	6.2	85.6
40	4	2.7	88.4
50	9	6.2	94.5
60	2	1.4	95.9
70	1	0.7	96.6
80	3	2.1	98.6
90	1	0.7	99.3
100	1	0.7	100.0

Table 20

Effect of Recreational Delays on The Quality of The Boating Trip During Typical Weekends

Effect on Experience	N	% of Respondents
Detracted greatly from the quality of the boating trip	10	11.4
Detracted a little from the quality of the boating trip	47	54.3
Had no effect on the quality of the boating trip	29	33.0
Had a positive effect on the quality of the boating trip	2	2.3

Table 21

Boater Perceptions of Potential Problems at Chickamauga Lock During Typical Weekends When No Special Events Are Scheduled

Problem	Extent of Problem				
	Never (%)	Seldom (%)	Sometimes (%)	Often (%)	Almost Always (%)
Delays due to commercial traffic	11.7	20.0	40.7	21.4	6.2
Delays due to recreational traffic	29.4	45.5	19.6	3.5	2.1
Inability to predict when lock will be available for use	15.2	18.6	23.4	26.2	16.6
Possibility of getting trapped on wrong side during return trip	15.1	22.6	30.8	21.2	10.3
Rowdy or obnoxious behavior of some boaters	22.4	36.4	32.2	7.7	1.4
Unsafe boating practices	28.0	40.6	16.8	10.5	4.2
Intoxicated boaters	25.2	38.5	26.6	9.1	0.7
Number of boats allowed in lock at one time	37.3	40.8	16.9	4.9	0.0

Table 22

Reasons Boaters Avoid At Chickamauga Lock During Typical Weekends When No Special Events Are Scheduled

	Is a Reason (%)	Is Not a Reason (%)
Danger of getting trapped on wrong side during return trip	64.6	35.4
Takes too long to lock through	55.7	44.3
Too crowded	26.6	73.4
Unsafe boating practices	22.8	77.2
Rowdy or obnoxious behavior of other boaters	19.0	81.0

Table 23

Percent of Attempts During Which Recreational Boaters Are Delayed by Commercial Traffic When Attempting To Use Chickamauga Lock During Special Events

Percent of Attempts	Number of Boaters	Percent of Boaters	Cumulative Percent
0	48	33.8	33.8
1	3	2.1	35.9
2	1	0.7	36.6
5	4	2.8	39.4
10	23	16.2	55.6
15	5	3.5	59.2
20	3	2.1	61.3
25	14	9.9	71.1
30	5	3.5	74.6
33	1	0.7	75.4
40	6	4.2	79.6
50	17	12.0	91.5
57	1	0.7	92.3
60	1	0.7	93.0
70	3	2.1	95.1
75	3	2.1	97.2
90	1	0.7	97.9
100	3	2.1	100.0

Table 24

Effect of Commercial Delays on The Quality of Boating Trip Experiences During Special Events

Effect on Experience	N	% of Respondents
Detracted greatly from the quality of the boating trip	40	41.7
Detracted a little from the quality of the boating trip	42	43.8
Had no effect on the quality of the boating trip	9	9.4
Had a positive effect on the quality of the boating trip	5	5.2

Table 25

Percent of Attempts During Which Recreational Boaters Are Delayed By Recreational Traffic When Attempting To Use Chickamauga Lock During Special Events

Percent of Attempts	Number of Boaters	Percent of Boaters	Cumulative Percent
0	31	21.8	21.8
1	1	0.7	22.5
5	8	5.6	28.2
10	26	18.3	46.5
15	2	1.4	47.9
20	6	4.2	52.1
25	11	7.7	59.9
30	3	2.1	62.0
33	1	0.7	62.7
40	2	1.4	64.1
45	1	0.7	64.8
50	26	18.3	83.1
60	1	0.7	83.8
75	3	2.1	85.9
80	4	2.8	88.7
90	5	3.5	92.3
95	1	0.7	93.0
100	10	7.0	100.0

Table 26

Effect of Recreational Delays on The Quality of Boating Trip Experiences During Special Events

Effect on Experience	N	% of Respondents
Detracted greatly from the quality of the boating trip	22	20.0
Detracted a little from the quality of the boating trip	62	56.4
Had no effect on the quality of the boating trip	24	21.8
Had a positive effect on the quality of the boating trip	2	1.8

Table 27

Boater Perceptions of Potential Problems at Chickamauga Lock During Special Events

