

## Chapter Four: Methodology – The Kennebec River Survey

### Purpose & Significance

The Edwards Dam was the first major dam in Maine to be removed. A major step leading up to the removal was a benefit-cost analysis conducted by the Federal Energy Regulatory Commission. Included in the benefits portion of this analysis was an estimate of the value of the fishery to be created when the dam was removed. The Edwards Dam is a special case study of a dam removal in which the value of the fishery was estimated prior to removal.

However, since removal of Edwards Dam in 1999, little research or monitoring has been done. Namely, the credibility and accuracy of the benefits estimates used in the benefit-cost analysis leading to removal have not been investigated. The survey at hand serves as a partial ex-post analysis of the value of the Kennebec River fishery since removal of Edwards Dam.

This survey yields data which is used for one measure of the “success” of the dam removal. The economic benefits estimates that this survey generates serve as an objective, quantitative measure of the success of the dam removal decision.

The Edwards Dam case study is also unique in that (to my knowledge) no such study exists which has had a fishery valuation completed both before and, now, after dam removal. The precision of the ex-ante (pre-dam removal) valuation is tested and in the following chapter is compared to the ex-post valuation found. This comparison holds especially important implications for future dam removal decisions, in that if the post-dam removal fishery is generating a much greater economic benefit than previously estimated, dam removal decision makers in the future may be more inclined to lobby for dam

removal. Conversely, if the estimate of the value of the post-Edwards Dam fishery is significantly less than that determined prior to removal, this study could serve as an indication of the potential detrimental effects that a dam removal can have on the value of a fishery.

Whenever dam removal decisions are made, an investigation of relevant past literature and past case studies is necessary. Because of the unique ex-post evaluation component of the Edwards Dam removal of this study, the results should be especially informative and useful in future dam removal decisions.

#### Methodology & Statistical Results

A mail survey entitled ‘Kennebec River Survey’ was used as the method of data collection for this study. Sent out in early January, 2006, the survey contained both travel cost and willingness-to-pay questions in order to collect data on fishing activity and economic benefits arising from use of the lower Kennebec River fishery. The survey was designed after examining the study administered by Boyle et al. which produced the data for their study (1991). After discussing the project with the Maine Trout Unlimited (TU) council and the Maine Coastal Conservation Association (CCA) president, one-time access to a sample of their mailing lists was granted. 1,080 surveys were sent to TU members and 450 were sent to CCA members, for a total of 1,530 surveys sent out. An exact copy of this survey is found in Appendix A. Response statistics for the mailing lists are provided in Table 4-1 below.

Mailing List	CCA	TU	TOTAL
Surveys Sent	450	1080	1530
Failed Surveys	2	10	12
Returned	205	396	601
Response Rate	45.76%	37.01%	39.59%

Table 4-1: Survey Response Statistics

The cover page of the survey shows a map of the lower Kennebec River, portraying (from South to North) the city of Bath, Chops Point, Merrymeeting Bay, Gardiner, the Transmission Line Crossing, Augusta, Lockwood Dam, Waterville and finally the Sebasticook and Sandy Rivers. This map can be seen in Figure 4-1. It is also noted that the transmission line crossing was the former Edwards Dam site. This transmission line crossing above the river is the line above which a Maine inland fishing license is required to fish.

