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WEST BRANCH MONTREAL RIVER INTERNET FLOW STUDY OCTOBER 2007

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ABSTRACT

The West Branch of the Montreal is a low-volume, popular class IV-whitewater river located on the south shore of Lake Superior in northern Wisconsin, USA. Those seeking whitewater recreation can generally only find adequate flows during a week or two in early spring when the reservoir upstream spills. In this study researchers have utilized the structural norm approach and impact acceptability curves to examine instream flows for recreation on the West Branch of the Montreal. The range of acceptable flows, as determined by the impact acceptability curve was from 400-1,000 cfs. All average evaluations for flows between these levels were above the neutral line. 600 cfs received the highest average evaluation and is therefore considered to be the optimal flow. According to these data, a release of 600 cfs would appeal to the greatest variety of river users. Dam operations upstream of Gile Falls could allow for scheduled whitewater releases into the West Branch extending the recreation season for paddling in the Lake Superior area.

KEY WORDS

instream flows, flow management, recreation flows, flow study

INTRODUCTION

The West Branch of the Montreal is a low-volume river located on the south shore of Lake Superior in northern Wisconsin, USA. On the stretch of the West Branch between Gile Falls and Highway 2 a popular class IV- whitewater run exists. Although this stretch hosted the National Wildwater Championships in 1992 and the Pan Am races in the early 1980's, paddlers can generally only find adequate flows for whitewater runs during a week or two in early spring when the reservoir upstream spills.

Researchers have utilized the structural norm approach and impact acceptability curves to examine instream flows for recreation on a variety of river stretches across the United States including the Grand Canyon of the Colorado River in Arizona (Whittaker & Shelby, 2002). River managers can manipulate instream flows through controlled dam releases. On river stretches where manipulation is possible, flow management has become a central issue in recreation management. Dam operations upstream of Gile Falls could allow for scheduled whitewater releases into the West Branch extending the recreation season for paddling in the Lake Superior area. To explore this possibility an internet flow survey was conducted between the spring of 2006 and 2007.

Whitewater paddlers who responded to the internet survey were enthusiastic about the possibility of scheduled releases. Many expressed difficulty in predicting runnable flows for the West Branch and some respondents had never done the run due to the extremely short season when adequate flows spilled from the dam. Respondents articulated a need for whitewater opportunities in the warm weather summer months in the upper Midwest and many were willing to travel long distances for scheduled releases on the weekend. Results from the impact acceptability curve suggest that instream flow releases of 600-1,000 cfs would be acceptable to a majority of river users. A Saturday release was favored by 56% of respondents and the average preferred time and duration for instream releases were 10am and 6 hours respectively.

METHODS

The structural norm approach is a technique used to represent social norms graphically. Structural characteristics of norms are displayed visually through a device referred to as an impact acceptability curve. This visual representation has proven useful to the process of communicating normative concepts to resource managers. The potential for conflict index (PCI) developed by Manfredo, Vaske, and Teel (2003) advanced the graphic representation of social norms by visually displaying information about their central tendency, dispersion and form simultaneously (Vaske, Needham, Newman, Manfredo, & Petchenik, in press).

Instream flow is the amount of water in a river at a given time. Understanding the relationship between instream flows and resource values can aid in the creation of standards for recreation use (Whittaker & Shelby, 2002). Using the structural norm approach, impact acceptability curves and the PCI (Figures 1 & 2) researchers have described optimum flows, ranges of tolerable flows, intensity and crystallization (i.e., respondent agreement) for numerous specific river settings (Shelby, Vaske, & Donnelly, 1996; Whittaker, Shelby, & Abrams, in press). The impact acceptability curve takes norms related to the acceptability of specific instream flows, measured at the individual level and then aggregates them to describe social norms by plotting the averages of individual's response evaluations (Shelby et al., 1996). The set of specific instream flows measured are displayed on the horizontal axis. Average evaluations are displayed on the

vertical axis, with negative evaluations on the bottom, a neutral line in the middle, and positive evaluations on top (Whittaker & Shelby, 2002).

The highest point or peak of the curve represents the optimum flow. The range of flows with average evaluations above the neutral line represents the range of tolerable flows. The points where the curve intersects with the neutral line define the standards to be associated with too high and too low a flow. The relative distance of the curve in relationship to the neutral line defines the intensity of a norm. The variation among evaluations at each flow level constitutes the crystallization of the norm but is typically not visually displayed on a impact acceptability curve. In this study we use the PCI bubbles (Figure 2) to describe crystallization graphically on the curve, where the larger the PCI bubble, the less agreement between respondents and the smaller the bubble, the greater the agreement.

