

**PPRP-DC-3**

**PPRP**

**SURVEY OF NONCOMMERCIAL  
RECREATIONAL USE OF WHITEWATER  
IN THE UPPER YOUGHIOGHENY  
RIVER, 1996-1997**

JUNE 1998

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**MARYLAND POWER PLANT  
RESEARCH PROGRAM**

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The Maryland Department of Natural Resources (DNR) seeks to preserve, protect and enhance the living resources of the State. Working in partnership with the citizens of Maryland, this worthwhile goal will become a reality. This publication provides information that will increase your understanding of how DNR strives to reach that goal through its many diverse programs.

John R. Griffin  
Secretary  
Maryland Department of Natural Resources

**SURVEY OF NONCOMMERCIAL  
RECREATIONAL USE OF  
WHITEWATER IN THE UPPER  
YOUGHIOGHENY RIVER,  
1996-1997**

Prepared for

Maryland Department of Natural Resources  
Power Plant Research Program  
Tawes State Office Building, B-3  
Annapolis, MD 21401

Prepared by

Stephen P. Schreiner  
Versar, Inc.  
9200 Rumsey Road  
Columbia, MD 21045

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## **FOREWORD**

This final report, "Survey of Noncommercial Recreational Use of Whitewater in the Upper Youghiogheny River, 1996-1997," was prepared by Stephen P. Schreiner of Versar, Inc., at the request of Rich McLean of the Maryland Department of Natural Resources (MDNR). This report documents work done under tasks SSH-3 and DC-3 of PPRP Contract PR96-055-001.



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## ABSTRACT

Because the interests of various users of Deep Creek Lake's resources often conflict, a plan was developed during the relicensing and permitting process to find balanced solutions to a variety of complex environmental and recreational issues in conjunction with economical operation of the power plant. The plan developed requires operation of the hydroelectric plant to take best advantage of water releases for the benefit of all user groups, including enhancement of whitewater boating opportunities. In an attempt to measure the effectiveness of this plan for whitewater boating opportunities, this survey of private (non-commercial) whitewater boating in the Upper Youghiogheny River, starting at Sang Run, Maryland, was conducted in 1996 and 1997 to measure use of the river relative to operation of the Deep Creek Hydroelectric Station as regulated by its Water Appropriations and Use Permit from the State of Maryland. Based on results of this study and others, the permit may be modified in the future to provide the most balanced benefits to all users of the Deep Creek Project.

The survey counted a total of 2,356 boaters from June 7 to October 14, 1996 and 4,249 boaters from April 18 to October 13, 1997. The total number of private boaters projected for the entire boating season (April 15 through October 15) was 3,510 for 1996 and 4,398 for 1997, when adjusted for days not surveyed. In comparison, there were 3,050 and 3,356 commercial raft customers reported for 1996 and 1997, respectively. Seventy-seven percent of boaters used the scheduled whitewater releases in 1996 while over 97% used these releases in 1997, a year in which fewer days were available with boatable natural flows or other scheduled and announced releases. Only a small percentage used natural flows, temperature enhancement releases, or other unscheduled releases. Most boaters surveyed reside in Maryland, Ohio, Pennsylvania, or West Virginia. A total of 41 states including the District of Columbia and 11 foreign countries were represented.

Because most scheduled whitewater releases occur on Mondays and Fridays, most use occurred on those days, regardless of whether or not these days were on holiday weekends. Use was very high on holiday weekends, with the highest average occurring on holiday Saturdays in 1997 (131 boaters per day). The maximum number of boaters on a single day occurred on July 19, 1997 (170 boaters in 154 boats of all types). Based on the numbers of commercial rafters reported for the last 7 years, usage of the Upper Youghiogheny River by commercial boaters appears to be relatively stable and not increasing in total numbers. No conclusive statements can be made regarding total annual usage patterns of the river by private boaters, based on results of this survey and two previous surveys. However, peak daily usage was greater in 1997 than in earlier years sampled (1988, 1995 and 1996).





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## 1.0 INTRODUCTION

Since its construction, Deep Creek Lake has evolved as the centerpiece of tourism in western Maryland. Discharges from the Deep Creek Hydroelectric Station enter the Youghiogheny River. This water discharge has the potential to effect lake-side recreation through changes in the lake's water level, as well as the downstream environment of the river. The Youghiogheny River is Maryland's only designated 'wild' river — it supports a developing trout fishery as well as one of the most challenging kayaking and rafting runs in the country. Because the interests of various users of Deep Creek Lake's resources are potentially conflicting, a plan was developed during the relicensing and permitting process to find balanced solutions to a variety of complex environmental and recreational issues in conjunction with economical operation of the power plant. The plan developed requires operation of the hydroelectric plant to take best advantage of water releases for the benefit of all user groups, including enhancement of whitewater boating opportunities.

The plan is implemented through the Water Appropriation and Use Permit for the Deep Creek Station (Permit No. GA92S009(01)), which requires the Pennsylvania Electric Company (Penelec) to release or retain water for various in-lake and downstream uses, including enhancement of whitewater recreation opportunities in the Upper Youghiogheny River. Penelec must make fixed, scheduled releases every Friday and Monday and one Saturday per month during the whitewater recreation season (April 15 to October 15). These releases are to last at least 3 hours when sufficient water is available, and they cannot be curtailed unless the lake level is 1 foot or more below the lower operating rule band (for Friday releases) or below the lower rule band (for Monday and Saturday releases). Reduced releases or shut-downs are required during certain hours when natural flows are navigable and when generation releases would result in river flows too high for boating. The permit provides for special whitewater releases on other occasions. The permit also requires Penelec to make releases to maintain river water temperature below 25°C for trout habitat during the summer. A protocol has been developed to determine when these releases may be needed and to provide 2 to 6 hours notice when a release will be made (Penelec 1995; PPRP 1998), so whitewater boaters can take advantage of them.

Whitewater rafting by commercial companies on the upper Youghiogheny River is controlled by state regulations. These regulations limit the number of rafts to 33 rafts per day when the release is less than 3 hours long and to 51 rafts per day when there is sufficient natural flow or when the release is at least 3 hours long. Commercial operators (those who charge a fee to guide customers down the river) must obtain a permit for a certain number of rafts that they may take down the river and must report each month on the actual usage for each day. Private (noncommercial) boaters, however, do not need a permit to run the river, and little information is available on their usage of the river, particularly as related to Penelec's current permit conditions for operating the power plant. Some information is available in Graefe et al. (1989) and a survey conducted in 1995 by the Maryland Department of Natural Resources (MDNR), Deep Creek Lake Recreation Area (Appendix A). However, information is particularly lacking on the rates of utilization of the river in relation to natural flow levels,

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hydroelectric project operations, advance notification of releases, weekend/holiday/weekday periods, and the river's recreational carrying capacity.

This study measured noncommercial usage (private persons using the river for recreation and not paying a guide fee) of the upper Youghiogheny River in relation to operation of the Deep Creek Station. Information was also collected on general demographics of the user population and usage of the publicly-available telephone recording of releases from the station. This study focused on whitewater boating starting at Sang Run and does not include usage upstream or downstream of that location.

## **2.0 METHODS**

The boating survey was conducted at the noncommercial put-in at Sang Run because this is the primary location that boaters use to access the river. The survey was designed to include all dates from June 7 to October 15, 1996, and April 15 to October 15, 1997 when there was a release from Deep Creek Station usable for whitewater boating (between the hours of 0600 to 1300 at the station) or when the natural flow in the river was suitable for whitewater boating (greater than about 300 cfs at Oakland or about 1.9 feet on the Sang Run gage; see Table 11).

The survey was directed and coordinated by the MDNR Deep Creek Lake Recreation Area office, under the direct supervision of Mr. Dave Baker. A 1- or 2-person field crew conducted the Youghiogheny River boating survey using the data recording sheets shown in Figures 1 through 4. The field crew recorded information on the total number of boats and other information about the users. Scheduling of the crew was at the discretion of the area supervisor, using the following guidelines. Both crew members participated in the survey on days with a scheduled whitewater release from the project (Fridays, Mondays, designated Saturdays, and other special days as listed in Table 1). One or both crew members may have been present (at the discretion of the area supervisor) on other weekend days when the natural flow was boatable. Only one crew person was required to be present at the site to conduct the survey on days without scheduled whitewater releases, or when the natural flow was boatable on weekdays. The crew person scheduled to collect survey data on dates without a scheduled whitewater release was instructed to call Penelec's information recording to obtain the release schedule for that day. The schedule also was checked daily (including weekends) for releases that were not otherwise scheduled in advance (i.e., temperature enhancement releases and emergency generation releases). During the months of June through August and on dates without a scheduled release, the recording was checked at 0730, 0930, and 1130 to find out if a temperature enhancement release had been scheduled; if so, a survey was made on that date.

**UPPER YOUGHIOGHENY RIVER  
RECREATIONAL BOATING CENSUS - QUESTIONNAIRE**

Name of surveyor: \_\_\_\_\_

1. Date: \_\_\_\_\_ 2. Time: \_\_\_\_\_

3. Type of boat: Raft  Canoe  Kayak

4. Interviewee: Leader  Crew

5. Sex: M F (circle)

6. Age:            <18    18-25   25-35   36-45   46-55   >55  
                                                             

7. Place, state (or country) of residence: \_\_\_\_\_

8. What distance (miles) did you travel to reach the river:

< 1       
1-5       
6-10      
> 10   

9. Did you call in advance to confirm release ? Y N (circle)

10. Number of individual trips in the past:

first trip  
2-10      
11-20     
21-50     
50+    

11. How often do you use the river for fishing:

Never              
weekly     
monthly           
yearly             
less              

12. Number of additional passengers:

Figure 1. Upper Youghiogheny River recreational boating census — questionnaire form for 1996



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**UPPER YOUGHIOGHENY RIVER  
RECREATIONAL BOATING CENSUS - SUMMARY SHEET**

Name of surveyor: \_\_\_\_\_

1. Date: \_\_\_\_\_ 2. Time: \_\_\_\_\_

3. Weather: [ ] 1=sunny; 2=partly cloudy; 3=mostly cloudy; 4=rainy

4. Total Number of Vessels by Type:

Rafts: \_\_\_\_\_

Canoe: \_\_\_\_\_

Kayak: \_\_\_\_\_

5. Total number of People by Vessel Type:

Rafts : \_\_\_\_\_

Canoes : \_\_\_\_\_

Kayaks : \_\_\_\_\_

6. Scheduled release: Y N (Circle)

Figure 2. Upper Youghiogheny River recreational boating census — summary sheet for 1996



