

# THE ECONOMIC BENEFITS OF THE RESTORATION OF ATLANTIC SALMON TO NEW ENGLAND RIVERS

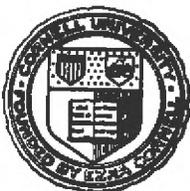
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Table of Contents

|  | <u>Page</u> |
|--|-------------|
| Introduction . . . . .   | 1           |
| Program Benefits . . . . .   | 3           |
| Comparisons with Wildlife Valuations in Other Studies . . . . .                            | 6           |
| Program Costs . . . . .  | 6           |
| Description of Questionnaire Responses . . . . .   | 8           |
| Respondent demographics . . . . .  | 8           |
| Respondent outdoor recreation experience and familiarity<br>with Atlantic Salmon . . . . . | 10          |
| Reasons for interest in Atlantic Salmon . . . . .  | 11          |
| Alternative Calculations of Benefit . . . . .  | 12          |
| Summary and Conclusions . . . . .  | 13          |
| Bibliography . . . . .   | 14          |
| Appendix I: Mail Questionnaire . . . . .   | 15          |
| Appendix II: Nonresponse Bias . . . . .  | 26          |
| Appendix III: Nonrespondent Follow-up Questionnaire . . . . .                              | 36          |

List of Tables

| <u>Table</u> | <u>Title</u>   | <u>Page</u> |
|--------------|--|-------------|
| 1            | Average willingness to pay for Atlantic Salmon Restoration:<br>In addition to fishing license fees . . . . .                                     | 4           |
| 2            | Average willingness to pay for Atlantic Salmon Restoration:<br>Maximum fishing license fees . . . . .  | 6           |
| 3            | Estimated costs of Atlantic Salmon Restoration on New England<br>Rivers . . . . .  | 7           |
| 4            | New England population proportions distributed by state, 1984<br>US Census figures and 1986 survey responses . . . . .                           | 8           |
| 5            | Age of respondents . . . . .   | 9           |
| 6            | Reasons for not buying a Maine salmon license for people who<br>knew of its existence . . . . .  | 11          |
| 7            | Median and mean willingness-to-pay estimated from equations<br>predicting the probability of agreeing to pay for Salmon<br>restoration . . . . . | 13          |

## Introduction<sup>1</sup>

New England is graced with close to three dozen major rivers or river systems, each of which empties into the Atlantic Ocean. At the time Europeans began to colonize the region, wild salmon populations were plentiful in at least 28 of the rivers, ranging from the Housatonic River in Connecticut north to the Aroostook River in Maine. It has been estimated that the number of salmon entering New England rivers annually at that time might have been greater than 300,000 individual fish.<sup>2</sup>

Two and a half centuries of human population growth and economic development devastated New England's Atlantic Salmon population. Overfishing, water pollution, and (above all else) dam construction accounted for the salmon's retreat. Were Atlantic Salmon to be restored now to their full historical range, upstream fish passage facilities would have to be provided at a minimum of 65 dams, and downstream fish passage facilities at almost 100 dams.<sup>3</sup>

Today only seven of the original twenty-eight Atlantic Salmon rivers support fairly stable but small wild Atlantic Salmon populations. Adult salmon in varying numbers return annually to eight additional rivers. The total number of salmon returning to all New England rivers adds up to less than 7,000 fish. Of these, only about 1,000 are not of hatchery origin.<sup>4</sup>

Atlantic Salmon restoration activities were first initiated well over a century ago, and revitalized with the formation of the Maine Atlantic Salmon Commission in 1947. Since then, state and federal agencies have coordinated efforts with private sector groups to promote, instigate, and explore the feasibility of a regional restoration program. Between 1967 and 1983 over 76 million dollars were spent on restoration efforts in New England. Given the fruits of these accumulated expenditures, the U.S. Fish and Wildlife Service believes the feasibility of the Restoration Program has now been demonstrated. However, the costs of a planned 25 years of further restoration activities exceed \$100 million.<sup>5</sup>

The Fish and Wildlife Service is poised to make a decision about the future of the Atlantic Salmon Restoration Program. Either substantial restoration efforts will continue as planned, or the Program will be cut back to minimum levels of legislatively mandated activity. Although many factors will influence this decision, it must ultimately rest on some

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<sup>1</sup> Financial support for this study was provided by Region Five of the U.S. Fish and Wildlife Service via Cooperative Agreement 14-16-009-1553, Work Order No. 5 with the Cooperative Fish and Wildlife Research Unit, Cornell University.

<sup>2</sup> US Fish and Wildlife Service, 1984, pp. 9-10.

<sup>3</sup> Ibid, p. 28.

<sup>4</sup> Ibid, p. 9.

<sup>5</sup> Ibid, p. 27.

comparison of the advantages and disadvantages, or costs and benefits, of the alternatives.

The costs and benefits of each alternative can and should be broadly defined by the Fish and Wildlife Service. Nevertheless, it is common to consider costs and benefits within the comparatively restricted vocabulary of economics. While this vocabulary necessarily distorts or excludes consideration of some deeply held values that are important to a comprehensive assessment of Atlantic Salmon restoration, it does permit an important level of argumentation in the persuasive language of money. The strength of an economic cost-benefit analysis is that it can reduce a complex set of economic relationships to a single decision parameter. This strength can be a weakness to the extent that the single parameter belies the richness of projection, analysis, assumption, judgment and prejudice that supports it.

The practice of conducting formal economic cost-benefit analyses of public investments has become increasingly commonplace, and has indeed been required for most federal programs since Executive Order 12991 was issued in 1981. But public programs that involve the protection or preservation of natural resources (e.g. the Atlantic Salmon Restoration Program) are of a class that poses special conceptual and practical difficulties for cost-benefit analysis. Because the economic "good" in question is not (and possibly could never be) traded in an established marketplace, there is no readily available economic measure of its value (e.g. market price). Thus, even though the dollar costs of investing in preservation or restoration activities may usually be estimated with some degree of precision and confidence, the measurement of benefit has been more difficult and more controversial. "Contingent valuation" methods address this difficulty.

A form of economic cost-benefit analysis using contingent valuation techniques has therefore been applied to the decision facing the Fish and Wildlife Service about the Atlantic Salmon Restoration Program. The contingent valuation methodology used in this study is an economic tool that has recently received a great deal of scrutiny and growing acceptance by the economics profession. It is the only method that can assign a "total economic value" to projects like the Atlantic Salmon Restoration Program.<sup>6</sup> Contingent valuation methods are based on questionnaires and survey responses to direct questions, and hence display many basic presumptions and assumptions more transparently than other methods economists normally apply.

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<sup>6</sup> This measure of total economic value is grounded in a theory of individual preference. The measure represents - at least theoretically - the maximum amount of money which an individual would be willing to sacrifice rather than do without the Atlantic Salmon restoration program. Thus, any value the individual can translate into a maximum "willingness-to-pay" will be counted. The values are total because they include value that may be based in current or prospective use (e.g. consumer surplus and option values, respectively) plus any value the individual may place on Atlantic Salmon that may be wholly independent of use of the resource (eg. "existence value"). Traditional benefit measures, based on estimated areas under a demand curve, account only for consumer surplus.

The purpose of this paper then is to report on estimates of the public value, or benefits, that would be associated with continuation of the restoration program. Numerical estimates of benefit will be presented first, together with some estimates of cost. It is clear, even under moderately conservative assumptions, that the total economic benefits of Atlantic Salmon restoration outweigh the costs.<sup>7</sup> The questionnaire sources and methodology used to develop the benefit estimates are described next, followed by a brief discussion of their validity.

#### Program Benefits

The benefits of the Atlantic Salmon Restoration program were calculated from a survey of New England households. After being presented with some initial information, questionnaire respondents were asked whether or not they "cared one way or the other whether there are Atlantic Salmon in any New England rivers". It was presumed that persons answering "No" to this question would place zero economic value on the restoration project. Everyone answering "Yes" to this question was asked to estimate the maximum amount they would be willing to pay in order to ensure that Atlantic Salmon would be found in the fourteen New England rivers primarily targeted by the Atlantic Salmon Restoration Program.<sup>8</sup> Persons who said they expected to someday fish for Atlantic Salmon were asked to express this value in two parts. First, they were asked about the most they would be willing to pay for an Atlantic Salmon fishing license valid only for these fourteen rivers. Second, if they noted that the economic value of finding Atlantic Salmon in those rivers exceeded the maximum amount they were willing to pay for a fishing license, they were asked how much additional money they would be willing to pay through other means (e.g. increased taxes) for continued restoration.

Persons who indicated that they had no intention of ever fishing for Atlantic Salmon were asked only to estimate the maximum amount they would have been willing to pay for restoration through increased taxes, electric bills, or other such payment vehicles.

A surprisingly large proportion (82%) of persons responding to the mailed questionnaire noted that they "cared" whether Atlantic Salmon were found in New England rivers. However, a nonrespondent follow-up survey

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<sup>7</sup> This does not necessarily mean that there is an economic imperative to continue this project, since an agency with limited funds might determine that other projects were even more worthy of investment. No attempt has been made to compare expenditures on Atlantic Salmon restoration with other project choices.

<sup>8</sup> See map, Appendix I. The Fish and Wildlife Service asserts that, with continued restoration effort, Atlantic Salmon can be successfully reestablished in all fourteen streams within a 25 to 50 year period. The minimally mandated levels of restoration (including some Federal support of state fishery agencies and certain administrative activities) would be required to sustain existing populations in a few of the seven other rivers shown, given that state restoration efforts also continued.

revealed that the mail questionnaire was more likely to be returned by persons who care about Atlantic Salmon. On the basis of the nonresponse analysis, a very conservative adjusted proportion of persons who "care" about Atlantic Salmon was estimated to be 58.3%.<sup>9</sup>

Not everyone who cares about Atlantic Salmon was willing or able to sacrifice money to further the restoration program: 43% of those "caring" respondents expecting never to fish; 24% who might someday fish; and 6% of those certain they would someday fish for Atlantic Salmon on the 14 rivers in question did not express a positive willingness to pay.

