MISCELLANEOUS PAPER R-80-1

RECREATION CARRYING CAPACITY FACTS AND CONSIDERATIONS

Title	Date
Report 1: Barkley Lock and Dam, Lake Barkley Project Area	Jul 1980
Report 2: Benbrook Lake Project Area	Jul 1980
Report 3: Hartwell Lake Project Area	Jul 1980
Report 4: Lake Ouachita Project Area	Jul 1980
Report 5: Lake Shelbyville Project Area	Jul 1980
Report 6: McNary Lock and Dam, Lake Wallula Project Area	Jul 1980
Report 7: Milford Lake Project Area	Jul 1980
Report 8: New Hogan Lake Project Area	Jul 1980
Report 9: Shenango River Lake Project Area	Jul 1980
Report 10: Somerville Lake Project Area	Jul 1980
Report 11: Surry Mountain Lake Project Area	Jul 1980

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This report provides selected recreation carrying capacity-related information for the Hartwell Lake Project. The information is based upon: 1) user and management surveys conducted at Hartwell Lake, and Urban Research and Development Corporation's observations and perceptions of the situations at the project's activity areas. The report provides information regarding activity situations, user characteristics, carrying capacity findings, and other findings; it then focuses on selected problem situations and their possible solutions.

PREFACE

This report presents the findings and recommendations of the Urban Research and Development Corporation (URDC) relative to recreational carrying capacity at the Hartwell Lake Project Area. Results of site analyses and user surveys are presented as they relate to existing carrying capacity conditions on the project. The study was conducted under Contract with the U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi, (Contract No. DACW39-78-C-0096).

Mr. Donald R. Detwiler, President of URDC, was Principal-In-Charge of this study, assisted by Mr. Martin C. Gilchrist, Executive Vice-President and Mr. David H. Humphrey, Vice-President. Mr. B. Thomas Palmer, Project Director, had the major responsibility for technical project direction; Messrs. Phillip D. Hunsberger and Paul L. Sabrosky were involved in the site analysis, conducting surveys, and the success analysis; and Mr. Timothy A. Fluck was involved in conducting surveys, survey analysis, and development of methodologies.

Mr. R. Scott Jackson, WES was the Project Monitor. Dr. Adolph Anderson, WES, was Program Manager of the Environmental Laboratory (EL) Recreation Research Program. The study was supervised by Dr. Conrad J. Kirby, Chief, Environmental Resources Division, EL, under the general supervision of Dr. John Harrison, Chief, EL.

COL John L. Cannon, CE, and COL Nelson P. Conover, CE, were Commanders and Directors of WES during this study. Technical Director was Mr. F. R. Brown.

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CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI)
UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
acres	4046.856	square metres
Fahrenheit degrees	5/9	Celsuis degrees or Kelvins
feet	0.3048	metres
horsepower (550 foot and pounds per second)	745.6999	watts
inches	2.54	centimetres
miles per hour (U. S. statute)	1.609344	kilometres per hour
miles (U. S. statute)	1.609344	kilometres
square feet	0.09290304	square metres
yards	0.9144	metres

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (5/9)(F - 32)$. To obtain Kelvin (K) readings, use $K = (5/9)(F - 32) + 273.15$.

PART 1: INTRODUCTION

RECREATION CARRYING CAPACITY FACTS AND CONSIDERATIONS

HARTWELL LAKE PROJECT AREA

PART 1: INTRODUCTION

This Report

Purpose

This report, prepared as the third in a series of the U. S. Army Engineer Waterways Experiment Station's (WES) Recreational Carrying Capacity Design and Management Study reports, provides selected carrying capacity-related information for the Hartwell Lake Project Area which cannot be found in the Technical Report. The information is based upon: 1) the user and management surveys conducted at Hartwell Lake, and 2) Urban Research and Development Corporation's (URDC) observations and perceptions of the situations at the project's study activity areas. Some observations and suggestions dealing with project area planning, design, and/or management are included, even though they are not specifically carrying capacity related. The report also suggests specific solutions and treatments of specific recreation activity areas.

The report first provides information regarding activity situations, user characteristics, carrying capacity findings, and other findings; it then focuses on selected problem situations and their possible solutions. Although suggestions regarding possible solutions to problems are included, this report is not intended to be a substitute for master planning or to provide answers to all project area capacity problems. Instead, this report should be viewed as a constructive, informative document which points out directions and techniques for consideration by project managers and designers in the near or distant future.