**UPPER YOUGHIOGHENY RIVER  
RECREATIONAL BOATING CENSUS - SUMMARY SHEET 1997**

Name of surveyor: \_\_\_\_\_

1. Date: \_\_\_\_\_

2. Release time on recording (0730-0830) \_\_\_\_\_ Time called: \_\_\_\_\_

Release time on recording (0930-0945) \_\_\_\_\_ Time called: \_\_\_\_\_

Release time on recording (1115-1130) \_\_\_\_\_ Time called: \_\_\_\_\_

3. Sang Run Gage Reading at start of survey (feet) \_\_\_\_\_ Time: \_\_\_\_\_

4. Weather: [ ] 1=sunny; 2=partly cloudy; 3=mostly cloudy; 4=rainy

5. Total Number of Vessels by Type:

Kayak: \_\_\_\_\_

Raft: \_\_\_\_\_

Decked Canoe: \_\_\_\_\_

Open Canoe: \_\_\_\_\_

6. Total number of People by Vessel Type:

Kayak: \_\_\_\_\_

Raft: \_\_\_\_\_

Decked Canoe: \_\_\_\_\_

Open Canoe: \_\_\_\_\_

7. Scheduled release: Y N (Circle)

8. Sang Run Gage Reading at end of survey (feet) \_\_\_\_\_ Time: \_\_\_\_\_

Figure 4. Upper Youghiogheny River recreational boating census — summary sheet for 1997

Table 1. Schedule of Saturday and special whitewater releases (release times listed in Appendix B)	
1996	1997
Saturday, May 4	Saturday, April 26
Saturday, May 25	Saturday, May 3
Saturday, June 1	Saturday, May 24
Thursday, July 4	Saturday, June 7
Saturday, July 6	Saturday, June 21
Saturday, July 20	Saturday, July 5 (4 hours)
Wednesday, July 31 [high river levels, not boatable]	Saturday, July 19
Saturday, August 3	Saturday, August 2
Thursday, August 29 (6 hours for Upper Youghiogheny race)	Thursday, August 21 (6 hours for Upper Youghiogheny race)
Saturday, August 31	Saturday, August 30 (4 hours)
Tuesday-Thursday, October 1-3 (week following Gauley River festival)	Saturday, September 6
Saturday, October 5	Tuesday-Thursday, September 23-25 (Gauley River festival)
	Saturday October 4

On days when releases from Deep Creek Station provided boatable flows, crew person(s) were present 1 hour before the release reached Sang Run until 1 hour before the flow ended at Sang Run (see Table 11 for the definition of boatable flows). The crew was not required to be present before 0800 hours or after 1500 hours, except when requested by the area supervisor. (For a typical whitewater release scheduled from 1000 to 1300 hours, the crew was scheduled to be present at the site to collect survey information from 1030 to 1430.) On days when the natural river flow was boatable, the crew was present between 0800 and 1400 hours, or other hours as determined by the area supervisor to collect an accurate survey of river usage on that day. Days that were not surveyed but which may have had noncommercial whitewater boaters (based on commercial rafting records) were July 24, July 30, August 31, September 14, and September 28, in 1996 and April 26, May 15, June 25, August 4, and September 2, 1997. Of these dates, August 31, 1996 and April 26 and August 4, 1997 had scheduled whitewater releases. There is no record of whether the telephone recording provided an announcement of releases on the remaining dates.

For the purposes of this survey releases were categorized into five general types: (1) no release; (2) release scheduled for whitewater (generally every Monday, Friday, and

designated days as listed in Table 1, unless water levels were too high for boating); (3) release for temperature enhancement (from June 1 through August 31 as provided by the protocol designated in permit condition 16); (4) other scheduled release (generally those announced several hours in advance on Penelec's telephone recording but not included in 2 above); and (5) unscheduled releases (those releases not announced in advance or those for which there is no record of whether it was announced on the recording).

No information on commercial rafters was collected as part of this study, but daily numbers of commercial rafts and customers were obtained from permit reports submitted to DNR. These numbers are summarized in Table 2, and the details are included in Appendix B. Table 3 lists the number of commercial rafts for the years 1991 through 1997.

Table 2. Summary of commercial rafters (April 15 to October 15) based on permit reports submitted to DNR.		
	1996	1997
Rafts	1115	1198
Customers	3050	3356
Total People (assuming 1 guide per raft)	4165	4454
Customers per raft	2.7	2.8
People per raft	3.7	3.8

Table 3. Number of commercial rafts by year based on permit reports submitted to DNR			
Year	Number of Rafts	Year	Number of Rafts
1991	1078	1995	1223
1992	1121	1996	1115
1993	1218	1997	1198
1994	1315		

### 3.0 RESULTS

Table 4 shows that most noncommercial boaters surveyed were kayakers (85% to 86%), followed by rafters (11%) and canoers (3% to 4% — these were primarily decked canoes or C2's); these results were based on the raw survey data, without adjusting for the days when a survey was not made. Using the survey data, estimates were also made for

total usage of the river during the 1996 and 1997 seasons by private boaters, adjusted based on flow criteria, day-of-week averages, and other criteria listed in Appendix B; these estimates are listed for each day. The total number of noncommercial boaters estimated to have run the upper Youghiogheny was 3,510 in 1996 and 4,398 in 1997, as compared with 3,050 and 3,356 commercial raft customers in 1996 and 1997, respectively. Total usage on the river (including guides), therefore, is estimated as 7,675 for 1996 and 8,952 for 1997. Estimates for June through August in 1995 were 1,860 private boaters (see Appendix A). In comparison, private boater counts for the same three months in 1996 and 1997 were 1,612 and 2,446, respectively. Graefe et al. (1989) estimated that a total of 10,000 boaters ran the upper Youghiogheny during 1988, of which approximately 6,400 were rafters (about 90% commercial) and 3,600 that were kayakers or users of watercraft other than rafts. This estimate of commercial rafters is much higher than the number counted since then (Table 3), although the estimated number of kayakers is similar for 1996 and 1997. Graefe et al.'s estimate of private boaters is based on only 26 days of sampling in 1988 between August 15 and October 14 and on the assumption that rafters represented 64% of total boaters with the remainder being other watercraft, mostly kayaks. Thus, their estimate contains much more uncertainty than the present survey.

From a hydrologic standpoint, the summer months of 1996 were the second wettest on record while the summer of 1997 was close to the long-term average (Table C-1). Results presented for 1996 reflect what would occur in a very wet year while those for 1997 reflect what would occur in an average year. Results from Graefe et al. (1989) were based on sampling conducted in 1988 (the 6th driest summer). It is important to note that other, more difficult to measure, variables may affect river usage, including economic factors, expanding opportunities, and availability of water at other rivers (resulting in a reduction in repeat rate for users), as well as other reasons. Thus, it is not possible to make any conclusions about trends in the numbers of private boaters between years, based on these results.

Table 4. Summary of number of noncommercial boats and boaters surveyed				
Boat Type	Canoe	Kayak	Raft	Total
<b>1996 (June to October)</b>				
No. of Boats	90	1,994	126	2,210
No. of People	92	1,994	270	2,356
Avg. Boaters/Boat	1.02	1	2.1	—
<b>1997 (April to October)</b>				
No. of Boats	110	3,670	211	3,991
No. of People	113	3,670	466	4,249
Avg. Boaters/Boat	1.03	1	2.2	--

The remaining results described here were obtained by analyzing the raw data without adjusting for days that were not surveyed. These results show that boaters were predominantly adult males (Table 5) and with the greatest number in the age 26 to 35 category (Table 6). More than 67% of boaters had been down the river more than 10 times (Table 7). Very few boaters fished in the Youghiogheny River (Table 8).

Table 5. Summary of number of boaters by gender				
	1996 Number	1997 Number	1996 Percent	1997 Percent
Female	266	394	11.3	9.3
Male	2,053	3,769	87.1	86.6
Not Recorded	37	86	1.6	2.0

Table 6. Summary of number of boaters by age class				
Age Class	1996 Number	1997 Number	1996 Percent	1997 Percent
< 18	28	41	1.2	1.0
18 to 25	505	873	21.4	20.5
26 to 35	1076	1,487	45.7	35.0
36 to 45	565	1,226	24	28.9
46 to 55	126	336	5.3	7.9
> 55	25	91	1.1	2.1
Not Recorded	31	195	1.3	4.6

Table 7. Summary of number of boaters by experience level				
Number of Past Trips	1996 Number	1997 Number	1996 Percent	1997 Percent
1	92	331	4	8
2 to 10	531	948	23	22
11 to 20	526	420	22	10
21 to 50	451	795	19	19
> 50	729	1,619	31	38
Not Recorded	27	136	1	3

Table 8. Summary of number of boaters by fishing frequency				
Fishing Frequency	1996 Number	1997 Number	1996 Percent	1997 Percent
Never	2261	3,955	96	93.1
Weekly	3	21	0.1	0.4
Monthly	11	21	0.5	0.4
Yearly	31	40	1.3	0.9
Less than Yearly	26	11	1.1	0.3
Not Recorded	24	201	1	4.7

Table 9 lists the number of boaters by day of week. Days of week were also subdivided into those which occurred on or near a holiday weekend; holiday weekends and weekdays during the surveyed period are defined here as including Memorial Day weekend, July 4th weekend, Labor Day weekend, and Columbus Day weekend. These results show the greatest percentage of users on Mondays and Fridays, regardless of holiday status. This result was expected because most scheduled whitewater releases occur on those days. There were fewer numbers and percentages of boaters during midweek days in 1997 than in 1996, since there were fewer announced releases for temperature enhancement and fewer days of boatable natural flows on these days in 1997 as compared with 1996 (see footnote on page 15). Table 10 lists the number of boaters by month, for each year. These results show a 25% (for August) to 85% (for September) increase in boaters for the months of July through October 1997, as compared with these months in 1996.

Table 11 shows the boating suitability of natural flows in the Youghiogheny River at various locations based on previous studies. This information was used to categorize which days had natural flow suitable for whitewater boating (not too low or too high). Flow values used for this analysis were the instantaneous values at 1200 hours on each day, rather than the daily average. The noon value is more representative of the flow experienced by a whitewater boater during the day than the daily average, especially during rising or falling water levels. This information was also used to determine which days became suitable for boating with a release from Deep Creek Station (natural flow too low) and which days became unsuitable for boating because the release resulted in a flow that was too high.

Table 12 confirms that the boating suitability of flows listed in Table 11 are largely accurate. Only a small number of private boaters surveyed for this study used the river in 1996 or 1997 at natural flows less than 459 cfs above Deep Creek Station. The lowest flow used by private boaters in either year was 389 cfs on September 12, 1996, consisting of only baseflow above the power plant and no release. The lowest flow used by commercial rafters in 1996 was recorded on April 27, equivalent to 299 cfs at the power plant with no release. The lowest flow used by commercial rafters in 1997 was recorded on May 5, equivalent to 271 cfs above the power plant, with no release. This flow was probably utilized only because the scheduled whitewater release was cancelled without notification. Field notes indicate



Day of Week	Total				Holiday				Non-holiday			
	Total Number of Boaters		%		Number		%		Number		%	
	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
Sunday *	198	0	8.4	0	0	0	0	0	198	0	11.5	0
Monday	674	963	28.6	22.7	205	265	32.4	25.1	469	698	27.2	21.9
Tuesday	110	59	4.7	1.4	-	-	-	-	110	59	6.4	1.8
Wednesday	87	136	3.7	3.2	-	-	-	-	87	136	5	4.3
Thursday	271	156	11.5	3.7	76	-	12	0	195	156	11.3	4.9
Friday	682	1,684	28.9	39.6	268	400	42.4	37.8	414	1,284	24	40.2
Saturday	334	1,251	14.2	29.4	83	392	13.1	37.1	251	859	14.6	26.9
TOTAL	2,356	4,249	100	100	632	1,057	99.9	100	1,724	3,192	100	100

\* In 1997, no Sundays were surveyed but there could have been boaters on two dates. On the remaining four Sundays there were 4 unannounced temperature enhancement releases. See Appendix B for details.

that private boaters chose not to run the river at this flow but some commercial rafters did. Most private boaters (about 81% in 1996 and 95% in 1997) used flows between 459 and 998 cfs; only 16% in 1996 and 5% in 1997 boated when flow was between 998 and 1,928 cfs, and only 13 and 6 individual private boaters used flows greater than 1,928 cfs in 1996 and 1997, respectively. The highest flow used by private boaters was 2,190 cfs, on September 19, 1996. Commercial rafters used a greater percentage of the larger flow category: 64% in 1996 and 88% in 1997 rafted on flows between 459 and 998 cfs, and 34% in 1996 and 11% in 1997 used flows between 998 and 1928 cfs. Less than 2% of all rafters rafted when the flow exceeded 1,928 cfs.