Table 1. Average willingness to pay for Atlantic Salmon Restoration:  
In addition to fishing license fees.

| <u>Will respondent fish for AS?</u> | <u>Mean WTP</u> | <u>Respondents who care about AS restoration</u> | <u>Total Willingness-to-pay (Millions)</u> |
|-------------------------------------|-----------------|--|--|
| Certainly will                      | \$31.93         | 19.1%  | \$13.6                                     |
| Might                               | \$10.81         | 35.3%  | \$ 8.5                                     |
| Probably won't                      | \$27.45         | 45.6%  | \$27.9                                     |
|                                     |                 | (100%)   | SUM \$50.0                                 |

As shown in Table 1, given that a respondent said he or she cared about Atlantic Salmon, the respondents expecting to "certainly fish" for Atlantic Salmon someday were willing to pay an average (inclusive of the zero values just noted) of \$31.93 above and beyond their maximum willingness to pay for a fishing license. Persons who said they "might" fish for Atlantic Salmon someday said they were willing to pay for an average of \$10.81 above and beyond their maximum willingness to pay for a fishing license. Persons who were not expecting to ever fish for Atlantic Salmon were willing to pay an average of \$27.45 in increased taxes or other revenues.<sup>10</sup>

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<sup>9</sup> This assumes that persons about which no information was available (either because they could not be reached or would not cooperate) did not care about Atlantic Salmon. Appendix II has details of the nonresponse analysis. A second conservative assumption about the benefit estimates is that the sample was restricted to New England residents. This effectively assumes that no one who lives outside this region is interested in New England's Atlantic Salmon. This is assuredly an inaccurate simplification.

<sup>10</sup> The willingness to pay asked about was for a maximum one time payment. This payment could be thought of as a "present value" that would be equivalent to a stream of annual payments that have been discounted to the present (see section on costs below).

Extrapolating from census reports, we estimate that there are 4,442,522 occupied households in New England.<sup>11</sup> We estimate that 86% of these households were in the sampling frame,<sup>12</sup> and that all of the uncovered households have zero willingness to pay for Atlantic Salmon restoration. This implies that 2,227,392 households<sup>13</sup> "care" about Atlantic Salmon restoration. The total willingness to pay for Atlantic Salmon is then found by combining this information with that in the first two columns of Table 1.

The data presented in Table 1 do not include those values elicited about willingness to pay for Atlantic Salmon licences. Such values were asked of respondents who indicated they certainly would, or might, someday fish for Atlantic Salmon. These respondents were asked to predict the maximum amounts they would pay for a license that allowed them to keep no salmon, one salmon, five salmon, ten salmon, or more than ten salmon. The survey informed respondents that the state of Maine currently sells Atlantic fishing licenses, with an annual limit of five fish, at a cost of \$10 for in-state residents and \$30 for out-of-state residents. The averaged maximum amount that these respondents suggested for any of the five licenses is reported in Table 2.<sup>14</sup>

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11 This extrapolation was calculated from 1980 ratios of occupied housing to state population totals (Bureau of Census, 1980 Census) applied to 1984 population figures (Bureau of Census, Current Population Reports). The calculations are therefore probably a conservative estimate of households at the time of the survey (late 1986).

12 The 1980 Census indicates that 95.4% of New England households have telephones. In 1973, it was estimated that 14.7% of New England households with phones had unlisted numbers. This is lower than the national average of 17.8% (Blankenship, p. 41). These figures suggest that about 81% of New England households have a telephone or a listed number. However, our sample was drawn from a commercially supplied phone list supplemented by auto registration that covers 86% of all households nationally (Survey Sampling, Inc.). We adopt the 86% figure as a seemingly conservative approximation for New England.

13  $58.3\% \text{ who "care"} * 86\% \text{ coverage} * 4,442,522.$

14 These numbers are also conservative. Respondents were actually asked to give the maximum amount that they would be willing to pay annually over a three or five year period in order to reserve an Atlantic Salmon license at the end of that period. Following Brookshire, Eubanks and Randall, this approach was adopted to 1) try and minimize the conceptual possibility of "free riding", and 2) try and allow more time for continued restoration activities that might enable license limits to be legitimately raised above the current level of 5 salmon per year. The numbers reported in Table 2 used only a single year's payment. Using this figure is equivalent to discounting payments from years two and up at 100%. This is done on grounds of conservatism and because there are indications that the three or five year payment mechanism was not understood by some respondents.

Table 2. Average willingness to pay for Atlantic Salmon Restoration:  
Maximum fishing license fees

| <u>Will respondent fish for AS?</u> | <u>Mean WTP</u> | <u>Respondents who will fish for Atlantic Salmon</u> | <u>Total Willingness-to-pay (Millions)</u> |
|-------------------------------------|-----------------|--|--|
| Certainly will                      | \$31.92         | 35.1%  | \$13.6                                     |
| Might                               | \$22.55         | 64.9%  | \$17.7                                     |
|                                     |                 |  | SUM \$31.3                                 |

The grand total willingness to pay for Atlantic Salmon restoration is the sum of the license fee figure from Table 2 and willingness to pay other increased fees from Table 1.<sup>15</sup> This grand total, at \$81.3 million, exceeds the estimated costs (see below) of continued restoration with adoption of any rate of discounting future expenditures that exceeds three percent.<sup>16</sup> Given that the benefit estimates have many conservative assumptions built into them, the economic costs of Atlantic Salmon Restoration appear to be clearly less than the benefits.

#### Comparisons with Wildlife Valuations in Other Studies

The results for mean willingness-to-pay appear to be in the range found by other researchers using a variety of contingent valuation techniques to estimate the economic value of wildlife. Brookshire, Eubanks and Randall found a range from \$9.70 to \$29.16 for mean bids big game hunters were willing to pay for grizzly bear and bighorn sheep hunting licenses under various conditions; while non-use related mean bids ranged from \$6.90 to \$24.00. Boyle estimated mean willingness-to-pay bids for bald eagle preservation between \$10.62 and \$75.31; while estimated mean bids for preservation of a less popular animal, the striped shiner, were close to \$5.00. Other studies of the economic value of Canada Geese (Bishop, Heberlein, and Kealy) and of elk (Brookshire, Randall, and Stoll) found mean bids that are generally bracketed by this range.

#### Program Costs

The economic costs considered for the Atlantic Salmon Restoration program are of three varieties. First, there are the construction costs associated with building upstream and downstream fish passage facilities. These were assumed to be incurred in the single year in which the Fish and Wildlife Service plans to construct each fish passage facility.

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<sup>15</sup> The validity of this summation depends on the extent to which the nonangling valuations reported by anglers are truly increments to their willingness to pay for a fishing license.

<sup>16</sup> The official discount rate for federal water and land related resource projects during fiscal year 1986 was 8 5/8% (Water Resources Council).

Table 3. Estimated costs of Atlantic Salmon Restoration on New England Rivers.

| Discount Rate | (Total of 313,000 Megawatt-hours between 1986 and 2036)               |  | Combined construction, operation and maintenance costs for fish passage facilities on New England rivers (1986 to 2036) |
|---------------|---|--|---|
|               | Dollar value at 12 cents per kilowatt-hour (millions of 1986 dollars) | Dollar value at 9 cents per kilowatt-hour (millions of 1986 dollars) |   |
| 0%            | \$38.4  | \$28.8   | \$109.7   |
| 1%            | \$29.5  | \$22.1   | \$ 93.5   |
| 2%            | \$23.1  | \$17.3   | \$ 81.2   |
| 3%            | \$18.5  | \$13.9   | \$ 71.6   |
| 4%            | \$15.0  | \$11.2   | \$ 64.0   |
| 5%            | \$12.4  | \$ 9.3   | \$ 57.9   |
| 6%            | \$10.5  | \$ 7.9   | \$ 52.8   |
| 7%            | \$ 8.9  | \$ 6.7   | \$ 48.6   |
| 8%            | \$ 7.7  | \$ 5.8   | \$ 45.1   |
| 9%            | \$ 6.7  | \$ 5.0   | \$ 42.0   |
| 10%           | \$ 5.9  | \$ 4.4   | \$ 39.3   |
| 15%           | \$ 3.4  | \$ 2.6   | \$ 29.9   |

Second, there are annual operating and maintenance (O&M) costs of each facility. These costs were assumed to be incurred each year following the year of fish passage construction through the end of a fifty year program period (ie. the year 2036). Third, there is the cost of foregone hydroelectric power that is incurred because the fish passages must divert some water around the turbines. These costs were assumed to begin the same year as construction begins, whether for an upstream or downstream passage.<sup>17</sup>

The program cost sensitivities to varying rates of time discounting are detailed in Table 3. All estimates of construction and O&M costs and

<sup>17</sup> Although upstream passages normally divert more water, some water is required for downstream passages. Upstream and downstream passages are not necessarily planned for the same year at each dam. Since the estimates of annual foregone megawattage did not distinguish between up- and downstream facilities, the annual energy loss was conservatively assumed to begin at the date of construction of the first type of fish passage. A high value of 12 cents per kilowatt-hour was applied to the energy losses. This is a penny or so higher than the current highest marginal residential electricity prices in New England. (Gene Heinze-Fry, personal communication; see also Heinze-Fry, 1984.)

annual foregone megawatt-hours were provided by the U.S. Fish and Wildlife Service for each dam, as was a timetable for implementation.