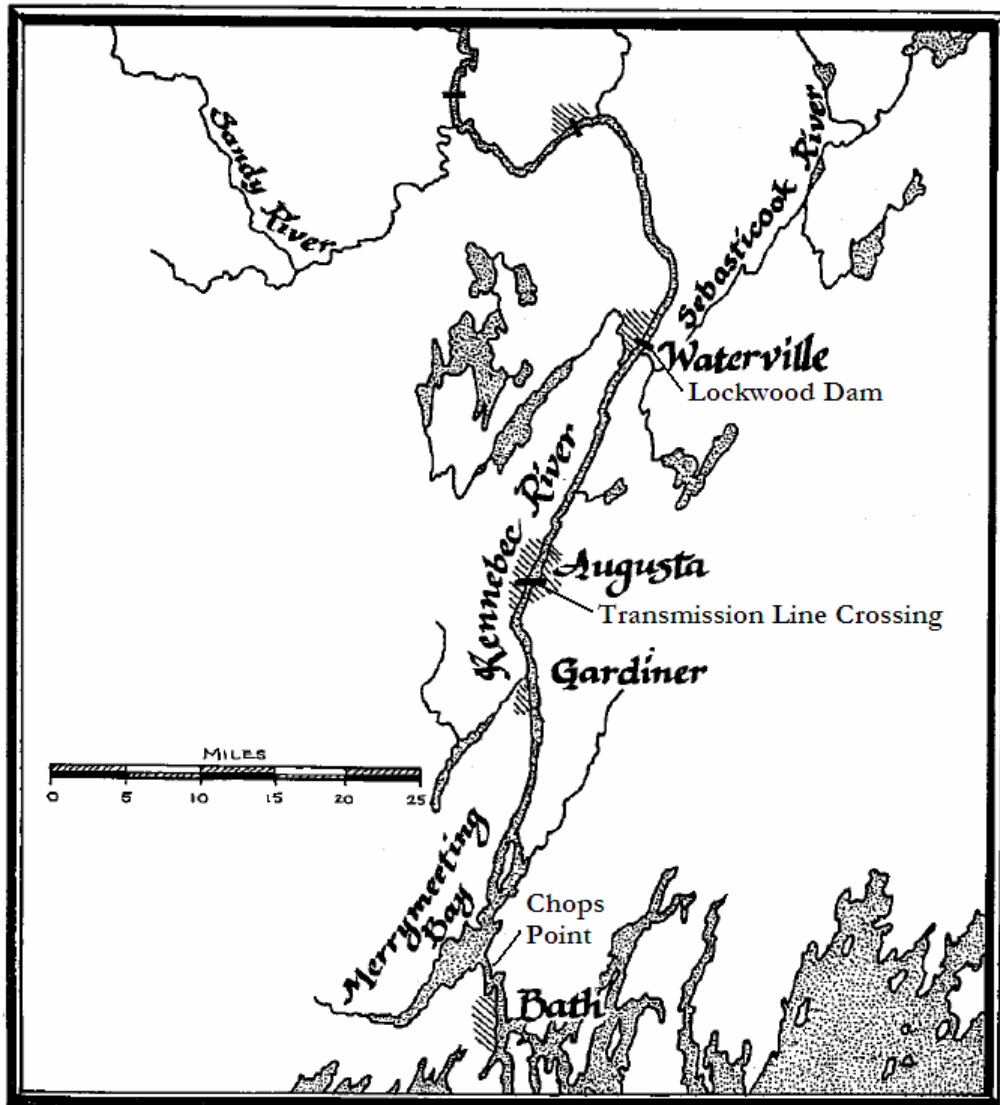


Figure 4-1: Map of Kennebec River Shown on Cover Page of Survey

Later in the survey, the river is separated into a 'Tidal Water' section, from Chops Point to the transmission line crossing, and a 'Freshwater' section, between Lockwood Dam and the transmission line crossing. The map is used for reference in sections II and III of the survey.

The decision to designate the section from Chops Point to the transmission line crossing as 'tidal water' was made after much discussion. It was decided to call this section 'tidal water' instead of 'saltwater' because this section of river is brackish water, not simply saltwater. Removal of the Edwards Dam potentially allows tidal changes in river water levels to occur above the transmission line crossing, but by labeling this stretch 'tidal water,' the respondent is aware that a Maine inland fishing license is not necessary to fish this stretch of the river, while at the same time acknowledging that the water is not, in fact, saltwater.

Section I of the survey, titled 'General Fishing Information,' is aimed at general fishing activity in Maine. Respondents were asked to report the first year they fished a freshwater fishery in Maine, the first year they fished a saltwater fishery in Maine, and approximately how many days per year they fish different types of fisheries in Maine. These fishery types were: Lakes or Ponds, Streams or Brooks, Rivers, and Coastal or Ocean Waters. By asking for the specific year in which the respondent first fished a fresh and saltwater fishery in Maine, and also for the approximate number of days they fish different types of fisheries, quantitative results can be obtained. The survey made by Boyle et al. asked respondents to indicate the first year they fished a fresh or saltwater fishery by choosing a corresponding ten-year bracket. Not only does this

question fail to distinguish between beginning fresh and saltwater fishing activity, but it also does not give an exact date. The survey made by Boyle et al. also fails to obtain data on fishing days in fresh and saltwater areas. Instead, they ask respondents to indicate how often they fish fresh or saltwater, by choosing categories such as “Every year,” or “Less than half of the years.” These labels are confusing and inconclusive.