An internet specific instream flow survey was conducted between the spring of 2006 and 2007. The survey was advertised on the American Whitewater website through a number of articles. The Wisconsin Hoofers Outing Club also played a role in attracting respondents to the internet based survey. Individuals interested in the possibility of scheduled whitewater releases on the West Branch were invited to take part in the survey regardless of their skill level, whitewater experience, craft used or familiarity with the stretch.

A wide range of variables were measured for this study. Respondents evaluated the acceptability of 13 specific flows from the West Branch dam. The flows ranged from 100 cfs to 1,000 cfs (see Table 1 for a complete listing of flow levels measured). Each flow was evaluated on a 7-point scale: totally unacceptable (-3), moderately unacceptable (-2), slightly unacceptable (-1), neutral (0), slightly acceptable (1), marginally acceptable (2) and totally acceptable (3). Acceptable flows, optimal flows, and norm crystallization were determined for all respondents. Three release preference variables were measured including preferred release time of day (i.e. 9am, 10am etc.), preferred release duration (i.e. 1 hour, 2hours, etc.) and preferred day of release (Saturday, Sunday., or either). A set of open ended flow related variables were also measured including optimum, standard, increased challenge, and preferred release flow.

TABLE 1

Mean acceptability rating, Standard Deviation and Potential for Conflict Index value for measured specific cfs flows on the West Branch Montreal, Wisconsin, USA

Specific Flow CFS	Mean Acceptability	Standard Deviation	PCI
100	-2.82	0.40	0
150	-2.60	0.84	0
200	-2.10	1.45	0.06
250	-1.88	1.54	0.07
300	-0.90	2.13	0.40
350	-0.70	2.45	0.53
400	0	2.49	0.74
450	0.54	2.34	0.49
500	1.33	1.92	0.27
600	1.5	1.83	0.12
700	1.33	1.72	0.22
800	1.27	1.74	0.17
1000	0.83	1.80	0.28

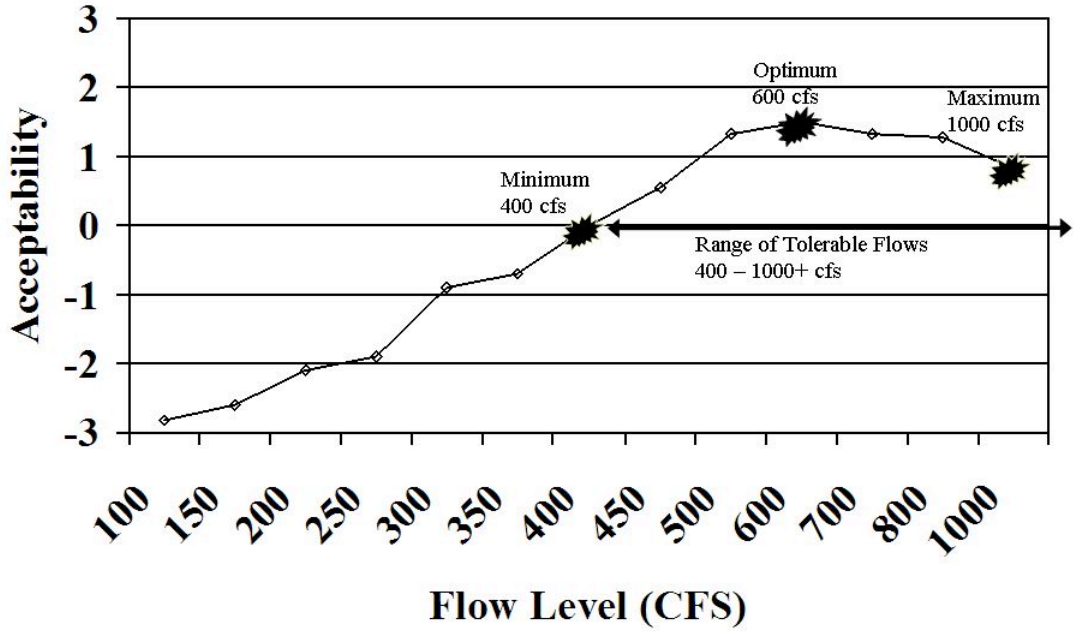
RESULTS

Under the structural norm approach, flows between 100 cfs and 350 cfs were, on average, unacceptable (Figure 1). Flows of 450 cfs and greater were within the range of acceptable flow conditions. Flows of 600, 700 and 800 cfs were considered optimal. Flows of 1,000 cfs were, on average, considered acceptable. Flows greater than 1,000 cfs were not measured. While some individuals have run the river at these higher flows these opportunities are limited and unlikely to be provided for during a controlled release.