#### Description of Questionnaire Responses

The contingent valuation estimates were derived from a questionnaire that collected much related information besides that already reported. In the following discussion, some of this information is presented and compared where possible with known characteristics of the New England population from which the questionnaire sample was drawn.

The questionnaire was divided into six sections.<sup>18</sup> The first section asked several questions regarding the familiarity of the respondent with Atlantic Salmon, and also asked for basic fishing and outdoor recreational experience. The second section provided a brief (two paragraph) description of the situation and history of Atlantic Salmon in New England. It also stated that the Atlantic Salmon Restoration Program would 1) leave the fish in only 7 of the smaller Maine rivers if reduced to minimally mandated levels, or 2) eventually secure a salmon population in 14 additional New England rivers if restoration were continued. A map detailed the rivers affected. The third section asked respondents whether they care one way or the other that Atlantic Salmon can be found in New England rivers, and if so, why. The fourth and fifth sections separated probable salmon anglers from probable non-anglers, and provided the core of the contingent valuation information discussed previously. Anglers were presented more detailed information about the purchase of several types of fishing licenses, then queried as to their willingness to purchase such licenses. Nonanglers, and anglers whose economic self-valuation of Atlantic Salmon exceeded their willingness to pay for a fishing license, were asked similar contingent valuation questions using "payment vehicles" other than a fishing license. The final section asked respondents a standard series of demographic questions (age, sex, income, etc.).

#### Respondent Demographics

In 1984 the 12.5 million residents of New England were distributed in households across the six states of the region as shown in Table 4. As can also be seen from Table 4, this distribution is closely reflected in the questionnaire responses.

Table 4. New England population proportions distributed by state, 1984 US Census figures and 1986 survey responses.

| <u>State</u> | <u>Census (1984)</u> | <u>Survey (1986)</u> |
|--------------|----------------------|----------------------|
| CT           | 25.0%                | 23.0%                |
| ME           | 9.1%                 | 11.8%                |
| MA           | 46.2%                | 46.5%                |
| NH           | 7.7%                 | 9.0%                 |
| RI           | 7.7%                 | 6.3%                 |
| VT           | 4.2%                 | 3.5%                 |

<sup>18</sup> A copy of the questionnaire is found in Appendix I.

Although just over half of the total New England population is female, 77% of the respondents to the mail questionnaire were male. The primary reason for this difference is that questionnaires were addressed to the household member in whose name the telephone was listed. These persons are overwhelmingly male. Since males tend to be more interested in fishing than are females, it is also possible that some females passed questionnaires on to more interested household males.

The 1980 Census figures show mean New England household sizes to have ranged from 2.7 persons per household in Rhode Island to 2.76 persons in Connecticut. The Atlantic Salmon survey results indicate an overall New England average household size of 2.9 persons (68% of households are comprised of two or fewer persons). The small positive difference may well reflect the "baby boomlet" that has gathered force in the seven years separating the surveys.

The age of survey respondents is presented in Table 5. The average age of the respondents was 46 years (median of 43). The median age of New Englanders in 1980 was 31.2 years. Respondent ages are much greater than for the population as a whole for obvious reasons: children and young people are unlikely to have their own telephone and hence are not included in the directories from which the sample was drawn. Census data on household heads only shows an age distribution closer to that found in the sample. Of course, it makes most sense anyway to direct questions regarding willingness to pay for salmon restoration at non-dependent adults.

Table 5. Age of respondents.

| <u>Age group</u> | <u>Percent</u> |
|------------------|----------------|
| Over 70 years    | 8.1            |
| 66 to 70 years   | 6.4            |
| 31 to 65 years   | 67.3           |
| 19 to 30 years   | 16.9           |
| 18 years or less | 1.3            |

Even after adjusting for the observed nonresponse bias (see Appendix II), the survey results show that substantial proportions of the sample were fairly well educated professionals with sizable household incomes. Just under two fifths (39%) had obtained a college degree, which was slightly more than the 37% who had terminated their educations at or before their high school graduation. The remaining 24% finished some college.

Similarly, one quarter of the responding New Englanders could be classified as managers or professionals. A second quarter of the sample noted that they were already retired. The remaining half of the respondents were engaged in a variety of occupations, though approximately 4% said they were unemployed.

Over a fifth of respondents (21% - unadjusted for nonresponse bias) answering the income question reported total 1985 household incomes of

\$50,000 or greater. A similar proportion (23.7%) reported annual incomes under \$20,000. The median 1985 household income reported by survey respondents was in the range between \$30,000 and \$39,999.

Respondent outdoor recreation experience and familiarity with Atlantic Salmon

Salmon are a popular and well known fish, and the Atlantic Salmon Restoration Program is one which is recognizably of general interest.<sup>19</sup> Still, an unexpectedly high 69% of mail questionnaire respondents claimed they knew even before receiving our survey that Atlantic Salmon could be found in some New England rivers.<sup>20</sup> Furthermore, just over half of the respondents said they had personally seen some kind of salmon at least once in their lives. Of this half, most had viewed salmon at a visit to some kind of special observation center such as a dam or museum, but almost as many had seen salmon while fishing (not necessarily for salmon).

Many respondents (22%) had fished specifically for some kind of salmon at one time or another. While the majority of these salmon anglers had fished for either coho or chinook or other kinds of salmon, approximately 7% of all survey respondents said they had themselves fished for Atlantic Salmon. Furthermore, 34% of the respondents had eaten some kind of salmon that "they or someone else had caught while fishing for sport".<sup>21</sup>

Since there were only a few thousand Atlantic Salmon licenses sold in 1986 by the state of Maine, it was a fair assumption that few or none of the randomly selected New England residents would have actually purchased one of these licenses. In fact, only 30% of the respondents explicitly expressing an interest in fishing for Atlantic Salmon someday were even aware that it was possible to buy a Maine fishing license for Atlantic Salmon. The persons who were aware were asked why they had not purchased a license. Table 6 lists the reasons given. Note that distance from home was by far the most common, and that as more rivers are restored, these distances will decline for many New Englanders.

When asked about general outdoor recreation activities in 1986, over one-third (34%) of the respondents indicated that they had engaged in some kind of freshwater fishing during the year. A somewhat smaller proportion (28%) had enjoyed saltwater fishing during the year, while 13%

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<sup>19</sup> The New York Times, for example, carried several general interest stories on the restoration efforts during the course of this research (see July 27th, 1986 and January 25, 1987 papers).

<sup>20</sup> It was not possible to adjust for suspected nonresponse bias to this question and many of the other questions next discussed, except as noted.

<sup>21</sup> Less than half of these had caught the fish themselves.

Table 6. Reasons for not buying a Maine salmon license for people who knew of its existence.

|                              |     |
|------------------------------|-----|
| COST OF LICENSE              | 19% |
| DISTANCE OF RIVERS FROM HOME | 68% |
| SCARCITY OF SALMON IN RIVERS | 31% |
| SIZE OF SALMON               | 7%  |
| LICENSE LIMITATIONS ON FISH  | 5%  |
| COST OF GEAR                 | 11% |
| CROWDING AT FISHING SITES    | 34% |

had hunted in 1986.<sup>22</sup> Forty-four percent of respondents had been camping or hiking during the year, and a substantial majority of 71% had been boating or swimming in lakes, rivers or the ocean in the past year.

Respondents were asked to describe the type of area in which they lived. Approximately one-fifth of them said they lived in large cities (primarily Boston), and slightly less than a fifth in the suburbs of large cities. An additional fifth of the respondents said they lived in small cities, while the largest single proportion of the New England respondents (about a third) said they lived in small towns. Finally, the remaining tenth classified their surroundings as rural.

#### Reasons for interest in Atlantic Salmon

Respondent who indicated that they care about Atlantic Salmon restoration were asked additional details about their interests in the fish. The vast majority (91%) had no special interest in any smaller subset of the 14 rivers included in the restoration program. Of the few who did name specific rivers, the Connecticut River was most often mentioned by far. Similarly, 83% of respondents said their interest in Atlantic Salmon was neither more nor less than in other wildlife. These results intimate that some of the value of Atlantic Salmon that was developed earlier in this report might also be at least partly a proxy measure for willingness to pay for wildlife preservation in general.<sup>23</sup>

Less than one-third of the respondents who cared about Atlantic Salmon said they expected to personally see or fish for them someday.

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<sup>22</sup> Statistics from the 1980 National Survey of Fishing, Hunting, and Wildlife Associated Recreation showed approximately 760,000 exclusive freshwater anglers over 16 years of age, about 489,000 saltwater anglers, and about 507,00 anglers in both salt and freshwater. The data show that the number of hunters was about one-third the number of anglers. (Tables 43 and 45)

<sup>23</sup> When asked to list something of more or less equal value to Atlantic Salmon upon which they already had spent money, most respondents did not answer. Of the 31% who did, about one fourth of them made comparisons to other fish or fishing expenditures, another fifth made comparisons to other kinds of wildlife expenditures, while another fifth gave answers in a more general conservation or environmental category.

However, more than three-fourths said they would be pleased to know that Atlantic Salmon could be found in New England rivers even if they never did see or fish for salmon themselves. Just as many (over three-fourths) agreed with the statement that, "I think the return of Atlantic Salmon is an important sign that river pollution has been cleaned up". And only slightly fewer (73%) felt that there was a need to act on restoration now for the benefit of future generations of people. A lower proportion, but still the majority (61%), agreed with the statement that, "I think that Atlantic Salmon should be returned to New England rivers to restore the lost balance of nature".