Month	Total			
	Total Number of Boaters		%	
	1996	1997	1996	1997
April (15-30)	not surveyed	102	-	2
May	not surveyed	446	-	10
June	264 *	644	11	15
July	626	901	27	21
August	722	901	31	21
September	502	927	21	22
October (1-15)	242	328	10	8
TOTAL	2,356	4,249	100	99

\* Starting June 7, 1996.

Suitability	Flow at Oakland (cfs)	Flow Above Deep Creek Station (cfs)	Flow at Friendsville (cfs)	Sang Run Gage (ft)
Flow too low, most boaters	< 325	< 459	< 600	1.9
Flow OK, most boaters	325 - 724	459 - 998	600 - 1300	1.9 - 2.5
Flow OK, expert boaters only	724 - 1427	998 - 1928	1300 - 2500	2.5 - 2.9
Flow too high, most boaters	> 1427	> 1928	> 2500	> 2.9

Table 12. Summary of boatable flow groups by boat types									
Flow Group	Flow Range	Persons by Boat Type							
		Private Raft		Canoe		Kayak		Commercial Raft Customers	
		1996	1997	1996	1997	1996	1997	1996	1997
1	< 459	0	4	4	0	43	18	4	26
2	459-998	224	435	79	112	1,608	3,454	1,885	2,939
3	998-1928	46	27	9	1	330	192	1010	365
4	> 1928	0	0	0	0	13	6	47	26
TOTAL		270	466	92	113	1,994	3,650	2,946	3,356

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Tables 13a and 13b shows the same data as Table 9 but with the number of boaters normalized based on the number of boatable days as defined in Table 11 and listed in Appendix B. The greatest number of boaters per day occurred on Mondays, Fridays, and Saturdays because scheduled releases for whitewater occurred most frequently on these days. This pattern is maintained on nonholiday Mondays, Fridays, and Saturdays, but with somewhat fewer boaters per day. There were greater numbers of boaters per day in 1997 as compared with 1996 for all days of the week but especially on Mondays, Fridays, and Saturdays. Use was very high on holiday weekends, with the highest average of 131 boaters per day on holiday Saturdays on 1997 (see Appendix B). The maximum number of private boaters on a single day occurred on July 19, 1997, with 170 boaters in 154 boats of all types. In comparison, the greatest number of private boaters in 1996 was 136 in 1996 (July 5) and 150 in 1995 (July 4 - see Appendix A); private boaters were not counted separately in 1988. The greatest number of kayakers on a single day was 145, 121, and 89 in 1997, 1996 and 1988, respectively (the number of kayakers was not recording separately in 1995). These results seem to indicate greater peak usage by private boaters in 1995 to 1997 as compared with 1988. Fluctuations in usage in the three recent years may have been the result of less availability of natural flows for whitewater on other area rivers in 1995 and 1997, as compared with 1996, resulting in greater use of the Upper Youghiogheny in drier years.

Table 14 shows that nearly 78% of boaters used the scheduled whitewater releases in 1996; most of the rest used other scheduled releases that year. A small percentage of boaters used natural flows, temperature enhancement releases, or other unscheduled releases. These results are probably somewhat skewed by the fact that 1996 was such a wet year. This condition led to only 8 temperature enhancement releases and more days of boatable natural flow. Even when adjusted for the number of boatable days, about 41 boaters per day used scheduled whitewater releases, more than twice the rate of other scheduled releases. In 1997, there was no notification of temperature enhancement releases, very few other scheduled releases, and only a few days with natural boatable flow. Thus, over 97% of boaters used the scheduled whitewater releases, which was the primary type available<sup>1</sup>.

More than 90% of boaters travel greater than 10 miles to get to the river (Table 15a). Boaters who live close to the river can more easily take advantage of the unscheduled and temperature enhancement releases (which generally have 2 to 6 hours notice) because they can get to the put-in site quickly. This element of the survey was expanded in 1997 to include more detailed information on the distance travelled to the site as shown in Figure 3. Results shown in Table 15b shows that the majority of users are within 300 miles of the river but that a substantial number (more than 20%) travel more than 300 miles.

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<sup>1</sup>In 1996, all but one of the 8 temperature enhancement releases were announced as required by the release protocol. All but two of these releases were determined prior to 1200, requiring an announcement of the release on the telephone recording. In contrast, there were 13 temperature releases in 1997, of which none were announced on the recording. Of these 13 releases, 8 were determined after 1100 and were not required to be announced on the recording. The remaining 5 releases were determined prior to 1200 hours and should have been announced on the recording. Penelec has stated that it intends to improve its ability to provide timely announcements of temperature releases and other unscheduled releases which are potentially usable by whitewater boaters.

Day of Week	Total			Holiday			Non-holiday		
	Number of Boaters	Boatable Days Surveyed	Number per Day	Number	Boatable Days Surveyed	Number per Day	Number	Boatable Days Surveyed	Number per Day
Sunday	198	7	28	0	0	-	198	7	28
Monday	674	18	37	205	3	68	469	15	31
Tuesday	110	7	16	-	-	-	110	7	16
Wednesday	87	6	15	-	-	-	87	6	15
Thursday	271	9	30	76	1	76	195	8	24
Friday	682	17	40	268	3	89	414	14	30
Saturday *	334	9	37	83	1	83	251	8	31
Total	2356	73	32	632	8	79	1724	65	27

\* Survey not taken on Saturday August 31, so holiday numbers based on only Saturday July 6.

Day of Week	Total			Holiday			Non-holiday		
	Number of Boaters	Boatable Days Surveyed	Number per Day	Number	Boatable Days Surveyed	Number per Day	Number	Boatable Days Surveyed	Number per Day
Sunday	0	0	0	0	0	0	0	0	0
Monday	963	23	42	265	3	88	698	20	35
Tuesday	59	5	12	-	-	-	59	5	12
Wednesday	136	5	27	-	-	-	136	5	27
Thursday	156	7	22	-	-	-	156	7	22
Friday	1,684	26	65	400	4	100	1,284	22	58
Saturday	1,251	11	114	392	3	131	859	8	107
Total	4,249	77	55	1,057	10	106	3,192	67	48

Table 13b. Number of boaters surveyed by day of week in 1997 normalized by the number of boatable days surveyed (as defined in Table 11 and listed in Appendix B).

Release Type	Number		Percent		Number of Boatable Days		Average Boaters per Day	
	1996	1997	1996	1997	1996	1997	1996	1997
None	12	41	0.5	1.0	4	5	3	8
Whitewater Scheduled	1830	4132	77.7	97.2	45	63	41	66
Other Scheduled	388	76	16.5	1.8	22	9	18	8
Temperature Enhancement	39	0	1.7	0	8	6	5	0
Unscheduled	87	0	3.7	0	16	9	5	0

Miles Travelled	Number	Percent
< 1	3	0.1
1 to 5	95	4
6 to 10	105	4.5
> 10	2129	90.4
Not Recorded	24	1

Miles Travelled	Number	Percent
< 10	81	1.9
10 to 100	900	21.2
101 to 300	1895	44.6
301 to 500	360	8.5
> 500	569	13.4
Not Recorded	444	10.5

As listed in Table 16a and 16b, most boaters are from Maryland or other nearby states (Pennsylvania, West Virginia, Ohio, and Virginia each had more than 5% of all boaters visiting the Youghiogheny). A total of 41 states including the District of Columbia were represented. Visitors from 11 foreign countries (Canada — 92; France — 10; New Zealand — 8; England — 7; Denmark and Germany — 4 each; Ireland — 3; Australia and Costa Rica — 2 each; Portugal and Switzerland — 1) were also represented.

Table 17 shows that nearly 60% of boaters called Penelec's recording in 1996 to confirm that a release would occur on the day of their planned trip but only 21% did so in 1997; this is probably because the vast majority of boatable days in 1997 occurred on days with scheduled whitewater releases. As expected, boaters who used the temperature enhancement releases (1996 only) called to confirm a release the greatest percentage of the time, followed by boaters using other scheduled releases (Table 18a and 18b). The smallest percentage of boaters who called to confirm a release used the natural flows.

Rank	State	Number	Percent	Rank	State	Number	Percent
1	MD	580	24.6	21	TX	10	0.4
2	PA	528	22.4	22	OR	8	0.3
3	WV	262	11.1	23	MA	7	0.3
4	OH	203	8.6	24	NM	7	0.3
5	VA	176	7.5	25	AR	6	0.3
6	NC	75	3.2	26	KY	6	0.3
7	DC	54	2.3	27	NH	6	0.3
8	CO	52	2.2	28	WY	6	0.3
9	NY	34	1.4	29	IA	5	0.2
10	IN	33	1.4	30	WI	5	0.2
11	NJ	32	1.4	31	FL	4	0.2
12	TN	32	1.4	32	MT	4	0.2
13	GA	25	1.1	33	MN	3	0.1
14	MI	23	1	34	MS	3	0.1
15	VT	21	0.9	35	AK	2	0.1
16	ID	16	0.7	36	CA	2	0.1
17	IL	16	0.7	37	MO	2	0.1
18	ME	14	0.6	38	AZ	1	< 0.1
19	CT	13	0.6	39	NV	1	< 0.1
20	SC	13	0.6				



Rank	State	Number	Percent	Rank	State	Number	Percent
1	PA	1078	28.1	22	MA	17	0.4
2	MD	756	19.7	23	IL	12	0.3
3	WV	607	15.8	24	NM	11	0.3
4	OH	298	7.8	25	WI	11	0.3
5	VA	298	7.8	26	FL	10	0.3
6	CO	79	2.1	27	MN	10	0.3
7	NJ	79	2.1	28	LA	9	0.2
8	NC	69	1.8	29	OR	9	0.2
9	TN	52	1.4	30	IA	7	0.2
10	GA	49	1.3	31	ID	7	0.2
11	NY	48	1.3	32	NH	6	0.2
12	TN	46	1.2	33	AK	5	0.1
13	CT	44	1.1	34	WY	5	0.1
14	ME	39	1.0	35	AL	3	0.1
15	MI	32	0.8	36	AZ	1	< 0.1
16	SC	32	0.8	37	HI	1	< 0.1
17	KY	23	0.6	38	KS	1	< 0.1
18	VT	22	0.6	39	MS	1	< 0.1
19	CA	20	0.5	40	ND	1	< 0.1
20	DC	20	0.5	41	TX	1	< 0.1
21	MO	20	0.5				