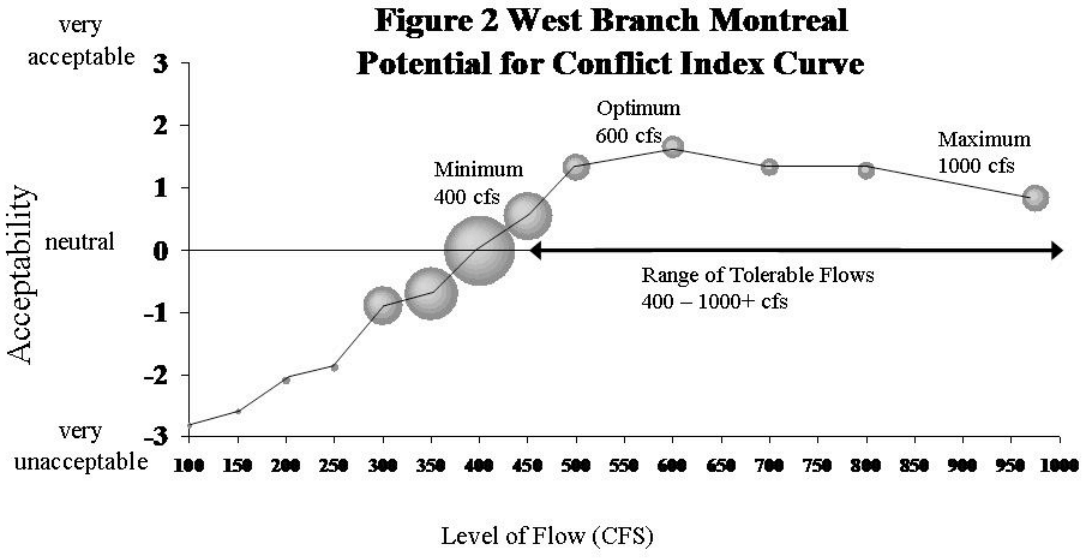
Under the set of open ended flow response questions 905 cfs was considered, on average, to be the optimum flow, with responses ranging from 400-2,500 cfs. The average standard flow was 730 cfs on average, with a response range of 400-2,000 cfs. A flow of 1,310 cfs was the average flow for an increased challenge trip, with a range of 600-5,000 cfs. The average preferred release flow was 875 cfs, with a range of 400-2,500 cfs. The average preferred duration or length of a release was on average 6 hours, with a range from 4 hours to 1 week in length. The average preferred time of day for a release was 10 am, with a range from 9 am – 1 pm. When asked what their preferred day for a release would be, 56% of respondents chose Saturday, 3% preferred a Sunday release and 41% responded that either day of the weekend was acceptable.

The Potential for Conflict Index ranges from 0 (no conflict, high consensus) to 1 (high conflict, low consensus). PCI scores for the acceptability of specific flows ranged from .00 (100 and 150 cfs), to .73 (400 cfs). Using the traditional norm acceptability curve (Figure 1), the average flow evaluation for 400 cfs was at the neutral line, suggesting that

Figure 1 Impact Acceptability Curve
West Branch Montreal



a flow of 400 cfs was within the acceptable range of flows. When the curve is displayed with PCI bubbles (Figure 2), it is apparent that some boaters evaluated a flow of 400 as unacceptable. The bubble straddles the neutral line and the PCI value is the largest measured for any of the specific flow evaluations (.73). PCI scores at the optimal flows of 600, 700, and 800 cfs were .22, .17 and .17 respectively, the lowest for any of the flows measured with average ratings above the neutral line. These relatively low PCI values (small bubbles, Figure 2) suggest that across all boaters there was considerable consensus regarding the acceptability of these optimum flow levels. PCI values, as well as mean evaluations and standard deviations, for the flows evaluated under the impact acceptability curve are displayed in Table 1.



DISCUSSION

Understanding the impact acceptability curves for river stretches where instream flow manipulation is possible is fundamental to the proper recreation management of these stretches. Instream flow releases can provide unique recreation opportunities for multiple user groups and can help flow diversion and storage operations meet their protection, mitigation and enhancement measures necessary to re-license their operations under the Federal Energy Regulatory Commission (FERC) (Whittaker & Shelby, 2002). Xcel Energy manages Gile Flowage which provides water to their Saxon Falls Hydroelectric Project and Montreal Hydroelectric Project downstream. Gile Flowage is a storage impoundment and not a licensed project, but paddlers are still interested in determining the potential for a scheduled flow release or releases.

This study was implemented to help determine the instream flow-recreation relationship and to help determine at which flow level a scheduled release would be most appropriate.