Relationship to Technical Report and Handbook

In addition to this Project Area Report and similar reports on the other ten study project areas,* the overall capacity study effort produced a Technical Report and a Capacity Handbook:

a. The Technical Report describes the overall study process, reports detailed study findings, and suggests and demonstrates methods and techniques for capacity management.

b. The Capacity Handbook is a more graphic, "how-to-do-it" type of report, designed to serve as a useful field tool for determining carrying capacity and applying techniques for capacity design and management.

This project area report is different from the Technical Report and Handbook in several ways: it includes information not found in the Technical Report and Capacity Handbook; it reports and examines user survey information by activity area and project area, rather than from the total survey population; it addresses specific problems and examines possible solutions; and it does not include the methodologies for determining and monitoring social and resource capacity. For these reasons, this report is intended to compliment the Technical Report and the Handbook, and is not intended to substitute for them.

Qualifications

The information in this report is based on the Management/Site Survey conducted on November 19-21, 1978 and the User Survey conducted on June 22-25, 1979 by Urban Research and Development Corporation (see Appendix B). The user survey information was collected over a one-weekend period, which may or may not have been representative of a typical or heavy use weekend at Hartwell Lake. Interviews were limited at some activity areas because of such factors as lack of users and weather conditions. For these reasons and because carrying capacity analysis is dynamic rather than static, this report is not intended to provide the final answers. Rather, it is a foundation for future analysis and carrying capacity progress.

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* See definition of "Study Project Area" in Appendix A for a listing of these project areas.

Summary Project Area Description*

Hartwell Lake** was authorized for the purposes of flood control and hydroelectric power generation. Located about midway between Charlotte, South Carolina and Atlanta, Georgia, the lake is in a region of rapidly growing population. This very large lake of 55,950 acres[§] has over 200 access points along the 962 mile shoreline and a total project area of over 80,000 acres. The Tugaloo arm of the lake is 49 miles long; the Seneca arm of the lake is 45 miles long. The Corps administers a narrow strip of land (averaging 200 feet in width) around the shoreline.

It is one of the most heavily used Corps lakes in the nation with a 1978 visitation of 11,420,500 recreation days, more than double that of the next highest lake studied. The topography around the reservoir is rugged, with slopes varying between five percent to over 25 percent in the upper reaches of the reservoir. Cut-over mixed pine and upland hardwood forests predominate. The climate is mild, with normal summer temperatures in the middle 80's (degrees F), and annual precipitation consists of 48 inches of rain and two inches of snow. Primary access to the project is via I-85. Encircling the reservoir and connecting with I-85 are numerous primary and secondary roads.

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* Appendix C contains a more detailed project area description for your future use.

** See map inside back cover.

§ A table of factors for converting U. S. customary units of measurement to metric (SI) units is found on page iv.

PART 2: SURVEY FINDINGS BY ACTIVITY

BOATING AND WATERSKIING

Orientation

Boating and waterskiing are popular activities at Hartwell. The lake's many islands, coves, and inlets are quite popular with boaters and picnickers. The water areas near ramps, marinas, and recreation areas receive heavy use, and the narrow configuration of portions of the lake result in areas where nodal carrying capacity problems exist. There are over 4000 private docks on the lake which make carrying capacity control and management unusually difficult. In some areas severe shoreline erosion exists; riprapping and bulk-heading are being used to stabilize this problem. Some user conflicts on the lake surface occur between sailboats and power boats, and between boaters and swimmers.

The findings presented in the remainder of this section are based on the User Survey. This survey obtained 24 responses from boaters and waterskiers at Hartwell Lake.

User characteristics

Table 1 indicates the characteristics of the boaters and waterskiers surveyed at Hartwell. The most significant differences in the characteristics of the boaters and waterskiers surveyed at Hartwell from those of other study project areas are the relatively large number coming from nearby areas and the relatively large proportion of power boats.

Table 1

Boater and Waterskier Characteristics

Age	Percent of Boaters/Waterskiers
<18	21*
18 - 25	42*
26 - 40	21
41 - 55	17
56 - 65	0
>65	0

Group Size	Percent of Boaters/Waterskiers
1	0
2	8**
3 - 4	46
5 - 8	33
9 - 12	13
>12	0

Travel Time to Project Area	Percent of Boaters/Waterskiers
<15 minutes	25
15 - 30 minutes	17
30 - 60 minutes	42*
1 - 2 hours	4**
2 - 3 hours	13**
3 - 5 hours	0
>5 hours	0

Visit Duration	Percent of Boaters/Waterskiers
1 - 4 hours	38
5 - 8 hours	46
1 day	8
2 days	4
3 days	0
4 days	0
5 - 7 days	0
>7 days	4

No. of Other Activities	Percent of Boaters/Waterskiers
0	17
1	13
2	17
3	21
4	17
5	8
6	8
>6	0

Equipment	Percent of Boaters/Waterskiers
Sailboat	5**
Canoe/Rowboat	0**
Power Boat (>25 h.p.)	95

*Significantly higher than total survey sample.
**Significantly lower than total survey sample.