Release Confirmed	Number		Percent	
	1996	1997	1996	1997
No	935	3239	40	76
Yes	1390	874	59	21
Not Recorded	31	136	1	3

Table 18a. Summary of release confirmation by release type in 1996										
Release Confirmed	No Release		Whitewater		Other Scheduled		Temperature Enhancement		Unscheduled	
	No.	%	No.	%	No.	%	No.	%	No.	%
No	8	67	773	42	100	25	8	21	46	53
Yes	4	33	1032	56	286	74	31	80	37	43
Not Recorded	0	0	25	1	2	1	0		4	5
Total	12		1830		388		39		87	

Table 18b. Summary of release confirmation by release type in 1997										
Release Confirmed	No Release		Whitewater		Other Scheduled		Temperature Enhancement		Unscheduled	
	No.	%	No.	%	No.	%	No.	%	No.	%
No	16	39	3172	78	51	67	0	0	0	0
Yes	24	59	825	20	25	33	0	0	0	0
Not Recorded	1	2	54	1	0	0	0	0	0	0
Total	41		4051		76		0		0	

#### 4.0 SUMMARY AND CONCLUSIONS

The survey of private whitewater boating counted a total of 2,356 boaters (92 in canoes, 1,994 in kayaks, and 270 in rafts) from June 7 to October 14, 1996, and 4,249 boaters (113 in canoes, 3,670 in kayaks and 466 in rafts) from April 18 to October 13, 1997. The total number of private boaters projected for each boating season (April 15 through October 15) was 3,510 for 1996 and 4,398 for 1997, when adjusted for days not surveyed. In comparison, there were 3,050 commercial raft customers reported in a total of 1,115 rafts in 1996 and 3,356 customers in 1,198 rafts in 1997. Seventy-seven percent of boaters used the scheduled whitewater releases in 1996, while over 97% of boaters used these releases in 1997, a year in which fewer days were available with boatable natural flows or other scheduled and announced releases. Only a small percentage of boaters used natural flows, temperature enhancement releases, or other unscheduled releases. Results for 1996 were affected by the second wettest summer on record since 1942; 1997 results were for an average year in terms of natural flow during the summer months.

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Because most scheduled whitewater releases occur on Mondays and Fridays, most use occurred on those days, regardless of whether or not these days were on holiday weekends. Use was very high on holiday weekends, with the highest average of 131 boaters per day on holiday Saturdays in 1997. The maximum number of boaters on a single day occurred on July 19, 1997 (170 boaters in 154 boats of all types).

Private boaters were predominantly adult males between 18 and 45, and most were between the ages of 18 and 35. More than 67% of boaters had been down the river more than 10 times. Most boaters surveyed reside in Maryland, Ohio, Pennsylvania, or West Virginia. A total of 41 states including the District of Columbia were represented, plus visitors from 11 foreign countries.

Most private boaters (81% in 1996 and 95% in 1997) used flows between 460 and 1000 cfs; only 16% in 1996 and 5% in 1997 boated when flows were between 1000 and 1930 cfs, and only 13 private boaters in 1996 and 6 in 1997 used flows greater than 1930 cfs. Commercial rafters used a greater percentage of the larger flow category: 64% in 1996 and 88% in 1997 rafted on flows between 460 and 1000 cfs, and 34% in 1996 and 11% in 1997 used flows between 1000 and 1930 cfs. Only 47 commercial rafters in 1996 and 26 in 1997 (less than 2%) rafted when the flow exceeded 1930 cfs.

Based on the numbers of commercial rafters reported for the last 7 years, usage of the Upper Youghiogheny River by commercial boaters appears to be relatively stable and not increasing in total numbers. No conclusive statements can be made regarding total annual usage patterns of the river by private boaters, based on results of this survey and two previous surveys. However, peak daily usage was greater in 1997 than in earlier years sampled (1988, 1995 and 1996). Usage levels in the Youghiogheny River were probably higher in 1997 when other area rivers had more days with insufficient natural flow. In 1997 boaters used more of the available releases at the Youghiogheny than in 1996, when other rivers in the region had more days of boatable natural flow.

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## 5.0 REFERENCES

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- PPRP. 1998. Youghiogheny River Temperature Enhancement Protocol: Model Development and Results for 1995 and 1996. PPRP-DC-2.



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**APPENDIX A**

**UPPER YOUGHIOGHENY SUMMARY OF PRIVATE  
BOATER USE 1995 SUMMER SEASON**

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# **YOUGHIOGHENY SCENIC AND WILD RIVER**

## **UPPER YOUGH**

### **SUMMARY OF PRIVATE BOATER USE**

#### **1995 SUMMER SEASON**

**Prepared by:**

**R.F.C. James Adams**

**Maryland Department of Natural Resources**

**Public Lands-State Forest and Park Service**

**Deep Creek Lake Recreation Area**

**March 1996**

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## INTRODUCTION

This report represents a summary of information gathered from a voluntary sign-in sheet for private boaters during the months of June, July and August of 1995. This sign-in sheet was located at the "Private Boaters Field" at Sang Run Access Area. The information obtained through the sign-in sheet was in response to local concerns that the river may be becoming over crowded due to the increase in the number of private boaters using the river. The main objective of this study was to determine the safety of the river in relationship to the amount of boat traffic. This study also was intended to give the Department of Natural Resources an idea of the demographics of private boat users on the Upper Youghiogheny River, as well as use patterns during the boating season, April through October. This study will continue in 1996 and will include April through October which is the normal boating season.

### Data Collection

In the early summer of 1995 a sign-in sheet was placed at the "Private Boaters Field" at Sang Run. We asked the private boaters the following information:

Date:

Name:

Place of Residence:

Type of boat used: (Decked, Open or Raft)

Number of individual trips taken in the past:

These information sheets were collected several times a week and after every scheduled Penelec release. On three different



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occasions a representative was stationed on the Sang Run Bridge just downstream from the put-in area. This representative arrived at the bridge prior to the arrival of "usable water" and stayed through the entire release until the water became "unusable" again. This was done to determine the percentage of compliance in regards to how many actually ran the river compared to how many filled out the voluntary sign-in sheet. The rate of sign-in was determined to be 50%.

#### A. Place of Residence

It was determined from the information gathered that users traveled from 33 different states and from four different countries:

##### States represented included:

North Carolina	Massachusetts
Missouri	Tennessee
Georgia	Oregon
Arizona	New Mexico
New York	California
Florida	Illinois
Montana	Wisconsin
Mississippi	Pennsylvania
Maryland	District of Columbia
Connecticut	West Virginia
Ohio	Virginia
South Carolina	Indiana
Michigan	Nevada
Maine	New Jersey
Vermont	Colorado
New Hampshire	Texas

##### Countries represented included:

- Canada
- New Zealand
- England
- Australia

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## B. Experience on the "Upper Yough."

In determining the "Upper Yough." experience levels, we asked how often the person had been down the river previously? We also wanted to determine how many people were running the river for the first time. To acquire this information, we asked the boaters to put themselves into a specific category:

- A = First trip
- B = 2-20 trips
- C = 21-50 trips
- D = 50 + trips

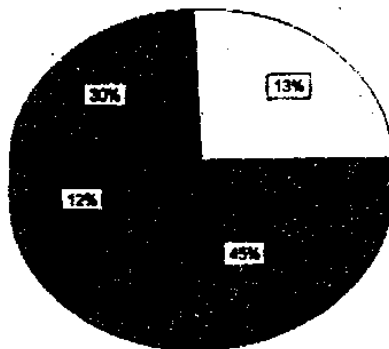
During the month of June, 13% said it was their first trip down the river. 30% said that they had been down the river between 2 and 20 times. 12% had been down the river between 21 and 50 times. And 45% said they had gone down the river 50 or more times. (See the chart "Experience levels, June")

During the month of July first timers declined to 8%. Those with 2 to 20 trips rose to 36%. 18% said that they had been down the river between 21 and 50 times while those with 50 or more trips declined to 38%. (see the chart "Experience Levels, July")

August totals were as follows; First trip 7%, 2 to 20 trips 35%, 21-50 trips 9% and more then 50 trips 49% (see the chart "Experience levels, August")

There could be several reasons for the fluctuations of percentages. Obviously once a person has gone down the river for the first time, they will move into the next category. The same holds true for the other categories, as the season progress so does people's experience levels.

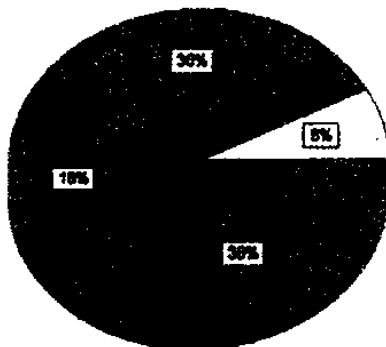
EXPERIENCE LEVELS (JUNE)



1st Time    2/20  
21-50    50+

YOUGHIOGHENY SCENIC AND WILD RIVER

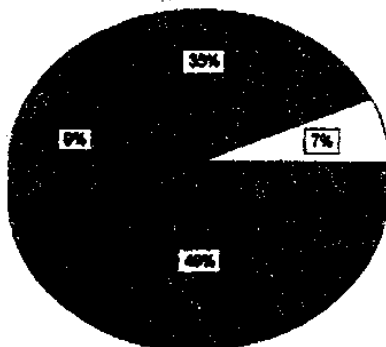
EXPERIENCE LEVELS (JULY)



1st Time    2/20  
21-50    50+

YOUGHIOGHENY SCENIC AND WILD RIVER

EXPERIENCE LEVELS (AUGUST)



1st Time    2/21  
21-50    50+

C. Usage of the "Upper Yough."

Information from this survey also gave us some insight as to the number of trips taken on the river during the months in question and on each given day of the week.

During the month of June 221 trips were signed-in, when the compliance rate of 50% is added it brings the total for June to 442.

(see the chart, 1995 Private Trips, Monthly)

During the month of July 302 trips were signed-in (604 total with the 50% compliance rate added).