#### Alternative Calculations of Benefit

An attempt was made to validate the estimates of Atlantic Salmon valuations reported in Tables 1 and 2 through alternative calculations. Instead of calculating mean willingness-to-pay from the highest values reported by survey respondents, related calculations were derived from a "Yes/No" question. Questionnaire recipients were asked whether they would be willing to pay a certain preselected dollar amount for Atlantic Salmon restoration. The dollar amount selected varied across individuals. Hanneman (1985) has hypothesized that individuals are more likely to be able to answer a yes/no question than to give a specific maximum figure. This type of question also avoids the possibility of starting point bias, where respondents anchor their maximum answers to the initial dollar figure presented them. Bishop and Heberlein (1979) first implemented this procedure, while Hanneman (1984a) has developed it in a utility-theoretic framework.

As suggested by these authors, logistic regression was used to predict how the probability of being willing to pay for restoration varies with the dollar amount presented to the respondent. The estimated logistic equation serves as the basis for calculating willingness-to-pay.<sup>24</sup> As can be seen from Table 7, the dollar values that are generated by this process are higher than shown in Tables 1 and 2.<sup>25</sup> The values in Tables 1 and 2 are preferred only on grounds of developing a conservative estimate of benefits.

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<sup>24</sup> Calculations of mean and median willingness to pay depend upon the explicit or implicit assumption of a particular utility function. The values reported in Table 6 implicitly assume a simple utility function that is linear in income and a constant. Hanneman (1984a) shows that under this assumption the median and mean are equal.

<sup>25</sup> All respondents had the opportunity to answer the willingness to pay questions in the discrete choice form and then as a maximum value. In a number of cases (37 - or about 7% of all respondents) people agreed to pay an amount that was higher than the maximum bid they then entered in the following question. In about half as many cases (20) people refused to pay an amount that was lower than the highest amount they subsequently entered. In this sense, more people revised their bids downwards than upwards when given a chance to reconsider their answer to the question in the yes/no format.

Table 7. Median and mean willingness-to-pay estimated from equations predicting the probability of agreeing to pay for Salmon restoration.

|  | <u>Median and mean payment</u> |
|--|--------------------------------|
| Willingness to pay<br>for a special licence<br>allowing five salmon<br>to be kept            | \$43.25                        |
| Willingness to pay<br>increased taxes or<br>other fees to help<br>restore Atlantic<br>Salmon | \$40.44                        |

The measurements of willingness to pay presented earlier presume that New Englanders must purchase, in effect, the right to enjoy the benefits of Atlantic Salmon. An alternative, and equally valid, microeconomic perspective starts from the presumption that New Englanders begin with the right to enjoy the benefits of Atlantic Salmon in the region's rivers. From this perspective, the value of the restoration program must be measured as the minimum payment that New Englanders will accept (eg. in tax savings), on average, to forgo successful restoration. Note that values are not constrained by income here. Empirical estimates of "willingness to sell" typically yield values that are an order of magnitude greater than that of payments.<sup>26</sup> They are also more difficult to assess because it is harder to present a realistic or believable contingent situation in which respondents would sell their "rights". Although no dollar estimate of willingness to sell will therefore be reported, it will be noted that only 5 out of 364 relevant respondents said they would rather take the dollar savings offered (which ranged from \$1 up to \$600) in return for discontinuation of the Atlantic Salmon Restoration Program.

#### Summary and Conclusions

The data which has been reported reveals a strong and widespread interest in Atlantic Salmon restoration throughout the New England area. The benefit calculations indicate that this interest translates, at least within the artificial context of the contingent valuation questionnaire, into a substantial dollar value. Because even conservative estimates of this dollar value exceed, when expanded over the New England population, the Fish and Wildlife Service's estimates of program costs, it can be concluded that there are economically as well as politically convincing grounds for continuation of Atlantic Salmon restoration in New England.

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<sup>26</sup> Hanneman (1984b) suggests that, in general, large empirical differences between the measures may be indicative "of a general perception on the part of the individuals surveyed that the private market goods available in their choice set are, collectively, a rather imperfect substitute for the public good under consideration."

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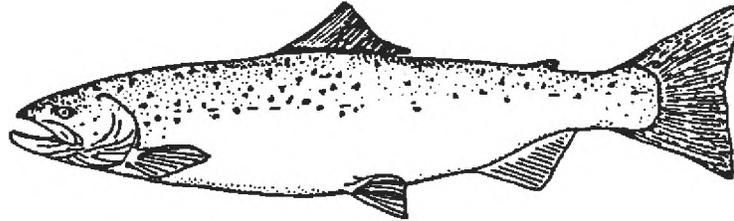
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APPENDIX I

Mail Questionnaire



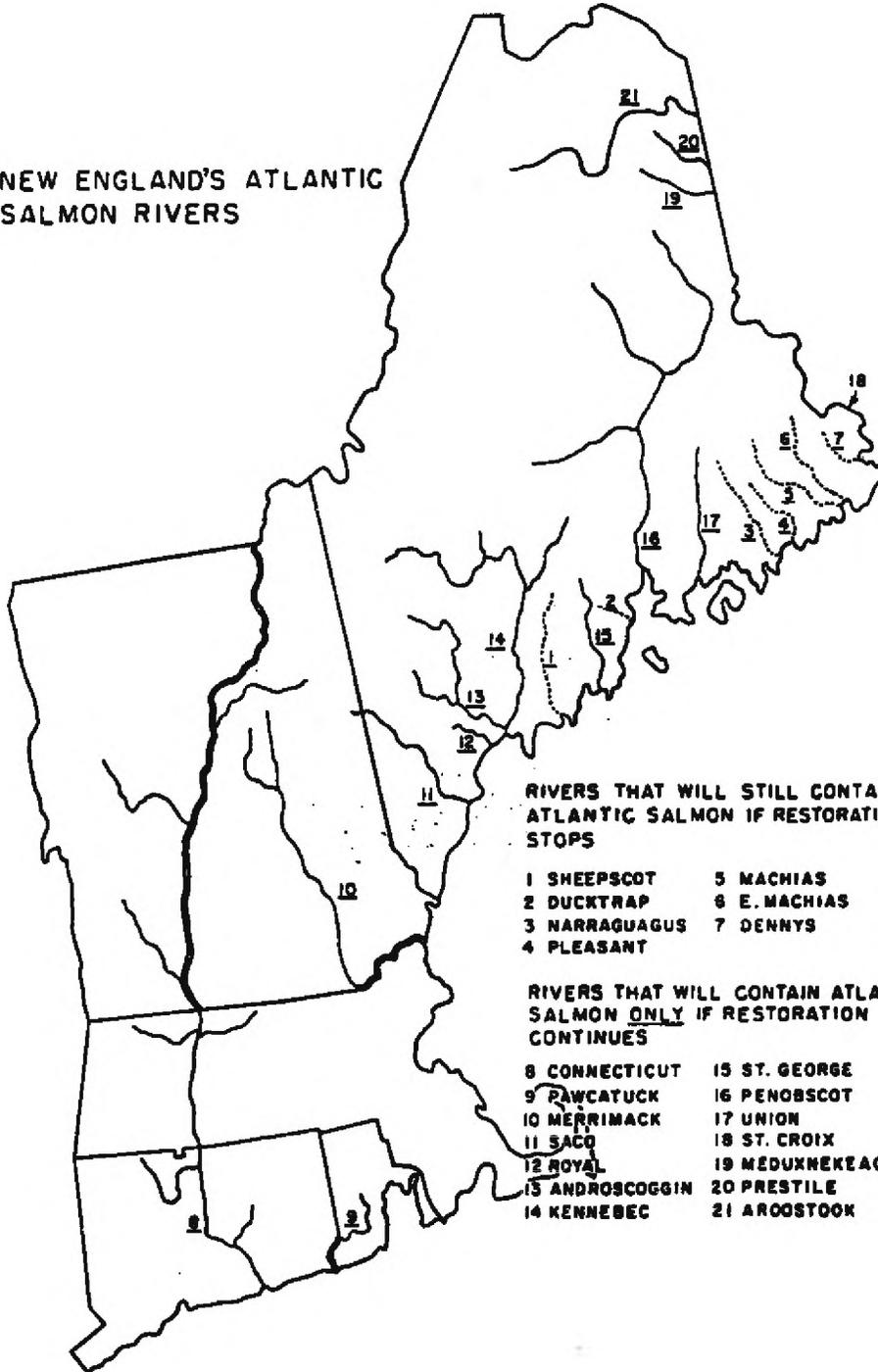
# ATLANTIC SALMON RESTORATION:

## A PUBLIC OPINION SURVEY



Department of Natural Resources  
New York State College of Agriculture and Life Sciences  
A Statutory College of the State University  
Cornell University, Ithaca, N. Y.

**NEW ENGLAND'S ATLANTIC SALMON RIVERS**



**RIVERS THAT WILL STILL CONTAIN ATLANTIC SALMON IF RESTORATION STOPS**

- 1 SHEEPSCOT
- 2 DUCKTRAP
- 3 NARRAGUAGUS
- 4 PLEASANT
- 5 MACHIAS
- 6 E. MACHIAS
- 7 DENNYS

**RIVERS THAT WILL CONTAIN ATLANTIC SALMON ONLY IF RESTORATION CONTINUES**

- 8 CONNECTICUT
- 9 PAWCATUCK
- 10 MERRIMACK
- 11 SACO
- 12 ROYAL
- 13 ANDROSCOGGIN
- 14 KENNEBEC
- 15 ST. GEORGE
- 16 PENOBSCOT
- 17 UNION
- 18 ST. CROIX
- 19 MEDUXNEKEAG
- 20 PRESTILE
- 21 AROOSTOOK

1. FIRST WE WOULD like to get a sense of how familiar you are with ATLANTIC SALMON. By ATLANTIC SALMON we mean only those salmon that spend part of their lives in northeastern rivers (see our map) and part of their lives in the Atlantic Ocean.