The next question of the survey asks respondents to indicate the types of fish species they have targeted while fishing in Maine. In total, 28 fish species are listed, with a space for other species to be hand-written in. The percentages of the five fish species most targeted by respondents in each mailing list are shown in Table 4-2:

<u>TU</u>		<u>CCA</u>		<u>TOTAL</u>	
	(n = 376)		(n = 203)		(n = 579)
Brook Trout:	97.34%	Striped Bass:	98.02%	Brook Trout:	89.64%
Landlocked Salmon:	85.64	Bluefish:	83.74	Landlocked Salmon:	80.14
Brown Trout:	78.19	Brook Trout:	75.37	Striped Bass:	78.41
Striped Bass:	67.82	Mackerel:	70.44	Brown Trout:	72.88
Smallmouth Bass:	63.56	Landlocked Salmon:	69.95	Smallmouth Bass:	62.52

Table 4-2: Targeted Fish Species

The second page of the survey has four questions which ask respondents their perceptions of different aspects of the river since removal of the Edwards Dam. An introductory paragraph precedes these questions and reads:

In 1999, the Edwards Dam, which was located on the Kennebec River in Augusta, was removed. The removal of the dam allowed anadromous fish (fish that live in salt water, but breed in fresh) to reach an additional 17 miles of spawning habitat in the river. This river habitat had been unreachable for these fish since 1837.

The first question simply asks the respondent whether or not they think removal of the Edwards Dam was beneficial; the second question asks the respondent how they feel the water quality of the Kennebec River has changed. Respondents were asked to choose one of six statements provided. The statements provided were: Worsened, Remained the Same, Improved a Little, Improved Significantly, Improved Dramatically or No Opinion. The third asks how they feel the amount of wildlife surrounding the river has changed. Statements presented were: Worsened, Remained the Same, Increased a Little, Increased Significantly, Increased Dramatically or No Opinion. The final question asks respondents how they feel the numbers and types of fish in the river have changed. The statements provided for the last question were identical to the previous one.

Although these questions hold no implications as far as the actual estimate of the economic value of the post-Edwards Dam fishery is concerned, they do provide interesting information on the post-dam perceptions of anglers. Responses to these perception questions are shown in the following four tables.

	TU	CCA	TOTAL
	(n = 384)	(n = 203)	(n = 587)
Yes:	84.11%	81.77%	83.30%
No:	2.34%	3.45%	2.73%
No Opinion:	13.54%	14.78%	13.97%

Table 4-3: Do you think that Removal of Edwards Dam was Beneficial?

	TU	CCA	TOTAL
	(n = 381)	(n = 202)	(n = 583)

Worsened:	0.00%	0.99%	0.34%
Remained the Same:	9.19%	11.39%	9.95%
Improved a Little:	17.85%	21.29%	19.04%
Improved Significantly:	28.35%	21.78%	26.07%
Improved Dramatically:	14.96%	14.36%	14.75%
No Opinion:	29.66%	30.20%	29.85%

Table 4-4: Since Removal, How do you feel Water Quality has Changed?

	TU	CCA	TOTAL
	(n = 380)	(n = 203)	(n = 583)
Decreased:	0.53%	0.00%	0.34%
Remained the Same:	12.11%	15.76%	13.38%
Increased a Little:	18.95%	23.15%	20.41%
Increased Significantly:	20.53%	19.21%	20.07%
Increased Dramatically:	9.21%	6.40%	8.23%
No Opinion:	38.68%	35.47%	37.56%

Table 4-5: Since Removal, How do you feel the Amount of Wildlife has Changed?

	TU	CCA	TOTAL
	(n = 380)	(n = 203)	(n = 583)
Decreased:	1.05%	2.96%	1.72%
Remained the Same:	3.68%	12.81%	6.86%
Increased a Little:	20.79%	23.15%	21.61%
Increased Significantly:	33.68%	31.53%	32.93%
Increased Dramatically:	15.00%	6.40%	12.01%
No Opinion:	25.79%	23.15%	24.87%

Table 4-6: Since Removal, How do you feel the Numbers and Types of Fish in the River have Changed?