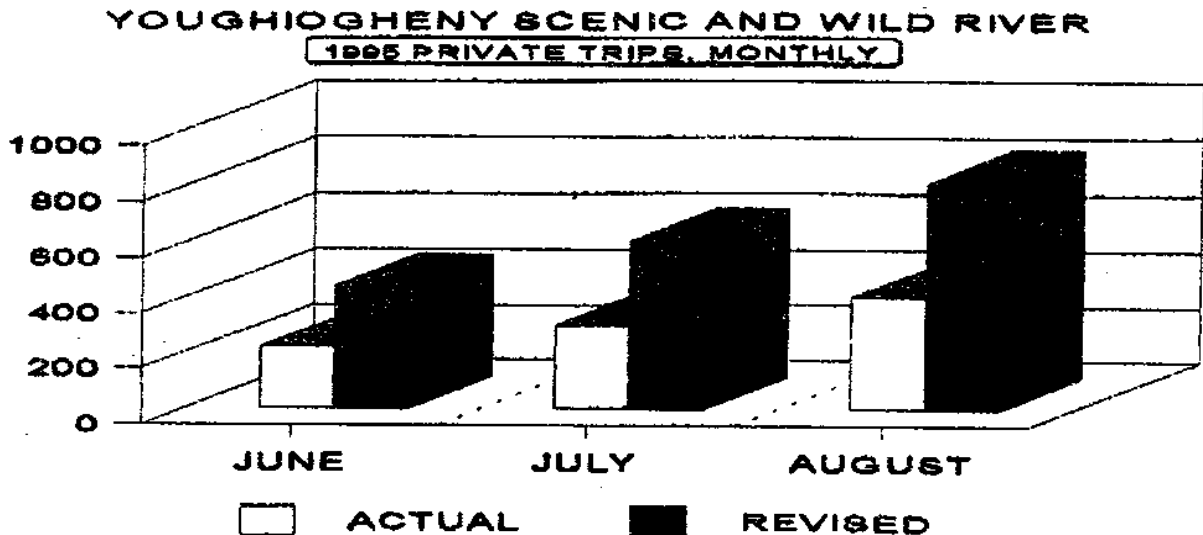
(see the chart, 1995 Private trips, Monthly)

407 trips signed-in for the month of August (A total of 814 with the 50% compliance rate added).

(see the chart, 1995 Private Trips, Monthly)

Some main reasons for the increase as the season progressed can be attributed to: vacation schedules and flow availabilities at other rivers during the drier summer months.

One draw to the "Upper Yough." during the summer is the fact that the scheduled Penelec releases virtually guarantees enough water for the river to be run, while other rivers located nearby are totally dependent upon natural flow.



We could also determine which days of the week boaters ran the river. Since releases were scheduled on Mondays, Wednesdays, and Fridays, we would expect these to be the busiest. In addition, water was also released on the first Saturday of each month.

There were 13 Mondays during the June - August time period with a corrected total of 394 trips. (50% compliance rate included)

There were 13 Tuesdays during the June - August time period with a corrected total of 104 trips. (50% compliance rate included)

There were 13 Wednesdays during the June -August time period with a corrected total of 144 trips. (50% compliance included)

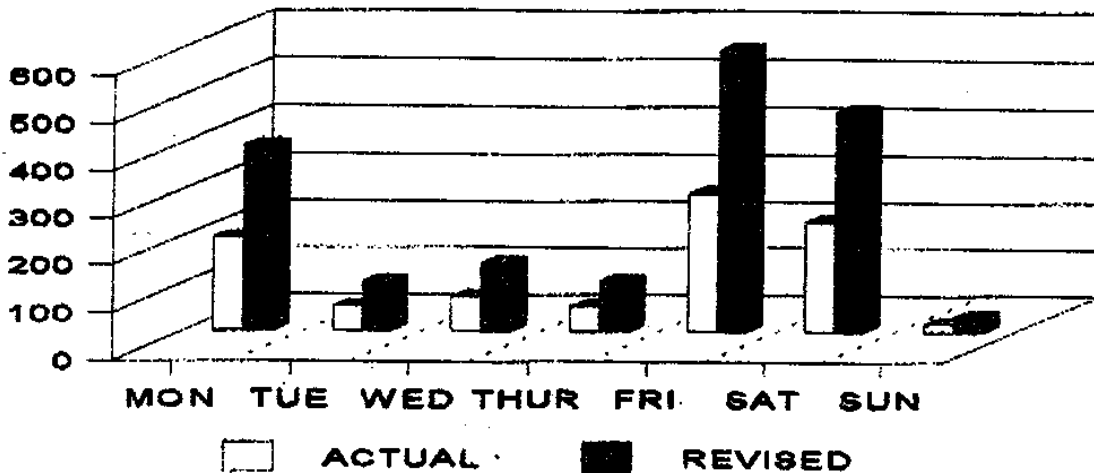
There were 14 Thursdays during the June -August time period with a corrected total of 106 trips. (50% compliance included)

There were 14 Fridays during the June - August time period with a corrected total of 598 trips. (50% compliance included)

There were 14 Saturdays during the June - August time period with a corrected total of 468 trips. (50% compliance included)

There were 14 Sundays during the June - August time period with a corrected total of 34 trips. (50% compliance included) (see the chart, Private trips, Daily)

**YOUGHIOGHENY SCENIC AND WILD RIVER  
1995 PRIVATE TRIPS, DAILY**



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## CONCLUSION

There are several conclusions we can draw from the information gathered in this survey.

The busiest days were Fridays, Saturdays, and Mondays. This may be because of releases, weekends, and holidays. The rest of the days, Tuesdays, Thursdays, and Sundays were days that did not have scheduled releases. If water was released and was unscheduled, boaters would have been unable to plan to travel to the river. As in the case of commercial rafters, private boaters, use the river more on scheduled release days.

The lowest number signed-in for a day was 5 and the highest was 150. The 150 represents an extremely busy day on the river. It was Saturday of the July 4th holiday weekend, with a scheduled release. It was also a busy day for the commercial companies, with all companies having near capacity trips.

The boaters that are running the "Upper Yough." are traveling from across the country and in some cases from around the world.

Earlier in the season there are fewer boaters and a higher percentage of less experienced "Upper Yough." boaters than at other times of the season.

Scheduled release days are the busiest, with the weekend releases even busier.

An estimated total number of private trips down the "Upper Yough." during the 1995 season was 1,860.

This survey also brings new questions that should be answered.

Are the less experienced boaters running the river with more experienced "Upper Yough." Boaters?

Are the large numbers of boaters on the holiday and Saturday releases a safety issue?

Is the large number of boaters on those days compromising the quality of the experience?



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**APPENDIX B**

**YOUGHIOGHENY RIVER RECREATION SURVEY  
DAILY SUMMARY TABLE FOR  
THE 1996 AND 1997 BOATING SEASONS**





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## Key to Data

- Column 1: year  
Column 2: month  
Column 3: day  
Column 4: day of week  
Column 5: daily average flow, Oakland gage (cfs)  
Column 6: flow at noon, Oakland gage  
Column 7: flow above Deep Creek Station, based on Oakland noon flow (converted using formula  $Q_{dc} = (Q_{oak}^{.97}) * 1.68$ )  
Column 8: flow at Deep Creek plus generation flow when generating 640 cfs at full gate (< 80 cfs natural flow at Oakland) and 560 cfs at efficient gate ( $\geq$  80 cfs natural flow)  
Column 9: boating suitability of natural flow, based on the criteria listed in Table 11.  
Column 10: boating suitability of natural flow plus generation (using same flow criteria as in column 9) \*indicates flow too high based on Table 11 but some boating occurred.  
Column 11: release type: n = none or < 2 hr, os = other scheduled (announced on recording), te = temperature enhancement announced on recording as indicated in column 17, u = unscheduled (not announced on recording), ww = whitewater scheduled. Note: Penelec did not record which releases were included on the telephone recording system, so the listing here of 'other scheduled' vs. 'unscheduled' is based on survey sheets or a best estimate of whether a release was announced for that day.  
Column 12: release time  
Column 13: survey taken (y/n)  
Column 14: no. of private vessels  
Column 15: no. of private boaters  
Column 16: no. of private boaters projected  
Column 17: basis for no. of boaters projected  
i.e.: off-sea avg. based on off-season average (after labor day and before Columbus day) for that day of the week; too low and too hi based on flow criteria (Table 11); dates shown used for average value of projection for a similar day; no notice indicates that release probably was not used since no release would have been expected.  
Column 18: no. of commercial boats  
Column 19: no. of commercial customers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Gens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type				persons		boats	cust	
96	4	15	M	200	195	280	840	lo	ok	w w	1000-1300	n			31	off-sea. avg	8	19
96	4	16	TU	796	1000	1366	1926	ok	ok	os	0900-1300	n			27			
96	4	17	W	769	739	1018		ok		n		n			27			
96	4	18	TH	607	600	832		ok		n		n			15			
96	4	19	F	538	552	767	1047	ok	ok	w w	1000-1300, one unit	n			23		17	42
96	4	20	SA	447	439	614		ok		n		n			17		2	6
96	4	21	SU	350	350	493		ok		n		n			24			
96	4	22	M	285	279	396	956	ok	ok	w w	1000-1600	n			31		7	14
96	4	23	TU	251	242	345	905	lo	ok	u	1430-1900	n			0	too low		
96	4	24	W	252	250	356		lo		n		n			0			
96	4	25	TH	206	202	289		lo		n		n			0			
96	4	26	F	190	183	263	823	lo	ok	w w	1000-1300	n			23	off-sea. avg	15	41
96	4	27	SA	204	209	299		lo		n		n			0	too low	2	4
96	4	28	SU	164	159	229		lo		n		n			0			
96	4	29	M	151	150	217	777	lo	ok	w w	1000-1300	n			31	off-sea. avg	13	30
96	4	30	TU	233	195	280		lo		n		n			0	too low		
96	5	1	W	280	262	372		lo		n		n			0	too low		
96	5	2	TH	464	513	715		ok		n		n			15	off-sea. avg		
96	5	3	F	473	506	705	1265	ok	ok	w w	1000-1300	n			23		19	52
96	5	4	SA	522	450	629	1189	ok	ok	w w	0900-1200	n			17		39	115
96	5	5	SU	1406	1490	2010		hi		n		n			24			
96	5	6	M	1915	2090	2792	3352	hi	hi	u	1800-2400	n			0	too hi	2	4
96	5	7	TU	1121	1040	1419		ok		n		n			27	off-sea. avg		
96	5	8	W	1071	977	1335	1895	ok	ok	u	0800-2400	n			27			
96	5	9	TH	2364	2850	3771	4331	hi	hi	u	0800-2400	n			0	too hi		
96	5	10	F	1450	1400	1893	2453	ok	hi	u	0800-2400	n			0	too hi	2	6
96	5	11	SA	1217	1040	1419	1979	ok	hi*	u	0820-2400	n			17	off-sea. avg		
96	5	12	SU	1505	1510	2037	2597	hi	hi	u	0800-2400	n			0	too hi		
96	5	13	M	981	968	1323	1883	ok	ok	w w	1100-1400,1900-2200	n			31	off-sea. avg	3	7
96	5	14	TU	664	661	914	1474	ok	ok	u	1120-1200	n			27			
96	5	15	W	569	469	655	1215	ok	ok	u	1600-2400	n			27			
96	5	16	TH	1365	1590	2141	2701	hi	hi	u	0703-2300	n			0	too hi		
96	5	17	F	1558	1760	2363	2923	hi	hi	u	0500-1000,1050-2400	n			0	too hi		
96	5	18	SA	1116	1100	1498	2058	ok	hi*	u	0001-0050,0800-2400	n			17	off-sea. avg	1	3
96	5	19	SU	740	732	1009	1569	ok	ok	u	1000-1300,1730-2310	n			24			
96	5	20	M	516	513	715	1275	ok	ok	w w	0710-0805,0900-2300	n			31		16	48