Problem	Extent of Problem				
	Never (%)	Seldom (%)	Sometimes (%)	Often (%)	Almost Always (%)
Delays due to commercial traffic	14.1	29.6	36.6	13.4	6.3
Delays due to recreational traffic	12.0	33.8	31.0	16.2	7.0
Inability to predict when lock will be available for use	15.6	18.4	27.7	20.6	17.7
Possibility of getting trapped on wrong side during return trip	12.5	19.4	29.2	22.9	16.0
Rowdy or obnoxious behavior of some boaters	24.1	29.8	31.2	8.5	6.4
Unsafe boating practices	23.0	29.5	26.6	15.8	5.0
Intoxicated boaters	24.1	35.5	24.1	9.26	7.1
Number of boats allowed in lock at one time	24.6	31.0	29.6	7.7	7.0

Table 28

Reasons Boaters Avoid at Chickamauga Lock

During Special Events

	Is a Reason (%)	Is Not a Reason (%)
Too crowded	67.8	32.2
Danger of getting trapped on wrong side during return trip	67.0	33.0
Takes too long to lock through	65.2	34.8
Unsafe boating practices	40.4	59.6
Rowdy or obnoxious behavior of other boaters	39.3	60.7

Table 29

Boater Support For Management Alternatives at Chickamauga Lock

Management Action	Strongly Support (%)	Support (%)	Neither (%)	Oppose (%)	Strongly Oppose (%)
FM repeater announcing estimated times of commercial lockages	43.9	35.7	17.9	1.0	1.5
FM repeater announcing estimated times of recreational lockages	42.1	37.1	17.8	1.0	2.0
Construct separate lock for commercial traffic	38.8	24.9	21.9	9.0	5.5
Schedule regular periods for recreational lockages	35.7	26.1	17.1	11.1	10.1
Create more public ramps downstream	24.0	28.0	42.0	3.5	2.5
Enlarge size of existing lock	26.3	22.7	38.1	8.2	4.6
Create more public ramps upstream	20.8	25.5	46.4	4.2	3.1

Table 30

Respondents' Predictions of How Their Frequency of Use of Chickamauga Lock Will Change Over The Next Three Years

Future Lock Use Level	N	%
Use will decrease	15	9.1
Use will remain the same	88	53.7
Use will increase 50 %	47	28.7
Use will increase 100 %	14	8.5

Table 31

Boaters' Prediction of Change In Frequency of Use of Chickamauga Lock Under Varying Conditions

	Change in Frequency of Lock Use				
	Great Increase (%)	Slight Increase (%)	No Change (%)	Slight Decrease (%)	Great Decrease (%)
Average waiting time decreases by 30 %	24.4	48.1	26.9	0.6	0.0
Average waiting time increases by 30 %	2.0	1.3	26.8	38.6	31.4
Additional marinas are built downstream	21.3	27.1	46.5	3.9	1.3
Additional ramps are built downstream	5.9	10.5	72.5	9.8	1.3
Additional ramps are built upstream	5.8	7.1	84.4	1.9	0.6

Table 32

Annual Attendance at Chattanooga's River Bend Festival (Based On The Number of Admission Pins Sold) (From Chattanooga Times)

Year	Attendance
1982	15,000
1983	26,000
1984	42,000
1985	64,000
1986	75,000
1987	89,000
1988	>100,000

Table 33

The Relationship Between Quantitative Measures of Commercial Delays and Recreational Boaters' Evaluations of This Type of Delay

	Boaters' Evaluation of Commercial Delays					
	Seldom-Never a Problem		Sometimes a Problem		Often-Almost Always a Problem	
Quantitative Measure	Actual Freq.	Expected Freq.	Actual Freq.	Expected Freq.	Actual Freq.	Expected Freq.
FREQUENCY OF DELAYS						
0 %	18	6.3	2	8.0	0	5.6
1-25 %	27	21.2	35	26.9	5	18.9
26-49 %	0	7.0	14	8.8	8	6.2
50+ %	0	10.5	6	13.2	27	9.3
		$X^2 = 104.49$, $P < 0.0001$				
LENGTH OF DELAYS						
60 minutes or less	24	17.5	37	34.4	16	25.0
More than 60 minutes	4	10.5	18	20.6	24	15.0
		$X^2 = 15.63$, $P = 0.0004$				

APPENDIX A: ONSITE CONTACT SHEET

1.) How many years have you been boating on Chickamauga Lake? _____ YEARS

2.) Have you noticed an increase in # of boats on Lake over this period?

No -----> Go to question 3

Yes

a.) When did you first begin to notice this change? (Gradual, Last year, last 3 years, last 5 years, etc.).

_____

b). Do you ever avoid going out on lake due to the increased use?

