Performance Indicator Summary

Performance indicator: Net economic value lost by recreational boaters and charter boat patrons as water level varies from ideal levels for boating.

Technical Workgroup: Recreational Boating and Tourism TWG

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Modeled by: Connelly, N.A., Bibeault, J.F. for water level - impact relationships that were used by PFEG in the STELLA Shared Vision Model

Activity represented by this indicator: Net economic value or boaters' willingness-to-pay for boating over and above what they are already paying. Net economic value was calculated on a per day basis. Average value per day varied based on water reach, country (U.S. or Canada), water access method (private dock, marina, launch ramp, charter boat), boat type, and length class. The average value by boater type and length class by reach, was multiplied by days boated per month unconstrained by water levels. Days unconstrained by water level was the sum of actual days boated in 2002 plus boaters' estimates of days that would have been boated if water levels were not a problem.

Link to water levels: Boaters cannot safely boat when there is insufficient water depth for the boat to float in the water. We took depth measurements at slips in marinas, at boat launching ramps, and asked boaters at private docks for water depth information to determine when boats would have insufficient water. Boaters also can not boat when water levels are too high. We measured and defined "too high" as the point when docks become inundated and are unsafe to use. Traditionally, high water levels have occurred in the spring and low water levels in the fall. When the water level drops in late summer – early fall, it typically reaches a level too low for safe boating, at which point boats must be removed from the water, effectively ending the boating season.

Importance: We estimated that in 2002, 310,000 people participated in recreational boating in the study area. They spent (US) $429.7 million at local businesses related to their boating trips. As an example, of the $178 million in total expenditures on the U.S. side, $68 million resulted from tourist-related spending (from boaters residing outside four groupings of counties along the New York border of these waters). This tourist-related spending, after considering indirect effects, resulted in total output of $96 million and 1,380 full-time equivalent jobs. The economic impact can influence the vitality of municipalities and counties, especially in summer. (See contextual narrative for further discussion of the importance of recreational boating.) U.S. and Canadian boaters received a net benefit or consumer surplus of approximately (US) $278.4 million in 2002.

Performance Indicator Metrics: Net economic value impacts are determined through boater survey results and measured bathymetry at boating facilities. This is reported as dollars lost by month and reach as water levels vary.

Temporal validity: Data was collected in 2001 and 2002 and is therefore valid for that time period. The boating season is limited to April through November of each year.

Spatial validity: The study area was divided into 6 reaches - Lake Ontario, Upper St. Lawrence River (Alexandria Bay and Ogdensburg), and Lower St. Lawrence River (Lake St. Louis, Montreal-Contrecoeur and Lake St. Pierre). Water level – impact relationships were created for each reach using the performance indicator of net economic value lost. The area of investigation encompassed the entire study area and is therefore spatially valid for the entire area.

Links with hydrology used to create the PI algorithm: Depth measurements taken at marinas, private docks, and boat launch ramps were standardized to the gauge within their respective reach. For the Lake Ontario Reach, which includes the lake itself and the portion of the St. Lawrence River up to and including Cape Vincent, the standardizing gauge was the one closest to the measurement location. The remainder of the Upper St. Lawrence River was divided into two reaches associated with the water level gauge measurements at Alexandria Bay and Ogdensburg. The three reaches on the Lower St. Lawrence River were referenced to the following water level gauges: Pointe Claire for Lake St. Louis, Sorel for Lake St. Pierre, and Varennes for Montreal-Contrecoeur. Figure 1 shows the reaches in the study area.

The Algorithm: A water level – impact relationship curve, sometimes referred to as a stage damage curve, was developed for each reach. As an example, Figure 2 shows the water level – impact relationship for Lake Ontario. (All other reaches have similarly shaped curves.) The lake level elevation is scaled to both feet and meters. Each line represents net economic value lost during a different month of the boating season. The graph shows that impacts of lower water levels would be greater in the summer months of July and August than early spring or fall months. Lake Ontario Reach users start to experience losses when water levels drop below 247 ft. (75.3 m). The losses are minor until about 245.5 ft. (74.8 m) when they start to increase, and then a dramatic increase occurs at 244.8 ft. (74.6 m). By way of example, looking at the month of August, we see that if the water level is maintained at 247 ft. (75.3 m) for that entire month, boaters could boat as often as they wished because no one would be affected by low or high water levels. As water levels drop, benefits would be lost because boats could not launch. Approximately (US) $7.5 million in net economic benefits would be lost if the water level were 244 ft. (74.4 m) for the entire month of August.