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Gens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type					persons		boats	cust
96	5	21	TU	667	382	537	1097	ok	ok	u	0730-0815,0915-1845	n			27			
96	5	22	W	1059	1000	1366		ok		n		n			27			
96	5	23	TH	604	600	832	1392	ok	ok	u	0800-2400	n			15		3	7
96	5	24	F	441	433	606	1166	ok	ok	w w	1000-1300	n			42		16	41
96	5	25	SA	357	361	508	1068	ok	ok	w w	1000-1400	n			46	7/1,7/8,10/14	31	92
96	5	26	SU	300	283	401	961	lo	ok	u	0800-2400	n			46		4	12
96	5	27	M	582	481	671	1231	ok	ok	w w	0800-2400	n			46		26	74
96	5	28	TU	1053	1030	1405	1965	ok	hi*	os	0800-2400	n			3	6/11-6/13		
96	5	29	W	2018	2480	3296	3856	hi	hi	os	0800-2400	n			0	too hi		
96	5	30	TH	1815	1750	2350	2910	hi	hi	os	0800-2400	n			0	too hi		
96	5	31	F	972	960	1313	1873	ok	ok	os	0001-1130,1400-2359	n			32	6/7,6/14	19	50
96	6	1	SA	625	627	868	1428	ok	ok	w w	0900-2359	n			32		42	121
96	6	2	SU	451	450	629	1189	ok	ok	os	0800-2359	n			32		2	6
96	6	3	M	350	345	486	1046	ok	ok	w w	0800-2400	n			19	6/10,6/13	16	43
96	6	4	TU	307	301	426	986	lo	ok	os	0001-0330,0800-2359	n			3	6/11-6/17		
96	6	5	W	271	270	383	943	lo	ok	os	1000-1300	n			3		1	2
96	6	6	TH	207	202	289	849	lo	ok	os	1000-1300,1422-1730	n			3			
96	6	7	F	164	162	234	794	lo	ok	w w	1000-1300,1442-1745	y	34	36			21	57
96	6	8	SA	404	142	206	766	lo	ok	u	0835-0851,0918-1432,2050-2200	n			0	no notice		
96	6	9	SU	1099	1150	1564	2124	ok	hi*	os	0800-2359	y	5	5				
96	6	10	M	559	532	740	1300	ok	ok	w w	0800-2359	y	5	5			11	29
96	6	11	TU	357	340	480	1040	ok	ok	u	0600-2359	y	5	8		no notice		
96	6	12	W	346	340	480	1040	ok	ok	u	0001-2359	y	0	0		no notice		
96	6	13	TH	286	279	396	956	lo	ok	os	0001-2359	y	0	0				
96	6	14	F	250	212	303	863	lo	ok	w w	1000-1300,1400-1700	y	24	30			20	56
96	6	15	SA	349	340	480	1040	ok	ok	u	1230-1815	n			6	6/9-6/11		
96	6	16	SU	215	212	303	863	lo	ok	u	1054-1230	n			0	no notice		
96	6	17	M	168	165	238	798	lo	ok	w w	1000-1600	y	27	33			8	23
96	6	18	TU	147	144	208	768	lo	ok	u	1000-1300	n			0	no notice		
96	6	19	W	224	177	255		lo		n		n			0	too low		
96	6	20	TH	258	238	339		lo		n		n			0			
96	6	21	F	186	180	259	819	lo	ok	w w	1000-1300	y	50	52			19	51
96	6	22	SA	138	136	197		lo		n		n			0			
96	6	23	SU	115	114	166		lo		n		n			0			
96	6	24	M	121	97	142	702	lo	ok	w w	1000-1300	y	27	36			8	21

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Gens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type				persons		boats	cust	
96	6	25	TU	188	202	289	849	lo	ok	u	1415-1700,2042-2100	n			0			
96	6	26	W	123	119	173		lo		n		n			0			
96	6	27	TH	93	90	132		lo		n		n			0			
96	6	28	F	76	75	111	671	lo	ok	ww	1000-1300	y	49	50			19	54
96	6	29	SA	66	66	98	658	lo	ok	te	1230-1430	n			0	no notice		
96	6	30	SU	59	60	89	649	lo	ok	te	1100-1300	y	8	9				
96	7	1	M	55	54	80	640	lo	ok	ww	1000-1300	y	44	52			11	27
96	7	2	TU	48	48	72	712	lo	ok	te	1415-1515	n			0			
96	7	3	W	127	177	255	815	lo	ok	n		n			0	too low		
96	7	4	TH	106	101	148	708	lo	ok	ww	1000-1300	y	73	76			12	32
96	7	5	F	67	66	98	658	lo	ok	ww	1000-1300	y	134	136			27	78
96	7	6	SA	50	50	75	715	lo	ok	ww	1000-1300	y	78	83			33	101
96	7	7	SU	42	41	62	702	lo	ok	te	1200-1400	n			9	6/30		
96	7	8	M	65	43	65	705	lo	ok	ww	1000-1300	y	43	43			14	36
96	7	9	TU	66	62	92	652	lo	ok	te	1230-1430,1500-1700	n			9	6/30		
96	7	10	W	44	43	65	705	lo	ok	u	1210-1230	n			0	too low		
96	7	11	TH	35	35	53	693	lo	ok	n		n			0			
96	7	12	F	30	30	46	686	lo	ok	ww	1000-1300	y	36	38			14	38
96	7	13	SA	28	27	41	681	lo	ok	te	1100-1300	y	17	17				
96	7	14	SU	28	29	44	684	lo	ok	te	1033-1630	y	13	13				
96	7	15	M	39	41	62	702	lo	ok	ww	0700-1300	y	34	41			16	38
96	7	16	TU	53	56	83	643	lo	ok	u	1320-1920	n			0	no notice		
96	7	17	W	38	36	54	694	lo	ok	te	1100-1700	n			9	6/30		
96	7	18	TH	229	39	59	699	lo	ok	n		n			0	too low		
96	7	19	F	3668	3570	4692	5252	hi	hi	ww	1000-2359	y	0	0				
96	7	20	SA	4317	4180	5468	6028	hi	hi	os	0600-2200	y	0	0				
96	7	21	SU	1103	1030	1405	1965	ok	hi*	u	0730-2359	y	2	2		no notice		
96	7	22	M	1095	1130	1537	2097	ok	hi*	ww	0800-2359	y	2	2			11	28
96	7	23	TU	989	951	1301	1861	ok	ok	os	0700-2000	y	0	0				
96	7	24	W	561	545	758	1318	ok	ok	os	0800-2000	n			2	7/23,7/25	3	7
96	7	25	TH	376	366	515	1075	ok	ok	os	0800-2000,2220-2240	y	4	4				
96	7	26	F	288	292	414	974	lo	ok	ww	0800-2000	y	12	12			39	109
96	7	27	SA	216	212	303	863	lo	ok	os	0800-2000	y	38	38			6	14
96	7	28	SU	172	168	242	802	lo	ok	os	0800-2000	y	24	24			5	13
96	7	29	M	157	153	221	781	lo	ok	ww	0800-2000	y	39	45			24	68
96	7	30	TU	427	469	655	1215	ok	ok	os	0800-2000	n			7	8/6-8/8	2	5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Gens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type				persons		boats	cust	
96	7	31	W	3111	3560	4680	5240	hi	hi	os	0730-2359	n			0	too hi		
96	8	1	TH	2174	2030	2714	3274	hi	hi	os	0001-2000	n			0	too hi		
96	8	2	F	932	902	1236	1796	ok	ok	w w	0700-1100,1400-2100	y	14	18			16	43
96	8	3	SA	574	565	785	1345	ok	ok	w w	0800-2000	y	44	50			42	121
96	8	4	SU	387	382	537	1097	ok	ok	u	0845-2100	y	29	34		no notice (?)	7	20
96	8	5	M	277	274	389	949	lo	ok	w w	0800-2000	y	18	18			30	79
96	8	6	TU	213	212	303	863	lo	ok	os	0800-2000	y	13	13			1	3
96	8	7	W	171	168	242	802	lo	ok	os	0800-2000,2034-2054	y	0	0		?	1	2
96	8	8	TH	143	142	206	766	lo	ok	os	0800-2000	y	8	8		?	2	4
96	8	9	F	235	266	378	938	lo	ok	w w	0800-2000	y	16	17			24	64
96	8	10	SA	165	159	229	789	lo	ok	os	0800-2000	y	29	31			3	7
96	8	11	SU	124	119	173	733	lo	ok	os	0800-2000	y	39	40				
96	8	12	M	446	150	217	777	lo	ok	w w	0830-2010	y	28	28			19	51
96	8	13	TU	1853	1980	2649	3209	hi	hi	os	0800-2000	n			0	too hi		
96	8	14	W	677	620	859	1419	ok	ok	os	0800-2000	y	4	6				
96	8	15	TH	355	345	486	1046	ok	ok	os	0800-2000	y	7	7			4	9
96	8	16	F	307	297	421	981	lo	ok	w w	1000-1600	y	25	31			19	54
96	8	17	SA	350	320	452	1012	lo	ok	os	1000-1600	y	31	32			3	7
96	8	18	SU	211	205	294	854	lo	ok	os	1000-1630	y	47	47			1	3
96	8	19	M	166	162	234	794	lo	ok	w w	1000-1300	y	13	13			20	54
96	8	20	TU	136	133	193		lo		n		n			0	too low		
96	8	21	W	121	114	166		lo		n		n			0			
96	8	22	TU	204	223	319		lo		n		n			0			
96	8	23	F	127	122	177	457	lo	lo	w w	1000-1400, one unit	y	35	35			19	51
96	8	24	SA	163	139	201	481	lo	ok	w w	1000-1400, one unit	y	49	49			8	22
96	8	25	SU	167	156	225		lo		n		n			0			
96	8	26	M	116	112	163	723	lo	ok	w w	1000-1300	y	35	51			22	57
96	8	27	TU	98	97	142		lo		n		n			0			
96	8	28	W	91	92	135		lo		n		n			0			
96	8	29	TH	89	92	135	695	lo	ok	w w	1000-1700	y	92	103			3	7
96	8	30	F	74	73	108	668	lo	ok	w w	1000-1315	y	91	91			20	56
96	8	31	SA	63	62	92	652	lo	ok	w w	1000-1300	n			120	9/2	36	107
96	9	1	SU	51	50	75		lo		n		n			0	too low		
96	9	2	M	47	46	69	709	lo	ok	w w	1000-1300,2050-2140	y	118	120			25	67
96	9	3	TU	49	45	67	707	lo	ok	os	1000-1300	y	10	10				
96	9	4	W	71	68	101	661	lo	ok	os	1000-1300	n			10	9/3,9/5		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Gens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type				persons		boats	cust	
96	9	5	TH	159	112	163	723	lo	ok	os	1000-1300,1545-1745	y	9	9			2	4
96	9	6	F	755	315	445	1005	lo	ok	ww	0715-2400	y	12	14			16	44
96	9	7	SA	2384	2470	3283	3843	hi	hi	u?	0001-2400	n			0	too high		
96	9	8	SU	1361	1310	1774	2334	ok	hi	u?	0001-2400	n			0	too high		
96	9	9	M	983	968	1323	1883	ok	ok	ww	0001-2400	y	3	3			12	32
96	9	10	TU	829	822	1129	1689	ok	ok	os	0001-2400	y	18	18			1	2
96	9	11	W	734	724	998	1558	ok	ok	os	0001-2400	y	15	15				
96	9	12	TH	333	274	389		lo		n		y	12	12				
96	9	13	F	412	310	438	998	lo	ok	ww	1000-1600	y	35	36			12	34
96	9	14	SA	377	377	530	1090	ok	ok	u	1000-1300	n			24	9/12,9/13	1	2
96	9	15	SU	253	246	350		lo		n		n			0	too low		
96	9	16	M	356	223	319	879	lo	ok	ww	1000-1300	y	27	28			22	65
96	9	17	TU	1523	1720	2311	2871	hi	hi	os	0800-2000	n			0	too hi		
96	9	18	W	1526	1660	2233	2793	hi	hi	os	0800-2000	n			0	too hi		
96	9	19	TH	1079	1200	1630	2190	ok	hi*	u ?	0800-2000	y	4	4			2	6
96	9	20	F	818	985	1346	1906	ok	ok	ww	0800-1100,1300-2100, one unit	y	10	10			9	25
96	9	21	SA	651	814	1118	1678	ok	ok	u ?	0800-2000	y	9	10				
96	9	22	SU	596	776	1068	1628	ok	ok	u ?	0800-2000	y	24	24				
96	9	23	M	585	799	1098	1658	ok	ok	ww	0800-2000	y	65	65			6	18
96	9	24	TU	378	320	452	1012	lo	ok	os?	1000-1300	y	23	26				
96	9	25	W	341	297	421	981	lo	ok	os?	1000-1300	y	31	31			2	5
96	9	26	TH	299	250	356	916	lo	ok	os?	1000-1300	y	27	29				
96	9	27	F	270	223	319	879	lo	ok	ww	1000-1300	y	18	18			14	38
96	9	28	SA	270	216	309	869	lo	ok	u	1000-1300	n			26	9/25-9/27	9	25
96	9	29	SU	297	306	433		lo		n		n			0	too low		
96	9	30	M	421	242	345	905	lo	ok	ww	1000-2200	y	17	20			12	34
96	10	1	TU	401	209	299	859	lo	ok	ww	1000-2200	y	30	35				
96	10	2	W	384	192	275	835	lo	ok	ww	1000-2200	y	30	35				
96	10	3	TH	259	186	267	827	lo	ok	ww	1000-1300	y	16	19			4	11
96	10	4	F	224	177	255	815	lo	ok	ww	1000-1300	y	17	17			19	49
96	10	5	SA	207	159	229	789	lo	ok	ww	1000-1300	y	24	24			3	7
96	10	6	SU	156	150	217		lo		n		n			0	too low		
96	10	7	M	201	274	389	949	lo	ok	ww	0700-0745,1000-1300	y	29	29			10	24
96	10	8	TU	111	80	118		lo		n		n			0			
96	10	9	W	118	104	152		lo		n		n			0			