NO

YES (USE IT LESS FREQUENTLY)

3.) Have you used Chickamauga Lock before?

No -----> Go to question 4

Yes

a.) How many years have you been using Chickamauga Lock? _____ YEARS

b.) Have you noticed an increase in lock use over this period?

c.) When did you first begin to notice this change? (Gradual, Last year, last 3 years, last 5 years, etc.).

_____

d.) Do you ever avoid the lock because of the number of boats?

NO

YES

4.) I don't want to take up any more of your free time today, but we do have a few more specific questions about boating conditions we'd like to ask regarding use of the area and your opinions about how boating conditions might be improved. We're looking for volunteers to respond to a mail questionnaire. Would you be willing to complete a short questionnaire if we mailed it to your home.

NAME _____

ADDRESS _____

CITY _____ STATE _____

ZIP CODE _____ TIME _____

MARINA _____ SLIP GAS/STORE UNKNOWN

BOAT TYPE _____

APPENDIX B: MAIL QUESTIONNAIRE

_____

CHICKAMAUGA LOCK USE STUDY

General Information. We would appreciate a few minutes of your time to answer this survey. The University of Tennessee in cooperation with the U.S. Army Corps of Engineers is collecting information about recreational use of Chickamauga Lake, Nickajack Lake, and Chickamauga Lock in an effort to better serve your recreation needs.

GENERAL USE OF CHICKAMAUGA LAKE

1.) Is this the first year you have boated on Chickamauga Lake?

_____ YES → Skip to Question 4

_____ NO

↓

2.) How many years have you been boating on Chickamauga Lake (including this year)?

_____ YEARS

3.) About how many days per year do you boat on Chickamauga Lake during the:

_____ SPRING (Mar-May)?

_____ SUMMER (Jun-Aug)?

_____ FALL (Sep-Nov)?

_____ WINTER (Dec-Feb)?

4.) Have you ever boated on Nickajack Lake?

_____ NO → Skip to Question 1 on next page

_____ YES

↓

5.) How many years have you been boating on Nickajack Lake (including this year if you have already boated on Nickajack Lake)?

_____ YEARS

CHICKAMAUGA LOCK USE

1.) Have you ever used the lock at Chickamauga Dam before?

_____ NO → Skip to Question 11

_____ YES

2.) What type of boat (e.g. bass boat, runabout, pontoon boat, etc.) do you most frequently use to pass through Chickamauga Lock?

_____ TYPE OF BOAT

a.) What is the length of this boat?

_____ FEET

b.) How long have you owned this boat?

_____ YEARS

3.) Please indicate where you typically launch this boat (marina, public ramp, private dock, or other area) on days when you use Chickamauga Lock.

_____ Marina → a.) Which marina?

_____

b.) How far do you live from this marina?

_____ MILES

_____ Public ramp → a.) Which ramp? (e.g. Harrison Bay State Park)

_____

b.) How far do you live from this ramp?

_____ MILES

_____ → a.) About how many river miles is this from Chickamauga Lock?

Other, please indicate. (e.g. private dock)

_____ MILES

b.) How far do you live from this area?

_____ MILES

4.) How many years (including this year if you have used Chickamauga Lock) have you been using the lock?

_____ YEARS

5.) About how many times per year do you use Chickamauga Lock during <u>each</u> of following seasons? (Count each pass through the lock separately. For example, if you went through the the lock twice in one day, that would count as two times).

_____ SPRING (Mar-May)

_____ SUMMER (Jun-Aug)

_____ FALL (Sep-Nov)

_____ WINTER (Dec-Feb)

6.) People may pass through the lock for a variety of reasons. Please indicate how frequently <u>each</u> of the following is a reason that you use the lock.

	Never a Reason	Sometimes a Reason	Frequently a Reason
To attend a special event (e.g. Annual Raft Race, River Bend Festival, etc.)	( )	( )	( )
To escape the crowds on Chickamauga Lake	( )	( )	( )
To reach better fishing areas	( )	( )	( )
To see the scenic gorge	( )	( )	( )
Passing through the lock is a novel experience for myself or my guests	( )	( )	( )
To eat at one of the downstream restaurants	( )	( )	( )
To attend football games	( )	( )	( )
To boat in an area that I do not often use	( )	( )	( )
Other (Please specify):			
_____	( )	( )	( )
_____	( )	( )	( )

7.) What times during the week do you use the lock? (Check one)

_____ WEEKDAYS (Mon-Fri) ONLY ➡ Skip to Question 11

_____ WEEKENDS (Sat-Sun) ONLY

_____ BOTH WEEKENDS AND WEEKDAYS

Please answer Questions 8-10 based on your experiences during a typical weekend, when no special events such as the Annual Raft Race, River Bend Festival, etc. are scheduled. Remember, do not include special event days.