Section II of the survey, beginning on page 3, asks respondents about their fishing activity in the freshwater part of the Kennebec River, from the

transmission line crossing to the Lockwood Dam in Waterville. The introductory paragraph reads:

This section asks about your fishing activity in the un-dammed, freshwater parts of the Kennebec River. That is, the stretch of river from Lockwood Dam in Waterville, to tidal water in Augusta. The tidal water is marked by a transmission line crossing above the river (please refer to map on cover page).

The first question asks respondents whether or not they have ever fished this stretch of the river. Respondents answering 'No' to this question were asked to skip to the next page. The second question asks respondents the approximate number of days per year they fish this section of the river. Again, the study conducted by Boyle et al. did not ask for specific dates or actual numbers of fishing days. The survey used in this study generated more usable quantitative results for these questions.

The third question asks respondents to report the first year they had fished this stretch, and the fourth question, the most recent year they had fished the stretch. In conjunction, these two questions can determine which anglers have fished the Kennebec River both before and after 1999; that is, which anglers fished the river both before and after dam removal. Data from respondents who fit this criterion can be evaluated specifically as a unique subsample of all respondents.

The question which reports the respondent's most recent year they fished the section of the river is also used to calculate the respondent's expenditures in 2005 dollars. The expenses of respondents who reported they fished the freshwater section of the river in years earlier than 2005 were adjusted accordingly using CPI data from the Bureau of Labor Statistics. It was

necessary to report travel costs in 2005 dollars for the comparisons of direct economic benefits which are presented in the following chapter.

The final question on page 3 is the freshwater travel-cost portion of the survey. Respondents were asked to report the approximate costs they paid on a “typical one-day freshwater fishing trip to the Kennebec River,” the last time they fished the freshwater section of the river. Spaces were given for the following expenses, as well as space for ‘Other’ costs: Transportation, Public Transportation, Food and Beverages, Lodging, Guide Fees, Bait, Boat Rental, Shuttle Service, and Fuel. It was emphasized that respondents should report the cost of bait used for one trip. In hopes of capturing *all* costs that anglers might experience while fishing the Kennebec River, more detailed descriptions of the types of expenditures were provided than those on the survey by Boyle et al. In addition, neither Boat Rental nor Shuttle Service was provided as an expense category in their survey.

The travel-cost question is concluded by asking respondents how many people the reported expenses cover. By including this final question, average *per-person* costs can be obtained. The study by Boyle et al. did not include a question investigating how many people the expenses cover; instead they asked respondents to report their “share of the expenses.” Average freshwater per-person expenses are shown in Table 4-7 below. These expenses are given in 2005 U.S. dollars.

	<u>TU</u>	<u>CCA</u>	<u>TOTAL</u>
	(n = 130)	(n = 47)	(n = 177)
Transportation	\$10.59	\$15.17	\$11.81
Public Transportation	0.45	0.00	0.33
Food and Beverages	7.25	11.27	8.32
Lodging	1.66	12.16	4.45

Guide Fees	12.73	44.59	21.19
Bait	0.78	0.99	0.84
Boat Rental	0.33	1.20	0.56
Shuttle Service	0.18	0.64	0.30
Fuel for Boat	2.02	3.97	2.54
Other	2.08	2.26	2.13
Total Expenses	\$38.07	\$92.25	\$52.47

Table 4-7: Average Freshwater Per-Person Expenses

It should be re-emphasized that respondents who had never fished the freshwater section of the Kennebec were asked to skip the travel-cost question of the freshwater section of the survey. Thus, the mean expenses shown above were reported by anglers who had traveled to, and fished the freshwater section of the river.

Page 4 contains the freshwater willingness-to-pay questions of the survey. The good to be valued was a one day fishing trip:

Consider a full day (8 hour) guided fishing trip on the Kennebec River covering water from either Waterville to Sidney or Sidney to Augusta. All flies, lures and/or bait would be provided as well as fishing rods and a lunch, snacks and drinks for the trip. The trip would be run on the guide's fishing boat.