1. Did you know before today that Atlantic Salmon could be found in some New England rivers? .....  NO  YES

2. Have you ever seen any kind of live salmon? .....  NO  YES

If YES, how did you see the fish? (check answers that apply)

- WHILE FISHING  
 VISIT TO A SPECIAL OBSERVATION CENTER  
 BY CHANCE IN OPEN WATER  
 OTHER (explain: \_\_\_\_\_)

3. Have you ever fished for any kind of salmon? .....  NO  YES

If YES, for what kind of salmon? (check answers that apply)

- DON'T KNOW  
 ATLANTIC SALMON  
 PACIFIC SALMON (eg coho or chinook)  
 OTHER (explain: \_\_\_\_\_)

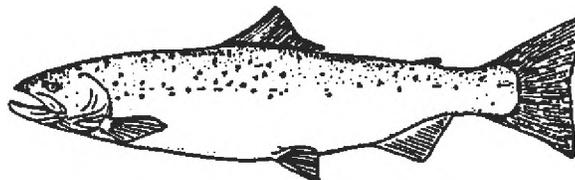
4. Have you ever eaten any kind of salmon that you or someone else caught while fishing for sport? .....  NO  YES

5. Which of the following outdoor recreation activities have you participated in during the past year? (check all that apply)

- FRESHWATER FISHING (other than for salmon)  
 SALTWATER FISHING  
 HUNTING  
 HIKING OR CAMPING  
 BOATING OR SWIMMING IN LAKES, RIVERS, or OCEAN

6. How would you describe the area in which you live?

- RURAL  
 SMALL TOWN or VILLAGE  
 SMALL CITY (less than 50,000 people)  
 LARGE CITY (more than 50,000 people)  
 SUBURB OF A LARGE CITY



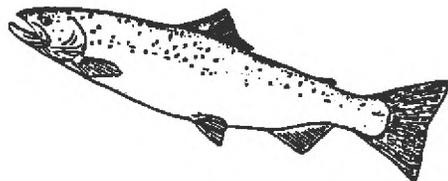
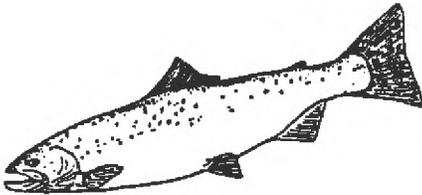
II. IN THIS SECTION we present a little more information about Atlantic Salmon in New England's rivers.

Many years ago large numbers of Atlantic Salmon lived in most of New England's rivers. That is no longer true. As the number of people grew, the number of salmon fell. The decline was caused by over-fishing, water pollution, and the building of dams that blocked many rivers. Today, hydro-electric dams are the biggest barrier to the return of the Atlantic Salmon.

There are now small but secure numbers of salmon in 7 of the shorter Maine rivers (see map, dotted lines). State and federal programs have already begun to restore Atlantic Salmon to other New England river systems. The programs could lead to secure levels of salmon in each of these 14 additional river systems within 25-50 years (see map, solid lines). Of course, if the programs are stopped, no salmon will be found in these rivers. The programs work by:

- \* releasing young salmon into the rivers;
- \* providing ways, such as "fish ladders", for the salmon to safely get past barriers like dams;
- \* improving the condition of the rivers in ways that benefit the salmon; and
- \* regulating the type and amount of salmon fishing allowed.

Assuming the Program continues, within 10-15 years there should be several thousands of adult salmon returning to the Connecticut River and the Merrimack River, and even more to the Penobscot River. Fewer fish would return to the other 11 river systems.



III. NOW WE WOULD like you to answer some questions about how important it is to you to have salmon in New England rivers.

7. Do you care, one way or the other, whether there are Atlantic Salmon in any New England rivers?.....[ ]NO [ ]YES

If NO, skip ahead to The Final section on the last page.  
If YES, in which of the rivers do you care about the presence of Atlantic Salmon? (See our map, then check one answer)

- [ ] MOST OR ALL OF THEM
- [ ] ONLY THE RIVER WHICH IS CLOSEST TO MY HOME: \_\_\_\_\_
- [ ] ONLY THE FOLLOWING RIVERS: (please list the river names)

|       |       |
|-------|-------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

8. How does your interest in Atlantic Salmon compare to your interest in other wildlife, including other wild fish? (check one answer)

- I HAVE COMPARATIVELY MORE INTEREST IN ATLANTIC SALMON  
 MY INTEREST IS ABOUT THE SAME AS IN OTHER WILDLIFE  
 I HAVE COMPARATIVELY LESS INTEREST IN ATLANTIC SALMON

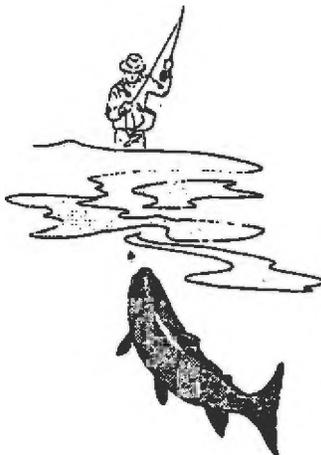
9. Which of the following statements or opinions apply to your interests in Atlantic Salmon? (check all answers you agree with)

- I VERY PROBABLY WILL SEE OR FISH FOR WILD ATLANTIC SALMON  
 IT WOULD PLEASE ME JUST TO KNOW THAT ATLANTIC SALMON WERE IN NEW ENGLAND RIVERS EVEN IF I COULD NEVER FISH FOR THEM OR SEE THEM MYSELF  
 IT MATTERS TO ME THAT WE ACT NOW SO THAT FUTURE GENERATIONS OF PEOPLE WILL FIND ATLANTIC SALMON IN NEW ENGLAND RIVERS  
 I THINK THE RETURN OF ATLANTIC SALMON IS AN IMPORTANT SIGN THAT RIVER POLLUTION HAS BEEN CLEANED UP  
 I THINK THAT ATLANTIC SALMON SHOULD BE RETURNED TO NEW ENGLAND RIVERS TO RESTORE THE LOST BALANCE OF NATURE  
 I THINK THAT THE EFFORT TO RESTORE ATLANTIC SALMON TO THE 14 NEW ENGLAND RIVERS IS A MISTAKE (please explain)
- 

IV. NEXT, WE ARE INTERESTED in finding out how strongly you value the return of Atlantic Salmon to any or all of the 14 rivers that are affected by the Salmon Restoration Program.

10. Might you ever fish for Atlantic Salmon on any of the 14 river systems affected by the Program to restore Atlantic Salmon (see map)?

- I ALMOST CERTAINLY WILL (continue on next page)  
 I MIGHT (continue on next page)  
 I PROBABLY WON'T (skip to SECTION V, Q. 20 on page 6)



FISHING: Because of the need to protect Atlantic Salmon from over-fishing, the amount of fishing is tightly controlled. You must have a license to legally fish for Atlantic Salmon on any river, even if you do not plan to keep any salmon. The number of fish you may keep is also limited, and only fly fishing is allowed. About 2,500 Atlantic Salmon licenses were sold for fishing in Maine this year.



11. Did you know you could buy a license to fish for Atlantic Salmon in Maine this year? .....  NO  YES

If YES, which of the following strongly influenced your decision to buy or not buy the license this year?

(check any that apply)

- COST OF A SALMON LICENSE
- DISTANCE OF THE SALMON RIVERS FROM HOME
- NUMBER OF SALMON IN THE RIVERS
- SIZE OF THE SALMON
- LICENSE LIMITS ON THE NUMBER OF FISH CAUGHT
- THE COST OF SALMON FISHING GEAR
- CROWDING AT SALMON FISHING SPOTS

We would like to know whether you would buy an Atlantic Salmon license if the Program to restore Atlantic Salmon were stopped, and salmon lived only in the 7 rivers not affected by the Program.

The existing license allows you to keep up to 5 Atlantic Salmon each year. This year a license cost \$30 for people who do not live in Maine, and \$10 for people who do live in Maine.

12. Assume that the Program to restore Atlantic Salmon is stopped. Then Atlantic Salmon fishing will only occur on the 7 rivers not affected by the Program (dotted lines on map). If the price (\$30, or \$10 for Maine residents) and the limit on the number of fish (up to 5) stays the same, how likely is it that you would buy a license in the next few years?

- I ALMOST CERTAINLY WOULD BUY A LICENSE.
- I PROBABLY WOULD BUY A LICENCE.
- I'M NOT SURE IF I WOULD BUY A LICENSE.
- I PROBABLY WOULD NOT BUY A LICENSE
- I ALMOST CERTAINLY WOULD NOT BUY A LICENSE

13. What is the very highest price (if any) you would seriously consider paying for such a license?.....\$ \_\_\_\_\_

14. What is the very highest price (if any) you are almost certain you would be willing to pay for such a license?.....\$ \_\_\_\_\_

Out of a total of about 750 Atlantic Salmon caught on all New England rivers this year, almost 600 were caught by people traveling to the Penobscot River. Still, the average fisherman on the Penobscot must now fish almost 20 times to catch one salmon. The Atlantic Salmon Program will increase the number of salmon in each of 14 river systems - including the Penobscot (see map).

15. What is the greatest distance you would be willing to travel away from home for the sole purpose of fishing for Atlantic Salmon? ..... \_\_\_\_\_ MILES

Any decision to go ahead with the Program must consider the number of people who will be interested enough in fishing to buy an Atlantic Salmon license. If there are not enough people interested in buying licenses, the Program may have to be stopped. We next ask if you would be willing to pay a kind of "special restoration fee" for a license to fish the 14 river systems affected by the Program.

Assume for the purposes of this questionnaire that only people paying the special fee would be allowed to fish for salmon on those river systems, though you could still buy a license to fish on the other 7 salmon rivers.

Because of the small number of salmon now in the 14 rivers, fishing would have to be very restricted until more fish have been restored to them.