User opinions

Spacing preferences - Tables 2 and 3 indicate the spacing that the boaters and waterskiers surveyed at Hartwell and elsewhere prefer.

Table 2

Preferred Distance Responses*

Sample	Sample Size	Range	Mean	Median	Mode
All Boaters Surveyed	135	30- a	531	300	300
Hartwell Lake	4	50-300	275	300	300
All Waterskiers Surveyed	95	30- a	520	300	300
Hartwell Lake	16	100-1500	431	300	300

*In feet; see Appendix A for definitions of terms.

a - response of "alone" or "out of sight."

Table 3

Preferred Distance Responses in Planning Range and Preference Groupings*

Sample	% in Planning Range[1] (100'-1500')	% in A[2] (100'-199')	% in B[2] (200'-450')	% in C[2] (451'-1500')
All Boaters Surveyed	79%	29%	37%	34%
Hartwell Lake	75	0	100	0
Sample	**% in Planning Range[1] (100'-1500')**	**% in A[2] (100'-199')**	**% in B[2] (200'-400')**	**% in C[2] (401'-1500')**
All Waterskiers Surveyed	91%	22%	50%	28%
Hartwell Lake	100	19	56	25

*See Appendix A for definitions of terms; see Technical Report for a full development of spacing preference information.

[1]Percentage of all preferred distance responses.

[2]Percentage of all preferred distance responses in the Planning Range.

Reasons for pleasant/unpleasant experience - Table 4 indicates the impact that different factors had on making the boating or waterskiing experience pleasant or unpleasant for users at Hartwell Lake. Distance from other people, amount/convenience of facilities, people being in areas where they shouldn't be, and car parking facilities were the factors most often cited as being unpleasant. None of these factors was so unpleasant as to cause a surveyed user to indicate that he would not return to the lake.

Tables 5 and 6 indicate the changes in the physical condition and people's use of the area reported by boaters and waterskiers from their previous visit.

Table 5

Positive and Negative Changes Noticed in the Physical Conditions of the Area - Items Mentioned by Boaters/Waterskiers

Area	Positive Changes	Negative Changes
Lake and Adjacent Areas	"Gate house" (1) "More development" (1)	"Shoreline erosion" (1)

NOTE: The number in parenthesis (#) indicates the number of times the change was mentioned.

Table 6

Positive and Negative Changes Noticed in the People's Use of the Area - Items Mentioned by Boaters/Waterskiers

Area	Positive Changes	Negative Changes
Lake and Adjacent Areas	"More people" (1)	"More boats" (2)

NOTE: The number in parenthesis (#) indicates the number of times the change was mentioned.

Table 4

Reasons Making Recreation Experience Pleasant or Unpleasant--Boating/Waterskiing
Hartwell Lake

Reasons	Percentage* of Users Responding:		
	Pleasant	Unpleasant	Not Important
General Reasons			
Characteristics and behavior of other people	88	4	4
Distance from other people	63	38	
Number of people in other visitor groups	71	13	8
Number and type of other activities occurring here	83	13	4
Scenic views	92	-	8
Noise	71	4	21
Accidents or near accidents	83	13	-
Enforcement of rules/regulations	83	17	-
Car parking facilities	75	21	-
Theft	83	13	-
Vandalism	79	17	-
Land-Based Reasons			
Amount of facilities (restrooms, water, etc.)	61	33	-
Convenience to facilities (restrooms, water, etc.)	72	22	-
Maintenance of facilities	94	-	-
Condition of trees and landscape	89	6	-
Condition of grass or soil	83	11	-
Water-Based Reasons			
Water quality	83	17	-
Formal designation of places for your activity	50	-	-
Waiting time to launch boat	57	4	-
People in areas they shouldn't be	63	29	4

*Percentages may not total 100% because of those responding "Does Not Apply."

Acceptability of techniques - Table 7 indicates the acceptability of different techniques for solving problems to the boaters and water-skiers surveyed at Hartwell Lake.

The acceptability of many techniques is very clear: at least 60 percent of the respondents agreed on one of the three levels of acceptability for 8 of the 17 techniques. However, even for those techniques which were acceptable to most respondents, up to 42 percent responded that these techniques were unacceptable. Thus, project managers should expect some expression of opposition to any technique which they employ.