8.) When using Chickamauga Lock on typical weekends, how often (% of times) are you delayed due to commercial traffic (barges)?

_____ % OF TIMES DELAYED

a.) On those occasions when you are delayed by commercial traffic (barges), how long are you typically delayed?

_____ MINUTES

b.) Do these delays: (Check one)

_____ Detract greatly from the quality of your boating trip
_____ Detract a little from the quality of your boating trip
_____ Have no effect on the quality of your boating trip
_____ Have a positive effect on the quality of your boating trip

9.) When using Chickamauga Lock on typical weekends, how often (% of times) are you delayed due to recreational traffic?

_____ % OF TIMES DELAYED

a.) On those occasions when you are delayed by recreational traffic how long are you typically delayed?

_____ MINUTES

b.) Do these delays: (Check one)

_____ Detract greatly from the quality of your boating trip
_____ Detract a little from the quality of your boating trip
_____ Have no effect on the quality of your boating trip
_____ Have a positive effect on the quality of your boating trip

10.) Please indicate the extent to which you feel each of the following is a problem at the Chickmagua Lock on a typical weekend when there are no special events.

	Never a Problem	Seldom a Problem	Sometimes a Problem	Often a Problem	Almost Always a Problem
-Delay before entering lock due to commercial traffic	( )	( )	( )	( )	( )
-Delay before entering lock due to recreational traffic	( )	( )	( )	( )	( )
-Inability to predict when lock will be available for use	( )	( )	( )	( )	( )
-Possibility of getting trapped on wrong side of dam for hours on return trip	( )	( )	( )	( )	( )
-Unsafe boating practices	( )	( )	( )	( )	( )
-Number of boats allowed in lock at one time	( )	( )	( )	( )	( )
-Intoxicated boaters	( )	( )	( )	( )	( )
-Rowdy or obnoxious behavior of some boaters	( )	( )	( )	( )	( )

11.) Do you ever specifically avoid Chickamauga Lock on a typical weekday or weekend (i.e. on days when no special events such as the Annual Raft Race are scheduled).

_____ NO → Skip to Question 1 on next page

_____ YES

12.) If you sometimes avoid Chickamauga Lock on a typical weekend or weekday, please indicate which of the following reasons influences your decision to avoid using the lock. (Check all that apply).

_____ Too crowded
_____ Takes too long to lock through
_____ Unsafe boating practices
_____ Rowdy or obnoxious behavior of other boaters
_____ Danger of getting "trapped" on wrong side of dam on return trip
_____ Other. Please specify.

_____

_____

SPECIAL EVENTS

1.) The following is a list of special events which are held in the Chickamauga Lake/Nickajack Lake area.

_____ Annual Raft Race
_____ River Bend Festival
_____ Fall Color Cruise
_____ National Bass Fishing Tournaments
_____ Local Bass Fishing Tournaments
_____ Christmas on the River

a.) Have you ever passed through Chickamauga Lock to attend any of these events?

_____ NO → Skip to Question 5

_____ YES

b.) Beside each event, please write the number of times you have attended the event by passing through Chickamauga Lock.

Please answer Questions 2-6 based on your experiences <u>while attending special events</u> such as the Annual Raft Race, River Bend Festival, etc.

2.) When using Chickamauga Lock <u>during special events</u>, how often (% of times) are you delayed due to commercial traffic (barges)?

_____ % OF TIMES DELAYED

a.) On those occasions when you are delayed by commercial traffic barges, how long are you typically delayed?

_____ MINUTES

b.) Do these delays: (Check one)

_____ Detract greatly from the quality of your boating trip
_____ Detract a little from the quality of your boating trip
_____ Have no effect on the quality of your boating trip
_____ Have a positive effect on the quality of your boating trip

3.) When using Chickamauga Lock <u>during special events</u>, how often (% of times) are you delayed due to recreational traffic?

_____ % OF TIMES DELAYED

a.) On those occasions when you are delayed by recreational traffic how long are you typically delayed?

_____ MINUTES

b.) Do these delays: (Check one)

_____ Detract greatly from the quality of your boating trip
_____ Detract a little from the quality of your boating trip
_____ Have no effect on the quality of your boating trip
_____ Have a positive effect on the quality of your boating trip

4.) Please indicate the extent to which you feel <u>each</u> of the following is a problem at Chickmagua Lock <u>during special events</u>.