Validation: Data gathered in separate efforts on the U.S. and Canadian sides were cross-checked for validity. Results (such as number of boaters and net economic value per day) were compared with previous studies (e.g., Goss Gilroy 2003, Connelly et al. 1997), that showed our estimates to be similar. This provided us with a comparative validation.

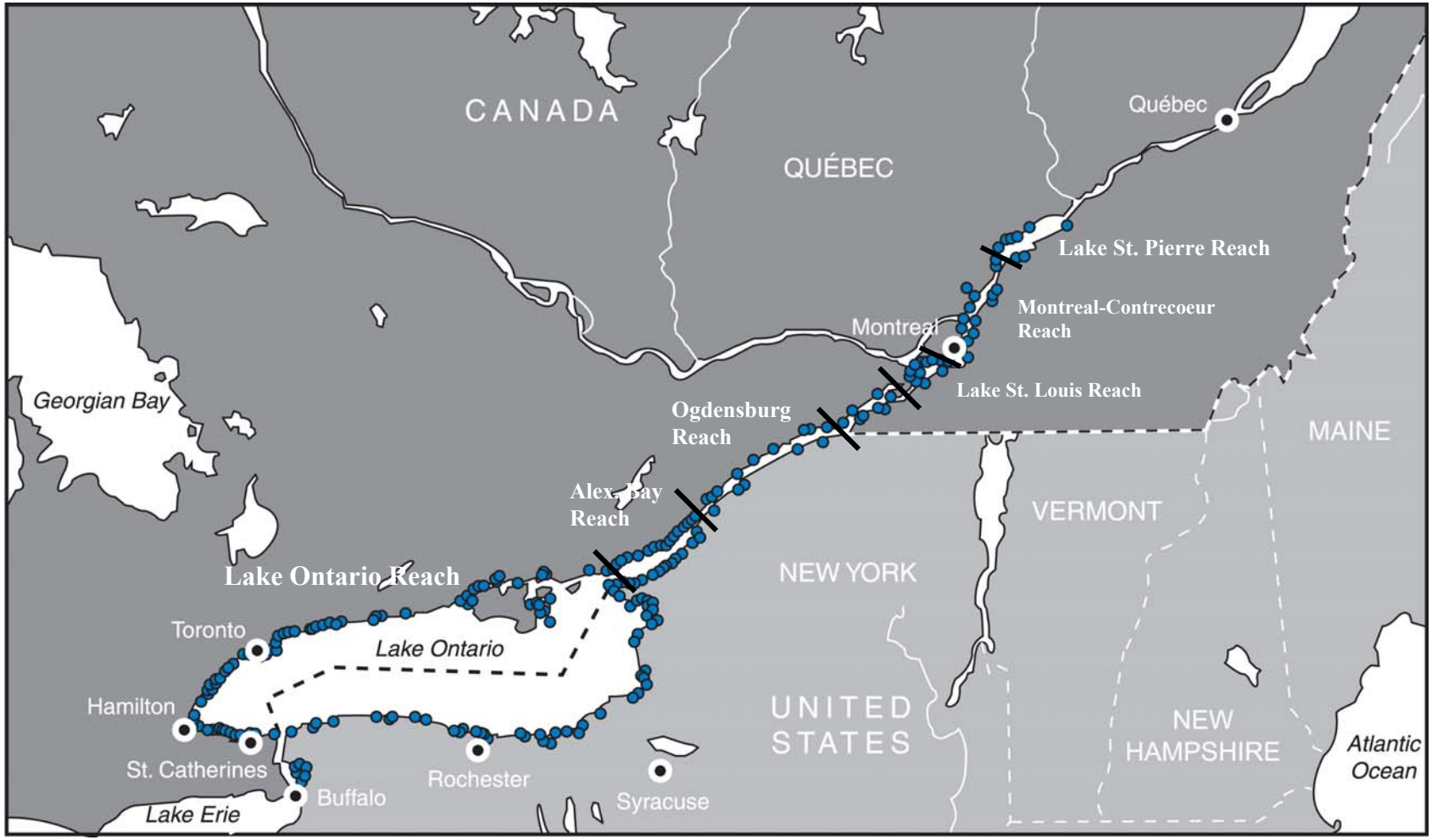

Figure 1. Map of study area showing reaches and marina locations.