In general, the more apparent and widespread that a problem of overcrowding or overuse is, the more likely users may accept a technique which addresses it. Thus, remedial techniques (which solve existing problems) are generally more acceptable than preventative techniques (which correct a problem before it becomes readily apparent).

The more users can understand the rationale and operation of a technique, the more likely they will accept the use of the technique. Education, therefore, would seem to be an important method of improving user acceptance of different techniques.

It also seems as though the more directly a technique impacts only the problem, and the less it operates to diminish recreational opportunities generally, the more likely users will accept the use of the technique. Thus, techniques which can be applied in the short-term or selectively to problem areas are favored (particularly if done in a crisis setting).

Techniques which call for reductions in existing opportunities to use recreational resources and facilities are strongly disfavored. User expectations of the opportunities available are critical in this determination. Consideration should be given initially to avoiding overdeveloping an area with the idea that selective cutbacks in services and facilities can be accomplished later. Users expectations will be based on the initial level, and subsequent reductions will be disfavored.

Table 7

User Acceptability of Techniques--Boating/Waterskiing
Hartwell Lake

Techniques	Levels of Acceptability Percentage* of Users Responding:		
	Very Acceptable	Mildly Acceptable	Unacceptable
General Planning Techniques			
Keep major recreation areas more separated	46	13	21
Make vehicle access to areas less convenient	8	8	79
Make area's existence less obvious	29	8	58
Site Planning Techniques			
Design for greater distance between people	17	4	8
Reduce number of parking spaces	38	8	54
Management Techniques			
Procedures:			
Require prior reservations	-	17	83
Require permits	17	25	58
Charge/increase fees	17	17	67
Rules and Regulations:			
Impose more rules	8	8	83
Provide stricter enforcement of rules	29	17	54
Close areas when natural resource destruction reaches critical point	79	13	8
Close areas when they become "too full"	63	17	20
Reduce number of activities in same area	42	8	42
Keep unnecessary vehicles out	63	8	4
Services:			
Provide more and better information	67	25	8
Increase maintenance and restoration	25	13	-
Reduce facilities and services	17	25	58

*Percentages may not total 100% because of those responding "Does Not Apply."

BOAT FISHING

Orientation

Sport fishing is a major attraction at Hartwell Lake. During the User Survey, interviews with boat fishermen were conducted on the lake surface in the general area between the Oconee Point and Twelve Mile recreation areas. Some user conflicts were observed between boaters and boat fishermen.

The findings presented in the remainder of this section are based on the User Survey. This survey obtained 15 responses from boat fishermen at Hartwell Lake.

User characteristics

Table 8 indicates the characteristics of the boat fishermen surveyed at Hartwell. The most significant differences in the characteristics of the boat fishermen surveyed at Hartwell from those of other study project areas are the relatively smaller typical group size and the relatively fewer fishermen participating in other activities.

Table 8

Boat Fisherman Characteristics

Age	Percent of Boat Fishermen	Group Size	Percent of Boat Fishermen
<18	7	1	13
18 - 25	13	2	53
26 - 40	27	3 - 4	27**
41 - 55	40	5 - 8	7**
56 - 65	7	9 - 12	0
>65	7	>12	0

Travel Time to Project Area	Percent of Boat Fishermen	Visit Duration	Percent of Boat Fishermen
<15 minutes	13	1 - 4 hours	27
15 - 30 minutes	33	5 - 8 hours	67
30 - 60 minutes	27	1 day	0
1 - 2 hours	13	2 days	0
2 - 3 hours	13	3 days	0
3 - 5 hours	0	4 days	0
>5 hours	0	5 - 7 days	7
		>7 days	0

No. of Other Activities	Percent of Boat Fishermen	Equipment	Percent of Boat Fishermen
0	60*	Power Boat (>25 h.p.)	100
1	20		
2	13**		
3	0**		
4	0		
5	7		
6	0		
>6	0		

*Significantly higher than total survey sample.
**Significantly lower than total survey sample.

User opinions

Spacing preferences - Tables 9 and 10 indicate the spacing that the boat fishermen surveyed at Hartwell and elsewhere prefer.

Table 9

Preferred Distance Responses*

Sample	Sample Size	Range	Mean	Median	Mode
All Boat Fishermen Surveyed	111	30 - 5280	555	200	100
Hartwell Lake	14	100 - 1500	765	750	1500

*In feet; See Appendix A for definitions of terms.

Table 10

Preferred Distance Responses in Planning Range and Preference Groupings*

Sample	% in Planning Range[1] (50'-1500')	% in A[2] (50'-199')	% in B[2] (200'-599')	% in C[2] (600'-1500')
All Boat Fishermen Surveyed	91%	49%	27%	24%
Hartwell Lake	100	21	14	64

*See Appendix A for definitions of terms; See Technical Report for a full development of spacing preference information.