16. Would you be willing to pay a special fee of \$ \_\_\_\_\_ each year to reserve a license for fishing on the restored salmon river systems \_\_\_\_\_ years from now? [ ]NO [ ]YES

Would you pay this fee if it...

- ....did not allow you to keep any salmon you caught? [ ]NO [ ]YES
- ....allowed you to keep just one salmon you caught? [ ]NO [ ]YES
- ....allowed you to keep up to five salmon you caught? [ ]NO [ ]YES
- ....allowed you to keep up to ten salmon you caught? [ ]NO [ ]YES
- ....allowed you to keep more than ten salmon? [ ]NO [ ]YES



17. What would be the very highest yearly fee you could be charged to reserve a license for \_\_\_\_\_ years from now before you would feel that the license for the 14 river systems wasn't worth the cost - if such a license....

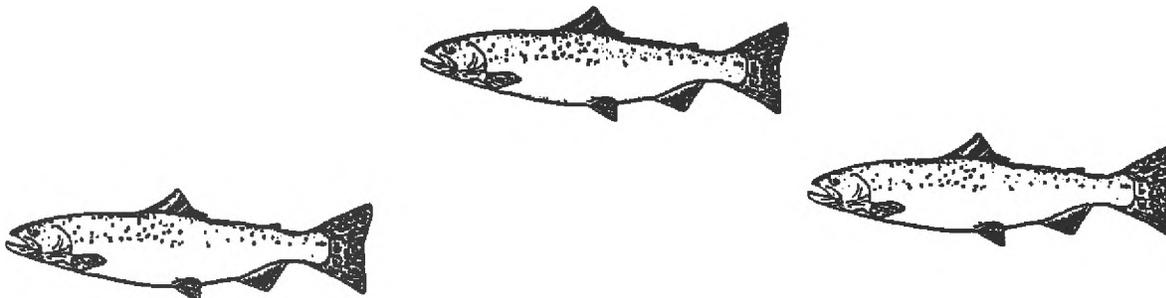
- ...did not allow you to keep any salmon you caught? \$ \_\_\_\_\_
- ...allowed you to keep one salmon each season? \$ \_\_\_\_\_
- ...allowed you to keep five salmon each season? \$ \_\_\_\_\_
- ...allowed you to keep ten salmon each season? \$ \_\_\_\_\_
- ...allowed you to keep more than ten salmon? \$ \_\_\_\_\_

18. If the yearly fee to reserve a license turned out to be set \$5 higher than the amounts you just listed as your highest, how likely is it that you might reconsider and decide to pay for a license anyway?

- ]VERY UNLIKELY
- ]SOMEWHAT UNLIKELY
- ]UNCERTAIN
- ]SOMEWHAT LIKELY
- ]VERY LIKELY

19. Is the total value of having Atlantic Salmon in the 14 rivers worth any more to you, in money terms, than the highest dollar amounts you have said you would be willing to pay for a fishing license?.....[ ]NO [ ]YES

If NO, skip to Question 28 on last page.  
If YES, continue here.



V. AS YOU MIGHT expect, the Program to restore Atlantic Salmon will cost money to complete. For this reason we will be asking you to think a little about the full dollar value, to you personally, of having salmon in New England's rivers. Your answers to the following questions will help policy makers decide whether or not to continue restoring Atlantic Salmon to the 14 river systems shown on our map; and how to best pay for the Program if it is decided to continue.

20. Can you think of anything you already spend money on that has about the same value to you as the Atlantic Salmon Program does? Please describe it if you can:

21. Have you donated any money for wildlife protection this year?..... [ ]NO [ ]YES

22. Several methods might be used to raise extra money for the Salmon Restoration Program. Of course, not everyone is affected in the same way by each method of payment. Of the type of payment that you normally must make anyway, which would you prefer to see used to pay for the Atlantic Salmon Program?

- FEDERAL INCOME TAXES
- STATE INCOME TAXES
- SALES TAXES
- ELECTRICITY BILLS
- OTHER (explain: \_\_\_\_\_)

NONE - I'M NOT WILLING TO PAY ANYTHING (skip to last page)

23. Would you be willing to pay \$\_\_\_\_\_ more next year to help bring Atlantic Salmon back to the 14 affected river systems - if it were decided to raise money using the payment method you just said you would prefer?.....[ ]NO [ ]YES

24. What is the very highest extra payment you would be willing to pay rather than see the Program stopped?.....\$\_\_\_\_\_



If too little public support for the Program to restore Atlantic Salmon to New England rivers is found, it could be stopped. Then some of the money that has already been budgeted for the Program would not be spent. This money could then be returned to you as lower taxes, as lower electricity bills, or maybe even as a special cash payment to people who do not normally pay such bills.

25. Imagine for a moment that you could be guaranteed a one-time "rebate" of \$\_\_\_\_\_ if the Program was stopped. Would you then prefer to see the Program continue or to get those money savings?

- CONTINUE THE PROGRAM
- GET THE SAVINGS AND HAVE THE PROGRAM END

26. Try to think carefully about what you would do with a rebate if you got one - and then answer this question:

What would be the very smallest one-time rebate you would prefer to get rather than see Atlantic Salmon continue to be restored to the 14 river systems?.....\$\_\_\_\_\_

27. If you happened to be near one of several dams with Special Visitor's Centers at the right time of year, you would be able to watch the annual migration of Atlantic Salmon in progress. Assuming the Program continued and you were able, would you have any interest in stopping to watch Atlantic Salmon swim past and to learn more about them? ..... [ ]NO [ ]YES

If YES: What is the very most you would be willing to spend on an entry ticket? \$\_\_\_\_\_

VI. THE FINAL SECTION - Your answers to this section will help us predict the number of people interested in Atlantic Salmon in all of New England. Your answers will be kept strictly confidential, and will never be linked to your name.

28. In what year were you born? ..... 19\_\_\_\_\_
29. What is your sex? ..... [ ] MALE [ ] FEMALE
30. What was your main occupation this year (if student, unemployed, or retired, please indicate) \_\_\_\_\_
31. In what city or county and state is your home? \_\_\_\_\_ COUNTY OR CITY  
 \_\_\_\_\_ STATE
32. How many other people live with you in your household? \_\_\_\_ OTHERS
33. What is the highest year of school that you have completed?
- [ ] 1-6 YEARS  
 [ ] 7-9 YEARS  
 [ ] 10-11 YEARS  
 [ ] HIGH SCHOOL GRADUATE  
 [ ] SOME COLLEGE  
 [ ] COLLEGE GRADUATE  
 [ ] SOME GRADUATE SCHOOL
34. What was your approximate total household income, before taxes, in 1985?
- [ ] \$0 - 9,999  
 [ ] \$10,000 - 19,999  
 [ ] \$20,000 - 29,999  
 [ ] \$30,000 - 39,999  
 [ ] \$40,000 - 49,999  
 [ ] \$50,000 - 75,000  
 [ ] more than \$75,000

Kindly return this questionnaire within two weeks of receiving it. Simply seal it in the enclosed stamped self-addressed envelope and deposit in any mail box. The postage has been provided.

THANK YOU FOR YOUR TIME AND EFFORT!

APPENDIX II

Nonresponse Bias

## NONRESPONSE BIAS

The questionnaire mailed to 1500 New England residents was eight pages long and relatively demanding of participants. Moreover, it was not anticipated that Atlantic Salmon restoration would be a subject of deep interest for most questionnaire recipients. These considerations led us to expect a relatively low response rate.<sup>1</sup> The 42% response rate discussed in the body of the report confirmed that expectation.

Because of the large proportion of nonrespondents, it was not possible to rule out a priori the possibility that our data were seriously biased or unrepresentative of the full population. In order to ascertain whether or not there were significant differences between respondents and nonrespondents, a telephone follow-up survey was conducted. A number of key questions - concerning nonrespondent interest in Atlantic Salmon, their willingness to pay for restoration, and a few standard demographic parameters - were extracted from the mail questionnaire and adapted slightly for the telephone (see Appendix III for questions).

At the time of sample selection for the nonrespondent survey, 772 of the initial questionnaire recipients had not responded. Because the original sample had been selected from telephone directories, telephone numbers were available for all of these nonrespondents. Attempts to interview nonrespondents continued in a randomly determined order until 118 contacts were made with persons willing to answer at least the key question: did they care one way or the other whether or not there were Atlantic Salmon in any New England rivers? Sixteen additional persons who had not returned the mail questionnaire were contacted, but they refused to answer even this question. Attempts to reach another 41 nonrespondents failed because the person had moved, died, or discontinued phone service at the given number. Finally, another 41 nonrespondents were called but never successfully reached after a minimum of at least two further calls (see Table II-1).

Administering the questions over the phone generally took less than a minute if the individual indicated no interest in Atlantic Salmon, and less than five minutes if some interest was expressed and all the follow-up questions asked.

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<sup>1</sup>Closely related issues for telephone surveys are discussed in Sharp, Laure M. and Joanne Powell. 1983. "Respondent Burden: A Test of Some Common Assumptions". Public Opinion Quarterly. Vol 47:36-53. Much of the literature cautions against expecting returns from more than 30% of the general public with mail questionnaires, but many authors demonstrate that persistent follow-ups can generate 70% response rates and higher. (See citations in Goyder, John. 1985. "Face-to-Face Interviews and Mailed Questionnaires: The Net Difference in Response Rate." Public Opinion Quarterly. Vol. 49:234-252; see also Brown, Tommy L. and Bruce T. Wilkins. 1978. "Clues to Reasons for Nonresponse and its Effect upon Variable Estimates". Journal of Leisure Research. Vol. 10:226-231 and Brown, Tommy L., Chad P. Dawson, Deborah L. Huston, and Daniel J. Decker. 1981. "Comments on the Importance of Late Respondent and Nonrespondent Data from Mail Surveys." Journal of Leisure Research. Vol. 13:76-79, for experiences with recreation and land use questionnaires.)