Respondents were asked to report the maximum amount they would pay for both a brown trout fishing trip and a smallmouth bass fishing trip. Questions on Boyle et al.'s study ask respondents "What is the most that a fishing trip could have cost before you would have decided not to take any fishing trips to this section of the lower Kennebec River?" This description is very different from the one above. The question above asks the respondent's willingness-to-pay for a full day guided trip on the indicated freshwater section of the river, while the question by Boyle et al. asks the amount that would deter the

respondent from fishing the stretch. Comparisons between responses of the current survey and Boyle et al.'s may be difficult for this reason.

Some respondents to these questions reported answers of 0. In many cases, these responses represent the respondent's true willingness-to-pay for the fishing trip. However, it may also be the case that some of these 0 responses were 'protest zeros.' Protest zeros are responses of zero to a question for the reason that the respondent rejected some portion of the survey, even though they may still hold a value for the question (Boyle, 1991). In order to compensate for these potential protest zeros, the mean willingness-to-pay was calculated using all of the reported zeros, half of the reported zeros and none of the reported zeros. It may be unlikely that half or even any of the zero responses are indeed protest zeros, but by performing these calculations, a range of mean willingness-to-pay is generated. Average willingness-to-pay for a one-day freshwater brown trout and smallmouth bass fishing trip are provided in Table 4-8 below. The three numbers provided in each cell represent the mean willingness-to-pay calculated with all the zeros, half the zeros and none of the zeros, respectively.

	TU	CCA	TOTAL
	(n = 356, 332, 308)	(n = 183, 169, 156)	(n = 539, 501, 464)
Brown Trout:	\$179.28, \$192.24, \$207.16	\$194.11, \$209.04, \$226.46	\$184.29, \$197.91, \$213.69
	(n = 353, 275, 197)	(n = 183, 157, 132)	(n = 536, 432, 329)
Smallmouth Bass:	\$92.80, \$119.12, \$166.28	\$149.54, \$174.29, \$207.31	\$112.17, \$139.17, \$182.74

Table 4-8: Average Freshwater Willingness to Pay

Section III of the survey, beginning on page 5, is aimed at 'tidal water' fishing activity on the Kennebec. The introductory paragraph reads:

This section asks about your fishing activity in the tidal parts of the Kennebec River. That is, the stretch of river from the transmission line crossing in Augusta, to Chops Point on Merrymeeting Bay (please refer to map on cover page).

The following questions of Section III on page 5 are identical to those of Section II, except targeted at the respondent’s fishing activity between the transmission line crossing in Augusta and Chops Point on Merrymeeting Bay. The average per-person expenditures reported for tidal water fishing, in 2005 dollars, are provided in Table 4-9. Again, only respondents who have ever fished the tidal water section of the river responded to this question.

	<u>TU</u>	<u>CCA</u>	<u>TOTAL</u>
	(n = 139)	(n = 98)	(n = 237)
Transportation	\$12.39	\$11.94	\$12.20
Public Transportation	0.19	0.72	0.41
Food and Beverages	10.54	8.03	9.50
Lodging	3.32	1.69	2.64
Guide Fees	21.36	20.08	20.83
Bait	1.44	2.20	1.75
Boat Rental	0.38	0.27	0.33
Shuttle Service	0.04	0.00	0.02
Fuel for Boat	4.78	10.27	7.05
Other	2.09	2.04	2.07
Total Expenses	\$56.53	\$57.24	\$56.80

Table 4-9: Average Tidal Water Per-Person Expenses

Regrettably, the instruction following the first question, which should have read, “If you answered No to question 8, please skip to page 6,” did not

include the word “to.” Close readers of the survey completely skipped the next page, which was not intended. Of the 338 respondents who reported they had not fished the tidal water section of the river, 50 (approximately 14.8%) skipped the entire next page, and 25 (approximately 7.4%) skipped the first half of the next page.

The first half of page 6 was the saltwater willingness-to-pay section of the survey. Respondents were given the following description:

Consider a full day (8 hour) guided fishing trip on the Kennebec River in the tidal area, between the transmission line crossing in Augusta and Chops Point on Merrymeeting Bay. All flies, lures and/or bait would be provided as well as fishing rods and a lunch, snacks and drinks for the trip. The trip would be run on the guide’s fishing boat and would depart on the river at a location of your choice between Augusta and Merrymeeting Bay.