	Never a Problem	Seldom a Problem	Sometimes a Problem	Often a Problem	Almost Always a Problem
-Delay before entering lock due to commercial traffic	( )	( )	( )	( )	( )
-Delay before entering lock due to recreational traffic	( )	( )	( )	( )	( )
-Inability to predict when lock will be available for use	( )	( )	( )	( )	( )
-Possibility of getting trapped on wrong side of dam for hours on return trip	( )	( )	( )	( )	( )
-Unsafe boating practices	( )	( )	( )	( )	( )
-Number of boats allowed in lock at one time	( )	( )	( )	( )	( )
-Intoxicated boaters	( )	( )	( )	( )	( )
-Rowdy or obnoxious behavior of some boaters	( )	( )	( )	( )	( )

5.) Do you ever specifically avoid Chickamauga Lock <u>during special events</u>.

_____ NO → Skip to Question 1 on next page

_____ YES

6.) If you sometimes avoid Chickamauga Lock during special events, please indicate which of the following reasons influences your decision to avoid using the lock. (Check all that apply).

_____ Too crowded
_____ Takes too long to lock through
_____ Unsafe boating practices
_____ Rowdy or obnoxious behavior of other boaters
_____ Danger of getting "trapped" on wrong side of dam on return trip
_____ Other. Please specify

_____

_____

MANAGEMENT AND FUTURE USE OF CHICKAMAUGA LOCK

1.) To what degree would you SUPPORT or OPPOSE each of the following management alternatives.

	Strongly Support	Support	Neither Support Nor Oppose	Oppose	Strongly Oppose
-Schedule regular periods during which lock would be used for recreational boats	( )	( )	( )	( )	( )
-Create more public ramps downstream	( )	( )	( )	( )	( )
-Create more public ramps upstream	( )	( )	( )	( )	( )
-FM repeater announcing estimated times of commercial lockages	( )	( )	( )	( )	( )
-FM repeater announcing estimated times of recreation lockages	( )	( )	( )	( )	( )
-Enlarge size of existing lock	( )	( )	( )	( )	( )
-Construct separate lock for commercial traffic	( )	( )	( )	( )	( )
Other. (Please specify). _____	( )	( )	( )	( )	( )
_____	( )	( )	( )	( )	( )

2.) Over the next three years, do you think that the number of times you use Chickamauga Lock per year will:

_____ Decrease
_____ Remain the same
_____ Increase 50% (1.5 times more than current use)
_____ Increase 100% (double current use)

3.) Please indicate how each of the following changes would affect the number of times you use Chickamauga Lock per year over the next three years.

	Greatly Increase Use	Slightly Increase Use	No Change In Use	Slightly Decrease Use	Greatly Decrease Use
-Average waiting time decreases by 30%	( )	( )	( )	( )	( )
-Average waiting time increases by 30 %	( )	( )	( )	( )	( )
-Additional marinas are built downstream	( )	( )	( )	( )	( )
-Additonal ramps are built downstream	( )	( )	( )	( )	( )
-Additonal ramps are built upstream	( )	( )	( )	( )	( )

VISITOR INFORMATION

This information is important to the success of this study and aids in making predictions about river use in the future. All of the information is STRICTLY CONFIDENTIAL and WILL NOT be associated with you as an individual.

1.) Your present age: _____ YEARS

2.) Sex: _____ MALE _____ FEMALE

3.) What is the highest level of education you have completed so far? (Circle one number)

1 2 3 4 5 6 7 8 — Elementary
9 10 11 12 — High School
13 14 15 16 17 18 18+ — After High School

4.) What is your occupation? (Be as clear as possible - tell what kind of work you do, not whom you work for. If student, housewife, unemployed, or retired; please say so).

_____

5.) Check the category which includes your 1988 total household income before taxes.

_____ Less than $5,000	_____ $30,000 up to $40,000
_____ $5,000 up to $10,000	_____ $40,000 up to $50,000
_____ $10,000 up to $20,000	_____ $50,000 up to $60,000
_____ $20,000 up to $30,000	_____ $60,000 or greater

USE THE REMAINING SPACE FOR ANY COMMENTS YOU WOULD LIKE TO MAKE.

PLEASE MAIL THIS COMPLETED SURVEY IN THE SELF-ADDRESSED ENVELOPE. NO STAMP IS NEEDED, THE POSTAGE HAS ALREADY BEEN ATTACHED.

THANKS FOR YOUR HELP AND COOPERATION

UNIVERSITY OF TENNESSEE
DEPARTMENT OF FORESTRY, WILDLIFE, AND FISHERIES