Table II-1. TELEPHONE FOLLOW-UP RESPONSE RATES

|     |   |
|-----|---|
| 772 | nonrespondents; from which random selection produced                                      |
| 118 | at least partially cooperative random contacts;   |
| 16  | total noncooperators;   |
| 41  | deceased or otherwise unreachable parties; and  |
| 41  | nonrespondents who could not be reached after several repeat calls; comprising a total of |
| 216 | nonrespondents called and   |
| 556 | nonrespondents not called.  |

The statistical depiction of nonrespondents that follows is therefore based on a sample of 118, accounting for 15% of all nonrespondents, or 55% of the nonrespondents called. Are these 118 nonrespondents representative of the remaining nonrespondents, especially with respect to interest in the Atlantic Salmon Restoration program? Because of the random calling order used, it can be assumed that the 216 nonrespondents called are collectively representative of the 556 not called. But there is not enough information available to unambiguously determine how closely the 118 cooperators may resemble the remaining 98 nonrespondents called.

Some assumptions must therefore be made.<sup>2</sup> It should be a reasonable if not entirely accurate<sup>3</sup> assumption that the 41 nonrespondents who could not be reached would not have differed significantly in their responses from the 134 (118 + 16) nonrespondents with whom personal contact was made (ie. about 5 of the 41 would probably have refused to cooperate, the remainder would have mirrored the interest in Atlantic Salmon of the 118 cooperators.) Thus, a total of about 10% [(16+5)/216] of the nonrespondents would be reasonably classified as noncooperators. We have

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<sup>2</sup>Some techniques exist for trying to avoid such informal assumptions, eg. by predicting nonrespondent characteristics on the basis of a small amount of known information (see Daniel, Wayne W. 1975. "Nonresponse in Sociological Surveys". Sociological Methods & Research. Vol. 3:291-305; and Smith, Tom W. 1983. "The Hidden 25 Percent: An Analysis of Nonresponse on the 1980 General Survey", Public Opinion Quarterly. Vol. 47:386-404). However, Smith notes ultimately that "we come close to the conclusion that nothing works in estimating nonrespondent bias".

<sup>3</sup>Smith (ibid) found that availability of respondents for interview was in fact related to labor force participation, socioeconomic status, age and marital status, health, and sex. Ignoring the difference in the types of people likely to be available for phone compared to mail interviews probably overstates the real differences between the mail nonrespondents and mail respondents, since the attempt to contact the mail nonrespondents was made over the phone.

essentially no relevant information about the noncooperators. Still, the most conservative and probably reasonable assumption about them would be that they have no interest in Atlantic Salmon restoration. Similarly, the most conservative assumption about the 41 deceased or otherwise unreachable contacts is that they also have no interest in Atlantic Salmon restoration. This assumption is perhaps overly conservative, since even the deceased nonrespondents might have had an interest in Atlantic Salmon at the time the sampling list was compiled; and some of the unreachable nonrespondents who have changed phone numbers or moved surely do have an interest in Atlantic Salmon.

In conclusion, the reader should bear in mind that for only 55% (118/216) of the nonrespondent subsample is analysis based on direct telephone responses. Since only 42% of persons receiving the mail survey returned a questionnaire, this means that there is little or no information on approximately 345 of the 1320 persons who received questionnaires. After accounting for the 180 undeliverable mail questionnaires, the figure rises to 525 of the initial 1500 questionnaires sent out; i.e. 35% of the population of households have been assigned by assumption to either the "no interest in Atlantic Salmon" group or the "just like the respondents" group. Thus, while the nonresponse follow-up increases knowledge about the magnitude and importance of possible bias, it does not eliminate the problem altogether.

Before proceeding to the mail/telephone follow-up response comparisons, a related consideration must be addressed. The corporation that selected the initial sample of 1500 (Survey Sampling, Inc.) warns that its data base covers only 86% of all households nationally. This coverage is based on listed phone numbers as supplemented in 26 states by auto registration data. Although 1980 census statistics show that 95.4% of New England households had phones,<sup>4</sup> mail coverage is lower because no addresses can be associated with unlisted telephone numbers.<sup>5</sup>

#### MAIL RESPONSES COMPARED TO TELEPHONE RESPONSES

The answers of the 559 mail respondents and the 118 telephone follow-up respondents were compared for 20 specific items. It was not possible to conclude that there were no significant differences between the two groups.

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<sup>4</sup>Table 149, Detailed Characteristics, US Summary, 1980 Census of Housing.

<sup>5</sup>Telephone directories of listed numbers only have been shown to disproportionately exclude households of lower socioeconomic status, a problem generally most problematic for surveys in urban areas. A recent study confirms that "telephone directories provide an acceptable and efficient sampling frame for general population mail surveys of rural areas". (Kviz, Frederick. 1984. "Bias in a Directory Sample for a Mail Survey of Rural Households". Public Opinion Quarterly. Vol. 48:801-806.) Over the whole of New England, this source of bias is probably small compared to other sources of bias.

Table II-2. Questions asked of every cooperator.

| <u>Variable Described</u>                      | <u>Mail Results</u> | <u>Follow-up Results</u> | <u>Difference*</u> |
|--|---------------------|--------------------------|--------------------|
| <u>Educational Level</u>                       | (n=540)             | (n=79)                   |                    |
| High School Grad                               | 29%                 | 42%                      | Large              |
| Some College                                   | 25%                 | 24%                      | Small              |
| College Grad                                   | 46%                 | 34%                      | Large              |
| <u>Occupation</u>                              | (n=529)             | (n=93)                   |                    |
| Professional                                   | 22%                 | 13%                      | Large              |
| Retired  | 20%                 | 29%                      | Large              |
| Other  | 48%                 | 48%                      | Small              |
| <u>Age</u>                                     | (n=543)             | (n=95)                   |                    |
| Over 50 years                                  | 40%                 | 43%                      | Small              |
| 31-50 years                                    | 42%                 | 42%                      | Small              |
| Up to 30 years                                 | 18%                 | 15%                      | Small              |
| <u>Sex</u>                                     | (n=556)             | (n=118)                  |                    |
| Male   | 77%                 | 73%                      | Small              |
| Female   | 23%                 | 27%                      | Small              |
| <u>State of residence</u>                      | (n=544)             | (n=118)                  |                    |
| Connecticut                                    | 23%                 | 35%                      | Large              |
| Maine  | 12%                 | 8%                       | Small              |
| Massachussetts                                 | 47%                 | 37%                      | Large              |
| New Hampshire                                  | 9%                  | 7%                       | Small              |
| Rhode Island                                   | 6%                  | 6%                       | Small              |
| Vermont  | 3%                  | 7%                       | Large              |
| <u>Cares about Atlantic Salmon Restoration</u> | (n=556)             | (n=118)                  |                    |
| Cares  | 82%                 | 60%                      | Large              |
| Doesn't Care                                   | 18%                 | 40%                      | Large              |

\* "Large" and "Small" indicate whether or not the difference between the two samples is statistically significant for a two-tailed test at a 95% confidence interval. Note that the differences between categories within a question are not independent of each other; hence sequential statistical tests of categories are invalid. Also, the number of respondents differs from question to question because of item nonresponse.

Table II-2 lists the six items that applied to every respondent: state of residence, sex of respondent, interest in Atlantic Salmon restoration, educational level, occupation, and age of respondent.

The differences between the two groups generally followed expected patterns. The people who did not read through and answer the complex 8 page mail questionnaire but who were willing to answer some questions over the phone were markedly less well-educated than the mail questionnaire respondents. Given reports of 13%-26% functional illiteracy among the general public,<sup>6</sup> it seems likely that the written survey was simply overwhelming for some people. Similarly, the mail survey respondents were more likely to be working professionals than the telephone follow-up respondents, a finding which is probably directly related to both the observed educational differentials and the difficulty of catching working professionals at home with telephone calls. Both differences are indirect indications that income levels of the mail respondents are probably higher than for the telephone follow-up sample, though because of expected respondent sensitivity about revealing incomes, this question was not asked over the phone.

It is also consistent with other studies that the telephone sample of nonrespondents contained a greater proportion of retirees than the mail survey. Retirees can be expected to be less active in general than working people. Some have greater difficulty in seeing the printed page, and some have less tolerance for the exertion, both mental and even to some extent physical, required to fill out a complicated questionnaire. While these problems are normally thought of in the context of age, it is noteworthy that despite the discrepancy in retirement status, the age and sex distributions of the two groups are very similar. Better understanding of the discrepancy would require a more sophisticated look at the relationships between age and retirement.<sup>7</sup>

The fact that a significantly lower (higher) proportion of mail respondents were from Connecticut (Massachusetts) is curious. The discrepancy may be due to different levels of coverage of restoration efforts by the Connecticut and Massachusetts media.

The most important discrepancy between the two samples is the much higher proportion of mail survey respondents claiming they care whether or not Atlantic Salmon will be found in New England rivers. Again, the discrepancy is in the direction expected: people with less interest in the issue should be less motivated to expend effort on a mail

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<sup>6</sup>US Bureau of Census figures cited in Publishers Weekly (May 23, 1986, Vol. 229:30) indicate that 13% of the English speaking population over 20 years of age is "functionally illiterate", as determined by a more liberal criterion than the sixth grade reading level often used to peg "functional illiteracy" at 26%.

<sup>7</sup>Again, it is possible that differences between the samples have been distorted because of a telephone nonresponse bias.

questionnaire; whereas the effort and attention required to give a short telephone response is much less.<sup>8</sup>

Because several of these discrepancies are significant,<sup>9</sup> the mail survey's single variable results have been adjusted where possible. Only a subset of the mailed questions were asked over the telephone. Because of the absence of some variables in the telephone follow-up survey, it is not possible to test or carry over all nonresponse adjustments into an analysis using multivariate models.