Then respondents were asked to report the maximum amount they would pay for a trip of this nature targeting striped bass, and then Atlantic salmon. Currently, Atlantic salmon are an endangered species in the Kennebec River; that is, they are not available for targeted fishing. On the Atlantic salmon question, it was noted that the fishing trip is hypothetical, and respondents were asked to “consider a situation where Atlantic salmon had once again become a species available for targeted fishing.” As was the case in the freshwater section of the survey, the good being valued in the above description is quite different from that described in the study by Boyle et al. Average willingness-to-pay for a one-day tidal water striped bass and Atlantic salmon fishing trip are provided in Table 4-10. As was the case in the freshwater willingness-to-pay questions of the survey, concern was given to potential

protest zeros. The three numbers provided in each cell represent the mean willingness-to-pay calculated with all the zeros, half the zeros and none of the zeros, respectively.

	<u>TU</u>	<u>CCA</u>	<u>TOTAL</u>
	(n = 324, 295, 266)	(n = 179, 171, 163)	(n = 503, 466, 426)
Striped Bass:	\$177.47, \$198.92, \$216.17	\$235.84, \$246.87, \$258.99	\$198.24, \$213.98, \$232.44
	(n = 324, 302, 281)	(n = 177, 169, 162)	(n = 501, 472, 443)
Atlantic Salmon:	\$228.81, \$248.48, \$263.83	\$270.77, \$283.59, \$295.84	\$243.63, \$258.60, \$275.53

Table 4-10: Average Tidal Water Willingness to Pay

The second half of page 6 presented a question which asked respondents whether or not they would purchase a saltwater fishing license, and if so, what is the most they would pay for it. A careful description of this scenario was given:

Currently, saltwater sportfishing in Maine does not require purchase of a fishing license. The Maine Department of Inland Fisheries & Wildlife regulates all freshwater fishing license sales in Maine. All proceeds from fishing licenses are used to fund the Maine Department of Inland Fisheries & Wildlife, which in turn is used to protect natural resources in the state of Maine. In other words, all money collected from fishing license sales stays within the agency. The Maine Department of Marine Resources is the agency responsible for the management of saltwater sport fishing in the state of Maine.

15. If the state of Maine were to establish a saltwater sportfishing license that was required by all who fish in saltwater fisheries in Maine, with the funds for the licenses going to the Department of Marine Resources for the enhancement of Maine's

recreational saltwater fish species, would you purchase this license?

The decision of whether or not to include this question was discussed at length. It was noted that some anglers may have very strong personal opinions either in favor or against a saltwater fishing license, so the wording of this question was done very carefully. The Maine Department of Inland Fisheries & Wildlife (DIF&W) is the organization which regulates all inland fishing license sales, so a telephone call was placed to them asking for a description of how the funds collected through license purchases was used. It was my hope in this question to create a situation where an organization would use the revenues from the saltwater license in very comparable ways. The question also asked those respondents who reported they would not purchase the saltwater license to write why they would not do so. The percentage of respondents who indicated they would purchase this license, and the average amounts they would pay for the license are shown in Table 4-11:

	TU	CCA	TOTAL
Would Purchase the License	69.48%	84.97%	75.05%
	(n = 344)	(n = 193)	(n = 537)
Mean Willingness to Pay	\$22.81	\$29.75	\$25.60
	(n = 239)	(n = 164)	(n = 403)

Table 4-11: Average Saltwater Fishing License Willingness to Pay

Section IV was the final section of the survey and was aimed at demographical data of the respondents. It was stressed at the beginning of this section that all answers would be held in strict confidentiality and that all answers were optional, but greatly appreciated. Questions in this section asked the respondent their age, sex and zip code; if the respondent was a Maine resident, they were asked how many years they have lived in the state; if the respondent was a non-resident, they were asked how many years they had

ished in the state of Maine. The final two questions asked what the respondent's completed level of education was, and what their total 2005 household income was. Eight monetary brackets were provided for the last question.

The survey concluded with a page thanking the respondents for their time and gave space for any comments, questions or concerns. Also, those respondents who wished to receive a copy of the final report could do so by providing their name and address. Descriptive statistics for each question of the survey can be found in Appendix B.

The following chapter details the final results from this study.