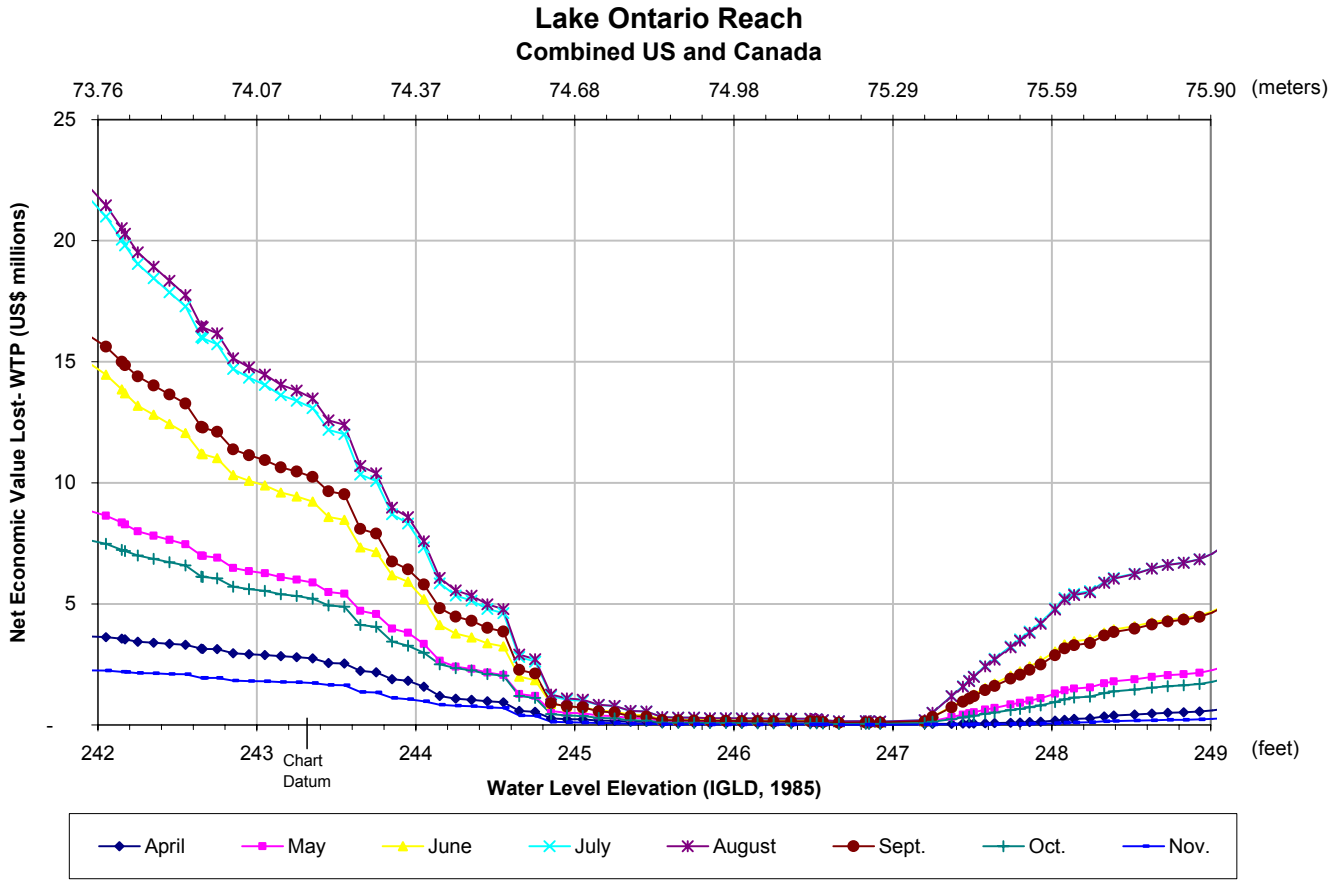

Figure 2. Water level – impact relationship using net economic values lost by month for all US and Canadian Lake Ontario Reach users.

Documentation and References:

Connelly, N. A., J-F. Bibeault, J. Brown, and T. L. Brown. 2005. Estimating the economic impact of changing water levels on Lake Ontario and the St. Lawrence River for recreational boaters and associated businesses. Human Dimensions Research Unit, Cornell University, Ithaca, NY.

Connelly, N. A., T. L. Brown, and B. A. Knuth. 1997. New York Statewide angler survey 1996 Report 1: angler effort and expenditures. NYSDEC, Albany, NY.

Connelly, N. A., T. L. Brown, and B. A. Knuth. 2000. Assessing the relative importance of recall bias and nonresponse bias and adjusting for those biases in statewide angler surveys. Human Dimensions of Wildlife 5(4):19-29.

Goss Gilroy Inc. 2003. Economic impact analysis of recreational boating in Canada: 2001. Final report, Discover Boating, CMMA.