[1]Percentage of all preferred distance responses.
[2]Percentage of all preferred distance responses in Planning Range.

Significantly more boat fishermen at Hartwell prefer group C spacing than at the other study project areas.

Reasons for pleasant/unpleasant experience - Table 11 indicates the impact that different factors had on making the boat fishing experience pleasant or unpleasant for users at Hartwell. "Catching fish," "convenience to facilities," and "distance from other people," were the factors which most often made the experience at Hartwell unpleasant. None of these factors was so unpleasant as to cause a boat fisherman to indicate that he would not return.

Tables 12 and 13 indicate the changes in the physical condition and people's use of the area by boat fishermen from their previous visit.

Table 12

Positive and Negative Changes Noticed in the Physical Conditions of the Area - Items Mentioned by Boat Fishermen

Area	Positive Changes	Negative Changes
Lake and Adjacent Areas	"Gate" (1)	(None mentioned)

NOTE: The number in parenthesis (#) indicates the number of times the change was mentioned.

Table 13

Positive and Negative Changes Noticed in the People's Use of the Area - Items Mentioned by Boat Fishermen

Area	Positive Changes	Negative Changes
Lake and Adjacent Areas	"Cleaner" (1) "More bass fishermen"(1)	(None mentioned)

NOTE: The number in parenthesis (#) indicates the number of times the change was mentioned.

Table 11

Reasons Making Recreation Experience Pleasant or Unpleasant--Boat Fishing
Hartwell Lake

Reasons	Percentage* of Users Responding:		
	Pleasant	Unpleasant	Not Important
General Reasons			
Characteristics and behavior of other people	93	7	-
Distance from other people	80	20	-
Number of people in other visitor groups	93	7	-
Number and type of other activities occurring here	93	7	-
Scenic views	100	-	-
Noise	93	-	7
Accidents or near accidents	87	13	-
Enforcement of rules/regulations	100	-	-
Car parking facilities	80	13	7
Theft	93	-	7
Vandalism	93	-	7
Land-Based Reasons			
Visual privacy from other people	33	-	60
Amount of facilities (restrooms, water, etc.)	87	13	-
Convenience to facilities (restrooms, water, etc.)	73	27	-
Maintenance of facilities	100	-	-
Condition of trees and landscape	100	-	-
Condition of grass or soil	100	-	-
Water-Based Reasons			
Water quality	100	-	-
Catching fish	53	33	-
People in areas they shouldn't be	93	7	-

*Percentages may not total 100% because of those responding "Does Not Apply."

Acceptability of techniques - Table 14 indicates the acceptability of different techniques for solving problems to the boat fishermen surveyed at Hartwell.

The acceptability of most techniques is very clear: at least 60 percent of the respondents agreed on one of the three levels of acceptability for 12 of the 17 techniques. However, even for those techniques which were acceptable to most respondents, up to 47 percent responded that these techniques were unacceptable. Thus, project managers should expect some expression of opposition to any technique which they employ.

Table 14

User Acceptability of Techniques--Boat Fishing
Hartwell Lake

Techniques	Levels of Acceptability Percentage* of Users Responding:		
	Very Acceptable	Mildly Acceptable	Unacceptable
General Planning Techniques			
Keep major recreation areas more separated	73	20	7
Make vehicle access to areas less convenient	47	27	27
Make area's existence less obvious	20	60	20
Site Planning Techniques			
Reduce number of parking spaces	53	-	47
Management Techniques			
Procedures:			
Require prior reservations	27	13	60
Require permits	13	27	60
Charge/increase fees	21	-	79
Rules and Regulations:			
Impose more rules	53	-	47
Provide stricter enforcement of rules	60	27	13
Close areas when natural resource destruction reaches critical point	73	13	13
Close areas when they become "too full"	43	36	21
Reduce number of activities in same area	73	20	7
Limit number of people in visitor groups	7	-	53
Keep unnecessary vehicles out	93	7	-
Services:			
Provide more and better information	100	-	-
Increase maintenance and restoration	93	7	-
Reduce facilities and services	33	-	67

*Percentages may not total 100% because of those responding "Does Not Apply."

BOAT LAUNCHING

Orientation

The Corps ramps are dispersed around the lake, have a high level of development, and each contains only one launching lane. During the User Survey, overcrowding and congestion were observed.

The findings presented in the remainder of this section are based on the User Survey. This survey obtained 17 responses from boat launchers at Twelve Mile Recreation Area.