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Gens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type				persons			boats	cust
96	10	10	TH	286	330	466		ok		n		n			0			
96	10	11	F	197	192	275	835	lo	ok	w w	1000-1300	y	41	41			4	11
96	10	12	SA	154	153	221		lo		n		n			0			
96	10	13	SU	135	133	193		lo		n		n			0			
96	10	14	M	122	119	173	733	lo	ok	w w	1000-1300	y	42	42			1	2
96	10	15	TU	113	112	163		lo		n		n			0			
												SUM:	2210	2356	3510		1115	3050



1	2	3	4	5	6	7	8.00	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Cens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type					persons		boats	cust
97	4	15	TU	108	104	152		lo										
97	4	16	W	99	94	138		lo										
97	4	17	TH	129	114	166		lo										
97	4	18	F	165	156	225	785	lo	ok	ww	1000-1300	Y	33	33			5	14
97	4	19	SA	164	159	229		lo		n		N						
97	4	20	SU	141	133	193		lo		n		N						
97	4	21	M	139	130	189	749	lo	ok	ww	800-1300	Y	16	17			5	13
97	4	22	TU	150	144	208		lo		n		N						
97	4	23	W	135	128	186		lo		n		N						
97	4	24	TH	133	125	182		lo		n		N						
97	4	25	F	162	165	238	798	lo	ok	ww	1000-1300	Y	39	40			10	26
97	4	26	SA	168	165	238	798	lo	ok	ww	1000-1300	N			22	5/3 proportional to commercial	11	28
97	4	27	SU	155	139	201		lo		n		N						
97	4	28	M	370	393	552	1112	ok	ok	ww	1000-1300	Y	12	12			6	15
97	4	29	TU	369	350	493		ok		n		N						
97	4	30	W	293	279	396		lo		n		N						
97	5	1	TH	253	242	345		lo		n		N						
97	5	2	F	212	198	284	844	lo	ok	ww	1000-1300	Y	51	52			23	59
97	5	3	SA	189	177	255	815	lo	ok	ww	900-1200	Y	107	111			47	141
97	5	4	SU	250	270	383		lo		n	2045-2125	N						
97	5	5	M	201	189	271		lo		n		Y	18	20	0	no release but included in survey	9	17
97	5	6	TU	191	183	263		lo		n		N						
97	5	7	W	179	171	246		lo		n		N						
97	5	8	TH	164	147	213		lo		n		N						
97	5	9	F	376	335	473	1033	ok	ok	ww	1000-1300	Y	33	33			13	32
97	5	10	SA	596	532	740		ok		n		N						
97	5	11	SU	669	640	886		ok		n		N						

1	2	3	4	5	6	7	8.00	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Cens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type					persons		boats	cust
97	5	12	M	499	475	663		ok		n		Y	9	9			5	15
97	5	13	TU	443	415	582		ok		n		N						
97	5	14	W	371	345	486		ok		n	2045-2100	Y	4	4				
97	5	15	TH	317	310	438		lo		n		N			0	May weekdays	3	9
97	5	16	F	284	279	396	956	lo	ok	ww	1000-1300	Y	35	41			14	39
97	5	17	SA	242	230	328		lo		n		N						
97	5	18	SU	213	202	289		lo		n		N						
97	5	19	M	192	180	259	819	lo	ok	ww	1000-1300	Y	1	1		announced this day	13	35
97	5	20	TU	357	415	582		ok		n		Y	0	0				
97	5	21	W	280	262	372		lo		n		N						
97	5	22	TH	235	226	323		lo		n		N						
97	5	23	F	204	195	280	840	lo	ok	ww	1000-1300	Y	41	43			16	43
97	5	24	SA	179	171	246	806	lo	ok	ww	1000-1300	Y	91	91			24	66
97	5	25	SU	245	171	246		lo		n		N						
97	5	26	M	1354	1450	1958		hi		n		Y	6	6		cancelled due to high water	9	26
97	5	27	TU	733	674	931		ok		n		Y	0	0				
97	5	28	W	460	433	606		ok		n		Y	0	0			1	2
97	5	29	TH	333	315	445		lo		n		Y	2	2				
97	5	30	F	272	262	372	932	lo	ok	ww	1000-1300	Y	29	33			21	60
97	5	31	SA	220	209	299		lo		n		N						
97	6	1	SU	197	186	267		lo		n		N						
97	6	2	M	251	283	401	961	lo	ok	ww	600-940,1000-2400	Y	13	15			7	19
97	6	3	TU	265	202	289	849	lo	ok	os	0800-2400	Y	0	0			2	6
97	6	4	W	426	421	590	1150	ok	ok	os	1000-1300,2055-2125	Y	2	2				
97	6	5	TH	287	274	389	949	lo	ok	os	800-2400	Y	0	0				
97	6	6	F	231	219	313	873	lo	ok	ww	1000-1300	Y	52	57			11	28
97	6	7	SA	198	189	271	831	lo	ok	ww	900-2200	Y	106	109			36	105

1	2	3	4	5	6	7	8.00	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Cens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type					persons		boats	cust
97	6	8	SU	172	165	238		lo		n		N						
97	6	9	M	148	142	206	766	lo	ok	ww	1000-1300	Y	36	38			15	40
97	6	10	TU	128	122	177		lo		n		N						
97	6	11	W	114	109	159		lo		n		N						
97	6	12	TH	105	101	148	708	lo	ok	os	1000-1300	Y	0	0				
97	6	13	F	624	869	1192	1752	ok	ok	ww	600-2200	Y	40	40			29	81
97	6	14	SA	462	415	582	1142	ok	ok	os	1000-1300	Y	6	6				
97	6	15	SU	268	250	356	916	lo	ok	os	1000-1300	N						
97	6	16	M	196	189	271	831	lo	ok	ww	1000-1300	Y	30	31			7	18
97	6	17	TU	186	189	271		lo		n		N						
97	6	18	W	279	150	217	777	lo	ok	u	1000-1300	N				no notice		
97	6	19	TH	417	361	508	1068	ok	ok	os	1000-1300	Y	0	0		announced this day		
97	6	20	F	219	202	289	849	lo	ok	ww	1000-1600	Y	58	61			23	66
97	6	21	SA	167	159	229	789	lo	ok	ww	1000-1600,2100-2230	Y	118	127			29	86
97	6	22	SU	145	130	189		lo		n		N						
97	6	23	M	129	125	182	742	lo	ok	ww	1000-1300	Y	49	67			7	19
97	6	24	TU	105	99	145	705	lo	ok	u	1100-1300,1430-1830	N				no notice		
97	6	25	W	91	87	128	688	lo	ok	u	1000-1550	N			0	no notice	1	2
97	6	26	TH	384	114	166	726	lo	ok	os	1100-1620	N				announced at 1100; stormy		
97	6	27	F	495	427	598	1158	ok	ok	ww	1000-1300	Y	30	34			14	37
97	6	28	SA	222	198	284		lo		n		N						
97	6	29	SU	158	147	213		lo		n		N						
97	6	30	M	131	122	177	737	lo	ok	ww	1000-1300	Y	37	57			20	55
97	7	1	TU	127	122	177		lo		n		N						
97	7	2	W	113	106	155		lo		n		N						
97	7	3	TH	95	92	135	695	lo	ok	u	1350-2000	N				no notice		
97	7	4	F	76	73	108	668	lo	ok	ww	1000-1300	Y	159	167			23	63
97	7	5	SA	66	64	95	655	lo	ok	ww	1000-1400	Y	148	156			31	89
97	7	6	SU	60	56	83		lo		n		N						
97	7	7	M	54	50	75	715	lo	ok	ww	1000-1300	Y	53	58			16	42
97	7	8	TU	49	46	69		lo		te	1420-1520	N				no notice required		