Risk and uncertainty assessment: The methods used are extensively documented in Connelly et al. (2005), but in general, similar methods were used to estimate the performance indicator for all reaches on both sides of the border. A number of assumptions had to be made, given the timeframe and funding constraints of the study, as is true of any study. Those that have the greatest possible impact on the performance indicator are discussed in the contextual narrative. Listed below are more specific assumptions and how they were addressed by the methodology chosen. Considering various water level plans and possible ranking of those plans, we believe it is unlikely that changes to any of these assumptions, with the possible exception of #4 (discussed below), would affect plan ranking for recreational boating. Changes in assumptions might affect the estimated loss for recreational boating as compared with other interests.

1. At marinas, yacht clubs, and private docks, we assumed that losses happen when a boat has no clearance under the keel. These losses would happen sooner if one assumes some safety margin, such as 6 inches, for safe boat operation. If desired, the water level - impact relationship curve for marinas, yacht clubs, and private docks could be shifted to the right by whatever safety margin was assumed.
2. On the U.S. side, all permanent slips at marinas and yacht clubs were assumed to be occupied for the calculation of the water level – impact relationships. As an alternative measurement, total slips could be reduced to the occupancy rate (88.4%) calculated for the summer of 2002.
3. Boaters were asked in the late fall of 2002 to recall the number of days they boated Lake Ontario or the St. Lawrence River by month for 2002 to date. Two types of bias could have affected their answers. One was response bias, such that respondents to the survey were more active boaters (boating more days) than nonrespondents. We found this to be the case when we compared respondents and nonrespondents' answers to a screening interview question regarding days boated thus far in 2002. We accounted for this bias by reducing the estimate of total days boated by 4.7%. A second type of bias is memory recall bias. Respondents could have trouble recalling exactly how many days they boated each month in 2002 by the fall of that year. Past research has shown a general trend toward overestimation of participation (Connelly et al. 2000). Although we tried to minimize this bias by sending out the questionnaires as soon as possible after the end of the boating season, we believe there is likely some overestimation.

4. Total possible days boated used to calculate the performance indicator was the sum of days boated in 2002 plus boaters' estimates of the number of additional days they would have boated by month if water levels had been sufficient. The hypothetical nature of the estimate of additional days raises the possibility that boaters would not have gone boating on all of these days. Since they were being asked after the fact what they would have done, we can be more certain that days were constrained by water level and the estimate of additional days is approximately accurate. The trend in boaters'estimates of additional days follows the typical water level pattern, giving further credence to their estimates, with a few days lost in spring due to high water, no days lost in the summer, and more days lost in the fall due to low water. The estimate of total possible days boated used in calculating the performance indicator therefore is unconstrained by water levels. However, this estimate should not be thought of as an "ideal" number of days boated because an ideal estimate would not be constrained by factors such as weather, gas prices, etc. If boaters overestimated the number of additional days they would have boated in the fall under ideal water levels, and if a water level plan was developed that favored higher levels in the fall compared with another plan, it is possible that plan ranking could be affected by a shift in the number of days boated in the fall. The shape of the fall water level – impact relationship curves would change slightly.

5. In calculating net economic value (willingness-to-pay), certain standard assumptions are made that result in modifications to the data set. First, outliers were eliminated. Using the U.S. data as an example, the 13% who indicated they were not willing to pay the amount they actually paid or any more than this amount were eliminated. Respondents whose maximum amount was considered out of range (unrealistic) also were eliminated. The latter adjustment affected the less than 1% of respondents who were willing to pay more than (US) $1,400 per day. The maximum cut-off value of $1,400 was determined by using the same relationship to mean expenditures as was used in the 1996 and 1988 New York Statewide Angler surveys (Connelly et al. 1997). Canadian data were adjusted in the same manner.

6. Strategic bias may also be a problem when asking boaters about their willingness to pay for boating. To address this bias, respondents were asked to indicate if they inflated the amount they reported as their maximum willingness to pay because they wanted to indicate that boating was important to them. Thirty-two percent of U.S. respondents indicated they had inflated their estimate. Their value was replaced with the mean per day value of those who did not indicate such an inflation. Canadian data were adjusted in the same manner.

7. On the Canadian side, data to be used to create performance indicators for days boated and willingness-to-pay were collected in the survey of Canadian power squadron members. These boaters are not representative of all Canadian boaters. They were considered to be representative of marina and yacht club users, but not of private dock or launch ramp users. To estimate performance indicators for private dock and boat launch ramp users, ratios developed from U.S. data (e.g., days boated by marina users/ days boated by launch ramp users) were applied to the Canadian power squadron data.