Table II-3. Interest questions asked only of cooperators who "care" about Atlantic Salmon.

| <u>Variable Described</u>   | <u>Mail Results</u> | <u>Follow-up Results</u> | <u>Difference*</u> |
|---|---------------------|--------------------------|--------------------|
| <u>Will see or fish for Atlantic Salmon</u>                             | (n=453)             | (n=66)                   |                    |
| Yes   | 32%                 | 44%                      | Large              |
| No  | 68%                 | 56%                      | Large              |
| <u>Atlantic Salmon pleasing even if will never fish for or see them</u> | (n=452)             | (n=64)                   |                    |
| Yes   | 77%                 | 100%                     | Large              |
| No  | 23%                 | 0%                       | Large              |
| <u>Act now for future generations</u>                                   | (n=453)             | (n=64)                   |                    |
| Yes   | 73%                 | 98%                      | Large              |
| No  | 27%                 | 2%                       | Large              |

\* "Large" and "Small" indicate whether or not the difference between the two samples is statistically significant for a two-tailed test at a 95% confidence interval.

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<sup>8</sup>Similarly, questionnaire respondents who returned their questionnaires promptly were more likely to "care" about Atlantic Salmon than those who responded only after several follow-up letters (chi-square value of 18.08).

<sup>9</sup>Since most of our research interest is directed only at the portion of the public with some interest in Atlantic Salmon, nonresponse bias was also investigated for the mail and phone sample subsets of only those persons indicating interest in Atlantic Salmon. Since most respondents were interested in the fish, the same patterns of mail and phone differences appear in the subsamples.

Responses to all of the questions displayed in Table II-3 show significant differences between mail and phone follow-up respondents. Though fewer phone follow-up cooperators cared about Atlantic Salmon restoration, Table II-3 reveals that the respondents who cared about Atlantic Salmon were more likely to expect to personally see or fish for them. It might then be concluded that these people were more likely to care about Atlantic Salmon because they had a direct or "use" interest in the fish. However, these same people also expressed much stronger indirect or altruistic interests in Atlantic Salmon: essentially all the people who cared about Atlantic Salmon indicated that they cared whether or not they would ever see or fish for Atlantic Salmon, and because they were interested in passing on a legacy to future generations. While these results can be taken at face value, a cautionary note might again be made with reference to differentials in the way people respond over the telephone and through the mails. Dillman, a survey research expert, has noted informally that there seem to be consistent differences in the way people answer identical questions over the telephone versus in a mail questionnaire versus in face-to-face interviews. In particular, people may be influenced by the relatively shorter time allowed for consideration of an answer in an interview, and tend to give more extreme responses on scaled variables.<sup>10</sup> The lower educational levels of the telephone follow-up respondents may relate to their greater interest in Atlantic Salmon restoration, since through analysis of mail responses it was determined that lower levels of education were positively correlated with willingness to pay to restore the fish.

Table II-4. Recreation participation questions asked only of respondents who "care" about Atlantic Salmon.

| <u>Variable Described</u>  | <u>Mail Results</u> | <u>Follow-up Results</u> | <u>Difference*</u> |
|--|---------------------|--------------------------|--------------------|
| They fished or hunted<br><u>during the past year</u>                                   | (n-449)             | (n-63)                   |                    |
| Yes  | 52%                 | 48%                      | Small              |
| They boated or swam in<br>lakes, rivers or the<br>ocean during the<br><u>past year</u> | (n-449)             | (n-63)                   |                    |
| Yes  | 77%                 | 76%                      | Small              |

\* "Large" and "Small" indicate whether or not the difference between the two samples is statistically significant for a two-tailed test at a 95% confidence interval.

<sup>10</sup>Lecture, 1986, Cornell University.

Table II-5. Willingness to pay questions asked only of respondents who "care" about Atlantic Salmon.

| <u>Variable Described</u>                                    | <u>Mail Results</u> | <u>Follow-up Results</u> | <u>Difference*</u> |
|--|---------------------|--------------------------|--------------------|
| Would prefer to pay increased federal <u>income tax</u>      | (n=449)             | (n=60)                   |                    |
| Yes  | 48%                 | 43%                      | -----              |
| Would prefer to pay increased state <u>income tax</u>        | (n=449)             | (n=60)                   |                    |
| Yes  | 32%                 | 40%                      | -----              |
| Would prefer to pay increased <u>electric bills</u>          | (n=449)             | (n=60)                   |                    |
| Yes  | 12%                 | 8%                       | -----              |
| Would prefer to pay <u>in some other fashion</u>             | (n=449)             | (n=60)                   |                    |
| Yes  | 17%                 | 8%                       | -----              |
| Would prefer to not <u>pay anything</u>                      | (n=449)             | (n=60)                   |                    |
| Yes  | 10%                 | 18%                      | -----              |
| Willing to pay the <u>amount we specified</u>                | (n=102)             | (n=25)                   |                    |
| Yes  | 79%                 | 79%                      | -----              |
| Average maximum will-<br>ingness-to-pay<br><u>for Salmon</u> | (n=88)<br>\$38.47   | (n=24)<br>\$50.37        | -----              |

\* Answers to these questions are reported only for that portion of each sample that cares about Atlantic Salmon and that expected to see or fish for them someday. Because of differences in the routing of anglers through the two surveys, even these subgroups are not strictly similar, so statistical comparisons could be misleading (see text that follows).

Table II-4 displays the differences in mail and telephone follow-up responses regarding recreational behavior for those persons indicating interest in Atlantic Salmon. Despite the differences noted for other variables, the recreational behavior of mail and phone respondents is similar.

Table II-5, finally contrasts the two groups with respect to questions about willingness-to-pay to continue the restoration program. The telephone follow-up did not differentiate willingness-to-pay questions for anglers versus non-anglers. Mail respondents expecting to fish for Atlantic Salmon someday would have first answered questions about willingness-to-pay for fishing licenses before answering (or skipping over) these questions, whereas all phone respondents interested in Atlantic Salmon would have answered only these willingness-to-pay questions. Since anglers as a group expressed greater total willingness-to-pay for Atlantic Salmon restoration in the mail responses,<sup>11</sup> it follows that had all anglers in the mail questionnaire directly answered the general willingness-to-pay question, then the \$38.47 figure would have been higher. Since \$38.47 and \$50.37 are in any event not statistically different from each other with high levels of statistical confidence (for the given sample size), it will be assumed that there is no nonresponse bias in the mail sample estimate of maximum willingness-to-pay, given that the respondents have said they "care" about Atlantic Salmon restoration. Similarly, the revealed preferred methods of payment are assumed to be accurately depicted in the mail sample results.

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<sup>11</sup>Total willingness-to-pay of persons saying they were certain they would fish for Atlantic Salmon someday was almost twice as high as persons saying they might someday fish for Atlantic Salmon, which was in turn somewhat higher than the total willingness-to-pay of nonanglers.

APPENDIX III

Nonrespondent Follow-up Questionnaire

The U. S. Fish and Wildlife Service must decide whether or not enough people are interested in Atlantic Salmon to justify continuing with their plans. They've already begun to restore this fish to many of the rivers in New England where Atlantic Salmon used to live. But the Fish and Wildlife Service may decide it is better not to spend the public's money on salmon restoration if not many people are interested. So...

1. Do you care one way or the other whether there are Atlantic Salmon in any New England rivers?

NO - skip to question 7.

YES - continue.

2. Now please tell me if any of the following statements about Atlantic Salmon apply to you:

NO      YES

       I VERY PROBABLY WILL SEE OR FISH FOR WILD ATLANTIC SALMON SOMEDAY

       IT WOULD PLEASE ME JUST TO KNOW THAT ATLANTIC SALMON WERE IN NEW ENGLAND RIVERS EVEN IF I COULD NEVER FISH FOR THEM OR SEE THEM MYSELF

       IT MATTERS TO ME THAT WE ACT NOW SO THAT FUTURE GENERATIONS OF PEOPLE WILL FIND ATLANTIC SALMON IN NEW ENGLAND RIVERS

3. If the program to restore Atlantic Salmon is continued, several methods might be used to raise extra money. Which of the following four kinds of payments would you prefer to see used to pay for the Atlantic Salmon Program? You may choose more than one, or none of these, but please choose a method of payment you normally make yourself. The choices are: (read the four)

FEDERAL INCOME TAXES

STATE INCOME TAXES

SALES TAXES

ELECTRICITY BILLS

(Don't read)     NONE - I'M NOT WILLING TO PAY ANYTHING (skip to Q. 6)

OTHER \_\_\_\_\_

4. Using an increase in [choice from Q. 3], would you be willing to pay \$\_\_\_\_\_ more next year only - in order to help the Salmon Restoration Program succeed in bringing Atlantic Salmon back to New England rivers?

NO  YES

5. What is the very highest extra payment you would be willing to pay rather than see the Program stopped? \$\_\_\_\_\_

6. Now, could you please tell me if you have participated in any of the following outdoor recreation activities during the past year?

- HIKING OR CANOEING  
 FISHING OR HUNTING  
 BOATING OR SWIMMING IN LAKES, RIVERS, or the OCEAN

7. In what year were you born? ..... YEAR

8. What was your main occupation this year (such as unemployed, laborer, secretary, doctor, etc.) \_\_\_\_\_

9. And finally, what is the highest year of school that you have completed?

- 1-6 YEARS  
 7-9 YEARS  
 10-11 YEARS  
 HIGH SCHOOL GRADUATE  
 SOME COLLEGE  
 COLLEGE GRADUATE  
 SOME GRADUATE SCHOOL

THANK YOU VERY MUCH FOR YOUR COOPERATION!