The range of acceptable flows, as determined by the impact acceptability curve (Figure 1), is from 400-1,000 cfs. All average evaluations for flows between these levels were above the neutral line. 600 cfs received the highest average evaluation (1.5) and is therefore considered to be the optimal flow. According to these data, a release of 600 cfs would appeal to the greatest variety of river users.

Where respondents were able to identify flow characteristics in an open ended response format, average flow evaluations were slightly higher. This combined with the above neutral acceptability evaluation on the impact acceptable curve for 1,000 cfs, suggests that there is a significant population of river users who would prefer higher flow releases. When asked directly what flow level would be their preferred release, the range of responses was from 400-2,500 cfs, with a mean of 875 cfs. Respondents interested in release flows over 1,000 cfs were most likely looking for an increased challenge whitewater experience. Evidence of this phenomenon comes from the mean response to an open ended, preferred flow question for an increased challenge trip of 1,310 cfs. Users who are not as experienced river runners, or who preferred a more moderate whitewater challenge, are more likely to be comfortable with flows closer to the minimum acceptable flow of 400 cfs. All river users are likely to find these lower flows to be acceptable, but more experienced and daring river users may not find the level of whitewater challenge that they are looking for.

The Potential for Conflict Index (PCI) helps to identify the agreement between respondents at each individual flow level. Table 1 and Figure 2 reveal a PCI score trend that is similar to previous studies (Vaske, Stafford, Shelby & Whittaker, in review). Users are in the most agreement at flow levels which are highly unacceptable and highly acceptable. Users are in the least agreement when average response evaluations are near the neutral line. At the instream flow of 400 cfs, users are highly divided over the acceptability of this flow for whitewater recreation. Some respondents felt that this flow was too low for a meaningful whitewater experience, while other users found this to be an acceptable flow. It is possible that the acceptability of flows on the lower end of the flow spectrum have been influenced by the limited availability of days during the year when this stretch is runnable. Some users may find lower flows acceptable because these are the only flows they have been able to catch on this stretch.

PCI scores on the higher end of the flow spectrum show strong agreement between users. Flows of 600, 700, and 800 cfs had PCI scores of .22, .17, and .17 respectively. For whitewater river running a certain amount of flow is necessary just to navigate a stretch. In general, once that minimum flow level is passed, the stretch becomes runnable up to a certain much higher level of flow, which can be dictated by a number of variables, including skill level, experience and craft type. For the West Branch Montreal the majority of river users were in agreement that flows up to and beyond 1000 cfs are acceptable and are not out of their range of acceptable flows.

This study has a number of limitations. Internet studies are by nature a biased and hard to control medium for conducting research. For instream flow related research they may prove to be acceptable because instream flow research normally does not look to sample the general population. For most studies only experienced river users are surveyed because prior research suggests that experienced boaters are more knowledgeable about how flows affect recreation attributes and are most capable of evaluating specific flows (Shelby, Brown, & Baumgartner, 1992). Reaching out to experienced users through internet surveys is a very real possibility. There is also the chance that less experienced users who are not truly capable of estimating and determining the difference between specific flow levels will respond and should therefore be considered a limitation of this

study. 63% of respondents estimated flow levels for their previous runs and 95% of respondents recalled their level of flow from memory. Flow level estimations can be a reliable source for actual levels from experienced river users, but in this study there is no way to determine the experience level of different respondents.

Another limitation to this study was the amount of respondents who had not run this stretch prior to responding to the survey. 38% of respondents had not completed the West Branch Montreal and an average of 31 respondents skipped the questions referring to specific flow levels. This can be attributed to the extremely short season for whitewater recreation on this stretch, but this also shows that there is strong interest in scheduled releases for this run. Respondents who have not completed this run were very likely the same respondents who skipped flow related questions and therefore would have little, if any affect on the variables used to determine the acceptability of instream flows.

This survey provides most, if not all of the necessary components to determine an acceptable instream flow level, a time of day, duration and day of the week for scheduled whitewater releases on the West Branch Montreal. The data strongly suggest that a minimum release level should be 600 cfs, as this flow level was found to be acceptable to the greatest variety of river users. The data also suggest that varying the flow levels released over multiple release days or a release weekend may provide for an even more varied group of river runners. An optimum release schedule for a weekend of two releases, according to this study, would begin with a release of 600 cfs on Saturday morning at 10 am and would last until 4 pm, and would have a second release day of 800-1,000 cfs on Sunday, which would begin at 10 am and would last until 4 pm. If the release schedule had to be limited to one day then a flow of 600-800 cfs should be released between 10 am and 4 pm on a Saturday. Considering this studies limitations, a follow up survey of participants is recommended subsequent to an initial whitewater release in order to obtain a more accurate instream flow – recreation relationship for the West Branch.

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