1	2	3	4	5	6	7	8.00	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Cens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type					persons		boats	cust
97	7	9	W	51	41	62		lo		n		N						
97	7	10	TH	111	106	155		lo		n		N						
97	7	11	F	62	58	86	646	lo	ok	ww	1000-1300	Y	50	53			21	59
97	7	12	SA	44	41	62		lo		te	1200-1300	N				no notice		
97	7	13	SU	38	35	53	693	lo	ok	te	1100-1300,1430-1830	N				no notice		
97	7	14	M	37	32	48	688	lo	ok	ww	1000-1600	Y	54	59			20	57
97	7	15	TU	33	30	46	686	lo	ok	u	1000-1700	N				no notice		
97	7	16	W	30	29	44	684	lo	ok	te	1230-1830	N				no notice		
97	7	17	TH	29	26	40	680	lo	ok	u	1100-1700	N				no notice		
97	7	18	F	32	30	46	686	lo	ok	ww	1100-1700	Y	109	117			14	36
97	7	19	SA	45	45	67	707	lo	ok	ww	1000-1330	Y	154	170			42	119
97	7	20	SU	34	32	48	688	lo	ok	te	1400-1600,2105-2115	N				no notice required		
97	7	21	M	26	24	37	677	lo	ok	ww	1000-1600,2045-2110	Y	35	52			16	43
97	7	22	TU	27	24	37		lo		n		N						
97	7	23	W	56	56	83		lo		n		N						
97	7	24	TH	415	216	309		lo		n		N						
97	7	25	F	243	192	275	835	lo	ok	ww	1000-1300,2112-2121	Y	32	32			23	65
97	7	26	SA	105	92	135		lo		n		N						
97	7	27	SU	71	66	98	658	lo	ok	te	1405-1605	N				no notice required		
97	7	28	M	59	54	80	640	lo	ok	ww	1000-1600	Y	30	37			16	45
97	7	29	TU	64	66	98	658	lo	ok	te	1230-1430	N				no notice		
97	7	30	W	48	45	67		lo		te	1505-1605	N				no notice required		
97	7	31	TH	37	35	53		lo		te	1515-1615	N				no notice required		
97	8	1	F	31	30	46	686	lo	ok	ww	1000-1300,1348-1407	Y	129	137			31	90
97	8	2	SA	28	26	40	680	lo	ok	ww	1000-1300	Y	142	150			46	133
97	8	3	SU	27	26	40		lo		te	1200-1300,2024-2041	N				no notice		
97	8	4	M	278	101	148	708	lo	ok	ww	1000-1300	N			42	Mondays in August average	25	68
97	8	5	TU	281	250	356		lo		n		N						
97	8	6	W	127	114	166		lo		n		N						
97	8	7	TH	84	78	115		lo		n		N						
97	8	8	F	61	56	83	643	lo	ok	ww	1000-1300	Y	47	47			27	75
97	8	9	SA	49	46	69		lo		n		N						
97	8	10	SU	42	39	59		lo		te	1415-1515	N				no notice required		
97	8	11	M	37	35	53	693	lo	ok	ww	1000-1300	Y	41	48			31	91
97	8	12	TU	34	32	48		lo		te	1415-1515	N				no notice required		

1	2	3	4	5	6	7	8.00	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Cens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type					persons		boats	cust
97	8	13	W	46	43	65		lo		n		N						
97	8	14	TH	72	75	111		lo		n		N						
97	8	15	F	49	46	69	709	lo	ok	ww	1000-1300,1600-1830	Y	77	77			29	81
97	8	16	SA	39	36	54	694	lo	ok	u	940-1010,1100-1700	N				no notice		
97	8	17	SU	229	292	414	974	lo	ok	te	1230-1430	N				no notice		
97	8	18	M	524	613	849	1129	ok	ok	ww	1000-1300, one unit	Y	36	40			32	91
97	8	19	TU	264	234	334		lo		n		N						
97	8	20	W	262	192	275		lo		n		N						
97	8	21	TU	432	439	614	894	ok	ok	ww	910-1500, one unit	Y	62	67			1	2
97	8	22	F	337	345	486	1046	ok	ok	ww	1000-1300	Y	42	47			28	75
97	8	23	SA	249	234	334		lo		n		N						
97	8	24	SU	184	174	250		lo		n		N						
97	8	25	M	147	139	201	761	lo	ok	ww	1000-1300	Y	36	38			20	53
97	8	26	TU	121	114	166		lo		n		N						
97	8	27	W	101	97	142		lo		n	1235-1300,1320-1335	N						
97	8	28	TH	187	230	328		lo		n	1350-1355	N						
97	8	29	F	138	128	186	746	lo	ok	ww	1000-1300	Y	104	105			16	54
97	8	30	SA	103	97	142	702	lo	ok	ww	1000-1400	Y	142	145			31	88
97	8	31	SU	84	80	118		lo		n	2214-2221	N						
97	9	1	M	71	66	98	658	lo	ok	ww	1000-1300,2002-2028	Y	139	151			30	94
97	9	2	TU	68	64	95	655	lo	ok	u	1230-1800	N			85	9/1 proportional to rafts; no notice	18	53
97	9	3	W	58	54	80		lo		n		N						
97	9	4	TH	55	54	80	640	lo	ok	os	1000-1300,1800-2100	Y	0	0				
97	9	5	F	45	43	65	705	lo	ok	ww	1000-1300,1800-2100	Y	38	41			20	53
97	9	6	SA	41	38	57	697	lo	ok	ww	1000-1300,2000-2115	Y	84	85			29	84
97	9	7	SU	38	36	54		lo		n	1555-2145	N						
97	9	8	M	37	36	54	694	lo	ok	ww	1000-1425,1800-1930	Y	28	29			10	24
97	9	9	TU	35	32	48	688	lo	ok	ww	1000-1300,1800-2100	Y	6	7				
97	9	10	W	65	73	108	668	lo	ok	os	610-625,1000-1300	Y	46	47				
97	9	11	TH	86	92	135	695	lo	ok	os	1000-1300,1800-2100	Y	20	21				
97	9	12	F	59	56	83	643	lo	ok	ww	1000-1300	Y	50	53			10	30
97	9	13	SA	44	41	62		lo		n	845-905	N						
97	9	14	SU	39	36	54		lo		n	1940-2030	N						
97	9	15	M	38	35	53	693	lo	ok	ww	1000-1300	Y	21	23			3	9
97	9	16	TU	42	43	65		lo		n		N						

1	2	3	4	5	6	7	8.00	9	10	11	12	13	14	15	16	17	18	19
year	month	day	day of	daily	noon	DC flow	DC +	nat flow	gen. suit	release	release time	Cens	boats	pers	proj	basis	comm	comm
			week	avg flow	flow		gen	suit.		type					persons		boats	cust
97	9	17	W	49	48	72		lo		n		N						
97	9	18	TH	54	54	80		lo		n		N						
97	9	19	F	60	66	98	658	lo	ok	ww	1000-1300	Y	124	128			12	34
97	9	20	SA	69	62	92		lo		n		N						
97	9	21	SU	104	101	148		lo		n		N						
97	9	22	M	77	73	108	668	lo	ok	ww	1000-1300	Y	55	55			3	9
97	9	23	TU	66	64	95	655	lo	ok	ww	1100-1300	Y	51	52				
97	9	24	W	48	45	67	707	lo	ok	ww	1100-1300	Y	74	83				
97	9	25	TH	37	36	54	694	lo	ok	ww	1100-1300	Y	65	66			6	15
97	9	26	F	28	29	44	684	lo	ok	ww	1000-1300	Y	80	80			16	45
97	9	27	SA	25	25	38		lo		n		N						
97	9	28	SU	45	21	32		lo		n		N						
97	9	29	M	505	613	849	1409	ok	ok	ww	1000-1300	Y	6	6			13	34
97	9	30	TU	201	174	250		lo		n	1730-1830,1910-2020	N						
97	10	1	W	142	128	186		lo		n		N						
97	10	2	TH	126	119	173		lo		n	720-830,1911-1919	N						
97	10	3	F	95	90	132	692	lo	ok	ww	1000-1300,2307-2318	Y	48	48			12	35
97	10	4	SA	80	78	115	675	lo	ok	ww	726-740,1000-1300	Y	97	101			20	58
97	10	5	SU	68	64	95		lo		n		N						
97	10	6	M	62	60	89	649	lo	ok	ww	620-635,1000-1600	Y	42	44			3	8
97	10	7	TU	55	52	78	718	lo	ok	u	1345-1945	N						
97	10	8	W	49	46	69		lo		n	1838-2033	N						
97	10	9	TH	45	43	65	705	lo	ok	u	1240-1815	N				no notice		
97	10	10	F	44	41	62	702	lo	ok	ww	707-717,1000-1300	Y	82	85			8	24
97	10	11	SA	47	46	69		lo		n	915-930	N						
97	10	12	SU	41	38	57		lo		n		N						
97	10	13	M	39	38	57	697	lo	ok	ww	1000-1300,2105-2113	Y	49	50			10	26
												SUM:	3991	4249	4398		1198	3356

## **APPENDIX C**

**HYDROLOGIC RANKING OF THE YOUGHIOGHENY RIVER FLOW (CFS)  
AT THE OAKLAND GAGE (USGS NO. 03075500) FOR  
THE SUMMER MONTHS (JUNE-AUGUST), FROM 1942  
THROUGH 1997**





Table C-1. Hydrologic ranking of summer average flow in cfs at Oakland from 1942 through 1997 (USGS station 03075500).

Year	Rank	June	July	August	Average
1965	1	24	17	13	18
1991	2	25	20	11	19
1966	3	41	18	18	26
1953	4	46	10	23	26
1957	5	42	32	13	29
1988	6	72	20	17	36
1964	7	60	35	20	38
1959	8	60	38	23	40
1952	9	74	21	36	44
1944	10	112	29	11	51
1993	11	94	41	20	52
1983	12	139	73	28	80
1971	13	104	41	99	81
1960	14	94	77	83	85
1987	15	167	50	43	87
1995	16	111	37	116	88
1947	17	129	76	61	89
1976	18	187	76	38	100
1979	19	109	102	102	104
1973	20	202	59	73	111
1967	21	84	181	89	118
1977	22	100	117	139	119
1969	23	30	92	236	119
1968	24	253	33	82	123
1986	25	58	278	45	127
1962	26	264	103	20	129
1942	27	101	45	242	129
1946	28	331	49	19	133
1950	29	252	121	35	136
1943	30	70	147	208	142
1945	31	94	141	211	149
1970	32	198	109	156	154
<b>1997</b>	<b>33</b>	<b>240</b>	<b>75</b>	<b>150</b>	<b>155</b>
1994	34	69	109	316	165

Table C-1. (Continued)					
Year	Rank	June	July	August	Average
1955	35	180	74	246	167
1963	36	331	125	97	184
1949	37	109	387	70	189
1951	38	449	138	27	205
1954	39	261	71	337	223
1982	40	277	329	66	224
1975	41	195	74	405	225
1984	42	84	350	245	226
1974	43	571	84	46	234
1992	44	153	466	97	239
1958	45	75	410	331	272
1990	46	229	579	91	300
1961	47	410	85	411	302
1972	48	593	254	110	319
1978	49	182	629	154	322
1981	50	730	164	88	327
1948	51	345	508	154	336
1989	52	470	392	159	340
1985	53	568	496	85	383
1956	54	345	233	586	388
<b>1996</b>	<b>55</b>	<b>273</b>	<b>567</b>	<b>362</b>	<b>401</b>
1980	56	464	203	585	417
Average		202	162	135	166

